NURSE-SURGEONS IN THE AUSTRALIAN PUBLIC HEALTH SYSTEM: A MIXED-METHODS STUDY

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Declaration of Authorship and Sources

This thesis contains no material that has been extracted in whole or in part from a thesis that I have submitted towards the award of any other degree or diploma in any other tertiary institution.

No other person's work has been used without due acknowledgment in the main text of the thesis.

All research procedures reported in the thesis received the approval of the relevant Ethics Committees.

Professor Elisabeth Jacob, Dr Adam Burston and Professor Vasiliki Betihavas contributed to the conceptualisation of this research project, the interpretation and analysis of data gathered, and assisted in the reviewing and proofreading of this document.

Signed,

Grota

Candidate

Dedikasyon

Sa aking pinakamamahal na mga magulang Ginoong Manuel Grota at Ginang Cynthia Grota,

Ikinalulugod kong ialay ang pananaliksik na ito, na bunga ng aking ilang taong pagtitiyaga at pagsusumikap, sa inyo Nanay at Tatay na puno ng pagpaparangal, pagmamahal at pasasalamat. Kayo ang nagsilbing tanglaw, kaakibat at sandigan ko sa aking buhay, at ito ay walang hanggan kong pinahahalagahan.

Sa aking nanay na isang maka-Diyos na katoliko, sa bawat hakbang ko sa buhay, ikaw ang naging inspirasyon ko. Ang iyong mga sakripisyo mula pa noong ako'y bata hanggang ngayon, kalakip ang walang hanggang pagmamahal, pang-unawa, at pagsuporta ay nagdala sa akin sa mga matatayog na bahagi ng aking paglalakbay sa buhay. Ang iyong mga pangaral ukol sa kabutihan, edukasyon, at pananampalataya ay nagbukas ng mga pintuan patungo sa katuparan ng ating mga pangarap bilang pamilya.

Sa aking tatay, ang iyong patnubay, karunungan, pagtitiyaga at pagtitiwala ay nagpatibay ng pundasyon upang ako ay patuloy na maging mapangunawa, matatag at determinado. Ang iyong mga tahimik na payo at tagubilin ay nagbigay inspirasyon sa akin upang patuloy na magsumikap at mangarap kahit pa tila wala nang pag-asa sapagkat tayo'y nagaadhika lamang.

Ang tagumpay na ito ay hindi lamang sa akin. Ito ay tagumpay ng ating pamilya. Ating pinatunayan na ang pagmamahal, dedikasyon, pagtitiwala, at suporta sa isa't isa ay makapagbibigay-daan sa pagtupad ng anumang pangarap.

Nanay at Tatay, maraming salamat po sa lahat. Ito ang aking munting handog at paraan ng pagpapakita ng aking pasasalamat at pagpaparangal sa inyo.

English translation

Dedication

To my dearest parents Mr Manuel Grota and Mrs Cynthia Grota,

It is with great pleasure that I dedicate this work, a product of my years of perseverance and diligence to you, Nanay and Tatay, with great honour, love, and gratitude. You have been my guiding light, companion, and foundation in life, and I value this endlessly.

To my mother who is a devout Catholic, you have been my constant inspiration throughout every stage of my life. Your sacrifices from my childhood until now, coupled with your unending love, understanding, and support, have propelled me to the highest points in my life's journey. Your teachings on kindness, education, and faith have opened doors toward the realisation of our family's dreams.

To my father, your guidance, wisdom, perseverance, and trust have strengthened the foundation for me to remain compassionate, steadfast, and determined. Your silent advice and example have inspired me to continue to strive and dream even when hope seemed to be lost because we were but dreamers.

This success is not just mine. It is our family's success. We have proven that love, dedication, trust, and support for each other pave the way for the fulfillment of any dream.

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Table of Contents

Glossary of Terms

1. **Access to surgery** (variant: surgical access) – a measure of access to surgical services based on four elements: timeliness, capacity in terms of workforce and infrastructure, safety, and affordability (Alkire et al., 2015).

2. **Advanced Practice Nursing** - a specialised nursing role defined by advanced education and clinical skills, focusing on comprehensive patient care, illness prevention, and managing complex health issues (International Council of Nurses, 2020).

3. **Developed country** – countries (see Appendix K) with advanced economies as specified by the International Monetary Fund (2022).

4. **Developing country** – countries (see Appendix K) with developing or emerging economies as specified by the International Monetary Fund (2022).

5. **Disease Burden** – a measurement used by policymakers in a given health system to improve the delivery of health services and eliminate disparities in health outcomes by quantifying the impact of diseases, injuries and risk factors in a person's life and overall health (Institute for Health Metrics and Evaluation, 2022).

6. **Global surgery** – a contemporary terminology to define an emerging multidisciplinary field that aims for improvement and equity of global surgical care (Bath et al., 2019)

7. **Nurse Practitioner** – a Registered Nurse in Australia with a Nurse Practitioner endorsement (Australian Health Practitioner Regulation Agency [Ahpra], 2022). An endorsement is a recognition of a professional's extended scope of practice in a specified area through an Ahpra-approved further qualification (Ahpra, 2022).

8. **Nurse-surgeon** – a nurse who undertakes surgeries independently (Grota et al., 2022; White et al., 1987)

9. **Perioperative** – "the days and weeks immediately preceding and following a surgical intervention" (McQueen et al., 2015, p. 265) divided into "preoperative (from the decision to operate to entry into the theatre suite), intraoperative (from entry into the

theatre suite to leaving the recovery area), and postoperative (following transfer from the recovery area)" stages (Chazapis et al., 2018, p. 52 and 55).

10. **Physician** – a healthcare practitioner who holds a medical degree and is licenced to practise medicine. (Merrian-Webster, 2024).

11. **Registered nurse** – a nurse who has completed a bachelor's degree in nursing and passed a registration exam for Registered Nurses. In Australia, a Registered Nurse is a licensed health professional that is listed as a Registered Nurse in the Ahpra (2022) register of nurses.

12. **Surgeon** – a physician who performs surgeries (Merriam-Webster, 2022)

13. **Surgery** – an invasive procedure undertaken by physicians, nurses, and other non-physicians using aseptic technique and anaesthesia to diagnose and/or treat various surgical conditions (Debas et al., 2006).

14. **Task Shifting** – a strategy developed by the World Health Organization in 2008 to improve patients' access to surgery by distributing specific clinical tasks to other members of the healthcare team for a more efficient and timely delivery of care (World Health Organization, 2008).

15. **Waiting list** (variants: waiting times, waitlist) – a list of consumers needing specific healthcare services indicative of "excess demand over supply, unmet needs, and inadequate resources" (Amoko et al., 1992, p. 18).

Peer-reviewed Journal Papers

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Abstract

Background:

Amidst the persistent global surgical crisis that leaves over five billion people worldwide without adequate surgical care, innovative solutions are imperative. Nurse-surgeons, or nurses undertaking surgery independently, have emerged as a promising innovation in the field of surgery, presenting a unique opportunity to address the surgical access gap.

Aim:

To consolidate the data around the nurse-surgeon role, training, education, career prospects and experiences in the Australian public health system.

Methods:

This explanatory sequential mixed-methods research involved two phases. The first phase was a non-experimental descriptive survey of 28 nurse-surgeons in Australia, including 22 females and six males. The survey questionnaire consisted of four sections: demographics; roles; training; and perceptions. Data collection methods encompassed email surveys sent to public hospitals, crowdsourcing, and snowball sampling. The results underwent descriptive analysis. The second phase involved semi-structured interviews of five nurse-surgeons using purposive sampling. Data analysis was conducted using an inductive approach, following Braun and Clarke's six phases of thematic analysis. Both phases adhered to ethical standards and consolidated criteria for reporting.

Results:

Quantitative findings revealed that most of the nurse-surgeon participants held a master's degree and trained for an average of 2.27 years (95% CI [1.47, 3.07]). Training consisted of practical and theoretical components, along with rigorous competency assessments before independent practice. Nurse-surgeons faced challenges in the form of limited job opportunities, political resistance, and opposition from Australian medical societies, contributing to poor to average employment prospects. However, the support from their colleagues—nurses, surgeons, and management—remained strong, despite occasional undercurrents of jealousy and resentment. Nurse-surgeons expressed high job satisfaction and a resolute intention to continue their practice. They emphasised the need for standardised training and practice to secure the future of their role. The qualitative findings showed consistently positive interactions with clinical supervisors

marked by unwavering support throughout their training and into independent practice. In contrast, their interactions with nurses and physicians beyond their clinical supervisors were initially antagonistic, but with time, evolved positively as the value nurse-surgeons brought became increasingly evident. Qualitative analysis unveiled the crucial facilitators and barriers to nurse-surgeon integration within the Australian healthcare system, including raising awareness, fostering collaboration, creating a standardised national credentialing pathway, and addressing geographic, political, and financial challenges.

Conclusion:

This mixed-methods research offered a comprehensive understanding of nurse-surgeons within the Australian public health system. Challenges and opportunities faced by nurse-surgeons have been highlighted, emphasising the need for standardised training and enhanced support. As the field of nurse-surgeon practice continues to evolve, our findings serve as a roadmap for evidence-based policies and practice, nurturing the growth and recognition of nurse-surgeons within the Australian surgical workforce and beyond. The urgency of a standardised national credentialing pathway to ensure the sustainability of this innovative role in addressing the global surgical crisis is underscored. Policymakers and stakeholders have a pivotal role to play in expanding surgical care, innovating surgical delivery, and closing the global healthcare access gap by addressing the identified challenges and reinforcing support for nurse-surgeons considering their invaluable role within the healthcare system.

Chapter 1 Introduction and Overview

1.1 Introduction

Millions of people undergo surgery every year and often it is the sole clinical intervention to alleviate morbidities or prevent mortalities. (World Health Organization, 2022c). Surgically treatable conditions represent 13% of the world's overall disease burden (World Health Organization, 2022c). Disease burden is a measurement used by policymakers in a given health system to improve the delivery of health services and eliminate disparities in health outcomes by quantifying the impact of diseases, injuries and risk factors in a person's life and overall health (Institute for Health Metrics and Evaluation, 2022).

Access to surgery is integral to the full realisation of universal health coverage (World Health Organization, 2014). However, surgery as a global agenda continues to be widely ignored and has been described as the "neglected stepchild" (Farmer et al., 2008) and "Cinderella" (Bath et al., 2019) of global health. This is amidst the staggering statistics indicating that five billion people or 62% of the world's population do not have access to surgery (Alkire et al., 2015; Chamie, 2020; Meara et al., 2015). Of these five billion people, at least 18 million die every year from conditions that could have been treated by surgery (Reddy et al., 2020).

The everyday burdens caused by limited access to surgery are typically faced by citizens of low to middle-income countries, which depict the chronic, stark, and palpable inequity in the provision of surgical care between the poor and more developed nations (Bath et al., 2019). However, when a global pandemic caused by the highly contagious SARS-CoV-2 virus (Muralidar et al., 2020) devastated the world in 2019, even modern healthcare systems in high-income countries struggled to meet the health needs of its people (Wiersinga et al., 2020). With cases and death tolls rising to millions in days (World Health Organization, 2022b), rapid national decisions had to be instituted. A series of restrictions and lockdowns ensued causing uncertainties across all sectors and industries. These uncertainties have heavily impacted the delivery of surgical care globally with multiple cancellations in elective surgeries resulting in many countries struggling to provide surgical care to millions of patients thereby increasing surgical backlogs on waiting lists that were already increasing pre-pandemic (Carr et al., 2021; COVIDSurg Collaborative, 2020).

Timely access to surgery is multifactorial and a problem faced by every nation in the world. The billions of people in both developing and developed countries requiring surgery, coupled with the adverse clinical outcomes transpiring from surgical delays, are compelling reasons to consider surgical care as a priority global health issue.

1.2 Definition of surgery

The World Health Organization define surgery as any invasive procedure undertaken by physicians, nurses, and other surgical care providers using aseptic technique and anaesthesia to diagnose and/or treat various surgical conditions (Debas et al., 2006). According to the Victoria State Government, Department of Health and General Surgeons Australia (2023), surgeries are typically classified based on surgical approach (open or minimally invasive), the degree of seriousness (major or minor), and urgency (elective or emergency). These classifications help guide clinical decisions and treatment plans.

In terms of surgical approach, surgeries can be open or minimally invasive. Open surgeries involve a large incision, allowing direct access to the surgical site, while minimally invasive surgeries employ smaller incisions and specialised instruments to achieve the same surgical objectives with reduced tissue disruption (Zhao & Gu, 2022). Examples of open surgeries include laparotomy, caesarean section, and open-heart surgery. Conversely, laparoscopy, angioplasty and endoscopic surgeries, such as bronchoscopy, gastroscopy, colonoscopy, cystoscopy, hysteroscopy, and arthroscopy, exemplify minimally invasive surgeries (Kumar et al., 2016).

The seriousness of surgeries further classifies them into major or minor categories. Major surgeries involve extensive tissue manipulation or organ involvement with a high risk for severe blood loss, surgical complications, longer patient recovery time, or death (Townsend et al., 2017). Minor surgeries, on the other hand, typically entail less invasive procedures with limited impact on surrounding structures potentially resulting in less surgical complications and faster patient recovery time (Townsend et al., 2017). Exemplary major surgeries include pancreaticoduodenectomy, hysterectomy, hip replacement, and coronary artery bypass graft surgery, whereas minor surgeries include biopsy, abscess incision and drainage, circumcision, and laceration repair.

Lastly, surgeries can be classified by their urgency as either elective or emergency. Elective surgeries are planned procedures scheduled in advance to address non-life-threatening conditions, providing time for thorough preparation and consideration (Ghaferi et al., 2009). Emergency surgeries, on the other hand, are immediate interventions required to address urgent, often life-threatening situations that demand immediate clinical attention (American College of Surgeons, 2018). Examples of elective surgery include bariatric, cataract, and cosmetic surgeries. Examples of emergency surgery include trauma surgeries due to gunshots or accidents, repair of ruptured abdominal aortic aneurysm, and bowel obstruction surgeries.

1.3 Chronic shortage of surgeons in developing countries

In developing countries, the chronic shortage of skilled surgical providers inhibits the resources needed to deliver timely surgeries (Hoyler et al., 2014). At least 57 developing countries have a critical shortage of surgeons – a chronic problem that spans decades (Naicker et al., 2009; World Health Organization, 2022a). There are two main factors that may explain this phenomenon. Firstly, is brain drain, defined as the permanent emigration of highly skilled professionals from developing countries for a better standard of living (Botezat & Ramos, 2020). Brain drain is greatly beneficial to the receiving countries which tend to be developed nations, but to the countries from which surgeons emigrated, the implications are debilitating (Maharaj, 2014). Secondly, is the lack of people training to be physicians in developing countries as evidenced by their low physician-to-patient ratios (World Health Organization, 2022a). There are only 7.66 physicians to every 10,000 people in Southeast Asia and only 2.92 physicians per 10,000 people in the whole African continent and other low-income countries (World Bank, 2022; World Health Organization, 2022a). The World Health Organization does not prescribe an ideal physician-to-patient ratio. However, it considers countries with less than 10 physicians per 10,000 people as having an insufficient healthcare workforce capacity (World Health Organization, 2019). Forty-five percent of the World Health Organization member states fall below this threshold (World Health Organization, 2019). Of those countries, all are identified as developing nations (International Monetary Fund, 2022).

To address the shortage of surgeons in developing countries, the strategy Task Shifting was introduced by the World Health Organization in 2008 to ameliorate patient access to essential health services (World Health Organization, 2008). The strategy worked by distributing specific clinical tasks to other members of the healthcare team for a more efficient delivery of care (World Health Organization, 2008). In the surgical context, Task Shifting meant training

non-physicians to undertake surgeries in geographical areas where surgeons were scarce (Burton, 2017; Chu et al., 2009).

1.4 Access to surgery in developed countries

In developed countries, there are multiple factors that impede timely access to surgery. These are the ageing workforce (OECD iLibrary, 2019), work hour restrictions for junior physicians (Philibert et al., 2002), and maldistribution of surgeons (Phillips, 2022). In addition, systems of health care which do not provide universal health coverage but are reliant on fee for services and insurance, disadvantage persons from low socio-economic backgrounds (Venkatesh et al., 2019).

1.4.1 Ageing workforce

The medical workforce in developed nations such as Australia, is progressively ageing (OECD iLibrary, 2019). In 2000, physicians aged over 55 years represented one-fifth of the medical practitioners in high-income countries (OECD iLibrary, 2019). Almost two decades later, these older physicians covered a third of the global medical workforce (OECD iLibrary, 2019). Australia is following a similar trend as in 2015, one-fourth of Australian physicians were 55 years or over (Australian Institute of Health and Welfare, 2016). This is a concerning figure as these physicians will be retiring in the following decades leaving behind a population with increasing life expectancy and multimorbidity needing complex healthcare services (OECD iLibrary, 2019). Therefore, acknowledging this trend of retiring physicians steadily increasing in high income countries, it is well-timed to initiate effective and innovative workforce planning measures now rather than later.

Some strategies that Australia has used to expand their medical workforce included overseas recruitment (Iredale, 2009) and a push for rural-focused medical training (Phillips, 2022). Recruitment of overseas-trained physicians has been successful to some extent. However, the Australian government has failed to be aware of the consequences of this strategy (Iredale, 2009) which worsened the health inequity and surgical burden in the home countries of these overseas-trained physicians (Patel, 2003). Furthermore, while Australian medical schools reserve a specific percentage of their annual admissions for candidates with indigenous or rural backgrounds, the graduating count from this demographic has been relatively modest,

comprising only 44 individuals in 2019 and 65 in 2020 across the nation (Medical Deans Australia and New Zealand, 2021).

Australia has a low ratio of one medical school to 1.2 million people (Medical Deans Australia and New Zealand, 2021). Unless the Australian government decides to increase the number of medical schools and positions for medical students, the country may not be able to produce sufficient numbers of physicians in the decades to come. For now, a more suitable workforce planning solution amidst an ageing medical workforce is to upskill the other currently practising healthcare professionals who are experienced and capable of undertaking physician roles, a strategy called Task Shifting that the World Health Organization has been using successfully in developing countries (World Health Organization, 2008).

1.4.2 Work hour restrictions in junior physicians

To address the unsafe working hours within the medical profession, many developed countries have created recommendations (Philibert et al., 2002) to regulate the clinical hours worked by junior physicians to a safe standard to prevent burnout, suicide, and permanent attrition (Campaner, 2019). This argument was proven by a study in 2011 suggesting that junior physicians have faster clinical decision making and overall better global cognitive and motor skills when appropriately rested compared to poor decision making and laxed skills when fatigued (Flinn & Armstrong, 2011). The stress and fatigue from working unsafe hours contribute to the burnout and high suicide rates in the medical community (Australian and New Zealand College of Anaesthetists, 2018). A study in 2013 found that Australian physicians are more likely to suicide due to stress and burnout as compared to any other professionals or the general population (Wu et al., 2013). In the United States, about 60% of burned-out physicians consider leaving the profession altogether (Australian and New Zealand College of Anaesthetists, 2018).

The drives to restrict early career physicians from working unsafe hours have been advantageous to their physical and mental health, which are necessary to provide safe and effective patient care. However, these restrictions also resulted in major health service delivery gaps as the junior physicians who typically staff and provide the first-line surgical and diagnostic care to patients, are now restricted to work regulated clinical hours. There is no available conclusive data to explain why health systems were unable to employ more junior physicians to cover this gap. This may be attributed to the ongoing attrition and therefore shortage in the early career physician group due to burnout and stress – a “double-edged sword” that is the very same

reason for restricting young physicians' unsafe work hours (Shryock, 2021). Consequently, these gaps further aggravated the coverage to already limited surgical capacities particularly in the areas of diagnostic and cancer surgeries.

1.4.3 Maldistribution of surgeons

There is a marked difference in the number of surgeons available in metropolitan areas compared to rural areas in developed countries. The Australian government recognises this problem and despite consecutive attempts to resolve it, the shortage of generalist and specialist physicians in rural areas persists (Phillips, 2022). Due to this uneven geographical distribution of physicians, people in rural areas who have limited access and usage of healthcare services experience poorer health outcomes, higher incidence of chronic illnesses and lower life spans than people in metropolitan areas (Phillips, 2022).

There are several factors that may explain the rural maldistribution of physicians and the negative stigma towards rural medicine in Australia. These include the pervasive culture of undermining rural physicians within their own professional medical colleges (Hill et al., 2021), the insufficient number of medical graduates with rural backgrounds (Holloway et al., 2020), limited professional development opportunities, low income, limited infrastructure, isolation, longer working hours, and lack of opportunities for starting and raising a family (Phillips, 2022). In 2019, the Australian parliament has announced reforms that will address the rural maldistribution of physicians over the next ten years. These are development of five rural medical schools, implementation of new training programs to support rural practice, and new fee arrangements for rural physicians. However, the Parliament considers that these reforms will take time and finding a solution now is crucial (Phillips, 2022). Assessing the current rural health workforce and redefining clinical roles can be pivotal in resolving the issue.

1.5 Emergence of nurse-surgeons

Nurse-surgeons can be defined as nurses who undertake surgeries independently (Grota et al., 2022). There are many titles used synonymously which are usually based on the specialty area of practice. These include (but are not limited to) nurse cystoscopist, nurse endoscopist, nurse hysteroscopist, nurse practitioner, clinical nurse specialist, biopsy nurse, physican extender, perioperative specialist practitioner, and surgical care practitioner (Grota et al., 2021).

In developing countries, the emergence of nurse-surgeons may be attributed to the Task Shifting strategy of the World Health Organization (2008). However, extant literature suggests

that nurse-performed surgeries predate Task Shifting by at least six decades with the first documented "nurse-surgeon" having performed obstetric surgeries in Africa in the 1950s (White et al., 1987). Nevertheless, the task shifting of surgeries to nurses from 2008 onwards and the training of nurses to undertake surgeries in the 1950s were conceived on similar grounds – supply and demand. The health systems in these developing countries desperately needed to innovate and redesign their surgical capacity (supply) to meet surgical demands amidst the never-ending chronic shortage of surgeons (Bath et al., 2019; World Health Organisation, 2014).

In developed nations, including Australia, nurse-surgeons emerged for different operational and strategic reasons. However, similar to how nurse-surgeons were formed in developing countries, the implementation of nurse-surgeons in developed countries also arose from supply and demand (Grota et al., 2022). Surgical capacities needed to be redesigned to meet the ballooning surgical demands as ageing physicians are retiring (OECD iLibrary, 2019), junior physicians are restricted from working unsafe hours (Philibert et al., 2002), surgeons are unevenly distributed (Phillips, 2022), and specialist surgeons are tied up treating multimorbid patients who are living longer than usual (Vivekanantham & Gnanappiragasam, 2014).

1.6 Historical overview of the term "nurse-surgeon"

The word "nurse-surgeon" can be traced back to the early 16th century when King Henry VIII designated William Bullein as his private nurse-surgeon (Duffin, 2017). Bullein's early works were pivotal in the treatment of pleurisy and the epidemic called "English sweating sickness", which killed tens of thousands in early 1500s (Duffin, 2017). Bullein was never admitted as a physician, and it is unknown if he ever had a medical degree (Duffin, 2017).

The earliest record that used the term "nurse-surgeon" to describe nurses performing surgeries was published in the 20th century (White et al., 1987). In the document, a group of nurse-surgeons performed obstetric and gynaecological surgeries in the 1950s in Zaire, an African country that is now known as the Democratic Republic of Congo (White et al., 1987). In 1983, two American physicians proposed the development of Certified Registered Nurse Surgeons to perform minor surgeries on the written order of a surgeon (Litt & Brodsky, 1983). This proposal was reiterated by American nurses in 1985 (Judy, 1985).

"Nurse-surgeons" recognition and use increased in the 21st century. In 2001, nurse-surgeons were reported to perform minor surgeries, caesarean sections, and strangulated hernias

in Burkina Faso and Congo (Kowalewski & Jahn, 2001). In 2005, nurse surgeons were beginning to be trained in undertaking major and minor general, vascular, orthopaedic, ophthalmological, urological, colorectal, and gynaecological surgeries in Germany, UK, Netherlands, and other European countries (Marsh, 2005; Kingsnorth, 2005; Zorn, 2005). In 2007, nurse surgeons were reported to exemplify the continuously evolving surgical practices in Europe (Mitchell, 2007). By 2009, the United Kingdom public health system recognised nurse-surgeons as qualified non-medical surgeons who can practise safe surgery (Mickute, 2009).

The amount and type of surgeries performed by "Nurse-surgeons" have continued to increase over the last ten years (Eddy & Duffy, 2019; Judd, 2013; Wise, 2021). These surgeries include caesarean section, laparotomy, appendicectomy, herniorrhaphy, endoscopy, hysteroscopy, cystoscopy, biopsy, and carpal tunnel release (Grota et al., 2021). At present, nurse-surgeons are employed in many countries worldwide, including Australia, and many countries in Europe, Africa, Asia, and North America (Grota et al., 2021; Kowalewski & Jahn, 2001; Zorn, 2005).

1.7 Global impact of nurse-surgeons

The contribution of nurse-surgeons in global surgical care has been invaluable. The lives of at-risk pregnant women requiring emergency caesarean sections and hysterectomies were saved by nurse-surgeons who performed these surgeries (White et al., 1987). Life-threatening blood clots have been diagnosed and removed by nurse-surgeons through angiograms and percutaneous thrombectomies (Dryer, 2006). Patient access to essential gynaecologic (Bodle et al., 2008), endoscopic (Wright, 2000), and urological (Gidlow et al., 2000) surgeries has significantly improved following the implementation of nurse-surgeons in many local health systems in remote (Redwood, 2009) and urban settings.

Nurse-surgeons have been particularly effective in diagnostic surgeries to detect bowel, skin, and bladder cancers - the most common cancers in the world (World Health Organisation, 2021). Bowel cancer, in particular, is the world's second deadliest cancer (World Health Organisation, 2021) yet one of the most treatable if detected early. These lives saved through early cancer detection via nurse-performed diagnostic surgeries could have been part of the 18 million annual human deaths from surgically treatable illnesses (Reddy et al., 2020).

The implementation of nurse-surgeons in many health systems around the world has collectively led to reduction in surgical waiting time, improvement in patient access to essential surgeries in remote and rural communities, and prevention of mortalities from surgically treatable conditions. Johal & Dodd (2017), Salibian et al. (2016) and Joseph et al. (2015) reported the contributions of nurse-surgeons in offsetting the unnecessary treatment delays in various surgical specialties. This was further enforced by a 2022 study (Grota et al., 2022) that confirmed the categorically positive global impact of nurse-surgeons in emergency surgeries, diagnostic surgeries, minor surgeries, and rural health.

1.8 Impact of nurse-surgeons in Australia

There are at least 10,600 practising perioperative nurses in the Australian public health system (Australian Institute of Health and Welfare, 2015). From this number, it is unclear how many are practising in the role of nurse-surgeon. Two systematic reviews (Grota et al., 2022; Grota et al., 2021) have concluded the extremely limited literature around nurse-surgeons in Australia. However, this limitation did not hinder the recognition of the value of nurse-surgeons in improving the delivery of surgical care to Australians.

The earliest known use of nurse-surgeons in Australia was in 2004, when a group of advanced practice nurses performed upper gastrointestinal endoscopies in South Australia (Bull et al., 2006). This initiative was in line with the Australian government's National Bowel Screening Program with the goal of preventing deaths from bowel cancer through early detection (Department of Health and Aged Care, 2022). Bowel cancer is the second deadliest cancer in Australia, next only to lung cancer, but is the easiest to treat if detected early. Overall, Bull et al. (2006) reported that 96.2% of the nurse-performed endoscopies in 2004 were successful with no documented deaths, perioperative complications, and other adverse events. These findings were further confirmed and reinforced in three similar studies on nurse-performed endoscopies conducted in 2013 (Beck, 2013), 2017 (Duncan et al., 2017), and 2018 (Cusack et al., 2018).

In 2012, a study was conducted to explore the feasibility of introducing nurse cystoscopists in Australia, a type of nurse-surgeons performing flexible cystoscopies (Sapre et al., 2012). The initiative was developed and implemented at the Royal Melbourne Hospital to ease the pressure of delivering urological services to patients and aid in reducing the increasing workloads of urologists (Sapre et al., 2012). The main clinical goal of the initiative was to establish patients' efficient and timely access to early bladder cancer detection, surveillance, and

treatment (Sapre et al., 2012). Bladder cancer if left unmonitored can be an economic burden that is considered one of the most expensive cancers to treat (Sapre et al., 2012). Overall, the study reported a 65% reduction in the flexible cystoscopy waitlist, 97% patient confidence in the nurse-surgeons, and 90% positive patient satisfaction with 93% of the patients, indicating preference to nurse-surgeons over surgeons.

1.9 Advanced Practice Nursing and nurse-surgeons

According to the International Council of Nurses (2020), Advanced Practice Nursing is a distinct nursing role characterised by advanced education and clinical competencies, with a focus on comprehensive patient care, illness prevention, and management of complex health issues. This practice is grounded on nursing principles and aims to enhance healthcare services without competing with other professionals. Regulatory mechanisms for Advanced Practice Nursing vary internationally, often involving specific requirements for registration and educational standards that ensure practitioners meet established competencies (Scanlon et al., 2023). In this context, the role of nurse-surgeons may present some challenges in aligning with the definitions of Advanced Practice Nursing. While nurse-surgeons may have advanced surgical skills, their practice often overlaps with that of surgeons and other surgical providers, which can blur the boundaries of nursing. The International Council of Nurses guidelines (2020) suggest that maintaining a clear nursing identity, supported by regulatory frameworks, is important. Thus, despite their advanced surgical skills, nurse-surgeons may not fully align with the traditional concept of Advanced Practice Nursing, as their roles extend into surgery—a domain typically reserved for independently practicing surgical providers (American Association of Nurse Practitioners, 2022).

1.10 The Research Problem

The five studies (Cusack et al., 2018; Duncan et al., 2017; Beck, 2013; Sapre et al., 2012; Bull et al., 2006) on nurse-performed endoscopies and flexible cystoscopies are currently the only known literature on nurse-surgeons in Australia. However, similar to the diversity of practising nurse-surgeons in other countries, there might be other nurse-surgeons practising in Australia yet to be documented. Considering the positive impact of nurse-surgeons globally and its potential in easing the surgical burden in Australia, an initial exploration of this particular group of nurses is necessary.

To the author's best knowledge, there is no known study in Australia that explored nurse-surgeons as one category of nurses. The variation in advanced nursing titles has proven to be a barrier in undertaking this targeted approach to explore nurse-surgeons. The unregulated labelling of advanced nursing practice has resulted in the creation of extremely numerous and confusing job titles. A study in 2017 found that in the United Kingdom alone, there were 595 job titles shared by a sample of 17, 960 nurses including the various titles for nurse-surgeons (Leary et al., 2017). An Australian study argued that the lack of coordination in the creation of nursing titles can lead to role proliferation, blurring and confusion where unregulated roles rapidly increase, boundaries become less distinct, and providers and patients experience lack of clarity in the scope of roles (Duffield et al., 2011).

There is currently no known official umbrella term for nurses performing surgeries. "Surgeon" is a term for physicians performing surgeries regardless of surgical subspecialty. Correspondingly, "nurse-surgeon" should be an all-encompassing term to describe nurses performing surgeries regardless of surgical specialty. Therefore, consistency and standardisation of the language around nurse-surgeons are key to the accurate consolidation of data around nurse-performed surgeries in Australia and potentially globally.

1.11 Aim and objectives

Utilising the all-encompassing term "nurse-surgeon", this study aimed to consolidate the data around the nurse-surgeon role, training, education, career prospects, and experiences in the Australian public health system. The specific objectives of this research were the following:

(1) To investigate the roles of nurse-surgeons practising in the Australian public health system.
(2) To examine the training and education requirements of nurse-surgeons practising in the Australian public health system.
(3) To assess the perceptions of nurse-surgeons practising in the Australian public health system regarding employment prospects, support received from stakeholders, and the likelihood of continuing their practice.
(4) To explore the experiences of nurse-surgeons practising in the Australian public health system in terms of training, education, and integration into the health system.

1.12 Significance of this study

The study outlined what roles nurse-surgeons fulfil in the Australian health system. This study identified the roles of nurse-surgeons, their educational preparation for the role, and their experiences in the provision of surgical care across the country. The magnitude of nurse-performed surgeries and universal surgical care limit this study to a nationwide coverage as an initial project to explore nurse-surgeons. However, the universality of problems surrounding access to surgical care and the need to redesign surgical capacity make this study internationally relevant. Therefore, the author hopes that the findings of this study will lay the foundation for the following future endeavours:

(1) The findings of this study may be used by the Australian Department of Health and Aged Care in conjunction with the Australian Health Practitioner Regulation Agency (Ahpra) in standardising, credentialing, and regulating nurse-surgeon practice in Australia and internationally.

(2) The findings of this study may be used by the Australian Department of Health and Aged Care in developing sustainable and futureproofed plans for the nursing workforce across Australia and internationally particularly in terms of nurse-surgeon retention, career progression, the future of healthcare, and surgical capacity redesign.

(3) The findings of this study may be used by other countries to conduct an exploration of their own practising nurse-surgeons. Consequently, this will create opportunities for international collaborations to further lobby the potential of nurse-surgeons to policymakers in easing the global surgical burden.

1.13 Outline of the study design

An explanatory sequential mixed methods research design was employed in this study, guided by a pragmatic theoretical framework, to comprehensively investigate nurse-surgeons currently practising in the Australian public health system. The study was rooted in the pragmatic paradigm, emphasising practicality and relevance in addressing complex issues. The sequential approach involved an initial quantitative phase to gather broad data from the study sample, followed by a qualitative phase to provide deeper insights, explanations, and context. This approach allowed for a more comprehensive understanding of the research problem by triangulating quantitative and qualitative data. The study aimed to not only identify patterns and associations through quantitative measures but also to explore the nuances and underlying

reasons for these phenomena through qualitative exploration. This mixed-methods design aligned with the overarching goal of generating a holistic and nuanced understanding of nurse-surgeons within the context of the Australian public health system.

1.14 Overview of the thesis

This thesis outlines an explanatory sequential mixed methods study that investigated the roles, training, education, career prospects, and experiences of nurse-surgeons in the Australian public health system. Chapter 1 introduced and discussed the research topic, emphasising gaps in the literature and the problem being addressed, with defined study aims and objectives. Chapter 2 presents a scoping review of the global roles of nurse-surgeons, while Chapter 3 offers a systematic review of nurse-surgeon training and education worldwide. Chapter 4 focuses on a systematic review that explored the impact of nurse-surgeons in global surgical care. Chapter 5 details the methodology and design of the mixed-methods study, which involved quantitative surveys followed by qualitative interviews. Chapter 6 and Chapter 7 discuss the findings of the quantitative and qualitative phases, respectively. Chapter 8 integrates these findings, providing a comprehensive discussion. Finally, Chapter 9 concludes the thesis, offering recommendations for nursing practice, workforce management, and policy.

Chapter 2 Roles of nurse-surgeons in global surgical care: A scoping review (Paper 1)

2.1 Introduction

Chapter 1 presented a comprehensive introduction to the global health crisis posed by inadequate access to surgery. It defined the parameters of surgery, highlighting the chronic shortage of surgeons and the disparities in surgical access between developed and developing countries. Additionally, the chapter provided an introduction of the emerging role of nurse-surgeons, offering a historical overview, analysing their impact on surgical care, both globally and in Australia, and succinctly presented the research problem, aim, objectives, significance of the study and the study's design.

Chapter 2 is presented in the form of a published peer-reviewed paper. The paper reported on a scoping review that aimed to identify the roles that nurse-surgeons play in the delivery of global surgical care. This paper entitled “Roles of nurse-surgeons in global surgical care: A scoping review” was published in Journal of Advanced Nursing in 2023 (Grota et al., 2023). The review highlighted the crucial contributions of nurse-surgeons in undertaking various surgical procedures and emphasised the diverse roles and benefits of nurse-surgeons to patient care. The decision to select the Journal of Advanced Nursing as the preferred publisher for this paper was strategically driven, emphasising the alignment of the journal's commitment to advanced nursing and open access publishing with the goal of ensuring widespread accessibility. Additionally, the journal's Q1 status and a CiteScore of 6.4 underscore its reputation for high-impact research, contributing to increased visibility and recognition within the scholarly community.

A copy of the journal article is available below. Findings of this review revealed nurse-surgeon practice in 26 countries, involving 96 records and 41 titles, predominantly nurse practitioners, with 5,684,198 surgeries performed. Safety on par with physicians, improved surgical efficiency, high patient satisfaction, cost-effectiveness, and recommendations for standardisation were noted across the included records.

2.2 Journal article

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REVIEW

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Roles of nurse-surgeons in global surgical care: A scoping review

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Abstract

Aim: To identify the roles of nurse-surgeons in the provision of surgical care.

Design: Scoping review.

Methods: This scoping review adhered to the JBI guideline for scoping reviews and EQUATOR Network's PRISMA-ScR checklist. Searches were performed from May 2022 to July 2022 using a combination of MeSH headings, keywords and filters via database and hand searching based on the eligibility criteria. Keywords included nurse-surgeon, nurse endoscopist, nurse hysteroscopist and nurse cystoscopist. Data sources were CINAHL, Cochrane, Google Scholar, PubMed and Scopus. Descriptive analysis was used to report the findings.

Results: Ninety-six included records indicated nurse-surgeon practice in 26 countries. Forty-one nurse-surgeon titles were found, the majority of which were types of nurse practitioner. A total of 5,684,198 surgeries were performed by nurse-surgeons varying from laparotomies to biopsies. Nine records reported that nurse-surgeons perform surgeries safely and on par with physicians with zero to minimal complications. Nineteen records reported improved surgical care efficiency by nurse-surgeons in terms of patient access to surgery, waiting times, surgery times, patient show rates, patient education, physician workload and junior physicians' training. Seven records reported high patient satisfaction. Nurse-surgeons were cost-effective according to five records. Thirteen records recommended the standardization of nurse-surgeon practice.

Conclusion: Nurse-surgeons performed millions of surgeries worldwide assisting in easing the global surgical burden. This review identified the roles and benefits nurse-surgeons play in global surgical care. Research gaps on nurse-surgeon roles were discovered including the ambiguity in nurse-surgeon titles and the need to regulate nurse-surgeon practice.

Impact: This research addressed the clinical safety, quality, contribution to timely surgical access and cost efficiency of nurse-surgeon performed surgeries, as well as the need to standardize nurse-surgeon practice and use a more consistent nurse-surgeon title to ensure role identification and monitoring.

Protocol Registration: This scoping review is accessible at https://doi.org/10.17605/OSF.IO/SJ2WU.

KEYWORDS
advanced practice, day surgery, empowerment, endoscopy, nurse practitioners, nurse roles, surgical nursing, systematic reviews and meta-analyses, theatre nursing, workforce issues

1 | INTRODUCTION

Surgeries are invasive procedures performed under aseptic technique with or without anaesthesia by surgical providers such as physicians, nurses and other non-physicians to diagnose and/or treat surgical conditions (Debas et al., 2006). Access to surgery is crucial in achieving universal healthcare (World Health Organization, 2014). In countries with a fee for service, access to surgery is even more dire. Countries, such as the USA have seen an increase in travel tourism for persons without health insurance (Stoney et al., 2022). Yet, 5 billion people representing more than 60% of the world's population have no access to surgery (Alkire et al., 2015; Chamie, 2020; Meara et al., 2015). From this number, 18 million people die every year from illnesses that could have been managed by surgery (Reddy et al., 2020). Therefore, access to surgery should be prioritized as a global health agenda.

Access to surgery is a problem faced by both high-income countries and low- and lower-middle-income countries. In low- and lower middle-income countries, the longstanding scarcity of skilled surgical providers hinders the delivery of timely surgeries (Hoyler et al., 2014). To address this scarcity, the World Health Organization introduced the Task Shifting strategy in 2008 with the intention to improve patient access to essential healthcare services such as surgery (World Health Organization, 2008). Task Shifting refers to the extension of the scope of practice of less qualified healthcare workers by training them to perform clinical tasks that are traditionally performed by higher qualified healthcare workers only (World Health Organization, 2008). The clinical tasks are then equally redistributed among the healthcare workers which in turn ameliorates patient access to healthcare. In the surgical context, surgeries are redistributed, whereby nurses are trained to perform simple yet essential surgeries so the higher qualified surgeons can focus on more complicated surgeries. This results in a more efficient delivery of surgical care, and therefore, timely patient access to surgery in areas where surgeons are limited.

Conversely, in high-income countries, multiple factors can be attributed to the delay in patient access to surgery. These are the ageing healthcare workforce (OECD iLibrary, 2019), the setting of restrictions in the clinical hours worked by junior physicians (Abraham et al., 2016; Philibert et al., 2002), and the longstanding maldistribution of surgeons in urban and rural settings (Phillips, 2022). Additionally, some health systems in high-income countries do not allow universal health coverage to their citizens and are heavily reliant on service fees and insurance (Venkatesh et al., 2019). This ultimately disadvantages people especially those from the lowest socio-economic backgrounds.

Nurse-surgeons are nurses who perform surgery independently with current nurse-surgeon titles including nurse cystoscopist, physician extender, perioperative specialist practitioner, nurse endoscopist, surgical care practitioner, nurse hysteroscopist, biopsy nurse, nurse practitioner and clinical nurse specialist (Grota et al., 2021). The first usage of the term "nurse-surgeon" dates back to the early 1600s when King Henry VIII appointed a private nurse-surgeon named William Bullein (Duffin, 2017). The earliest known contemporary use of the term "nurse-surgeon" that describes nurses who perform surgeries independently was in the 1950s when a group of nurse-surgeons performed obstetric and gynaecological surgeries in Zaire, the predecessor of the Democratic Republic of Congo (White et al., 1987). Three decades later, two American physicians developed a proposal to train current registered nurses as Certified Registered Nurse Surgeons to undertake surgeries under a surgeon's written order (Litt & Brodsky, 1983). Nurses advocated for this proposal in 1985 (Judy, 1985).

"Nurse-surgeons" recognition and use steadily increased globally into the 21st century. From early 2000s onwards, "nurse-surgeons" performed major and minor general, vascular, orthopaedic, ophthalmological, urological, colorectal, obstetric and gynaecological surgeries (Kingsnorth, 2005; Kowalewski & Jahn, 2001; Marsh, 2005; Zorn, 2005). By 2009, nurse-surgeons have been recognized in the United Kingdom as duly qualified non-physician surgeons who can safely practice surgery (Mickute, 2009). "Nurse-surgeon" practice continued to increase over the past decade as they performed caesarean section, laparotomy, appendicectomy, herniorrhaphy, endoscopy, hysteroscopy, cystoscopy, biopsy and carpal tunnel release (Eddy & Duffy, 2019; Grota et al., 2021; Judd, 2013; Wise, 2021). Today, the practice of nurse-surgeons is widespread, with report practice in Europe, Oceania, Africa, Asia and North America (Grota et al., 2021; Kowalewski & Jahn, 2001; Zorn, 2005).

The inception of the modern "nurse-surgeons" may be ascribed to Task Shifting (World Health Organization, 2008). However, evidence suggests that nurse-surgeons precede Task Shifting by at least 60 years with the independent performance of caesarean sections and hysterectomies by African nurses in the 1950s (White et al., 1987). Regardless, the establishment of Task Shifting to improve surgical outcomes from 2008 onwards, and the training of nurses to perform obstetric surgeries in the 1950s were formulated from similar reasons – supply and demand. The desperate need of the health systems laid the foundation for the innovation of surgical capacity (supply) to meet surgical demands (Bath et al., 2019; World Health Organization, 2014). Similar with how nurse-surgeons were incepted in low- and lower-middle income countries, nurse-surgeons in high-income countries also emerged from supply and demand challenges (Grota et al., 2022). The provision of surgical services required innovation to meet ballooning surgical demands and achieve positive surgical outcomes amidst the ageing healthcare population (OECD iLibrary, 2019), the restrictions to ensure that junior physicians do not work unsafe hours (Abraham et al., 2016;

Philibert et al., 2002), and the uneven distribution of surgeons in rural and urban settings (Phillips, 2022).

Globally, nurse-surgeons have reduced surgical waiting times, improved patient access to surgery and prevented deaths from surgically treatable illnesses (Grota et al., 2021; Grota et al., 2022). The contributions of nurse-surgeons have been invaluable in decreasing the unnecessary treatment delays in various surgical specialties (Johal & Dodd, 2017; Joseph et al., 2015; Salibian et al., 2016). Grota et al. (2022) further confirmed the categorically positive global impact of nurse-surgeons in surgical outcomes particularly in emergency surgeries, diagnostic surgeries, minor surgeries and rural health. Therefore, considering the potential of nurse-surgeons in easing the surgical burden globally, initial mapping and scoping of the roles of this group of advanced practice nurses is necessary in the hopes of formally regulating their credentialing pathway and clinical practice. To the author's best knowledge, there is no known scoping review that explored the roles of nurse-surgeons as one category of advanced practice nurses in the provision of surgical care worldwide.

2 | THE REVIEW

2.1 | Aim(s)

The aim of this scoping review was to identify the roles of nurse-surgeons in the provision of surgical care.

3 | METHODS/METHODOLOGY

3.1 | Design

The authors' decision to conduct a scoping review was based on the JBI guidance for scoping reviews specifying the appropriateness of using scoping reviews to clarify a concept or body of literature exhibiting heterogeneity that is inapplicable to a more clear-cut systematic review (Peters et al., 2020; Peters et al., 2021). Heterogeneity of nurse-surgeon practice as a concept is therefore exhibited by the absence of a scoping review that examines nurse-surgeons as one category of advanced practice nurses. As there was limited literature focusing on the roles of nurse-surgeons in surgical care, a broad definition of "surgery" by the World Health Organization (Debas et al., 2006) was adopted which encompasses all service providers performing invasive surgical procedures independently regardless of surgical specialty and setting. This scoping review was registered on Open Science Framework and is accessible at https://doi.org/10.17605/OSF.IO/SJ2WU.

3.2 | Search methods

A search strategy was developed by the four authors (TG, VB, AB and EJ) which involved a combination of MeSH Headings, keywords and filters for each database (Appendix S1). The data sources were CINAHL, Cochrane Library, Scopus, PubMed and hand searching. Hand searching in scoping reviews involves manually identifying relevant studies and documents by systematically searching through sources beyond electronic databases (Arksey & OMalley, 2005). During database searching, peer-reviewed studies and reviews were searched. During hand searching, grey literature, government documents, organizational reports, white papers, evaluations, news articles, blogs, theses, text and opinion pieces, letters and editorials were searched. The searched articles were imported to Covidence®, a software-as-a-service platform for managing reviews (Covidence, 2022). Covidence® was also the tool that automatically detected any duplicate studies. One author (TG) conducted the initial title-abstract screening. Immediately prior to full text review, another layer of screening was conducted by one author (TG) to ensure that the articles fit the World Health Organization definition of surgery, which was an eligibility criterion of this review. Following screening, two of four authors (TG, VB, AB and EJ) reviewed the full text of the studies. Conflicts were resolved by discussion or via a third reviewer (one of VB, AB, EJ) where necessary.

3.3 | Inclusion and/or exclusion criteria

The Population, Concept, Context framework from the Updated JBI Guidance for Scoping Reviews (Peters et al., 2021) was adopted to develop the eligibility criteria for this scoping review (Table 1). The Population was patients undergoing surgery. The Concepts were nurse-surgeons and surgery. Nurse-surgeon definition is any nurse performing surgeries independently (Grota et al., 2022; White et al., 1987). Surgery as defined by the World Health Organization is any invasive procedures performed under aseptic technique and usually with anaesthesia by surgical providers such as physicians, nurses and other non-physicians to diagnose and/or treat surgical conditions (Debas et al., 2006). The Contexts were any health area in which surgery was performed including the perioperative department, operating room, medical centre, community clinic and nurse-led surgical service/clinic. Studies that were published in non-English language were excluded. No date restrictions were applied in the searches. Any surgical assisting roles where nurses do not perform surgeries independently were also excluded. As recommended by the JBI guidance on scoping reviews (Peters et al., 2021) and the PRISMA-ScR checklist (Tricco et al., 2018), published and unpublished articles were included.

3.4 | Search outcome

Eight thousand four hundred eighty-two references were identified from database and manual hand searches ($n = 8482$). Automated deduplication found 942 duplicates and manual deduplication found one duplicate which were removed, leaving 7539 references for title

TABLE 1 Eligibility criteria for the scoping review.

Inclusion criteria	Exclusion criteria
Population	Surgical assisting roles
Patients undergoing surgery	Non-nurse roles
Concept	
Nurse-surgeon	
Surgery (as per WHO definition)	
Context	
Any area in which surgery is performed, including perioperative department, operating room, operating theatre, day surgery unit, day procedure unit, endoscopy unit, hospital, medical centre, health service, practice, outpatient clinic, community clinic, catheterization laboratory or interventional, radiology and nurse-led surgical service/clinic	
English language	
Primary research papers	
Qualitative study, quantitative study, mixed-methods study, dissertation study	
Reviews	
Systematic review, scoping review, rapid review, narrative review, meta-analysis	
Non-research papers	
Editorial, letter, text, opinion, grey literature	
Government document, organizational report, white paper, evaluation	

and abstract screening. After title-abstract screening, 7394 references were excluded. One hundred forty-five records were assessed as eligible for full-text review. Following full text review, 49 records were excluded and 96 records were included for data extraction (see Figure 1).

3.5 | Quality appraisal

Quality appraisal was not undertaken as this was deemed unnecessary due to the study's aims/scope being exploratory only.

3.6 | Data abstraction

Following identification of the 96 included records, the relevant data from each record were extracted onto a data extraction form that was consensually approved by the four authors (TG, VB, AB and EJ) and created by one author (TG) in Covidence® (2022). Data abstraction for each record, also referred to as data charting in scoping reviews (Peters et al., 2021) was completed by two of four authors (TG, VB, AB and EJ) in Covidence® (2022). Disagreements were resolved by discussion, or a third reviewer (one of VB, AB, EJ) where necessary. Using the data extraction form, the 96 included records were extracted for the following data: title, author/s; publication year; DOI; country; study design; aim; start and end dates; population description; inclusion and exclusion criteria; method of participant recruitment; total number of participants; nurse-surgeon title; surgery performed by nurse; surgical specialty; number of surgeries performed by nurse; findings; funding sources; peer review; and conflict of interest (see Appendix S2).

3.7 | Synthesis

The completed data extraction form was exported by one author (TG) from Covidence® (2022) as a comma-separated values file and converted into an excel spreadsheet where data analysis occurred. The data obtained from this scoping review utilized a descriptive data analysis approach as the JBI guidance (Peters et al., 2021) noted that scoping reviews do not generally synthesize the results or outcomes of the included records and the data analysis of the extracted data should only involve basic descriptive analysis. One author (TG) analysed the final extracted data from the 96 included records via the Excel-converted spreadsheet which was then evaluated collectively by the three remaining authors (VB, AB and EJ) during the extraction and analysis stages of this scoping review.

4 | RESULTS

The presentation of the results of this scoping review was based on the JBI Manual for Evidence Synthesis (Peters et al., 2021) and PRISMA 2020 statement (Page et al., 2021).

4.1 | Descriptive findings

A total of 96 records were included in this scoping review (see Table 2). Forty-eight (50%) were primary research studies which included descriptive studies, non-randomized controlled trials, mixed methods studies, randomized controlled trials and a qualitative study. The other 48 (50%) did not describe primary research studies which included texts and opinions, reviews, discussion papers, editorials, reports and one news article. Fifty-three (55%) of the total records were published from 2011 to 2022, 38 (40%) from 1991 to 2010, and five (5%) from 1974 to 1990. The included records were conducted in 26 countries from Australia, Belgium, Burkina Faso, Canada, Comoros Islands, Congo, Ghana, Hong Kong, India, Ireland, Kenya, Korea, Malawi, Mozambique, Netherlands, New Zealand, Nigeria, Rwanda, South Africa, Sudan, Thailand, Uganda, United Kingdom, United States, Zambia and Zimbabwe. The majority of the included records were from Africa ($n = 14$) (54%) followed by Asia ($n = 4$) (15%), Europe ($n = 4$) (15%), North America ($n = 2$) (8%) and Oceania ($n = 2$) (8%). A world map of the countries where nurse-surgeons practice and the World Bank (2022) income classification of these countries are depicted in Figure 2.

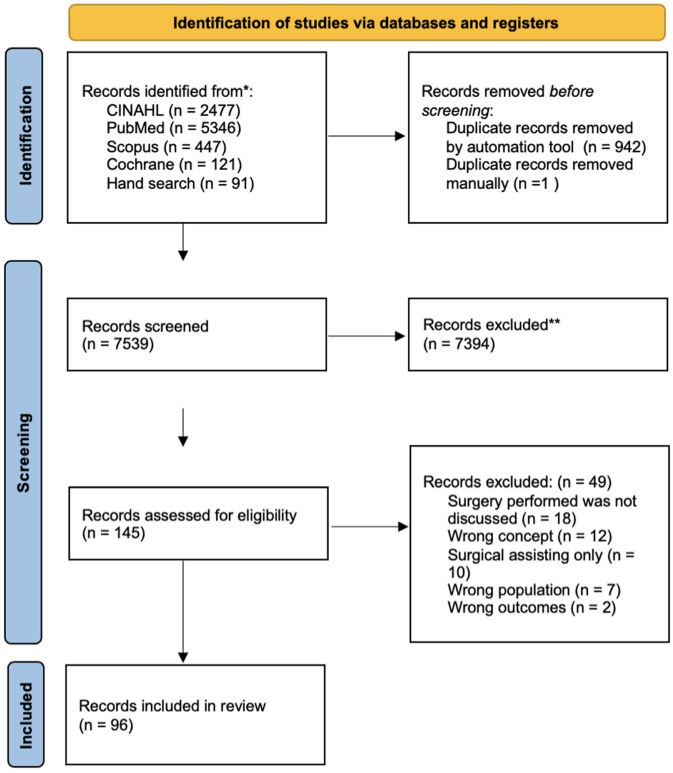


FIGURE 1 PRIMSA 2020 flow diagram (Page et al., 2021).

4.2 | Nurse-surgeon titles

There were 41 nurse-surgeon titles mentioned in the 96 included records (see Table 3). Titles mentioned at least twice were nurse practitioner, nurse endoscopist, nurse, surgical care practitioner, nurse-surgeon, advanced nurse practitioner, clinical nurse specialist, nurse cystoscopist, acute care nurse practitioner, advanced practice provider, non-physician, nurse-midwife, registered nurse, registered nurse first assistant and surgical first assistant (see Table 3). There were other unique nurse-surgeon titles that were mentioned in one or two records such as mid-level provider, nurse consultant, rural nurse specialist, nurse hysteroscopist and non-physician endoscopist (see Table 3 for the full list).

4.3 | Surgeries performed by nurse-surgeons

One hundred different types of surgeries in 24 surgical specialties and subspecialties were performed by nurse-surgeons in the included records (see Table 3). The surgical specialties were plastic surgery, general surgery, obstetrics, gynaecology, orthopaedics, dermatology, gastroenterology, pulmonology, urogynaecology, otorhinolaryngology, urology, oculo-plastics, ophthalmology, interventional radiology, vascular surgery, cardiothoracic, trauma, dental, neurosurgery, reconstructive surgery, paediatric surgery, maxillofacial surgery, paediatric otolaryngology and primary care.

Forty-six records (48%) reported a total of 5,684,198 surgeries performed by nurse-surgeons (see Table 3). This figure did not include the number of surgeries performed by nurse-surgeons in Zhang et al. (2018) and Abdullah et al., 2011 studies. Zhang et al. (2018) provided the total number of surgeries performed by Advanced Practice Professionals, the collective title that the study used for nurse practitioners and physician assistants. It was unclear how many of the 2.69 million surgeries in 2012 and 4.54 million surgeries in 2015 were performed by nurse-surgeons. (Abdullah et al., 2011) reported two different figures whereby the hospital administrator reported 4896 nurse-performed surgeries while only 2335 nurse-performed surgeries were documented on the surgical logbooks.

The surgeries that were mentioned at least thrice in the included records were biopsy, flexible sigmoidoscopy, colonoscopy, diagnostic or therapeutic excision, endoscopy, flexible cystoscopy, hernia repair, vein stripping, curettage, polypectomy, circumcision, incision and drainage of abscess, debridement, caesarean section, skin

TABLE 2 Published record descriptions.

Author	Title	Year	Country	Design
Abdullah et al.	Assessment of surgical and obstetrical care at 10 district hospitals in Ghana using on-site interviews	2010	Ghana	Quantitative descriptive
Abraham	Changing faces within the perioperative workforce: New, advanced and extended roles	2019	United Kingdom	Review
Abraham et al.	Development and implementation of non-medical practitioners in acute care	2016	United Kingdom	Review
Adamson et al.	Geographic Distribution of Nonphysician Clinicians Who Independently Billed Medicare for Common Dermatologic Services in 2014.	2018	United States	Retrospective review
Basnyat et al.	Nurse-led direct access endoscopy clinics: the future?	2001	United Kingdom	Quantitative descriptive
Beck	Nurse endoscopist skills training programme within a national health workforce innovation and reform project.	2013	Australia	Report
Brotherstone et al.	Uptake of population-based flexible sigmoidoscopy screening for colorectal cancer: a nurse-led feasibility study	2007	United Kingdom	Quantitative descriptive
Bull et al.	Upper gastrointestinal endoscopy training: a retrospective audit of the first 210 examinations performed by an Advanced Practice Nurse (APN) at a metropolitan hospital in South Australia	2006	Australia	Quantitative descriptive
Butler, Schultz & Drennan	Substitution of nurses for physicians in the hospital setting for patient, process of care, and economic outcomes	2020	Ireland	Review
Cera et al.	Defining the Role of the Urogynecology Nurse Practitioner: A Call to Contemporary Distinction through Subspecialty Certification.	2021	United States	Quantitative descriptive
Coldiron & Ratnarathorn	Scope of physician procedures independently billed by mid-level providers in the office setting.	2014	United States	Quantitative descriptive
Comola	A Nurse Practitioner's Experience in a Post-Graduate Nurse Practitioner Urology Fellowship.	2014	United States	Government / organizational report
Cooper	Introducing an ANP-led temporal artery biopsy service for patients with suspected giant cell arteritis.	2021	United Kingdom	Text and opinion
Cusack et al.	Evaluating nurse endoscopist advanced practice roles in a South Australia metropolitan health service	2018	Australia	Mixed methods
Davis et al.	The Role of Nurses and Midwives in Expanding and Sustaining Voluntary Medical Male Circumcision Services for HIV Prevention: A Systematic and Policy Review	2021	Kenya, Uganda, Rwanda, Mozambique, Zambia, Zimbabwe, Malawi	Review
Day et al.	Non-physician performance of lower and upper endoscopy: a systematic review and meta-analysis	2014	United States, United Kingdom, Canada, Netherlands, Hong Kong	Review
De Bruijn-Geraets et al.	National mixed methods evaluation of the effects of removing legal barriers to full practice authority of Dutch nurse practitioners and physician assistants	2018	Netherlands, Belgium	Mixed methods
Dimond	When the nurse wields the scalpel	1995	United Kingdom	Editorial
Dryer	Interventional radiology: new roles for nurse practitioners	2006	United States	Editorial
Duffield et al.	Nurse-Performed Endoscopy: Implications for the Nursing Profession in Australia	2017	Australia	Discussion paper
Duncan et al.	Introduction of the Nurse Endoscopist Role in One Australian Health Service	2017	Australia	Quantitative descriptive

(Continues)

TABLE 2 (Continued)

Author	Title	Year	Country	Design
Duthie et al.	A UK training programme for nurse practitioner flexible sigmoidoscopy and a prospective evaluation of the practice of the first UK nurse flexible sigmoidoscopist	1998	United Kingdom	Quantitative descriptive
Eddy & Duffy	A study of the skills, education, and qualifications of nurses performing dermatological surgery in the United Kingdom	2019	United Kingdom	Quantitative descriptive
Fitzgerald	Rural nurse specialists: clinical practice and the politics of care	2008	New Zealand	Text and opinion
Fox, Schira & Wadlund	The pioneer spirit in perioperative advanced practice--two practice examples	2000	United States	Text and opinion
Ge et al.	Advanced Practice Providers Utilization Trends in Otolaryngology From 2012 to 2017 in the Medicare Population	2021	United States	Quantitative descriptive
Gifford & Stone	Quality, access, and clinical issues in a nurse practitioner colposcopy outreach programme	1993	United States	Quantitative descriptive
Gilani et al.	The safety and feasibility of large volume paracentesis performed by an experienced nurse practitioner	2009	United States	Quantitative descriptive
Giramonti & Kogan	Paediatric penile surgery by a nurse practitioner in the operating room	2018	United States	Quantitative descriptive
Godsell	Dermatology. The development of a nurse biopsy role.	2005	United Kingdom	Discussion paper
Goodfellow, Fretwell & Simms	Nurse endoscopy in a district general hospital	2003	United Kingdom	Quantitative descriptive
Grota et al.	Current methods of nurse-surgeon training and education: Systematic review	2021	Australia	Review
Hallquist	Developments in the RN first assistant role during the Korean War	2005	Korea	Discussion paper
Hickey & Cooper	Varicose vein surgery performed by a surgical care practitioner	2009	United Kingdom	Text and opinion
Hillier	The advanced practice nurse in gastroenterology. Identifying and comparing care interactions of nurse practitioners and clinical nurse specialists	2001	United States	Quantitative descriptive
Hilton	Apps: Urology's new normal.	2018	United States	Text and opinion
Hlozek & Zacharias	The RN first assistant's role during inferior epigastric artery harvesting	1997	United States	Text and opinion
Hlozek, Zacharias & Mizener	RN first assistants expand their perioperative role	1998	United States	Text and opinion
Hough	Advanced role in colorectal screening.	2012	Ireland	Text and opinion
Hui et al.	Comparison of colonoscopic performance between medical and nurse endoscopists: a non-inferiority randomized controlled study in Asia	2015	Hong Kong	Quantitative RCT
Jalloh et al.	Credentialing and Privileging of Acute Care Nurse Practitioners to Do Invasive Procedures: A state-wide Survey	2016	United States	Quantitative descriptive
Johal & Dodd	Physician extenders on surgical services: A systematic review	2017	Canada	Review
Johnston	The National Nurse Endoscopist Project.	2008	United Kingdom	Report
Judd	Identifying ways to improve the health pathway of a child with a musculoskeletal problem: A comparison of practice of midlevel providers in the United States of America (USA) and the United Kingdom (UK)	2013	United Kingdom & United States	Review
Kanchanasinith et al.	Postpartum Sterilization by Nurse-Midwives in Thailand	1990	Thailand	Quantitative descriptive
Kingsnorth	General Surgery	2005	United Kingdom	Quantitative descriptive

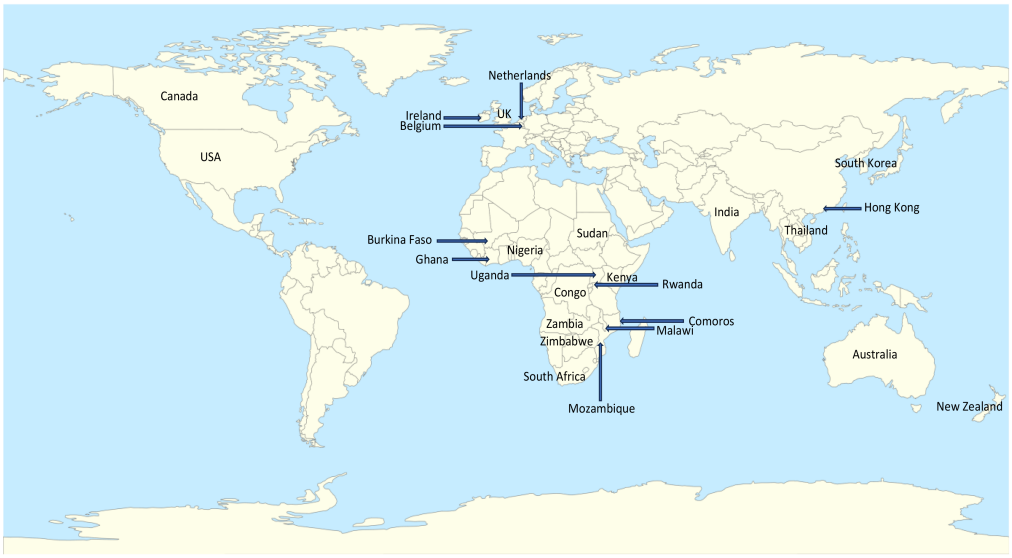
TABLE 2 (Continued)

Author	Title	Year	Country	Design
Koetsawang et al.	Postpartum sterilization by operating-room nurses in Thailand	1981	Thailand	Quantitative descriptive
Kowalewski & Jahn	Health professionals for maternity serrvices: experiences on covering the population with quality maternity care	2001	Burkina Faso, Congo	Review
Laing	Minor surgery: an extended role for ophthalmic nurses in the United Kingdom	1999	United Kingdom	Discussion paper
Lane & Minns	Empowering advanced practitioners to set up nurse led clinics for improved outpatient care	2010	United Kingdom	Text and opinion
Limoges-Gonzalez	Opening doors for nonphysician colonoscopists	2012	United Kingdom, United States	Text and opinion
Lucas	The learning curve of a surgical care practitioner performing local anaesthetic transperineal prostate biopsies: Cancer rate detection and complications	2020	United Kingdom	Quantitative descriptive
Marsh	Nurse-surgeons: New arrivals on the healthcare platform face a welcome - and controversy	2005	United Kingdom	Text and opinion
Maruthachalam et al.	Nurse led flexible sigmoidoscopy in primary care--the first 1000 patients	2006	United Kingdom	Quantitative descriptive
Massl et al.	Comparing quality, safety, and costs of colonoscopies performed by nurse versus physician trainees	2014	Netherlands	Quantitative descriptive
Mcconkey & Hahessy	Developing the advanced nursing practice role in non‚Äêmuscle invasive bladder cancer surveillance in Ireland.	2018	Ireland	Text and opinion
Mcconkey et al.	Development of an advanced nurse practitioner led bladder cancer surveillance service in Ireland: Preliminary audit results	2019	Ireland	Conference abstract
Meenan et al.	Training in radial EUS: what is the best approach and is there a role for the nurse endoscopist?	2003	United Kingdom	Quantitative descriptive
Melleney & Willoughby	Audit of a nurse endoscopist based one stop dyspepsia clinic	2002	United Kingdom	Quantitative descriptive
Meo et al.	Rural surgery in southern Sudan	2006	Sudan	Text and opinion
Mickute	Surgical training: what has changed?	2009	United Kingdom	Text and opinion
Moshakis, Ruban & Wood	Role of the nurse endoscopist in colorectal practice	1996	United Kingdom	Quantitative descriptive
O'Rourke	The orthopaedic nurse practitioner: Breaking tradition to fill gaps in care delivery through varied scopes of practice	2022	Australia	Review
Oliver	Meet the nurse who will soon perform surgery on patients alone	2017	United Kingdom	News article
Patel & Nguyen	Characterization of Biopsies by Dermatologists and Nonphysician Providers in the Medicare Population: A Rapidly Changing Landscape	2021	United States	Quantitative descriptive
Pearce	Operation in hand	2013	United Kingdom	Editorial
Pervaiz et al.	Office hysteroscopic morcellation service: Evaluation of women experience and factors affecting satisfaction	2021	United Kingdom	Quantitative descriptive
Puzey	A look at the life of an upper gastrointestinal nurse endoscopist	2013	United Kingdom	Text and opinion
Quick	The role of the surgical care practitioner within the surgical team	2013	United Kingdom	Qualitative
Quick	From novice to expert: a surgical care practitioner's reflection on their role development	2016	United Kingdom	Discussion paper
Ranjan et al.	Primary treatment of female urethral stricture by nurses leads to improved outcomes.	2016	India	Review

(Continues)

TABLE 2 (Continued)

Author	Title	Year	Country	Design
Rich et al.	Defining the role of advanced care practitioners in paediatric surgery practice	2021	United States	Quantitative descriptive
Salibian et al.	The National Ambulatory Medical Care Survey: pas and nps in outpatient surgery	2016	United States	Quantitative descriptive
Sapre et al.	Nurse-led flexible cystoscopy in Australia: initial experience and early results	2012	Australia	Quantitative descriptive
Satyapan et al.	Postpartum Tubal Ligation by Nurse-Midwives in Thailand: A Field Trial	1983	Thailand	Quantitative non-RCT
Schoenfeld et al.	Accuracy of polyp detection by gastroenterologists and nurse endoscopists during flexible sigmoidoscopy: a randomized trial	1999	United States	Quantitative RCT
Schultz	Practical and Legal Implications of Nurse Practitioners and Physician Assistants in Cystoscopy.	2011	United States	Text and opinion
Schwegel et al.	Meeting the evolving demands of neurointervention: Implementation and utilization of nurse practitioner	2019	United States	Narrative review
Shegafi et al.	Two decades on - cardiothoracic surgical care practitioners in the UK: a narrative review	2020	United Kingdom	Review
Shum et al.	A comprehensive training programme for nurse endoscopist performing flexible sigmoidoscopy in Hong Kong	2010	Hong Kong	Quantitative descriptive
Simcock et al.	A safety audit of the first 10,000 intravitreal ranibizumab injections performed by nurse practitioners	2014	United Kingdom	Quantitative descriptive
Sprout	Nurse endoscopist training: the next step	2000	United States	Text and opinion
Taylor et al.	The role of the nurse practitioner in interventional radiology	2012	United States	Review
Thommasen et al.	Cervical cancer screening performed by a nurse. Evaluation in family practice	1996	Canada	Quantitative descriptive
Tingle et al.	Performance and learning curve of a surgical care practitioner in completing hip aspirations	2016	United Kingdom	Quantitative non-RCT
Turner & Aslet	Nurse practitioner-led prostate biopsy in the United Kingdom	2011	United Kingdom	Review
Turner & Pati	Nurse practitioner led prostate biopsy: an audit to determine effectiveness and safety for patients.	2010	United Kingdom	Quantitative descriptive
Van Putten et al.	Nurse endoscopists perform colonoscopies according to the international standard and with high patient satisfaction	2012	Netherlands	Quantitative descriptive
Weinstein & Demers	Rural nurse practitioner clinic: the public's response	1974	United States	Quantitative non-RCT
Weiss et al.	Complications of circumcision in male neonates, infants and children: a systematic review	2010	Nigeria, United Kingdom, Comoros Islands, South Africa	Review
White, Thorpe & Maine	Emergency obstetric surgery performed by nurses in Zaire	1987	Congo (formerly Zaire)	Quantitative descriptive
Wildi et al.	Accuracy of esophagoscopy performed by a non-physician endoscopist with a 4-mm diameter battery-powered endoscope	2003	United States	Quantitative non-RCT
Williams et al.	Experience with implementation of a nurse practitioner-led newborn circumcision clinic	2020	United States	Mixed methods
Wise	The BMJ Awards 2021: Dermatology team of the year	2021	United Kingdom	Text and opinion
Wright	A description of the gastroenterology nurse endoscopist role in the United States	2000	United States	Quantitative descriptive
Zhang et al.	Trends and Scope of Dermatology Procedures Billed by Advanced Practice Professionals From 2012 Through 2015.	2018	United States	Quantitative descriptive



High-income countries*	Upper-middle-income countries*	Low- and lower-middle income countries*
Australia	South Africa	Burkina Faso
Belgium	Thailand	Comoros
Canada		Congo
Hong Kong		Ghana
Ireland		India
Netherlands		Kenya
New Zealand		Malawi
South Korea		Mozambique
UK		Nigeria
USA		Rwanda
		Sudan
		Uganda
		Zambia
		Zimbabwe

* Based on World Bank (2022) data

FIGURE 2 Countries where nurse-surgeons practice.

grafting, tubal ligation, minor, intermediate and complex repair, avulsion, dilation, aspiration, wound closure, carpal tunnel surgery, ureteric stent removal, saphenofemoral disconnection, sclerotherapy, episiotomy, fracture manipulation, esophagogastroduodenoscopy, paracentesis, pap smear, interventional radiology, neurostimulation, and destruction of benign, premalignant and malignant lesions. A multitude of varied surgeries were identified in one or two records such as laparotomy, hysterectomy, vasectomy, harvesting of artery, harvesting of skin grafts, organ resection, appendicectomy, flap reconstruction, local flap, reverse circumcision and tooth extraction (see Table 3 for the full list).

4.4 | Patient safety and complication rates

Patient safety was reported in 12 (13%) records (Davis et al., 2021; Day et al., 2014; Hickey & Cooper, 2009; Goodfellow et al., 2003; (Hough et al., 2012); Koetsawang et al., 1981; Maruthachalam

TABLE 3 Nurse-surgeon titles, types of surgeries, numbers and specialty areas.

Author	Nurse-surgeon title	Surgeries performed by nurse-surgeon	Number of surgeries performed by nurse-surgeons	Surgical specialty	Findings
Abdullah et al.	Midwives; nurse anaesthetists; theatre nurses	Suturing (including episiotomies), Diagnostic or therapeutic excisions (e.g. lipoma removal, ganglion excision), Other minor procedures (e.g. removal of foreign body), Incision and drainage of abscess, Wound debridement/management, Other minor gynaecological procedures (manual placenta removal, Norplant removal), Cervical cerclage, casting of fractures	4896 according to the hospital administrator, 2335 based on the surgical logbooks	Plastics, general, gynaecology, orthopaedics	Surgical and obstetrical care providers consisted of Medical Officers (8.5%), nurse anaesthetists (6%), theatre nurses (33%), mid-wives (50.7%) and others (4.5%). Major surgical cases represented 37% of overall case volumes with caesarean section as the most common type of major surgical procedure performed. The most common minor surgical procedures performed were suturing of lacerations or episiotomies
Abraham	Surgical care practitioner	Surgical care practitioners undertake some surgical operative procedures autonomously	Not stated	Not listed	Brief overview of new, advanced and extended practitioner roles in the perioperative environment.
Abraham et al.	Surgical care practitioner; surgical first assistant	Surgical interventions, investigations including radiology, catheterization	Not listed	Not listed	Not a primary research study
Adamson et al.	Nurse Practitioners	Destruction premalignant lesion, biopsy, repair, flaps, grafts, destruction of benign lesion, destruction of malignant lesion, malignant excision, benign excision	956, 944	Dermatology	The 938,147 unique clinicians billed Medicare in 2014. Of that number, 10,957 (1.2%) were dermatologists, 68,420 (7.3%) were Nurse Practitioners and 49,270 (5.3%) were Physician Assistants.
Basnyat et al.	Nurse-endoscopist	Proctoscopy, flexible sigmoidoscopy, biopsy	706	Gastroenterology	Ninety-nine percent of the 249 patients were satisfied with the nurse-practitioner performing the surgery. Of the 706 patients undergoing full sigmoidoscopic and proctoscopic examination by the nurse-endoscopist, a cause for bleeding was identified in more than 90% of the cases. The nurse-led service cost was $81 per patient whereas a consultant-led new outpatient department referral cost $112 and a further $59 for follow-up visits – a saving of $90 per patient.
Beck	Nurse-endoscopist	Colonoscopy	Not stated	Gastroenterology	Not applicable
Brotherstone et al.	Experienced nurse	Flexible sigmoidoscopy	280	Gastroenterology	Of the 510 people invited to attend, 280 (55%) underwent FS. Among non-attenders, 91 (18%) were ineligible for screening or did not receive the invitation, 19 (4%) accepted the offer of screening but were unable to attend during the study period, 52 (10%) declined the offer, 41 (8%) did not respond to the invitation, and 27 (5%) accepted the offer of screening but did not attend. Attendance among those eligible to be screened, who had received the invitation, was 67%. People from more socioeconomically deprived neighbourhoods were less likely to attend (OR: 0.90; CI: 0.84–0.96. Women were more likely to attend than men (OR: 1.44; CI: 1.01–2.05).
Bull et al.	Advanced Practice Nurse Endoscopist Trainee	Upper gastrointestinal endoscopy, biopsy	210	Gastroenterology	The overall procedural success rate was 96.2%. The completion rate increased with experience. There were no deaths or procedural complications as a result of the endoscopic examinations performed or from percutaneous gastrostomy placement. No adverse events related to medications administered or unrelated diseases occurred.
Butler, Schultz & Drennan	Nurse	Colonoscopy, open carpal tunnel reduction, pleural procedures for pleural effusions	Not stated	Gastroenterology, plastics, pulmonology	Not a primary research study

TABLE 3 (Continued)

Author	Nurse-surgeon title	Surgeries performed by nurse-surgeon	Number of surgeries performed by nurse-surgeons	Surgical specialty	Findings
Cera et al.	Nurse Practitioner	Cystoscopy, Botox injection via cystoscopy, vulvar biopsy, endometrial biopsy	Not stated	Urogynecology	Fifty-five Nurse Practitioners completed the survey, representing a range of states and practice experience, as well as experienced and recent graduate Nurse Practitioners. The majority of participants (79.9%) support subspecialized certification, and the importance of a national certification examination was deemed as moderately, very, or extremely important by 70% of respondents. Most respondents work collaboratively with physician colleagues. Results also detail an initial overview of general women's health and role-specific urogynecology responsibilities and procedures needed to provide competent, comprehensive care.
Coldiron & Ratnarathorn	Nurse practitioner	Destruction of benign, premalignant and malignant lesions, arthrocentesis, injection, drainage, aspiration, biopsy, urogenital procedures, debridement, excision, removal of impacted cerumen, posterior tibial neurostimulation, incision and drainage, intermediate and complex repair (forehead, cheek, chin, mouth, neck, axillae, genitalia, hands, feet)	1,789,020	Dermatology, orthopaedics, plastics, ENT, urology	Nurse practitioners undertake many dermatological procedures independently. Concern regarding whether Nurse Practitioners are educated to diagnose and manage these conditions. No reporting of complications. Recommend a data collection for adverse outcomes.
Comola	Nurse Practitioner	Cystoscopy, stent removal, suprapubic catheter exchange, urethral dilation, vasectomy.	Not stated	Urology	Not a primary research study
Cooper	Advanced Nurse Practitioner	Temporal artery biopsy, harvesting skin grafts, harvesting dermis fat grafts, excision of lesions, diathermy and wound closure.	137	Oculoplastics, ophthalmology	Standard 1: timely undertaking of the biopsy procedure (within 14 days). No one individual patient breached the 14-day limit, a 100% success rate, compared to audits in 2012 (81%) and 2014/2015 (87%). Standard 2: the appropriate length of specimen was obtained (over 15 mm). The average length of specimen over the duration of the audit period was 13 mm, which is above the minimum national requirement of 10 mm, but falls short of the 15 mm expected from the standard set from the previous audit. Standard 3: complications associated with surgery. No significant complications in the 137 cases undertaken during this audit period were reported.
Cusack et al.	Advanced Practice Nurse Endoscopist	Colonoscopy, snare polypectomy	409	Gastroenterology	Full implementation of the project was achieved. The required number of colonoscopies for each APNE ($n = 200$) was met within the established timeframe of 12 months. Out of the original three Advanced Practice Nurse Endoscopists who commenced, two completed. Of the 409 procedures that were completed, the caecal intubation rate was 97.3%. The recommended target was a caecal intubation rate of 90% or greater. The mean colonoscopy withdrawal time was 15.8 min for all procedures. The Advanced Practice Nurse Endoscopist withdrawal time decreased by 6 min from 16.4 min in August 2017 to 10.4 min in June 2018. Data was not collected on the number of polyps retrieved per procedure. There were seven complications (1.7%), none of which were directly related to the Advanced Practice Nurse Endoscopists' actions. There was a 53% response rate to the consumer feedback survey ($n = 53$), with the majority of responses indicative a positive experience for patients and high levels of satisfaction. There were 35 responses to a staff survey. The staff survey indicated overall support for the introduction of this role. Cost Consequences: The main costs considered were for the training of each nurse and comprised three components: initial training, financial contribution to support the training development component at the hospital site, and interstate project support. For nurses who complete the training and continue in the Advanced Practice Nurse Endoscopist role, an additional 10,672 procedures could be performed over a 5-year period with an average training cost per additional procedure of $49 and would take 2.2 years to redeem all training costs.

TABLE 3 (Continued)

Author	Nurse-surgeon title	Surgeries performed by nurse-surgeon	Number of surgeries performed by nurse-surgeons	Surgical specialty	Findings
Davis et al.	Nurse, nonphysician	Male circumcision	Unable to determine	Urology	The preponderance of evidence on male circumcision performed by nonphysicians is that it is safe, both by the standards of the often-cited 2% moderate/severe AE rate threshold and compared with physicians. The noted exceptions to the overall safety equivalence between physician and nonphysician cadres support cautions around ensuring adequate mentorship for new providers as they develop experience. Voluntary medical male circumcision performed by nurses is safe, yet many countries have not yet aligned national nursing and midwifery regulations with national policies to provide clear authorization to perform male circumcision.
Day et al.	Nurse, nurse practitioner, non-physician, mid-level provider	Flexible sigmoidoscopy, upper endoscopy, colonoscopy,	Unable to determine	Gastroenterology	Non-physicians can safely perform endoscopic procedures with similar quality, especially with respect to screening flexible sigmoidoscopy. Far fewer data was reported for non-physicians performing colonoscopy and upper endoscopy, but among this data non-physicians perform both procedures within accepted national benchmarks for quality measures used in endoscopy.
De Bruijn-Geraets et al.	Nurse Practitioner	Endoscopy, injection, puncture, small surgical procedure	Not stated	Not stated	Quantitative data included 1251 Nurse Practitioners, 798 Physician Assistants and 504 physicians. The proportion of Nurse Practitioners and Physician Assistants performing reserved procedures increased from 77% to 85% and from 86% to 93%, respectively. The proportion of procedures performed on own authority increased from 63% to 76% for Nurse Practitioners and from 67% to 71% for Physician Assistants. The mean number of monthly contacts between Nurse Practitioner/Physician Assistant group and Physician group about procedures decreased (from 81 to 49 and from 107 to 54, respectively), as did the mean duration in minutes (from 9.9 to 8.6 and from 8.8 to 7.4, respectively). Utilization of Full Practice Authority was dependent on the setting, as scepticism of physicians and medical boards hampered full implementation. Legal cross-compliance requirements were mostly fulfilled.
Dimond	Nurse	Appendicectomy, vein stripping	Not stated	General	Not a primary research study
Dryer	Nurse Practitioner	Fistulogram, vascular access, venography, image-guided diagnostic vascular and interventional procedures, image-guided diagnostic procedures for treating disease	Not stated	Interventional radiology	Not a primary research study
Duffield et al.	Nurse endoscopist	Endoscopy, polyp removal, flexible sigmoidoscopy	1458	Gastroenterology	Not a primary research study
Duncan et al.	Nurse Endoscopist Trainee	Colonoscopy	255	Gastroenterology	The Nurse Endoscopist trainee completed 212 unassisted colonoscopies achieving an 83% success rate. Polyps were removed from 100 patients, and no complications were reported. 80% of patients reported no pain or discomfort during the procedure, 95% of patients reported the personal manner of the Nurse Endoscopist trainee as very good or excellent, 80% of patients rated the explanation and information given by the Nurse Endoscopist trainee at the start as very good or excellent, 68% of patients rated the Nurse Endoscopist trainee's knowledge about their problem and medical history as very good to excellent, and 70% of patients reported not being anxious during the procedure.

TABLE 3 (Continued)

Author	Nurse-surgeon title	Surgeries performed by nurse-surgeon	Number of surgeries performed by nurse-surgeons	Surgical specialty	Findings
Duthie et al.	Nurse Practitioner / Nurse Endoscopist	Flexible sigmoidoscopy	215	Gastroenterology	Two hundred fifteen patients have been examined independently by the nurse practitioner. 93% of the examinations were judged successful and pathology was identified in 51%. The nurse endoscopist successfully identified all significant pathology whereas barium enema failed to identify pathology in 12.5%. There were no complications.
Eddy & Duffy	Nurse surgeon, nurse consultant, skin care nurse specialist, surgical nurse practitioner, dermatology nurse specialist, dermatology staff nurse, practice nurse, clinical nurse specialist	Excision (head and neck, trunk and limb), incisional biopsy, shave excision, shave biopsy, curettage and cautery, punch biopsy	Not stated	Dermatology	Great disparity in training access, roles, pay and titles.
Fitzgerald	Rural nurse specialists	Invasive procedures by the nurse, such as suturing, x-rays, cervical smears	Not stated	Not stated	Not a primary research study
Fox, Schira & Wadlund	Acute care nurse practitioner	Endotracheal Intubation, inserting/removing chest tubes, inserting central/arterial intravenous lines, suturing, bronchoscopy, diagnostic peritoneal lavage, minor procedures, wound closure, excision of skin lesions, repair of minor lacerations, incision and drainage of simple abscesses	Not stated	General	The acute care nurse practitioner provides another pathway for perioperative nurses in advanced nurse practice.
Ge et al.	Advanced practice provider (note: the article combined Physician Assistants and Nurse Practitioners as one group)	Balloon sinus dilation, flexible laryngoscopy, diagnostic nasal endoscopy, epistis control, canalith repositioning, fine needle aspiration, pressure equalization tube placement, mastoid bowl debridement, ear microscopy, sinus debridement, stroboscopy, skin biopsy, cerumen removal.	Not stated	Otolaryngology	Increasing number of Nurse Practitioners and Physician Assistants working in the area assisting with supply and demand issues.
Gifford & Stone	Nurse practitioner	Colposcopy, Pap smears, Ectocervical biopsies, Endocervical curettages	593	Gynaecology	Only 18 of the 73 (3%) discrepancies required re-examination by the consulting gynaecologist before a treatment plan could be set. Taking the service to the patient's hometowns raised show-rates to the 90–100% level.
Gilani et al.	Nurse practitioner	Large Volume Paracentesis	245	General	No difference in complications between two group
Giramonti & Kogan	Nurse practitioner/ advanced practice practitioner	Circumcision, revision circumcision, minor endoscopic procedures (e.g. intravesical Botox injection)	100	Urology	Excellent success with a well-trained Nurse Practitioner performing minor penile procedures on children in the operating room was demonstrated. The operating room times for the circumcision for the Nurse Practitioner as compared to the surgeon with a resident were reviewed and found the times similar, 25 versus 27 min (with the caveat that the attending cases were slightly more complex).

TABLE 3 (Continued)

Author	Nurse-surgeon title	Surgeries performed by nurse-surgeon	Number of surgeries performed by nurse-surgeons	Surgical specialty	Findings
Godsell	Skin cancer nurse specialist	Skin biopsy	1500	Dermatology	Nurse biopsy role decreased waiting times. Structured framework developed for training.
Goodfellow, Fretwell & Simms	Colorectal nurse practitioner	Endoscopy, flexible sigmoidoscopy	282	Gastroenterology	Nurse endoscopy is safe and efficient
Grota et al.	Nurse-surgeon	Flexible sigmoidoscopy, colonoscopy, polypectomy, oesophageal banding, sclerotherapy, intravitreal therapy, saphenofemoral disconnection, long saphenous vein stripping, avulsions, wound closure, caesarean section, supracervical hysterectomy for ruptured uterus, dilatation and curettage., symphysiotomy, suction extraction and episiotomy, laparotomy, hernia repair	5450	Gastroenterology, ophthalmology, vascular, obstetric, gynaecological, and general surgery	A total of 18 studies was included in this review. Current methods of nurse-surgeon training were identified as surgical speciality specific ($n = 18$). Most training courses were at least 1 year in length ($n = 4$) with a theoretical component ($n = 15$). All studies included a practical requirement ($n = 18$), which was generally supervised by a physician ($n = 16$). A competency assessment was required by 15 programmes, with 9 (9) using a formative assessment approach.
Hallquist	Nurse	Organ resection	Not stated	General	Not a primary research study
Hickey & Cooper	Surgical Care Practitioner	Saphenofemoral disconnection and long saphenous vein stripping, varicose veins avulsions, groin dissections	434	Vascular	No difference in outcomes between consultant performed procedures and through by the SCP.
Hillier	Nurse Practitioner / Clinical Nurse Specialist	Flexible sigmoidoscopy, paracentesis	16	Gastroenterology, general	Procedures performed by the Advanced Practice Nurses are predominantly those associated with enteral feeding tubes (19%) and flexible sigmoidoscopy (30%). 80% of Clinical Nurse Specialists and 40% of Nurse Practitioners felt studies looking at outcomes of Advanced Practice Nurse care (e.g. length of stay, number of emergency room and hospital visits, level of patient satisfaction, client compliance and number of repeat visits, and telephone management) were the best measures of cost-effectiveness of Advanced Practice Nurses.
Hilton	Advanced practice provider, nurse practitioner	Bladder instillations, intracavernosal injections for erectile dysfunction, percutaneous tibial nerve stimulation, cystoscopy for stent removal, neuromodulation with InterStim programming, priapism injection treatment, urodynamics	Not stated	Urology	Not a primary research study
Hlozek & Zacharias	Registered nurse first assistant	Harvesting of inferior epigastric arteries	Not stated	Cardiothoracic	Registered Nurses s can take on increased responsibilities.
Hlozek, Zacharias & Mizener	Registered nurse first assistant	Harvesting of radial artery for coronary artery bypass surgery	297	Cardiothoracic	Registered Nurse First Assistant use saves money for the health service.
Hough	Advanced nurse practitioner	Sigmoidoscopy, Colonoscopy, upper endoscopy	3870	Gastroenterology	Advanced Nurse Practitioner can undertake procedures safely and is cost effective. There is a need for a national education programme.

TABLE 3 (Continued)

Author	Nurse-surgeon title	Surgeries performed by nurse-surgeon	Number of surgeries performed by nurse-surgeons	Surgical specialty	Findings
Hui et al.	Nurse endoscopist	Colonoscopy	364	Gastroenterology	Nurse Endoscopists had a higher adenoma detection rate per procedure, but the rate becomes significantly lower than that of medical endoscopists after adjusting for the longer withdrawal time. The complication rates of the nurse endoscopists were comparable with those of the medical endoscopists (9.3% vs. 9.0%). The relatively high complication rate in this study is due to the stringent reporting of even minor adverse events such as transient desaturation or hypotension after conscious sedation. The nurse endoscopists performed well in terms of patients' pain and satisfaction scores as over 98% of patients were willing to have a repeat colonoscopy by the same endoscopist. The nurse endoscopists had a high level of patient acceptance.
Jalloh et al.	Acute care nurse practitioners	Paracentesis, thoracentesis, bone marrow biopsy, thoracostomy, bronchoscopy	Not stated	General	Acute Care Nurse Practitioner privileging varies among institutions. The only commonality is that the medical staff offices oversee the credentialing and privileging process. Although an attending physician provided supervision and proctoring in most hospitals, the number of proctored procedures before they could practice independently was not standardized and varied by institution and the procedure performed.
Johal & Dodd	Nurse practitioners/ physician's assistant	Thoracostomy, percutaneous endoscopic gastrostomy, tracheotomy	Unable to determine	Trauma, general	With the addition of Nurse Practitioners and Physician Assistants, patient length of stay decreased, and morbidity and mortality were unchanged. In addition, resident workload decreased, sleep time increased, and operating time improved. Patient and healthcare worker satisfaction rates were high. Several studies reported cost savings after the addition of Nurse Practitioners and Physician Assistants. The addition of NPs and PAs to surgical/trauma services appears to be a safe, cost-effective method to manage some of the challenges arising because of resident duty hour restrictions. More high-quality research is needed to confirm these findings and to further assess their economic impact.
Johnston	Nurse endoscopist	Endoscopy	Not stated	Gastroenterology	Not a primary research study
Judd	Advanced nurse practitioner	Minor surgery, for example, toenail ablation, fracture manipulation	Not stated	Plastics	Not a primary research study
Kanchanasinith et al.	Nurse-midwife	Postpartum Sterilization	541	Gynaecology	A comparison of 541 procedures done by nurse- midwives and 279 performed by physicians show that the two provider groups do not differ significantly with respect to the rate of surgical difficulties (2.2% among physicians and 3.1%among nurse-midwives) or the rate of complications 1 year after the operation (3.9% among physicians and 4.4% among nurse-midwives). However, there were significant differences regarding counselling about the operation ($p < .05$), with nurse-midwives providing more complete information about the surgery than the physicians. The results of the study support the training of nurse-midwives to perform postpartum sterilization.
Kingsnorth	Nurse surgeon	Hernia surgery	Not stated	General	A clinical scoring system is useful in guiding trainees through hernia surgery.
Koetsawang et al.	Operating room nurse	Postpartum tubal sterilization	1074	Gynaecology	Equivalence of outcomes between nurses and surgeons
Kowalewski & Jahn	Registered nurse and midwife (paramedic staff)	Minor surgery, caesarean section, strangulated hernia	Not stated	Obstetrics, general surgery	Poor midwifery coverage in rural areas
Laing	Ophthalmic nurse	Incision and curetting of cysts of Moll, Removal of sebaceous cysts or cysts of Zeiss, Incision and curetting chalazions (meibomian or tarsal cysts), Excision of small skin tags or papilloma	Not stated	Ophthalmology	Waiting time for an assessment appointment after referral by a general practitioner has been reduced from approximately 6 months in 1992, to 8 weeks in 1998 allowing time for health promotion, health education and a holistic care approach.

TABLE 3 (Continued)

Author	Nurse-surgeon title	Surgeries performed by nurse-surgeon	Number of surgeries performed by nurse-surgeons	Surgical specialty	Findings
Lane & Minns	Advanced nurse practitioner	Prostate biopsy	Not stated	Urology	Advanced Nurse Practitioner outcomes equal to medical colleagues. There is a need for professional development opportunities for nurses.
Limoges-Gonzalez	Nurse Practitioner, nurse endoscopist	Sigmoidoscopy, colonoscopy,	Not stated	Gastroenterology	With training, nurse endoscopists are equivalent to physicians. There is large variation in American states as to if nurse practitioners are allowed to undertake colonoscopies within their scope of practice.
Lucas	Nurse, Surgical Care Practitioner	Trans-perineal prostate biopsies	55	Urology	This work has demonstrated that transperineal prostate biopsy under local anaesthesia can be safely adopted by allied healthcare professionals with no detriment to oncological outcomes or patient experience and with zero complications.
Marsh	Nurse-surgeon	Vein stripping from the leg for Coronary artery bypass grafting, minor surgeries	Not stated	Vascular, orthopaedics, ophthalmology, gynaecology	Reduced the average time for bilateral varicose vein surgery by 30 min in one hospital and in the other enabled a 2-week target for bladder cancer treatment to be met.
Maruthachalam et al.	Nurse endoscopist	Flexible sigmoidoscopy	1002	Gastroenterology	Our study reinforces the fact that flexible sigmoidoscopy can be safely performed in primary care. It is the first study from the UK to demonstrate that flexible sigmoidoscopy can be safely performed by a nurse endoscopist for lower gastrointestinal tract symptoms in primary care with adequate support and training. Investigating patients at the community flexible sigmoidoscopy clinic resulted in reduction of the waiting time to flexible sigmoidoscopy and the time to histological diagnosis of colorectal cancer. In addition the clinic was able to generate additional capacity for endoscopy in secondary care by routing the flexible sigmoidoscopy service to primary care.
Massl et al.	Nurse endoscopist	Colonoscopy, polypectomy	866	Gastroenterology	Comparable outcomes between nurses and physician assistants. Nurses less costly to employ.
McConkey & Hahessy	Advanced nurse practitioner, nurse cystoscopist	Flexible cystoscopy, bladder biopsy, diathermy, removal of ureteric stents	Not stated	Urology	Not a primary research study
McConkey et al.	Nurse cystoscopist, Candidate Advanced Nurse Practitioner (abbreviated as cANP)	Flexible cystoscopy	Unclear	Urology	Twenty consecutive records of patients attending the candidate Advanced Nurse Practitioner for surveillance of high-grade non-muscle invasive bladder cancer demonstrated a 90% compliance rate (two patients unable to void anappropriate sample). 100% of patients who received a prophylactic antibiotic had a documented valid reason for administration. The Candidate Advanced Nurse Practitioner completed (supervised) 57% of all cystoscopies without a perceivable increase in the average time to complete an entire episode of care (26:27 vs. 26:12 min, s).
Meenan et al.	Nurse Endoscopist	Radial endosonography	5	Gastroenterology	The role of the nurse endoscopist could be expanded to encompass diagnostic endoscopic ultrasound and so meet the increasing demand for it. In view of the lengthy and demanding nature of EUS training, such an approach might also prove to be an attractive option in the long term, as gastroenterology fellows are more likely to move on to other institutions, with a net loss of skills.

TABLE 3 (Continued)

Author	Nurse-surgeon title	Surgeries performed by nurse-surgeon	Number of surgeries performed by nurse-surgeons	Surgical specialty	Findings
Melleney & Willoughby	Nurse endoscopist	Upper gastrointestinal endoscopy	84	Gastroenterology	The provision of a nurse endoscopist has facilitated the creation of the one stop service and will be important in its evolution and refinement in the future. Although the one stop dyspepsia clinic in our hospital has not, to date, achieved its original intention in terms of the rapid detection of important pathology, it has allowed the development of an integrated diagnostic service involving specialist physicians and a skilled nurse endoscopist. The system is popular with patients and provides the basis for a fast-track system to assess patients at a single hospital visit.
Meo et al.	Nurse	Caesarean section, hernia repair (inguinal, Busoga, congenital, lumbar, femoral, epigastric, umbilical, Spigelian), proctologic surgery, gynaecologic surgery, Management of and fluid therapy for shock, Incision and drainage of abscesses and pyomyositis, Management of wounds, burns, surgical infections, snakebites, Excision of lipomas, sebaceous cysts, small skin tumours, onchocercal nodules, encysted guinea worms, Uterine curettage, Manual removal of the placenta, Suprapubic puncture of the bladder with a trocar for urinary retention, Immobilization of fractured limbs, Skin grafting, Tooth extraction	Not stated	General, obstetrics, gynaecology, plastics, dental	A total of 1642 patients (71% males, 30% under the age of 16) have undergone anoperation. Altogether, 1264 elective procedures (77%) and 378 emergency procedures (23%) were performed. Hernia surgery comprised the main workload, followed by proctologic and gynecologic operations. Most operations were performed under spinal anaesthesia. Other cases required ketamine, and a small number of patients had local anaesthesia. There were 14 fatal complications, most of them related to the delay in obtaining medical attention. Based on the training results, the Sudanese personnel of two of the five health centres involved in the programme are already fully autonomous. Two doctors and two nurses are proficient in essential surgery; two not qualified nurses are proficient in primary anaesthesia, and others are proficient in scrubbing and surgical nursing.
Mickute	Nurse surgeon, Nurse Practitioner	Gastroscopy, colonoscopy	Not stated	Gastroenterology	Not a primary research study
Moshakis, Ruban & Wood	Nurse endoscopist	Flexible sigmoidoscopy, clinical coloproctology, haemorrhoids injection	150	Gastroenterology	Nurse training was stricter than those of physician. Comparable results.
O'Rourke	Orthopaedic nurse practitioner	Reduce dislocations and fractures, administer fascia iliaca compartment blocks, wound closures, sutures, carpal tunnel decompression procedures, harvest anterior cruciate ligament grafts,	Not stated	Orthopaedics	Nurse Practitioners can be effectively implemented in the perioperative setting to provide holistic care for all patients requiring surgical management of musculoskeletal injuries and/or conditions.
Oliver	Surgical care practitioner	Facial skin cancer excisions, skin grafts and flap reconstructions	Not stated	Plastics	Not a primary research study

TABLE 3 (Continued)

Author	Nurse-surgeon title	Surgeries performed by nurse-surgeon	Number of surgeries performed by nurse-surgeons	Surgical specialty	Findings
Patel & Nguyen	Nurse Practitioner	Skin cancer biopsy	Unclear	Dermatology	All 50 states had increases in the number of biopsies claims per 100,000 Medicare beneficiaries by nonphysician providers between 2012 and 2018, with dermatologists having an average decline over the same period. From 2012 to 2018, national biopsy rates per 100,000 Medicare beneficiaries for dermatologists decreased by 6%, whereas those for Nurse Practitioners and Physician Assistants increased by 97% and 82%, respectively. Each state showed variation in both the proportion of biopsies by provider type and the net change in biopsies rates over time. All states saw increases in the number of biopsies per 100,000 Medicare beneficiaries by nonphysician providers.
Pearce	Nurse, Surgical assistant prior to training for this surgery	Carpal Tunnel Surgery	Not stated	Plastics	When the nurse first suggested that she could do carpal tunnel surgery, the consultants at Stepping Hill were entirely supportive. Most of the resistance to change came from nurses. After extensive training, the nurse is now able to offer a seamless service to patients, from assessment through to surgery and discharge.
Pervaiz et al.	Nurse Hysteroscopist	Hysteroscopic morcellation	287	Gynaecology	The trainee and the nurse specialist were more likely to use local anaesthesia (OR = 4.8, 95% CI = 1.1–21.5). There was no significant difference between operators as regards to the use of gas and air (OR = 1.6, 95% CI = 0.3–8.2) or combined anaesthesia (OR = 1.15, 95% CI = 0.2–6.5). The majority confirmed receiving adequate preoperative information by doctors and nurses (97.3%). Consultants were significantly less likely to use local anaesthesia when compared to the trainees and nurse specialist probably due to the higher experience and confidence. However, this has not affected women satisfaction which remained high irrespective of the operator. Results suggest that the subjective estimation of the polyp size by consultants and nurses specialized in hysteroscopy may be an accurate and simple method of measurement.
Puzey	Nurse endoscopist	Oesophageal manometry, flexible sigmoidoscopy, endoscopy	Not stated	Endoscopy	Nurse endoscopist was training to perform oesophageal manometry and flexible sigmoidoscopy at time of interview
Quick	Surgical Care Practitioner	Saphenofemoral junction ligation and disconnection, long saphenous vein strip and harvest, avulsion, multiple stab avulsions, ablation therapy, sclerotherapy, open inguinal hernia	Not stated	Urology, trauma, orthopaedics, cardiothoracic, plastics and reconstructive surgery, neurosurgery, paediatrics, general surgery, vascular, maxillofacial, otorhinolaryngology, gynaecology	*"As a novice SCP, I drew upon the national SCP curriculum to guide me in acquiring the core knowledge and clinical skills required to perform the role safely and effectively. Learning the specialist knowledge required of a vascular and general SCP allowed me to move into the advanced beginner stage as I started to develop my own portfolio of cases I could assist for and perform. Successfully completing a national SCP training programme supported my competence at this level".*

TABLE 3 (Continued)

Author	Nurse-surgeon title	Surgeries performed by nurse-surgeon	Number of surgeries performed by nurse-surgeons	Surgical specialty	Findings
Quick	Nurse, Surgical Care Practitioner	Inguinal hernia repair	Not stated	General surgery	The findings from this study identified that as a permanent member of the surgical team, the nurse made a difference to the experience of the surgical patient. As a knowledgeable team member, the addition of a Surgical Care Practitioner to the surgical team was seen by the surgeons to directly improve patient care by ensuring patient understanding and compliance. Additional finding suggested that including a nurse in the surgical team encouraged a cohesive approach that improved the patient experience. In particular, the findings from this study suggest that the addition of a nurse to a surgical team enhances patient care, maintains surgical services and supports the training of junior doctors. Additional findings suggest that nurses who undertake innovative roles adhere to the professional, ethical and legal obligations of advanced perioperative practice. Interprofessional collaboration was improved, as was service provision.
Ranjan et al.	Nurse specialist	Cystoscopy, urethral dilation, urethroscopy	Not stated	Urogynaecology	One hundred ninety patients have been treated at the cystoscopy and dilation clinic and are at various stages of follow up. We find that the primary treatment performed by nurses at the institute leads to improved outcomes.
Rich et al.	Advanced Care Practitioner (collective term for Nurse Practitioners and Physician Assistants)	Removal of ear/nasal foreign body, tongue tie lysis, nasopharyngoscopy, flexible laryngoscopy	Not reported	Paediatric otolaryngology	The current study demonstrated that most Advanced Care Practitioners are involved in procedures (93%) with 83% at the bedside, 77% in the clinic (both 62% without supervision), and 34% in the operating room. A large proportion of respondents feel that the presence of Advanced Care Practitioners has a positive effect on surgical trainees, both fellows and residents. Their use in paediatric surgery is widespread. While staffing models vary, Advanced Care Practitioners perform a wide variety of tasks, cover many shifts, and bill for services. Overall, paediatric surgeons are satisfied with their respective Advanced Care Practitioner coverage model but endorse potential benefits of increased shifts and responsibilities. It is largely felt they enhance the paediatric surgery trainee experience.
Salibian et al.	Nurse practitioner	Local excision or destruction of lesion or tissue, aspiration curettage of uterus, circumcision, vasectomy, irrigation of ear	2,894,406	General surgery, obstetrics, gynaecology, orthopaedics, urology, ophthalmology, otolaryngology	Physician Assistants or Nurse Practitioners were involved in 5.9% of visits, though the percentage of patients seen by them alone (1.1%) was significantly lower ($p < .0001$). Physician Assistants and Nurse Practitioners were more likely to be involved in pre- or postop visits, and often saw the same diagnoses alone as physicians only.
Sapre et al.	Nurse	Flexible cystoscopy	720	Urology	The introduction of nurse-led flexible cystoscopy has reduced the waiting list from an average of 68 patients per month in the 3-month period preceding the introduction of this service to between 10–30 patients per month, currently.

TABLE 3 (Continued)

Author	Nurse-surgeon title	Surgeries performed by nurse-surgeon	Number of surgeries performed by nurse-surgeons	Surgical specialty	Findings
Satyapan et al.	Nurse-midwife	Tubal ligation	3549	Gynaecology	In only 18 cases (0.5%), assistance was needed from the supervising doctors because of difficulties resulting from one or more of the following conditions: thick abdominal fat, tubal adhesions, inadequate sedation and/or analgesia. The average operating times decreased as the nurse-midwives gained experience. The postoperative complication rates were not substantially different from the rates observed in the pilot study On discharge from the hospitals, 3457 subjects (97.4%t) reported full satisfaction with the service and said that they would recommend tubal ligation to friends. The results of the field trial of the nurse-training programme are similar to those of the pilot study, and further demonstrate that nurse-midwives with operating-room experience can safely perform post- partum tubal ligation under local anaesthesia in provincial settings.
Schoenfeld et al.	Nurse endoscopist	Flexible sigmoidoscopy	162	Gastroenterology	Gastroenterologists and nurse endoscopists had equivalent miss rates for adenomatous polyps (20% vs. 21%, respectively). No complications occurred in any patient. Polyp location in the descending colon (95% CI: 1.7–10.3) was highly associated with missed polyps.
Schultz	Nurse practitioners, nurse cystoscopist	Cystoscopy, sigmoidoscopy and colposcopy with biopsy		Urology	Nurse cytoscopists should be trained.
Schwegel et al.	Nurse Practitioner	Angiography	Not stated	Interventional radiology	The lack of both state and federal regulations for Nurse Practitioner work and standardization of clinical training has resulted in confusion regarding scope of practice. The title practitioner caused further misunderstandings because it included the term nurse. However, a view that Nurse Practitioners are encroaching on their training is additionally a major obstacle in specialty practice. This drives the fear that Nurse Practitioners overstep professional boundaries as they become autonomous. If duties and responsibilities can be appropriately apportioned, non-physician providers can relieve some of the excess clinical duties for both attending and trainee radiologists.
Shegafi et al.	Surgical care practitioner	Removal of sebaceous cysts, skin tags, basal cell papilloma and lipomas, varicose vein surgery, hip aspiration	Not stated	Dermatology, vascular, orthopaedics	Based on the available evidence, the role of Surgical Care Practitioners in cardiac surgery has been found to be effective in acting as first assistants or in teaching basic surgical skills to junior doctors. Even within other surgical settings, the presence of the Surgical Care Practitioner has been found to be of benefit in terms of their clinical outcomes, impact on the workforce and colleagues' opinions. However, this conclusion is weakened by several limitations that affect its external validity. Thus, this review advocates for prospective clinical research to examine the impact of Surgical Care Practitioners in cardiac surgery and other surgical settings.
Shum et al.	Trained nurse endoscopist	Flexible sigmoidoscopy	119	Gastroenterology	The examinations performed by the nurse endoscopist resulted in no procedure-related complications. If screening sigmoidoscopy is performed by the nurse endoscopist, the cost, manpower and resources will be better used. The sample size used in this paper was relatively small for clinical application or generalization. This study determined that flexible sigmoidoscopy is feasible for nurses to perform provided they are suitably motivated and technically skilled.

TABLE 3 (Continued)

Author	Nurse-surgeon title	Surgeries performed by nurse-surgeon	Number of surgeries performed by nurse-surgeons	Surgical specialty	Findings
Simcock et al.	Nurse Practitioner	Intravitreal therapy, minor lid surgery	10,006	Ophthalmology	The Nurse Practitioners administered 10,006 injections in the first 5.5 years of the service (1 May 2008 to 8 October 2013). This represented 84.1% of the total injections performed during this period. Four patients developed presumed infectious endophthalmitis (one was culture positive and three were culture negative). The incidence of post-injection endophthalmitis was 0.04%. There was no evidence of lens touch, retinal detachment, or systemic thrombo-embolic events. Carefully selected and well-trained Nurse Practitioners are capable of delivering a safe and effective wet age-related macular degeneration injection treatment service.
Sprout	Licensed vocational nurse, registered nurse, clinical nurse specialist, nurse practitioner	Colonoscopy, esophagogastroduodenoscopy, dilations, sclerotherapy, variceal banding, flexible sigmoidoscopy	Not stated	Gastroenterology	Discuss different training for nurse cystoscopists. Need for standardized training criteria.
Taylor et al.	Nurse practitioner	Skin and endometrial biopsy, minimally invasive image-guided interventional radiology	Not stated	Interventional radiology	These challenges of clinical practice have prompted interventional radiologists to partner with allied health professionals to meet the needs of growing and increasingly complex practices. These professionals include, but are not limited to, nurse practitioners, physician assistants, and radiology practitioner assistants. Each professional has different training and education, potential scope of practice, and ability to bill for service.
Thommasen et al.	Nurse practitioner	Papanicolaou smear	55	Gynaecology	Nurse practitioner in the study collected Pap smears that were of comparable quality to those collected by physicians in our clinic. Having the nurse practitioner take Pap smears has also been positive for the clinic and the community. Women no longer have to be concerned about whether a female healthcare provider is available to do a Pap smear if they prefer a woman. Having the nurse do routine Pap smears has allowed physicians (particularly our female physicians) more time for diagnosis and treatment of disease.
Tingle et al.	Surgical care practitioner	Hip aspiration	360	Orthopaedics	The hip aspiration failure rate for the Surgical Care Practitioner was significantly lower than for the surgeons, probably as a result of the learning curve, which this study demonstrated. Other trusts should consider delegating routine hip aspiration work to a Surgical Care Practitioner to lower failure rates.
Turner & Aslet	Nurse practitioner	Transultrasound-guided prostate biopsy, flexible cystoscopy	Not stated	Urology	Accreditation for advanced practice roles has yet to be implemented in the United Kingdom. Therefore, it is up to individual practitioners to develop themselves and their employing organization to authorize advanced practice.
Turner & Pati	Nurse practitioner	Transrectal ultrasound and prostate biopsy	116	Urology	Patient outcomes of nurse led clinic comparable to doctor led clinic outcomes.

TABLE 3 (Continued)

Author	Nurse-surgeon title	Surgeries performed by nurse-surgeon	Number of surgeries performed by nurse-surgeons	Surgical specialty	Findings
van Putten et al.	Nurse endoscopists	Colonoscopy, polypectomy	2013	Gastroenterology	Nurse endoscopists perform according to required standards. High patient satisfaction scores following colonoscopy.
Weinstein & Demers	Nurse practitioner	Minor surgery	35	Primary care	Of 275 patient visits for inoculations, injections, and laboratory tests, 189 (68.7%) were made. Visits for minor surgery rank low in all categories. Total visits number only 35, ranking tenth of 12. 37.1% of the 35 visits for minor surgery were recorded.
Weiss et al.	Nurse	Male circumcision	Not clear	Urology	Circumcision was common with few complications.
White, Thorpe & Maine	Nurse-surgeon	Caesarean sections, hernia repair, repair of ruptured uterus, hysterectomy, laparotomy for ruptured ectopic pregnancy, dilatation and curettage, symphysiotomy, suction extraction, episiotomy, tubal ligation	326	General, obstetrics, gynaecology	Two hundred seventy-eight of 321 caesarean sections were done by nurse-surgeons in 18 months, with two deaths. All 32 caesarean sections in 13 months were done by the nurse-surgeons, with one death. Of the 37 laparotomies done in both centres, 16 were by nurse-surgeons, and there were two deaths. Four of the five deaths were attributable to protracted labour with septicaemia, postoperative infection, and protracted labour with no blood pressure on admission.
Wildi et al.	Non-physician endoscopist	Oesophagoscopy	43	Gastroenterology	Esophagoscopy by a non-physician endoscopist is feasible and accurate in detecting oesophageal pathologies. The non-physician endoscopist missed six lesions. The identification of rings in the distal oesophagus is sometimes dependent on adequate air insufflation with maximal unfolding of the lumen.
Williams et al.	Nurse practitioner	Circumcision	239	Urology	High patient satisfaction rate with Nurse Practitioner circumcision for low-risk patients. Substantial cost savings.
Wise	Nurse surgeon	Skin surgery	5000	Dermatology	Not a primary research study
Wright	Nurse endoscopist	Flexible sigmoidoscopy, biopsy, polypectomy, hot biopsy, percutaneous endoscopic gastrostomy, esophagogastroduodenoscopy, colonoscopy	Not stated	Gastroenterology	Ten subjects reported they started as nurse endoscopists to provide colorectal cancer screening. Another subject was initially trained to do follow-up endoscopic gastroduodenoscopy and colonoscopy. Training generally consisted of a review of gastroenterology anatomy and physiology ($n = 4$), reading related literature ($n = 4$), observation of endoscopic procedures ($n = 6$), and hands-on practice ($n = 11$). Most subjects ($n = 12$) were taught endoscopy by a physician, though several were trained by a nurse or nurse/physician team ($n = 3$). Two subjects did not identify who taught them endoscopy. The number of supervised endoscopies required before independent practice as an endoscopist ranged from 10 to 104 (mode = 25). Twelve of 15 subjects supported the need for a standardized nurse endoscopist curriculum for standardized training. Reasons for supporting a standardized curriculum included the need to establish competency ($n = 3$), gain public trust ($n = 2$), instill confidence ($n = 4$), and identify a minimal standard of practice ($n = 4$).
Zhang et al.	Advanced Practice Professional (collective term for Certified Registered Nurse Practitioner and Physician Assistant)	Biopsy, shave, removal of benign lesion, removal of malignant lesion, destruction of benign lesion, destruction of malignant lesion, simple repair, intermediate repair, complex repair, local flap, full thickness graft,	2.69 million in 2012 4.54 million in 2015 Both figures shared by Advanced Practice Professional	Plastics, dermatology	Increasing number of dermatological procedures by nurse practitioners. Question need for credentialing of APPs and studies into patient outcomes.

et al., 2006; Ranjan et al., 2016; Rich et al., 2021; Sapre et al., 2012; Satyapan et al., 1983; Thommasen et al., 1996). All of these 12 records stated that nurse-surgeons can perform surgeries on patients safely with five records (Davis et al., 2021; Day et al., 2014; Hickey & Cooper, 2009; Koetsawang et al., 1981; Thommasen et al., 1996;) specifying that nurse-surgeons performed safe surgeries that were comparable with physicians. Davis et al. (2021) further noted that nurse-surgeon and physician performed surgeries were safe by the 2% moderate to severe adverse event rate. Satyapan et al. (1983) believed that nurse-surgeons with theatre nursing experience can safely undertake surgeries in rural areas.

Complication rates from nurse-surgeon performed surgeries were reported in 16 (17%) records. No complications were reported by Lucas (2020), Cusack et al. (2018), Duncan et al. (2017), Shum et al., 2010, Bull et al. (2006), Schoenfeld et al. (1999), Duthie et al. (1998), and Moshakis et al. (1996). Comparisons of complication rates between nurse-surgeons and physicians were studied in five records and all reported comparable outcomes (Gilani et al., 2009; Hui et al., 2015; Kanchanasinith et al., 1990; Lane & Minns, 2010; Turner & Pati, 2010). One record compared nurse-surgeons with physician assistants and the outcomes were also comparable (Massl et al., 2014). Two records (Simcock et al., 2014; Weiss et al., 2010) reported few complications with Simcock et al. (2014) specifying a 0.04% incidence rate of postsurgical complications.

4.5 | Surgical care efficiency

Efficiency of surgical care as an outcome of nurse-surgeon performed surgeries were reported in 19 (20%) records (Cooper, 2021; Cusack et al., 2018; Ge et al., 2021; Gifford & Stone, 1993; Giramonti & Kogan, 2018; Godsell, 2005; Goodfellow et al., 2003; Johal & Dodd, 2017; Kanchanasinith et al., 1990; Laing, 1999; Marsh, 2005; McConkey et al., 2019; Meo et al., 2006; Quick, 2013; Thommasen et al., 1996). All specified the positive impact of nurse-surgeons in the efficient delivery of surgical services in terms of patient access to surgery (Cooper, 2021; Cusack et al., 2018; Ge et al., 2021; Meo et al., 2006), waiting times (Godsell, 2005; Laing, 1999; Marsh, 2005; Sapre et al., 2012), surgery times (Giramonti & Kogan, 2018; Johal & Dodd, 2017; McConkey et al., 2019), patient show rates or the rate of patients showing up to their surgical appointment (Gifford & Stone, 1993), patient education (Kanchanasinith et al., 1990), physician workload and rest times (Johal & Dodd, 2017; Thommasen et al., 1996), and junior physicians' training (Quick, 2013; Rich et al., 2021). Cooper (2021) noted the 100% achievement of the ideal referral-to-treatment time upon the addition of nurse-surgeons in the service as compared to the prior to the implementation of nurse-surgeons with a referral to treatment time of 81% in 2012 and 85% in 2015. Marsh (2005) reported the achievement of a hospital's 2-week target for bladder cancer surgical treatment when nurse-surgeons were implemented.

As reported in 3 (3%) records, nurse-surgeons did not deviate from the usual amount of time a surgeon spends to complete a surgery and instead decreased the theatre flow time (the time patients spend from entering to leaving of the operating theatres) from 59 to 40 min, thereby improving surgical times (Cusack et al., 2018; Johal & Dodd, 2017; McConkey et al., 2019). Ge et al. (2021) and Meo et al. (2006) indicated that nurse-surgeons assisted with supply and demand in the context of perioperative service delivery. According to Gifford and Stone (1993), the introduction of nurse-surgeons in rural areas increased patient show rates (the rate of patients showing up to their surgical appointment) to the 90%–100% level. On average, Giramonti and Kogan (2018) found that nurse-surgeons completed paediatric penile surgeries in 25 versus 27 min by physicians. Nurse-surgeons decreased waiting times by 30 min (Marsh, 2005), from 6 months to 8 weeks (Laing, 1999), and from 68 per 3 months to 10–30 per month (Sapre et al., 2012). Nurse-surgeons decreased the junior physicians' workload which increased their sleep time (Johal & Dodd, 2017), assisted them in managing the restrictions in their work hours (Johal & Dodd, 2017), enhanced their surgical training experience (Quick, 2013; Rich et al., 2021), and allowed them more time to diagnose and treat other diseases (Thommasen et al., 1996). Finally, Kanchanasinith et al. (1990) found the statistically significant ($p < .05$) difference in the provision of more complete preoperative patient education by nurse-surgeons versus physicians.

4.6 | Patient satisfaction

Patient satisfaction was reported in 7 (7%) records (Basnyat et al., 2001; Cusack et al., 2018; Hui et al., 2015; Johal & Dodd, 2017; Satyapan et al., 1983; van Putten et al., 2012; Williams et al., 2020). All studies reported positive patient satisfaction. Using a patient questionnaire, 99% of the first 249 patients in Basnyat et al. (2001) study was satisfied with their surgery being performed by nurse-surgeons with 238 patients experiencing minimal discomfort and nine experiencing moderate discomfort. Cusack et al. (2018) evaluated the patients' overall satisfaction via a consumer feedback form with majority of responses indicating "high" (exact numerical figure was not explicitly provided) levels of satisfaction. Following full recovery validated by the ability to answer a 100-7 subtraction test three times, the patients in Hui et al. (2015) study were asked to rate on a scale of 1 (poor) to 5 (excellent) their satisfaction in terms of the nurse-surgeons' bedside manner, technique, level of explanation and overall experience. Overall, the patients in the nurse-surgeon arm rated their overall experience as excellent (standard deviation of 4.5). Of the 364 patients in the nurse-surgeon arm, 360 (98.9%) reported willingness to have their surgery performed by a nurse-surgeon again. Johal and Dodd's (2017) systematic review of 29 articles found six studies reporting improved or high patient satisfaction with the addition of nurse-surgeons and other non-physician surgical providers. In Satyapan et al. (1983) study, patients were interviewed by the nurse-surgeons' physician supervisor to determine their satisfaction with their procedure and 3, 457 (97.4%) reported full satisfaction with the surgical service they received and would recommend tubal ligation to friends. Van Putten et al. (2012) measured patient

satisfaction through a questionnaire that was filled in by patients at the time of their discharge from the post anaesthesia care unit. Of the 734 patients that completed the questionnaire, 694 (95%) were satisfied with the service. Finally, Williams et al. (2020), surveyed 239 patient families 6 weeks after their newborns' circumcision. Of the 49 (20.5%) patient families that responded, 89.5% rated the overall quality of care they received as excellent or very good and 87.5% were either extremely satisfied or satisfied with the appearance of their newborns' penis postoperatively.

4.7 | Economic outcomes

The implementation of nurse-surgeons was identified as cost-effective in 5 (5%) records (Basnyat et al., 2001; Hough et al., 2012; Johal & Dodd, 2017; Massl et al., 2014; Williams et al., 2020). These savings were substantial translating into a net saving of at least $90 per patient (Basnyat et al., 2001; Williams et al., 2020). Nurse-surgeons were less costly to employ as compared to surgeons and appeared to be a cost-effective method in managing the difficulties emerging from junior physicians' work hour restrictions (Johal & Dodd, 2017; Massl et al., 2014). Cost-effective ratios reported via net cost savings are provided in Appendix S3.

4.8 | Credentialing, professional development and standardization of nurse-surgeons

The standardization of nurse-surgeon practice in terms of nationwide regulation in titles, scope of practice, salary, training, credentialing and professional development was recommended by 13 (14%) records (Eddy & Duffy, 2019; Fox et al., 2000; Grota et al., 2021; Hough et al., 2012; Jalloh et al., 2016; Lane & Minns, 2010; Moshakis et al., 1996; Quick, 2013; Quick, 2016; Schultz, 2011; Schwegel et al., 2019; Sprout, 2000; Zhang et al., 2018). The lack of regulations to standardize nurse-surgeon scope of practice caused confusions due to the ambiguity of the titles used (Schwegel et al., 2019) and demonstrated the great disparity in nurse-surgeons' titles, roles, pay and training access (Eddy & Duffy, 2019). According to Quick (2013), the standardization of nurse-surgeon practice would assist in the adherence to professional, ethical and legal obligations of advanced perioperative practice. Most nurse-surgeon training programmes were at least 1 year which combined practical and theoretical components along with clinical supervision and competency assessment prior to independent practice (Grota et al., 2021) and the credentialing of nurse-surgeon was seen to provide an additional pathway for perioperative nurses in advanced nursing practice (Fox et al., 2000). Professional development opportunities for nurse-surgeons were also necessary (Lane & Minns, 2010).

5 | DISCUSSION

The findings from this scoping review identified various roles that nurse-surgeons play in global surgical care with data being predominantly published in the United Kingdom and United States. This reflects the scope and use of nurse-surgeons in high-income, upper-middle-income and low- and lower-middle-income countries. It is worth noting however the differences in the included records in these countries particularly in how nurse-surgeons emerged, and the types of surgeries nurse-surgeons performed. In low- and lower-income countries, nurse-surgeons emerged mainly from a chronic demand in specialized surgeons requiring nurses to perform complicated surgeries such as caesarean section, laparotomy and trauma surgery (White et al., 1987). Whereas, in high-income countries, nurse-surgeons mainly emerged as an answer to the ballooning waiting lists for diagnostic surgeries allowing them to perform targeted minor surgeries such as endoscopy, hysteroscopy, cystoscopy or biopsy which will then translate to faster specialist referrals should anomalies arise from such diagnostic surgeries (Bull et al., 2006; Marsh, 2005; Sapre et al., 2012). In both scenarios, access to surgery is paramount in truly achieving universal healthcare. Figure 2 displays the income classification of the countries in the included records.

Our findings suggest a gradual increase in published literature about nurse-surgeon roles has occurred from five records in the previous three to five decades to 53 in the most recent decade. Our scoping review found more than 5 million nurse-performed surgeries in multiple specialties. Due to the inclusion of grey literature and unpublished data, this scoping review found a more diverse set of nurse-surgeon performed surgeries and surgical specialties than identified in earlier reviews (Grota et al., 2021; Grota et al., 2022).

This scoping review also highlights the benefits and research gaps on nurse-surgeon roles. The identified benefits include high patient satisfaction, improved surgical care efficiency, comparable complication rates with physicians, high patient safety and improved cost-effectiveness. The research gaps, on the other hand, include the need for standardization and credentialing of nurse-surgeon practice and the ambiguity in nurse-surgeon titles.

A consistently high satisfaction of patients from surgical services provided by nurse-surgeons preoperatively, intraoperatively and postoperatively was found in the studies. Nurse-surgeons provide more time to educate patients preoperatively as compared with physicians (Kanchanasinith et al., 1990; Wright, 2000). Patients who were also satisfied with their nurse-surgeon during surgery and postoperatively, would recommend their nurse-surgeon to friends or opt to have a surgery provided by a nurse-surgeon again (Satyapan et al., 1983). These findings are consistent with Grota et al. (2022) and Grota et al. (2021) findings where both systematic reviews concluded the high patient satisfaction from nurse-surgeons.

This review also identified the positive contribution of nurse-surgeons in the efficient delivery of global surgical care in the context of timely patient access to surgery, waiting times, surgery times, patient show rates, preoperative patient education, physician workload and rest times, and junior physicians' training (Cooper, 2021; Cusack et al., 2018; Ge et al., 2021; Gifford & Stone, 1993; Giramonti & Kogan, 2018; Godsell, 2005; Johal & Dodd, 2017; Kanchanasinith et al., 1990; Laing, 1999; Marsh, 2005; McConkey et al., 2019; Meo et al., 2006; Quick, 2013; Rich et al., 2021; Sapre et al., 2012;

Thommasen et al., 1996). While Grota et al. (2021, 2022) also reported the contribution of nurse-surgeons in surgical access, waiting times and patient show rates, this scoping review further added the benefits of nurse-surgeons in improving patient show rates in rural settings and provision of a more comprehensive patient education prior to surgery. In lieu of the restrictions to junior physicians' work hours, this scoping review also found that nurse-surgeons contributed to the enhancement of junior physicians' training experience which offered them more time to rest and mitigate their clinical workload (Johal & Dodd, 2017; Quick, 2013; Rich et al., 2021; Thommasen et al., 1996).

Additionally, our findings suggest that nurse-surgeons perform safe surgeries. This was further proven by the low to no complication rates in nurse-surgeon performed surgeries as reported in the included records that were comparable with the physicians' complication rates. This indicates that nurse-surgeons can perform surgeries safely, effectively and efficiently. Finally, our findings suggest that nurse-surgeons are cost effective. To the authors' best knowledge, there is currently no known review to date that explored the cost-effectiveness of nurse-surgeons as one group of advanced practice nurses.

Our scoping review found at least two gaps in nurse-surgeon research. These were significant ambiguity in nurse-surgeon titles and the need to standardize and regulate nurse-surgeon practice on a national level. This scoping review found 41 unique titles that nurse-surgeons use worldwide. The systematic review conducted by Grota et al. (2021) also highlighted nurse-surgeon title inconsistencies which affected the clarity and generalizability of the studies included in the review. The use of various ambiguous titles seems to be a common practice in nursing. A study by Leary et al. (2017) found 595 titles used by the 17, 960 nurses who participated in the study. Duffield et al. (2011) studied the nurses in Australia and argued that the uncoordinated and unregulated use of nursing titles may cause blurring, confusion and proliferation of titles which results in boundaries and scopes of practice becoming unclear, and patients along with their service providers having trouble understanding the scope of such titles.

Moorthy et al. (2006) also identified this problem where the use of multiple titles such as laparoscopic nurse, surgical nurse practitioner, arthroplasty practitioner or specialist nurse can be confusing to both the health professionals and patients. Grota et al. (2021) recommended the use of "nurse-surgeon" to encompass the group of nurses who perform surgeries independently effectively matching the term "surgeon" which encompasses physicians who perform surgeries independently. The use of more consistent language around nurse-surgeon practice will prevent research fragmentation and isolation of data.

Another gap that this scoping review found is the need for national regulation and standardization of nurse-surgeons (Eddy & Duffy, 2019; Fox et al., 2000; Grota et al., 2021; Hough et al., 2012; Jalloh et al., 2016; Lane & Minns, 2010; Moshakis et al., 1996; Quick, 2013; Quick, 2016; Schultz, 2011; Schwegel et al., 2019; Sprout, 2000; Zhang et al., 2018). There is currently no known or widely accepted national credentialing regulations around nurse-surgeon practice internationally. This is due to the implementation of nurse-surgeons being highly dependent on the need of a surgical specialty within a local healthcare system or organization to innovate their service delivery to resolve an imminent surgical crisis resulting in localized pseudo-credentialing processes that may or may not be consistent with existing national standards of care (Eddy & Duffy, 2019; Schwegel et al., 2019). Additionally, our findings indicate the different specialties, countries and contexts of nurse-surgeon practice. However, there are similarities in the way nurse-surgeons worldwide are viewed as fully trained and therefore competent for independent practice. These are practical training, educational preparation, relevant clinical experience, clinical supervision by an experienced surgeon or nurse-surgeon, and competency assessment (Grota et al., 2021). These similarities may assist national health systems and policymakers in formulating a standardized credentialing process for nurse-surgeons. Considering the global impact of nurse-surgeons in improving the provision of surgical care, it is imperative to conduct further research on how to regulate nurse-surgeon training, professional development and practice on a national level.

5.1 | Implications

This scoping review mapped the roles of nurse-surgeons in global surgical care. In doing so, the large contribution of nurse-surgeons to global healthcare has been identified. Considering the global surgical burden and the need to improve access to surgical care, the main opportunity of nurse-surgeons here is in providing timely patient access to surgery while maintaining patient safety, maintaining clinical quality and improving cost-efficiency. Future high-quality quantitative and qualitative research is necessary to study and fully understand the roles, training, practice and experiences of nurse-surgeons in local and national health systems. International collaborative research may also aid in further strengthening the standardization and credentialing pathway of nurse-surgeons worldwide.

5.2 | Limitations

This scoping review included records that were written in the English language only as English is the primary language of three of four authors. Research on nurse-surgeon roles that was written in non-English language may have contributed to a more comprehensive scoping of the roles nurse-surgeons play in global surgical care. The nurse-surgeon titles that emerged from this scoping review was based on the search strategy developed by the authors based on what is known in extant literature and anecdotally. Therefore, there might be other nurse-surgeon roles that were not captured by this scoping review and would have made this review more robust.

As scoping reviews are designed to include all records that answer a broad review question, regardless of the data source being a primary research study, an opinion paper, or a news article, another limitation of this scoping review is the lack of high-quality primary research

studies which could have increased its methodological rigour resulting in a more detailed analysis of the findings. The limitations of the 48 included primary research study are outlined in Appendix S4.

6 | CONCLUSION

Nurse-surgeons perform millions of surgeries worldwide including major surgeries such as laparotomies, caesarean sections and organ resections to minor surgeries such as biopsies, endoscopies, dental extractions and repairs. This work assists in easing the global surgical burden. Although nurse-surgeons in contemporary literature have been practising since the 1950s, there is still limited research evidence supporting their clinical practice. The great disparity of titles nurse-surgeons use proved to be a major hurdle in mapping this group of advanced practice nurses. This scoping review found the multiple roles and benefits nurse-surgeons play in global surgical care which include patient safety, timely patient access to surgery, high patient satisfaction, surgical care efficiency and cost-effectiveness. This scoping review also discovered gaps on nurse-surgeon research prompting the need to standardize their career and training pathway and the usage of a more consistent nurse-surgeon title.

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The authors declare no known conflicts of interest that could have appeared to influence the work reported in this paper.

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DATA AVAILABILITY STATEMENT

The data that support the findings of this study are openly available in OSF at 10.17605/OSF.IO/SJ2WU.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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2.3 Summary

Chapter 2 presented the findings of a scoping review that explored the roles nurse-surgeons play in global surgical care. Nurse-surgeons performed a wide range of surgeries from major procedures like laparotomies and caesarean sections to minor interventions such as biopsies and dental extractions. Despite their longstanding presence in contemporary literature since the 1950s, there is limited research evidence supporting their clinical practice. The scoping review identified a significant challenge in mapping nurse-surgeons due to the disparity in titles used within this advanced practice group. The review also underscored the diverse roles and benefits nurse-surgeons brought to global surgical care, including enhancing patient safety, ensuring timely access to surgery, achieving high patient satisfaction, promoting surgical care efficiency, and contributing to cost-effectiveness. Additionally, it revealed gaps in nurse-surgeon research, emphasising the need for standardised career and training pathways, as well as a more consistent title for nurse-surgeons. Chapter 3 will present a review of literature regarding the training and educational preparation of nurse-surgeons.

Chapter 3 Current Methods of Nurse-Surgeon Training and Education: Systematic Review (Paper 2)

3.1 Introduction

Chapter 2 presented a published peer-reviewed scoping review investigating the roles of nurse-surgeons in global surgical care. Chapter 3 is presented in the format of a peer-reviewed publication, detailing a systematic review aimed at delineating the prevailing methods utilised in the training and education of nurse-surgeons globally. This journal article entitled "Current Methods of Nurse-Surgeon Training and Education: Systematic Review," found its publication platform in the International Journal of Nursing Studies Advances in 2021 (Grota et al., 2021). The review identified that there is no standard or recognised pathway for the education of nurse-surgeons in any country. The education of nurse-surgeons was usually undertaken over at least one year by medical surgeons for nurses with relevant surgical specialty experience within an individual health service. The key components of the education involved theoretical teaching using simulation delivered in a teaching hospital, a practicum involving a minimum of 35 supervised observations and procedures, and formative assessments involving the direct observation of procedural skills prior to the declaration of competence of the nurse-surgeon by the health service.

The designation of the International Journal of Nursing Studies Advances as the preferred publisher for this research work was influenced by the journal's commitment to promoting research in advanced nursing practice and its emphasis on open access to ensure broad accessibility. Additionally, the journal has a Q1 status and a CiteScore of 5.8 highlighting its position as a platform for impactful research thereby amplifying the paper's visibility and recognition within the scholarly community. A copy of the published article is provided below for reference.

3.2 Journal article

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Current methods of nurse-surgeon training and education: Systematic review

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ABSTRACT

Background: The role of nurse-surgeons has recently emerged to meet patient and health system surgical demands. However, methods of nurse-surgeon training and education requirements are unclear.
Objective: To identify and describe the current methods of nurse-surgeon training and education worldwide.
Design: Systematic review.
Method: An electronic search was conducted using Cumulative Index to Nursing and Allied Health, Cochrane Library, Medical Literature Analysis and Retrieval System Online, Public Medical Literature Analysis and Retrieval System Online, and Google Scholar databases. Key words included nurse-surgeon, training, education, and perioperative. Following screening for inclusion, a mixed methods critical appraisal tool was used to ascertain methodological rigour and the Grading of Recommendations, Assessment, Development and Evaluations framework to assess confidence in the evidence. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow diagram and checklist for reporting systematic reviews were used.
Results: A total of 18 studies was included in this review. Current methods of nurse-surgeon training were identified as surgical speciality specific (n = 18). Most training courses were at least one year in length (n = 4) with a theoretical component (n = 15). All studies included a practical requirement (n = 18), which was generally supervised by a physician (n = 16). A competency assessment was required by 15 programmes, with nine (9) using a formative assessment approach. The evidence available for this review is low in quality and certainty.
Conclusions: Current methods of nurse-surgeon training have been identified to be specific to speciality areas. Overall, training has required nurse-surgeons to undergo andragogical education in theory, supervision in practice by a surgeon and assessment of competency. An implication for practice is a streamlined nursing pathway to surgical residency training which would improve global surgical health outcomes and retain young perioperative nurses.

Contribution of the paper What is already known?

1. Nurse-surgeons perform safe and effective surgeries on par with their medical counterparts.
2. Nurse-surgeons are valuable in emergency surgery, cancer diagnoses, and rural and remote health.

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What this paper adds

1. This review found that the current methods of nurse-surgeon training are surgical specialty-specific and have three components in common: theory teaching; physician-supervised practicum; and surgical competency assessment.
2. With the negative impact of coronavirus restrictions on face-to-face training and education of surgical interns and medical students, this review provided an alternative to surgical capacity optimisation in the post-pandemic era through internal upskilling of experienced perioperative nurses to perform surgeries independently.
3. This review highlighted the lack of high-quality research in nurse-surgeon training and education, and in nurse-led surgery models of care as a whole.

1. Background

Almost five billion people or 62% of the world population do not have access to emergency and essential surgeries (Alkire et al., 2015; Chamie, 2020; Meara et al., 2015). As a result, 18 million lives are lost every year from surgically treatable conditions (Reddy et al., 2020). In 2014, the World Health Organisation, 2014 highlighted the critical need to strengthen the delivery of emergency and essential surgical services as a vital component of universal health care. However, a major barrier in achieving universal access to surgical care is in itself a global challenge that many health systems have grappled with for decades – the chronic shortage of fully trained surgeons (Holmer et al., 2015).

In 2008, the World Health Organisation, 2008 launched the strategy Task Shifting which aimed to improve public access to essential health services by redistributing specific tasks within healthcare for a more efficient use of the available clinical human resources (World Health Organisation, 2008). In the intraoperative and surgical context, this meant training nurses to perform surgeries autonomously in surgical specialties where surgeons were scarce (Burton, 2017; Chu et al., 2009).

Nurse-performed surgery is not a novel concept as it predates the Task Shifting strategy of the World Health Organisation (2008) by at least 60 years (White et al., 1987). In the 1950s, the first documented nurse-surgeon was trained by an American missionary surgeon to perform obstetric surgeries in sub-Saharan Africa (White et al., 1987). The decision to train this nurse-surgeon emerged from the same problem still experienced today, the need to redesign surgical capacity to meet surgical demands with limited physicians (Bath et al., 2019; World Health Organisation, 2014).

From the 1950s to early 2000s, nurse-surgeons were increasingly used in the United States (Giramonti and Kogan, 2018; Sprout, 2000; Spencer and Ready, 1977), United Kingdom (Moshakis et al., 1996) and many African countries (Gichangi et al., 2015) in the fields of general, obstetric and gynaecological surgery (White et al., 1987), ophthalmology (Gallagher, 2017), interventional radiology (Dryer, 2006), vascular surgery (Hickey and Cooper, 2009), and diagnostic cancer screening in gastroenterology (Wright, 2000), gynaecology (Bodle et al., 2008), urology (Gidlow et al., 2000) and dermatology (Godsell, 2005). In the past decade, Australia (Duncan et al., 2017), Canada (Smith, 2010), Denmark, Ireland, Netherlands (Pfeifer and Schilling, 2016), Hong Kong (Hui et al., 2015), Indonesia (Sediyo et al., 2018), New Zealand (Doughty and Watkins, 2018) and Spain (Lujan et al., 2013) have also developed their own nurse-led surgery models of care.

The global contribution of nurse-surgeons has been extensive. They performed emergency caesarean sections and hysterectomies that saved the lives of mothers and infants at risk (White et al., 1987). Nurse-surgeons have diagnosed and removed life-threatening blood clots through angiograms and percutaneous thrombectomies (Dryer, 2006). They improved patient access to urgently needed diagnostic screening of many gynaecological conditions (Bodle et al., 2008) and cancers of the bowel (Wright, 2000), skin (Godsell, 2005) and bladder (Gidlow et al., 2000) in rural (Redwood et al., 2009) and urban settings. Cancers of the bowel, skin and bladder are the most common cancers in the world (World Health Organisation, 2021). Bowel cancer, in particular, is the world's second deadliest cancer (World Health Organisation, 2021) yet one of the most treatable if detected early. Collectively, nurse-surgeons' contributions ultimately led to shortened wait times for essential surgical services across many specialties, improved patient access to essential surgeries in remote, rural, and indigenous areas, and prevention of deaths from numerous surgically treatable conditions.

The field of surgery has traditionally been defined by modern healthcare as an exclusive domain of physicians (Gough, 2009). However, there is now a growing body of evidence that this is no longer the case. Nurse-surgeons can perform safe and effective surgeries on par with their medical counterparts. This has been proven consistently over the past 70 years. Hence, with the support of the World Health Organisation and many health systems worldwide, there is now a compelling need to redesign the surgical workforce to address the global health challenges and therefore fully achieve universal access to surgical care (World Health Organisation, 2014).

Nurses are at the forefront of this innovation in surgery. However, as in any other innovations in health care, with the concept and utilisation of nursing practice in surgery continuously evolving, gaps in its development are also arising concurrently (Bartels, 2005). One major gap in the efficient delivery of nurse-led surgeries is the lack of a standard method of nurse-surgeon training and education (Bath et al., 2019). Although there is literature available, to the authors' best knowledge, there is no known study yet that synthesised the data from extant literature to benchmark the surgical training and education of nurse-surgeons. While physicians wanting to become surgeons undergo a defined surgical training and education set by national medical boards (Gough, 2009), nurses on the other hand, do not currently have a recognised pathway to surgical specialisation. Therefore, this systematic review aims to identify and describe the methods used to train and educate nurse-surgeons.

2. Methods

The methods of this systematic review were reported based on the Preferred Reporting Items for Systematic Reviews and Meta-analyses statement checklist (Page et al., 2021).

2.1. Eligibility criteria

The authors collectively developed detailed study eligibility criteria (Higgins et al., 2021; Aromataris and Munn, 2020) as shown in supplementary material 1. Population was practicing nurse-surgeons regardless of titles and surgical specialties. Interventions were the methods of training and education with training referring to the practical components and education as the theoretical components of the programme. The outcome was to enable nurse-surgeons to have the knowledge, skills, and competence to practice. Contexts were perioperative department, operating room, operating theatre, day surgery unit or outpatient clinic, endoscopy unit, catheterisation laboratory or interventional radiology, and nurse-led surgical service or clinic. Articles included were published in the English-language, qualitative, quantitative, and mixed methods studies with no date restriction. The authors have excluded grey literature and systematic reviews. Any surgical assisting roles were also excluded, including but not limited to Perioperative Nurse Surgeon's Assistant, Non-Medical Surgical Assistant, Registered Nurse First Surgical Assistant, and Registered Nurse First Assistant. Surgical assistants were excluded as they do not perform surgeries independently. For the purpose of this review, the authors adapted the World Health Organisation definition of surgery as invasive procedures that is performed aseptically, and usually with the use of appropriate anaesthesia, by trained surgeons, other physicians, nurses, and other non-physicians to investigate and/or treat surgical conditions (Debas et al., 2006).

2.2. Search strategy

A search strategy (Aromataris and Munn, 2020) was identified and the search undertaken in April 2021. The authors have considerable knowledge and experience in nursing education and perioperative nursing (Aromataris and Munn, 2020). The search terms included a combination of Medical Subject Headings, phrases, and keywords for each database (see supplementary material 2). The information sources were Cumulative Index to Nursing and Allied Health, Cochrane Library, Medical Literature Analysis and Retrieval System Online, Public Medical Literature Analysis and Retrieval System Online, Google Scholar and handsearching.

2.3. Selection process

The Preferred Reporting Items for Systematic Reviews and Meta-analyses flow diagram was used to guide the search results (Page et al., 2021). All articles were imported to Covidence®, an online platform that streamlines systematic reviews (Covidence, 2021). Covidence® was also the automation tool for duplicate detection. One author (TG) conducted the title and abstract screening. Two of four authors (TG, VB, AB, EJ) assessed the articles for full text eligibility. Disagreements were resolved by discussion or a third reviewer where necessary.

2.4. Quality assessment

The Mixed Methods Appraisal Tool was used for quality and risk of bias assessment (Hong et al., 2018). The tool was also used as an inclusion criterion. The remaining articles from the full text review were critically appraised independently by two of four authors (TG, EJ, VB, AB) in Covidence®. This was followed by the decision from two of four authors (TG, EJ, VB, AB) to include or exclude the studies that were critically appraised. Studies that did not qualify as research papers or did not explain the training and education method were excluded. Consensus was required to complete the quality assessment and inclusion of each article. Disagreements were resolved by discussion, or a third reviewer where necessary.

2.5. Certainty assessment

Certainty assessment of the included studies was performed by one author (TG) and validated by a second author (one of EJ, VB, AB). Disagreements were resolved by discussion or a third reviewer where necessary. The authors have rated theory teaching, practicum, and surgical competency assessment as the critical outcomes of this systematic review. Training eligibility, training duration and clinical supervision were rated as important outcomes of this review. Grading of Recommendations, Assessment, Development and Evaluations framework was used to assess confidence in the body of evidence for the abovementioned critical and important outcomes (Schünemann et al., 2013). The strength of recommendation was then offered based on the overall Grading of Recommendations, Assessment, Development and Evaluations certainty assessment (Schünemann et al., 2013). The results of the certainty assessment were tabulated using GRADEpro® (GRADE Working Group 2020), a software for summarising evidence in compliance with the Grading of Recommendations, Assessment, Development and Evaluations methodology (Schünemann et al., 2013).

2.6. Data extraction and synthesis

Included studies were extracted for the following data: author/s; publication year; country; design; aim; surgical speciality; nurse-surgeon role; participant; number of nurse-led surgeries; setting; peer review; possible conflict of interest; inclusion and exclusion criteria; and findings. Data extraction was performed independently by one author (TG) and validated by a second author (one of VB, AB, EJ) in Covidence®. Disagreements were resolved by discussion or a third reviewer where necessary. The extracted data was then exported from Covidence® as a comma-separated values file and converted into an evidence matrix. All authors (TG, EJ, VB, AB) concurred that a narrative synthesis should be used to report the findings as meta-analysis was not possible due to the heterogeneity in design and characteristics of the included studies (Deeks et al., 2021). One (TG) of the four authors synthesised the extracted data which was then collectively evaluated by the remaining three authors (VB, AB, EJ) throughout the selection, extraction, and synthesis stages of the review.

3. Results

3.1. Search results

Initial searches yielded 465 results (see Fig. 1). Covidence® found 85 duplicates which were immediately removed. The remaining 380 studies were screened against titles and abstracts. A total of three hundred and four articles were excluded on title and abstract review and 76 were assessed for full-text eligibility. Full text screening returned 27 articles for quality assessment.

3.2. Result of quality and certainty assessment

The remaining twenty-seven articles were appraised in Covidence® (2021) using Mixed Methods Appraisal Tool (Hong et al., 2018) as shown in Table 1. Following the quality and risk of bias assessment, nine articles were removed. Seven articles were classified as non-research papers, and two articles (Bodle et al., 2008; Fletcher et al., 2019) did not explain the training and education methods. No studies were excluded due to low quality (Hong et al., 2018). A final sample of 18 articles was included.

The results of the certainty assessment are outlined in Table 2. Using the Grading of Recommendations, Assessment, Development and Evaluations approach (Schünemann et al., 2013), the authors' confidence in the body of evidence available in this review for the critical and important outcomes are the following: low for education or theory teaching; low for training or the practical component; very low for surgical competency assessment; low for training eligibility; very low for training duration; and low for clinical supervision.

3.3. Study characteristics

The characteristics of the included studies are outlined in Table 3. Eighteen studies published between 1984 and 2020 met the eligibility criteria. The majority of the studies were conducted in the United States ($n = 7$) and United Kingdom ($n = 7$) followed by Hong Kong ($n = 2$), Australia ($n = 1$) and Congo ($n = 1$). Eleven of the included articles were quantitative descriptive, three were non-randomised controlled trials, two were randomised controlled trials, one was qualitative, and one was mixed methods. Peer review was reported in only one of the 18 articles. All studies were conducted in the hospital setting: 13 in endoscopy unit; two in day surgery; two in the operating theatre and one combined hospital endoscopy unit and rural health endoscopy service. Fourteen (78%) of the 18 studies stated that the training and education were organised either by the training hospital ($n = 12$) or the host country ($n = 2$) to address the need for additional surgical providers in their health systems. Training of nurse-surgeons was undertaken by surgeons in 15 (83%) of the 18 included studies.

A total of 5450 surgeries were performed by nurses in the included studies across a range of surgical specialties including gastroenterology ($n = 14$), ophthalmology ($n = 2$), vascular ($n = 1$) and a combined obstetric, gynaecological, and general surgery ($n = 1$).

3.4. Nurse-surgeon training and education

A variety of nurse-surgeon training and education methods was reported in the 18 included articles (see Table 4). These methods were grouped into six components representing the critical and important outcomes of this review: (1) training eligibility; (2) training duration; (3) theory teaching; (4) practicum; (5) clinical supervision; and (6) surgical competency assessment.

3.5. Training eligibility

Seventeen (94%) studies specified the background of the trainees as nurse ($n = 6$), Nurse Practitioner ($n = 5$), Registered Nurse ($n = 5$) and Surgical Care Practitioner ($n = 1$). In the Nurse Practitioner group, one allowed qualified Nurse Practitioners or Physician Assistants to train. In the Registered Nurse group, one recommended a master's degree, one recommended prescribing rights, and one allowed trainees with Registered Nurse or Licenced Practical Nurse qualification. One article (6%) did not state the trainee backgrounds.

Eleven studies (61%) noted that relevant experience is essential prior to nurse-surgeon training. Of these, five were satisfied with a

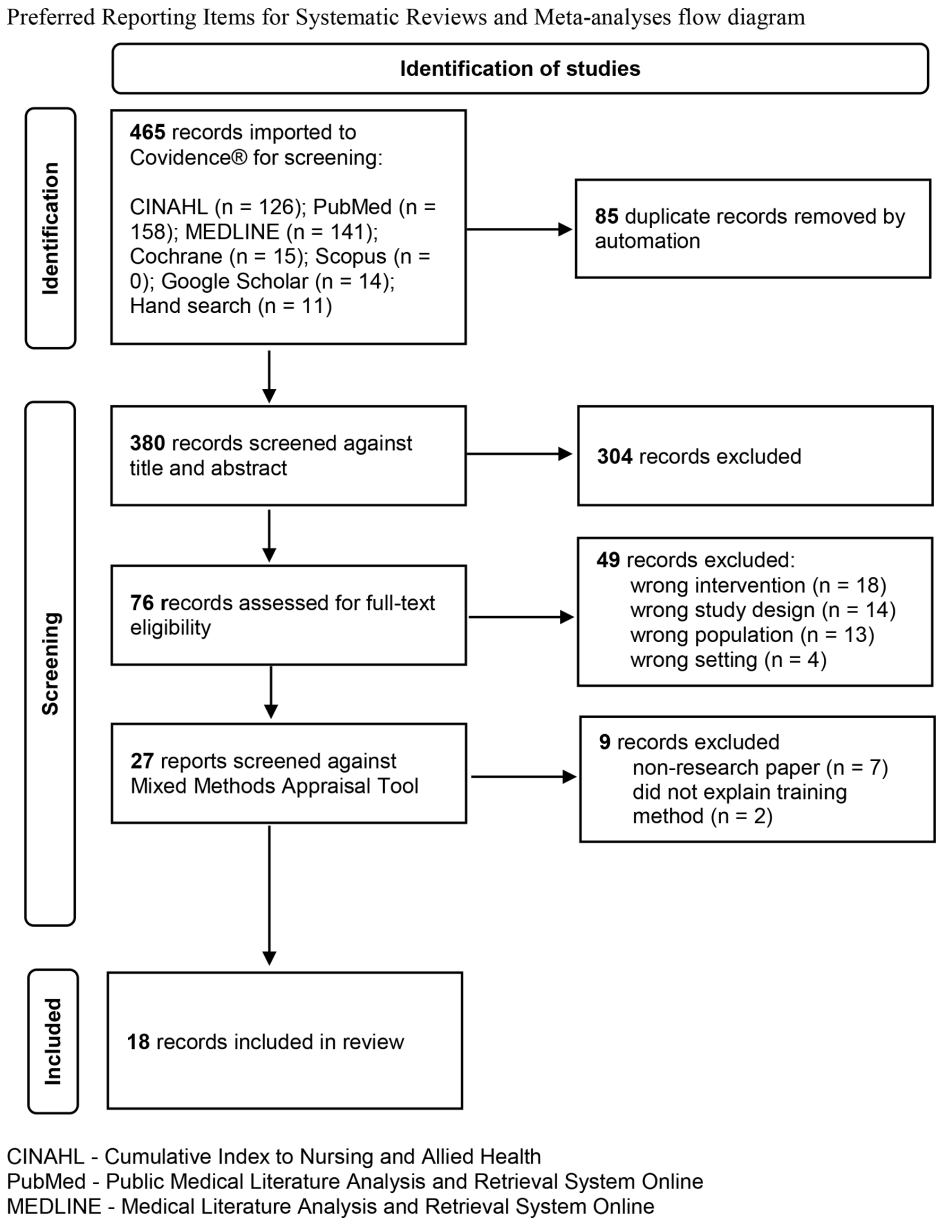

Fig. 1. Preferred Reporting Items for Systematic Reviews and Meta-analyses flow diagram
CINAHL - Cumulative Index to Nursing and Allied Health
PubMed - Public Medical Literature Analysis and Retrieval System Online

Table 1
Quality assessment.

Author	Reviewer	Overall appraisal	Category of study designs																								
			1. Qualitative					2. Quantitative randomised controlled trial					3. Quantitative non-randomised controlled trial					4. Quantitative descriptive					5. Mixed methods				
			1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	2.5	3.1	3.2	3.3	3.4	3.5	4.1	4.2	4.3	4.4	4.5	5.1	5.2	5.3	5.4	5.5
Cash et al., 1999	TG, EJ	Include																Y	Y	Y	N	Y					
Chapman et al., 2009	TG, EJ	Include	C	C	C	C	C																				
DiSario et al., 1993	TG, EJ	Include						Y	C	Y	N	Y															
Duncan et al., 2017	TG, EJ	Include	N	N	Y	C	C											Y	Y	Y	C	Y	N	Y	N	Y	C
Duthie et al., 1998	TG, VB	Include																N	N	Y	C	Y					
Gallagher, 2017	TG, VB	Include																Y	Y	Y	N	Y					
Goodfellow et al., 2003	TG, VB	Include																Y	Y	Y	N	Y					
Hasan et al., 2020	TG, VB	Include																C	C	Y	C	Y					
Hickey et al., 2009	TG, VB	Include																Y	Y	Y	Y	Y					
Hui et al., 2015	TG, VB	Include						Y	Y	Y	N	Y															
Maule, 1994	TG, AB	Include											Y	Y	Y	Y	Y										
Moshakis et al., 1996	TG, AB	Include											Y	C	C	C	Y										
Redwood et al., 2009	TG, AB	Include																Y	Y	C	C	C					
Rosevelt et al., 1984	TG, AB	Include											Y	Y	Y	C	Y										
Shum et al., 2010	TG, AB	Include																Y	Y	Y	Y	Y					
Spiegel, 1995	TG, AB	Include																C	Y	C	C	C					
White et al., 1987	TG, AB	Include																C	Y	Y	Y	C					
Wright, 2000	TG, AB	Include																Y	C	Y	C	C					
Abraham, 2019	TG, EJ	Exclude	not a research paper																								
Beck, 2013	TG, EJ	Exclude	not a research paper																								
Bodle, 2008	TG, EJ	Exclude	did not explain the training method															Y	Y	Y	C	Y					
Doughty et al., 2018	TG, EJ	Exclude	not a research paper																								
Dryer, 2006	TG, EJ	Exclude	not a research paper																								
Fletcher et al., 2019	TG, VB	Exclude	did not explain the training method															Y	C	Y	C	Y					
Godsell, 2005	TG, VB	Exclude	not a research paper																								
Gruber, 1996	TG, VB	Exclude	not a research paper																								
Hough, 2012	TG, VB	Exclude	not a research paper																								

Y – yes; **N –** no; **C –** can't tell

1.1. Is the qualitative approach appropriate to answer the research question? **1.2.** Are the qualitative data collection methods adequate to address the research question? **1.3.** Are the findings adequately derived from the data? **1.4.** Is the interpretation of results sufficiently substantiated by data? **1.5.** Is there coherence between qualitative data sources, collection, analysis, and interpretation? **2.1.** Is randomization appropriately performed? **2.2.** Are the groups comparable at baseline? **2.3.** Are there complete outcome data? **2.4.** Are outcome assessors blinded to the intervention provided? **2.5.** Did the participants adhere to the assigned intervention? **3.1.** Are the participants representative of the target population? **3.2.** Are measurements appropriate regarding both the outcome and intervention (or exposure)? **3.3.** Are there complete outcome data? **3.4.** Are the confounders accounted for in the design and analysis? **3.5.** During the study period, is the intervention administered (or exposure occurred) as intended? **4.1.** Is the sampling strategy relevant to address the research question? **4.2.** Is the sample representative of the target population? **4.3.** Are the measurements appropriate? **4.4.** Is the risk of nonresponse bias low? **4.5.** Is the statistical analysis appropriate to answer the research question? **5.1.** Is there an adequate rationale for using a mixed methods design to address the research question? **5.2.** Are the different components of the study effectively integrated to answer the research question? **5.3.** Are the outputs of the integration of qualitative and quantitative components adequately interpreted? **5.4.** Are divergences and inconsistencies between quantitative and qualitative results adequately addressed? **5.5.** Do the different components of the study adhere to the quality criteria of each tradition of the methods involved?

Table 2
Grading of Recommendations, Assessment, Development and Evaluations certainty assessment (narrative table).

Certainty assessment № of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Narrative description	Certainty	Importance
Theory teaching 15	Mixed (1 randomised controlled trial)	serious [a]	not serious	not serious	serious [b]	publication bias strongly suspected [c]	12 (80%) in the teaching hospital, 2 (13%) as formal university course, 1 (7%) did not explain in detail	⨁⨁◯◯ LOW	CRITICAL
Practicum 18	Mixed (2 randomised controlled trials)	serious [d]	not serious	not serious	serious [b]	publication bias strongly suspected [c]	11 (61%) included a series of observations and supervised procedures (median = 35 observations and 35 procedures), 6 (33%) did not explain in detail, and 1 apprenticeship style (6%). Surgeries performed by nurses ($n = 5450$)	⨁⨁◯◯ LOW	CRITICAL
Surgical competency assessment 15	Mixed (2 randomised controlled trials)	serious [e]	serious [f]	not serious	serious [b]	publication bias strongly suspected [c]	9 (60%) trainees deemed competent upon completion of training and performance of procedures (median = 57), 2 (13%) used an external assessment tool for assessing physicians, 2 (13%) were dependant on the clinical supervisor, 1 (7%) assessed by an independent physician, and 1 (7%) used a 50-single best answer examination.	⨁◯◯◯ VERY LOW	CRITICAL
Training eligibility 17	Mixed (2 randomised controlled trials)	serious [g]	not serious	not serious	serious [b]	publication bias strongly suspected [c]	Background: 6 (35.2%) nurses, 5 (29.4%) Nurse Practitioners, 5 (29.4%) Registered Nurses, 1 (6%) Surgical Care Practitioner.		
Relevant experience was essential prior to training in 11 studies: 5 (45.5%) Registered Nurse with relevant experience, 3 (27.3%) Nurse Practitioner with relevant	⨁⨁◯◯ LOW	IMPORTANT							

(continued on next page)

Table 2 (*continued*)

Certainty assessment № of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Narrative description	Certainty	Importance
experience, 2 (18.2%) prescribing rights and relevant experience, 1 (9%) relevant experience and master's degree.									
Training duration 11	Mixed (1 randomised controlled trial)	serious [h]	very serious [f]	not serious	serious [b]	publication bias strongly suspected [c]	4 (36.4%) were one year, 2 (18.2%) were 1 month, 2 (18.2%) were varied, 1 (9.1%) was 1–2 years, 1 (9.1%) was 8 months, 1 (9.1%) was 3 months. Median = 1 year	⨁◯◯◯ VERY LOW	IMPORTANT
Clinical supervision 16	Mixed (2 randomised controlled trials)	serious [i]	not serious	not serious	serious [b]	publication bias strongly suspected [c]	15 (94%) were physicians, 1 (6%) was either nurse or physician	⨁⨁◯◯ LOW	IMPORTANT

Certainty rating.
⨁◯◯◯ very low – the true effect is probably markedly different from the estimated effect.
⨁⨁◯◯ low – the true effect might be markedly different from the estimated effect.
⨁⨁⨁◯ moderate – The authors believe that the true effect is probably close to the estimated effect.
⨁⨁⨁⨁ high – The authors have a lot of confidence that the true effect is similar to the estimated effect.
Explanations.
a. 9 quantitative descriptive, 2 non-randomised controlled trials, 1 randomised controlled trial, 1 qualitative, 1 mixed methods.
b. Limited estimates of effect across the studies.
c. not reported.
d. 11 quantitative descriptive, 3 non-randomised controlled trials, 2 randomised controlled trials, 1 qualitative, 1 mixed methods.
e. 10 quantitative descriptive, 2 non-randomised controlled trials, 2 randomised controlled trials, 1 qualitative.
f. studies show mixed results.
g. 11 quantitative descriptive, 2 non-randomised controlled trials, 2 randomised controlled trials, 1 qualitative, 1 mixed methods.
h. 7 quantitative descriptive, 2 non-randomised controlled trials, 1 randomised controlled trial, 1 mixed methods.
i. 10 quantitative descriptive, 3 non-randomised controlled trials, 2 randomised controlled trials, 1 mixed methods.

Table 3
Characteristics of included studies.

Author (year)	Country	Study design	Aim of study	Participant	Surgeries performed by nurse	Setting	Training organised by	Surgical speciality (procedure performed by nurse-surgeon)	Peer review
Cash et al. (1999)	United States	Quantitative descriptive	To assess the state board of nursing guidelines about the performance of flexible sigmoidoscopy by nurses and to determine the current use and training of paramedical personnel in flexible sigmoidoscopy at gastroenterology fellowship programs in the United States	50/50 US Boards of Nursing; 162/164 US Gastroenterology Fellowship Training Programs	Not stated	Hospital Endoscopy Unit	Not stated	Gastroenterology (flexible sigmoidoscopy, colonoscopy, polypectomy, oesophageal banding, sclerotherapy)	Not stated
(Chapman and Cooper, 2009)	United Kingdom	Qualitative	To examine perceptions of United Kingdom nurse endoscopists regarding their experience of the role	8 nurses with at least one year experience as endoscopist	Not stated	Hospital Endoscopy Unit	Not stated	Gastroenterology (6/8 perform upper gastrointestinal endoscopy, 7/8 perform lower gastrointestinal endoscopy)	Not stated
DiSario et al. (1993)	United States	Quantitative Randomised Controlled Trial	To look at appropriate training programs for nonphysician personnel	246 patients scheduled for sigmoidoscopy	246	Hospital Endoscopy Unit	Training hospital	Gastroenterology (flexible sigmoidoscopy)	Not stated
Duncan et al. (2017)	Australia	Mixed methods	To describe the preparation, introduction, and evaluation of the Nurse Endoscopist role in Monash Health, Australia	40 patients who had colonoscopy performed by a nurse endoscopist	40	Hospital Endoscopy Unit	Australian government	Gastroenterology (colonoscopies to the terminal ileum, snare polypectomies, biopsy and tattooing, flexible sigmoidoscopy, and carbon dioxide insufflation of the bowel)	Not stated
Duthie et al. (1998)	United Kingdom	Quantitative descriptive	To design and evaluate a training programme for nurse endoscopists	215 colorectal patients examined by trained nurse practitioner	215	Hospital Endoscopy Unit	Training hospital	Gastroenterology (flexible sigmoidoscopy)	Not stated
Gallagher (2017)	United Kingdom	Quantitative descriptive	To determine the patient satisfaction of patients having nurse led intravitreal therapy	100 patients undergoing nurse led intravitreal therapy	100	Hospital Day Surgery	Training hospital	Ophthalmology (intravitreal therapy)	Not stated
Goodfellow et al. (2003)	United Kingdom	Quantitative descriptive	To describe the first full year of independent practice by a newly appointed nurse endoscopist in a district general hospital in the United Kingdom	282 patients who underwent nurse-led flexible sigmoidoscopy	282	Hospital Endoscopy Unit	Training hospital	Gastroenterology (flexible sigmoidoscopy)	Not stated
Hasan et al. (2020)	United Kingdom	Quantitative descriptive	To describe the Swindon model of training nurses to be independent intravitreal therapy injectors	22 ophthalmic nurses	Not stated	Hospital Day Surgery	Training hospital	Ophthalmology (intravitreal therapy)	Not stated
Hickey et al. (2009)	United Kingdom	Quantitative descriptive	To assess whether a Surgical Care Practitioner operating at advanced level could make a major contribution to day-case varicose vein surgery	1 Surgical Care Practitioner with theatre nursing background	152 sapheno-femoral disconnections (minus 1 where surgeon took over), 91 leg avulsions, 191 groin wound closure	Hospital Operating Theatre	Training hospital	Vascular (sapheno-femoral disconnection, long saphenous vein stripping, avulsions, and wound closure)	Not stated
Hui et al. (2015)	Hong Kong		To test the hypothesis that trained nurse endoscopists are not	787 patients undergoing colonoscopy but only	364	Hospital Endoscopy Unit	Not stated	Gastroenterology (colonoscopy and polypectomy)	Yes

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Table 3 (*continued*)

Author (year)	Country	Study design	Aim of study	Participant	Surgeries performed by nurse	Setting	Training organised by	Surgical speciality (procedure performed by nurse-surgeon)	Peer review
		Quantitative Randomised Controlled Trial	inferior to medical endoscopists in finding adenomas during colonoscopy	731 were used for analysis due to protocol deviation -					
Maule (1994)	United States	Quantitative non-Randomised Controlled Trial	To determine whether screening by flexible sigmoidoscopy could be performed safely and accurately by nurses	Patients undergoing flexible sigmoidoscopy – 1881 examined by nurses and 730 examined by physicians	1881	Hospital Endoscopy Unit	Training hospital	Gastroenterology (flexible sigmoidoscopy)	Not stated
Moshakis et al. (1996)	United Kingdom	Quantitative non-Randomised Controlled Trial	To compare the performance of flexible sigmoidoscopy by a nurse (trainee) vs a physician (trainer)	100 patients who had flexible sigmoidoscopy performed by nurse trainee or physician trainer	100	Hospital Endoscopy Unit	Training hospital	Gastroenterology (flexible sigmoidoscopy and clinical coloproctology)	Not stated
Redwood et al. (2009)	United States	Quantitative descriptive	To describe the development, implementation, and outcome of a program to train rural nurse practitioners and physician assistants to perform flexible sigmoidoscopy in rural Alaska	3 flexible sigmoidoscopy trainees – 3 nurse practitioners, 2 physician assistants, and 1 osteopathic doctor	419	Hospital Endoscopy Unit (Stage 1); Rural health endoscopy service (Stage 2)	State of Alaska	Gastroenterology (flexible sigmoidoscopy)	Not stated
Rosevelt et al. (1984)	United States	Quantitative non-Randomised Controlled Trial	Not stated	825 patients who underwent flexible sigmoidoscopy by trained nurse practitioner	825	Hospital Endoscopy Unit	Training hospital	Gastroenterology (flexible sigmoidoscopy, superficial biopsies)	Not stated
Shum et al. (2010)	Hong Kong	Quantitative descriptive	To describe the process and explore the feasibility of training a colorectal nurse in Hong Kong to perform flexible sigmoidoscopy.	119 patients who underwent flexible sigmoidoscopy by the trained nurse endoscopist	119	Hospital Endoscopy Unit	Training hospital	Gastroenterology (flexible sigmoidoscopy)	Not stated
Spiegel (1995)	United States	Quantitative descriptive	To describe a flexible sigmoidoscopy training program for nurses in an American hospital	100 patients who underwent sigmoidoscopy by nurse endoscopist	100	Hospital Endoscopy Unit	Training hospital	Gastroenterology (flexible sigmoidoscopy and biopsies)	Not stated
White et al. (1987)	Congo	Quantitative descriptive	To describe the performance of emergency obstetric surgeries by nurses in Congo	390 patients who had surgery – 326 performed by nurses, 64 performed by physicians	326	Hospital Operating Theatre	Training hospitals (Karawa and Wasolo hospitals)	Obstetrics and Gynaecology (caesarean section, supracervical hysterectomy for ruptured uterus, dilatation and curettage, symphysiotomy, suction extraction and episiotomy) / General (laparotomy and hernia repair)	Not stated
Wright (2000)	United States	Quantitative descriptive	To investigate the role and experiences of gastroenterology nurse endoscopists in the United States and their opinions regarding basic job and curriculum requirements for further developing this advanced practice role	17 practicing nurse endoscopists	Not stated	Hospital Endoscopy Unit	Not stated	Gastroenterology (flexible sigmoidoscopy)	Not stated

Table 4
Summary of nurse-surgeon training and education.

Author, year (Country)	Procedures performed by nurse-surgeon	Eligibility to commence training	Duration of training	Theory	Practicum	Competency assessment
Cash et al., 1999 (United States)	Flexible sigmoidoscopy, colonoscopy, polypectomy, oesophageal banding, sclerotherapy	10/50 States explicitly approve the practice by Registered Nurses. 25/50 States explicitly approve the practice by Nurse Practitioners. 48/50 States permit practice by Registered Nurses and/or Nurse Practitioners (based on explicit advisory opinions or decision-making models for the scope of nursing practice)	Not stated	None of the United States boards of nursing has a specific training program that must be completed before a nurse can perform flexible sigmoidoscopy independently	None of the United States boards of nursing has a specific training program that must be completed before a nurse can perform flexible sigmoidoscopy independently. 24/24 teaching hospitals have surgeons supervising the practical training	21/24 teaching hospitals require completion of at least 25 supervised flexible sigmoidoscopies as recommended for physicians by the American Society for Gastrointestinal Endoscopy or the American College of Physicians.
(Chapman and Cooper, 2009) (United Kingdom)	6/8 perform upper gastrointestinal endoscopy, 7/8 perform lower gastrointestinal endoscopy	2/8 have prescribing rights 4/8 recommend trainees to be Registered Nurse 5/8 recommend trainees to have endoscopy experience	Not stated	Variable – majority (specific number not stated) had gone degree-level Nurse Endoscopist courses. 2/8 did not complete degree-level Nurse Endoscopist courses.	Participants described a variety of education and training experiences (details not provided)	Not stated
DiSario et al., 1993 (United States)	Flexible sigmoidoscopy	Experience in gastroenterology nursing	Not stated	Written and video materials, didactic sessions and use of plastic colon models	Surgeon supervised all aspects of practical training	A mean of 20 supervised procedures was necessary to reach proficiency. 1/10 Registered Nurse did not achieve proficiency after 35 procedures
Duncan et al., 2017 (Australia)	Colonoscopies to the terminal ileum, snare polypectomies, biopsy and tattooing, flexible sigmoidoscopy, and carbon dioxide insufflation of the bowel	Grade 5 Clinical Nurse Consultant	12 months	Theoretical classes from the University of Hull in the United Kingdom, Master's degree on completion of training	Surgeon supervised the practical training	Competency is achieved after 100 unassisted, supervised colonoscopies and at least 90% caecal intubation rate
Duthie et al., 1998 (United Kingdom)	Flexible sigmoidoscopy	Colorectal Nurse Practitioner	Variable	Study days covering a broad spectrum of theoretical, moral, and legal issues relating to colorectal disease and flexible sigmoidoscopy	Surgeon supervised practicum involving 35 observations, 35 withdrawals, 35 full examinations.	Independent practice was permitted only when the clinical supervisor was satisfied with the competence of trainee, and theory and practicum had been completed successfully. The trainee should be able to identify both normal and abnormal anatomy and complete the examination

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Table 4 (*continued*)

Author, year (Country)	Procedures performed by nurse-surgeon	Eligibility to commence training	Duration of training	Theory	Practicum	Competency assessment
						within 20 min without assistance
Gallagher, 2017 (United Kingdom)	Intravitreal therapy	Extensive clinical expertise in ophthalmic patient care (specific length of experience not stated) and a prescribing qualification	Not stated	Anatomy and physiology of the eye, and medical retinal pathophysiology, clinical trials, pharmacology, and ocular coherence tomography interpretation.	Surgeon supervised consisting of wet lab training, 50 observations and 50 procedures.	Clinical supervisor (consultant ophthalmologists) assessed the competency using protocols and criteria approved by the local quality improvement team.
Goodfellow et al., 2003 (United Kingdom)	Flexible sigmoidoscopy	Colorectal Nurse Practitioner in first year of independent practice	1 year	Delivered by the University of Hull in the United Kingdom	Surgeon supervised involving 35 observations, 35 withdrawals, and 35 full procedures	Surgical competency was achieved on completion of the training
Hasan et al., 2020 (United Kingdom)	Intravitreal therapy	Ophthalmic Nurse Practitioner	12 weeks	There is a theoretical component, but details were not provided	Surgeon supervised involving 50 observations and 50 procedures	50 single best-answer questions (pass mark 100%), all competencies must be signed off prior to independent practice
Hickey et al., 2009 (United Kingdom)	Sapheno-femoral disconnection, long saphenous vein stripping, avulsions, and wound closure	Qualified Surgical Care Practitioner with a Master of Science qualification in Advanced Nursing Practice and completed Royal College of Surgeons of Edinburgh Basic Surgical Skills and Anatomy courses	Not stated	Skills in varicose vein surgeries were taught by a consultant surgeon in six training modulesduring surgical lists	Practicum based on the same standard set for surgical trainees. A surgeon supervised all aspects of the training.	Competency assessment was based on the same standard set for surgical trainees. Competencies in: (a) duplex-assisted marking achieved in three hours and 15 supervised practices; (b) varicose vein avulsions after 2 cases; (c) sapheno-femoral ligation after 7 cases; (d) long saphenous vein stripping after 5 cases
Hui et al., 2015 (Hong Kong)	Colonoscopy and polypectomy	At least 10 years' experience in endoscopy nursing	1 year	Not stated	Observation and hands-on experience and a documented assessment of proficiency based on the Joint Advisory Group on Gastrointestinal Endoscopy requirements; presence of a clinical supervisor not stated	A documented assessment of proficiency based on the Joint Advisory Group on Gastrointestinal Endoscopy requirements.
Maule, 1994 (United States)	Flexible sigmoidoscopy	Licensed Practical Nurse or Registered Nurse	Variable	Each nurse read a standard textbook on the rationale for screening and the technique of sigmoidoscopy and	3–5 weeks of practical training supervised by a surgeon involving 35	Independent practice was permitted on completion of practical training

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Table 4 (*continued*)

Author, year (Country)	Procedures performed by nurse-surgeon	Eligibility to commence training	Duration of training	Theory	Practicum	Competency assessment
				reviewed a collection of 35 mm slides showing endoscopic anatomy.	observations, 30 withdrawals, and 35 examinations.	
Moshakis et al., 1996 (United Kingdom)	Flexible sigmoidoscopy and clinical coloproctology	Not stated	Not stated	Anatomy, physiology, pathology, and clinical aspects of gastrointestinal disease, with special emphasis on the colorectum, general endoscopy equipment training covered the mechanisms, cleaning, and maintenance of flexible sigmoidoscopes. The principles and practice of infection control and the function and organization of endoscopy units were also taught	50 observations, 50 supervised procedures, and 50 procedures with the surgeon mentor immediately available. Trainee also learnt to use the proctoscope and inject haemorrhoids.	An independent consultant gastroenterologist compared the endoscopic performances of the surgeon mentor and the Nurse Endoscopist trainee. Pupil was considered competent when her assessment scores were equal to or within 15% of those of the surgeon mentor
Redwood et al., 2009 (United States)	Flexible sigmoidoscopy	Nurse Practitioner or Physician Assistant	4 weeks	Based on the Society of Gastroenterology Nurses and Associates' Core Curriculum and Competencies and the American Academy of Family Physicians flexible sigmoidoscopy curriculum. Trainees used a computer-based endoscopy simulator to develop familiarity with scope manipulation, the sensation of scope behaviour such as looping and resistance, and recognition of abnormal pathology. The simulator also indicated patient discomfort through a computer-generated voice.	At least 25 independent procedures	Surgical competency assessments involved pre and post-tests, at least 25 independent procedures, and quarterly logs.
Rosevelt et al., 1984 (United States)	Flexible sigmoidoscopy, superficial biopsies	Nurse Practitioner	1 month	Not stated	Four surgeons supervised the training involving 50 examinations	Not stated

(*continued on next page*)

Table 4 (*continued*)

Author, year (Country)	Procedures performed by nurse-surgeon	Eligibility to commence training	Duration of training	Theory	Practicum	Competency assessment
Shum et al., 2010 (Hong Kong)	Flexible sigmoidoscopy	Advanced practice nurse level	1 year	Weekly sessions conducted by one of the trainers. The training process included theoretical component but was not described in detail	Surgeon supervised involving 75 observations, 36 withdrawals, and 35 advancements and manipulations	There is final assessment process but was not explained in detail
Spiegel, 1995 (United States)	Flexible sigmoidoscopy and biopsies	3 years' experience as Registered Nurse inclusive of at least one year in gastroenterology nursing	8 months	8 weeks of theory and two weeks of simulated sigmoidoscopy training	5.5 months supervised practicum consisting of 35 withdrawals and 50 complete examinations. A gastroenterologist supervised the practical training of the two nurse trainees.	Deemed competent for independent practice on completion of training. For continued evaluation of competence, the nurse endoscopist is required to perform five sigmoidoscopies each quarter under the direct observation of the gastroenterologist
White et al., 1987 (Congo)	Caesarean section, supracervical hysterectomy for ruptured uterus, dilatation, and curettage, symphysiotomy, suction extraction, episiotomy, laparotomy, and hernia repair	A3 nurse (completed three years of secondary school followed by two years of nursing training)	1–2 years	Not stated	Nurse work primarily with one doctor (apprenticeship)	Not stated
Wright, 2000 (United States)	Flexible sigmoidoscopy	6/17 – a minimal requirement of licensure as a registered nurse, 5/17 – Bachelor of Science in Nursing degree, 7/17 specified Bachelor of Science in Nursing preferred, and 5/17 Master of Science in Nursing as a minimal requirement. 7/17 five years of general nursing experience. Subjects thought a nurse endoscopist should have gastroenterology experience and knowledge before endoscopic training ($n = 6$; mode = 2 years; range, 2–5 years)	Not stated	Review of gastroenterology anatomy and physiology ($n = 4$), reading related literature ($n = 4$),	observation of endoscopic procedures ($n = 6/17$), and hands-on practice ($n = 11/17$). 12/17 were taught by a physician, 3/17 were trained by a nurse or nurse/physician team, 2/17 did not identify their trainers.	The number of supervised endoscopies required before independent practice as an endoscopist ranged from 10 to 104.

Registered Nurse qualification and relevant experience to commence training, while six recommended further qualifications as a Nurse Practitioner ($n = 3$), prescriber ($n = 2$), or a master's degree holder ($n = 1$). Seven studies (39%) did not mention relevant experience as a component of their nurse-surgeon training.

3.6. Training duration

Training duration was stated in 11 (61%) of the 18 included studies (median = 1 year). Of these, four were one year, two were one month, one was varied from one to two years, one was eight months, and one was three months. The remaining seven (39%) articles did not report the training duration.

3.7. Theory teaching

Theory teaching was described in 15 (83%) of the 18 included studies: 12 were conducted in the training hospital with four of these studies reporting simulation training included; two were taught as a formal university course; and one was not explained in detail albeit was present in the training programme. Three (17%) studies did not state the theoretical component of the training.

3.8. Practicum

All studies indicated practicum or a practical section as a component of nurse-surgeon training. Eleven (61%) included a series of observations and supervised performance of surgical procedures (median = 35 observations and 35 procedures). Distribution of these 11 studies showed a majority of 50 observations and 50 procedures ($n = 3$) and 35 observations and 35 procedures ($n = 3$). The number ranged from 25 to 75 required observations and 25 to 35 required procedures.

One (6%) of the 18 articles described an apprenticeship style while six (33%) did not explain the practical component of the training in detail albeit present in the training programme.

3.9. Clinical supervision

Sixteen (89%) of the 18 studies had a supervisor during the practical training. Of these, 15 were physicians and one was either a nurse or a physician. Two (11%) articles did not confirm the availability of a clinical supervisor during training.

3.10. Surgical competency assessment

Fifteen (83%) of the 18 studies described the process of assessing the trainees' surgical competency. Nine (60%) of these 15 studies deemed the trainees as competent upon completion of training, and performance of a set number of procedures. The remaining six (40%) of the 15 studies that described surgical competency assessment had miscellaneous explanations: two used an external tool for assessing surgical competence of physicians; two was through the trainees' clinical supervisors with one using protocols and criteria approved by the training hospital's quality team and one using the supervisors' judgement only; one was through an independent physician that is not part of the training; and one was through a 100% mark on a 50-single best answer questions. Three (17%) of the 18 studies did not state surgical competency assessment as a component of their nurse-surgeon training.

The number of surgeries that nurse-surgeons needed to perform to attain surgical competence was dependant on surgical speciality. Eight (44%) of the 18 included studies stated a number of surgeries that ranged from 10 to 104; all of which were under the surgical speciality of gastroenterology. The nurse-surgeons that trained in the surgical specialties of vascular, obstetrics and gynaecology, ophthalmology and general surgery did not state a specific number of procedures to be performed to achieve surgical competence. These surgical procedures were stratified by surgical speciality in supplementary material 3.

4. Discussion

To the authors' knowledge, this systematic review is the first of its kind worldwide that investigated nurse-surgeon training and education. In the context of education, the closest study that we found is a scoping review by Hains et al., 2017 which reported the lack of a standardised approach to the education of non-medical surgical assistants in the United States, Canada, United Kingdom and New Zealand. In terms of training, a systematic review by Kogan et al., 2009 indicated the use of formative assessment, supervision, and direct observation as essential during practical training and assessment of the medical interns' clinical skills. Although Hains et al., 2017 and Kogan et al., 2009 were not representative of nurse-surgeon training and education, both studies were conducted within the perioperative context and reported similar findings to our review.

4.1. Implementation of nurse-led surgery models of care

The nurse-surgeon training and education in the included studies were organised either internally by the hospital or externally by the government as a healthcare initiative to address the need to expand the delivery of their surgical capacity. One study (Redwood et al., 2009) resulted in the successful implementation of a training and education programme for nurse-surgeons to provide essential cancer screening surgical services in the remote and indigenous communities of Alaska. Another study (Duncan et al., 2017) that was

conducted in Australia found that through the government initiative to train nurses to perform endoscopic procedures, a successful expansion of their surgical capacity ensued. Furthermore, the results of the 12 studies that initiated a local nurse-surgeon training and education programme within their hospitals were consistent in reporting the positive impact of nurse-led surgery models of care in terms of the improvement in the surgical waitlist and the timely provision of essential surgical services (Hasan et al., 2020; Gallagher, 2017; Shum et al., 2010; Hickey et al., 2009; Goodfellow et al., 2003; Duthie et al., 1998; Moshakis et al., 1996; Spiegel, 1995; Maule, 1994; DiSario and Sanowski, 1993; White et al., 1987; Rosevelt et al., 1984). Although the aim of our review was to identify and describe the current methods of nurse-surgeon training and education, the discussion of our findings regarding its implementation history is also vital particularly in leveraging the potential of nurse-surgeons to the international and national key stakeholders.

4.2. Training eligibility

Our findings suggest that it would be beneficial for nurse-surgeon trainees to have a relevant nursing background and experience in the surgical speciality that they aspire to train in. Further qualifications as a Nurse Practitioner (Hasan et al., 2020; Goodfellow et al., 2003; Redwood et al., 2009; Cash et al., 1999; Duthie et al., 1998; Rosevelt and Frankl, 1984), master's degree holder (Hickey et al., 2009; Wright, 2000) or prescriber (Gallagher, 2017) can also help particularly in clinical situations where state-regulated advanced practice such as prescription of intraoperative medications is needed.

4.3. Training duration

Five studies (Duncan et al., 2017; Hui et al., 2015; Shum et al., 2010; Goodfellow et al., 2003; White et al., 1987) recommended that nurse-surgeon trainings should be at least one year. This represents the majority and median of the included studies. This is relatively short compared to the three to seven years of surgical residency training for United States physicians before qualifying as surgeons (American College of Surgeons, 2021). However, the nurse-surgeons in the included studies were only trained to perform specific surgeries thereby effectively offsetting the difference.

4.4. Theory teaching

Most of the studies concluded that the theoretical component of nurse-surgeon training and education should be delivered in the training hospital. This coincides with the recommendation for residency trainings of physicians in which theory is also taught in the hospital setting (Rashid, 2017). Additionally, Rashid (2017) advocated for a more structured delivery of theoretical concepts using adult learning frameworks and simulation to improve the overall learning outcomes. Four studies (Gallagher, 2017; Redwood et al., 2009; Spiegel, 1995; DiSario and Sanowski, 1993) in this review also recognised the advantage of simulation and was incorporated in their programmes. It was unclear from the studies the level of the educator delivering the theory (nurse or physician).

4.5. Practicum and clinical supervision

Direct Observation of Procedural Skills is the method of choice in clinical training whereby a learner performs a procedure and is evaluated contemporaneously by a clinical supervisor following a set number of procedural observations (Erfani and Ebadi, 2018). It was interesting that in 83% of the studies, the clinical supervision and assessment of competence were undertaken by a surgeon. Clinical supervisors can function as preceptors, proctors, mentors, and coaches during practicum and are therefore vital in any surgical education and training models (Sachdeva, 2021). However, there is still an ongoing debate in terms of the number of procedures required during practicum to ensure the validity and reliability of the Direct Observation of Procedural Skills model (Mayne et al., 2020; Erfani and Ebadi, 2018). Our findings suggest that this is still the case as the included studies gave differing views on the number of procedures a nurse-surgeon trainee should observe and perform during practicum. The sample median in this review is 35 observations and 35 supervised procedures (Goodfellow et al., 2003; Duthie et al., 1998; Maule, 1994).

4.6. Surgical competency assessment

Our findings indicate that surgical competency assessment was present in 83% of the nurse-surgeon trainings in the included studies, regardless of surgical speciality. There is however a great diversity and ambiguity in the number of surgical procedures required to be performed by the nurse-surgeon trainees in the included studies. This coincides with the surgical residency programmes for physicians where surgical competency assessment is heavily dependant on the subspecialty of Surgery that they would like to specialise in (Meakins, 2001). Therefore, we do not recommend a specific number of procedures that a nurse-surgeon trainee must perform to attain surgical competence. Our study suggests that at a minimum, nurse surgical trainings should include a surgical competency assessment.

Nine studies (Duncan et al., 2017; Hickey et al., 2009; Wright, 2000; Goodfellow et al., 2003; Cash et al., 1999; Duthie et al., 1998; Spiegel, 1995; Maule, 1994; DiSario and Sanowski, 1993) utilised a formative approach to surgical competency assessment using the Direct Observation of Procedural Skills model, hence surgical competence upon completion of the training. Although this is the most widely accepted teaching and evaluation method in surgical training, Erfani and Ebadi (2018) argue that subjective factors such as assessor bias and dissimilarity could cloud the objectivity of this model. Nevertheless, Mayne et al. (2020) and Erfani and Ebadi (2018) agree that the Direct Observation of Procedural Skills model is an effective assessment tool during surgical training.

4.7. Limitations

Despite critical appraisal being undertaken, we acknowledge that the included studies did not score high for methodological rigour and quality using the Mixed Methods Appraisal Tool (Hong et al., 2018). We also acknowledge the limited number of studies included in this review, which is expected in emerging nursing practices and therefore proves that nurse-surgeon training and education is under reported. Furthermore, due to the eligibility criteria developed for this review, eight studies (Abraham, 2020; Beck, 2013; Bodle et al., 2008; Doughty and Watkins, 2018; Dryer, 2006; Fletcher and Russell, 2019; Godsell, 2005; Gruber, 1996; Hough et al., 2012) were excluded that could have further confirmed the existence, and diversified the countries, of nurse-surgeon practice. These excluded articles were conducted in Ireland (Hough et al., 2012) and New Zealand (Doughty and Watkins, 2018) that studied nurse-surgeon practice in the following specialties: dermatology (Godsell, 2005); gynaecology (Bodle et al., 2008); interventional radiology (Dryer, 2006); and urology (Fletcher and Russell, 2019).

4.8. Grading of recommendations, assessment, development and evaluations

Due to the low and very low certainty of evidence in this review and the limited number of available studies around nurse-surgeon training and education, our Grading of Recommendations, Assessment, Development and Evaluations recommendation is discretionary (Schünemann et al., 2013; Atkins et al., 2004). More high-quality studies are necessary to reach a strong recommendation for the appropriate method of nurse-surgeon training and education.

4.9. Implications for practice, policy, and future research

Although the body of evidence in this review is rated low in quality and certainty, indications from the included studies can be translated in the context of policy, practice, workforce, and future research around nurse-surgeon training and education internationally.

4.10. Policy

Our review provides the first known evidence that nurse-surgeon training and education can be streamlined by combining theory teaching, physician-supervised practicum, and surgical competency assessment. Our findings can be used by national decision makers in recommending and developing a streamlined nursing pathway to surgical residency training in many subspecialties of Surgery where surgeons are scarce, or where a surgical workforce is desperately needed to avoid the millions of deaths from many surgically treatable conditions and deliver surgical care to the billions of people needing these essential health services.

Our review is also well timed particularly in the development of policies to aptly utilise the perioperative nursing workforce in the pandemic era where optimisation of surgical capacity in many countries was further exacerbated by the coronavirus disease. Considering its restrictive impact on the face-to-face training and education of surgical interns and medical students (Al-Jabir et al., 2020), internal upskilling of nurses who are already employed within a given organisation can be an alternative in maintaining or improving the delivery and efficiency of surgical care, without the need to wait unpredictably for the coronavirus restrictions to be lifted so the surgical residency internships or clinical placements of medical students could proceed. Additionally, with the impact of coronavirus on critical care, re-deployment of surgeons and anaesthetists meant some of the surgeries might be cancelled or deprioritised (Al-Jabir et al., 2020). Again, this could be an opportune time for an internal theatre nurse to be trained to perform minor surgeries while the surgeon is re-deployed to treat a more complicated case.

4.11. Practice

Our review recommends standardisation of nurse-surgeon training and education by incorporating theory teaching, practicum, and surgical competency assessment in the programme. This standardisation will lead to consistency, uniformity, and ultimately accreditation of nurse-surgeon practice (Kriznik et al., 2019). The outcomes will be comparable and therefore could be regulated, replicated, measured, and subjected to quality improvement (Kriznik et al., 2019) to ensure that a high standard of care is provided to patients undergoing surgery. Additionally, a standard model of training and education is more likely to be adapted in practice than a novel approach without any scientific basis (Castillo, 2013).

Many inconsistencies and ambiguities in the nursing titles were also found across the included studies affecting clarity and generalisability of the studies. We recommend using a more consistent language on this topic to avoid fragmentation and isolation of research data. The authors believe that “nurse-surgeon” is the most suitable umbrella term to encapsulate this emerging perioperative nursing practice. This coincides with the terminology “surgeon” referring to physicians trained to perform surgery, regardless of surgical speciality.

4.12. Future research

Taking into account the low quality and certainty of evidence available in this review, a more rigorous research methodology should be utilised to enhance the quality and certainty of evidence around nurse-surgeon training and education. One issue that we found is the possibility of publication bias in many of the included studies (see Table 2). This could have been avoided through the use

of comprehensive reporting guidelines specific to the design of the study being conducted. Some of the included studies also used a limited number of trainees (see Table 3) affecting the generalisability of findings. A larger study might be required to improve this issue.

As our eligibility criteria excluded grey literature and non-research papers, it is highly likely that our review has not fully identified and captured the breadth of nurse-surgeon training and education worldwide. A scoping review that will include published and unpublished, research and non-research papers would be suitable in achieving this goal. Our search was also limited to English language studies which may have missed relevant studies in non-English speaking countries. Lastly, the lack of a specific medical subject heading for nurse-surgeons may have limited the ability of this review to identify all relevant studies. We therefore recommend that the keyword "nurse-surgeon" be included in the medical subject heading thesaurus.

4.13. Nursing workforce

The nursing workforce is ageing, and many early career nurses are leaving the profession (International Council of Nurses, 2021; World Health Organisation, 2020). We cannot control ageing, however, the International Council of Nurses (2021) and World Health Organisation (2020) argue that an attractive career advancement structure could be key to retaining our nurses and attracting the younger generation to enter the nursing workforce. Millennials are the most educated nurses in history, and they feel engaged through increased responsibility and maximisation of their potential; they will leave if these expectations are unmet (Keith et al., 2021). Therefore, supplying them with an attractive nursing career pathway and eliminating the notion that nurses will never equate to physicians in clinical practice might be advantageous. The World Health Organisation (2020) believe that investing in nurses will ameliorate health outcomes, sustain global health, and boost an inclusive economic climate. Nurse-led surgery is one example of an attractive career advancement pathway that has been proven to improve surgical health outcomes worldwide. Here is an innovative nursing practice that with a structured residency training, may engage nurses to stay in the profession and attract more people to enter the nursing workforce (Institute of Medicine, 2011). By empowering our perioperative nurses to reach the top of their scope of practice, we are challenging the status quo and instigating a transformational leadership within nursing that will redefine and ultimately futureproof our profession in the perioperative field (Institute of Medicine, 2011).

Conclusions

Nurse-led surgery models of care emerged from the need of many health systems worldwide to meet the growing surgical demands. Nurse-surgeon training and education were found to be at least one year in duration. The entrants would benefit from having a nursing background and experience in the relevant surgical speciality. Three components of nurse-surgeon training and education surfaced during the review. These are: andragogical theory teaching that is delivered in the teaching hospital with simulation; a practicum involving a minimum of 35 observations and performance of 35 procedures that are supervised by a surgeon; and the formative Direct Observation of Procedural Skills assessment model that deems the learner competent upon successful completion of training. An implication for policy is a recommendation for national decision makers to develop a streamlined nursing pathway to surgical residency and utilisation of internal perioperative nurses to optimise surgical capacity amidst the coronavirus restrictions on face-to-face surgical training and education of medical interns and students. For future research, a rigorous research methodology is required to improve the quality and certainty of evidence. The use of consistent language around nurse-surgeon training, education and practice may prevent fragmentation and isolation of valuable data. A scoping review might be a more suitable method in capturing the full breadth of nurse-led surgery. Standardisation of nurse-surgeon training and education will produce a consistent clinical practice that can be regulated, accredited, and adapted. A structured nurse-surgeon career pathway is an emerging nursing practice innovation that might be a key to retaining young nurses and futureproofing the profession in the perioperative setting through attractive retention strategies that are calibrated specifically for millennial nurses and the younger generation.

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Protocol

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Availability of data, code, and other materials

See supplementary material 4

Declaration Competing Interest

None

Supplementary materials

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3.3 Summary

Chapter 3 present a peer-reviewed paper that reviewed the extant literature on nurse-surgeon training and educational preparation. No formalised pathway was identified for the education of nurse-surgeons. The training and education for nurse-surgeons typically span at least one year, necessitating entrants with a nursing background and relevant surgical specialty experience. Three key components emerged from the systematic review: andragogical theory teaching delivered in a teaching hospital with simulation, a practicum involving a minimum of 35 supervised observations and procedures, and a formative assessment model, the Direct Observation of Procedural Skills, declaring competence upon successful training completion. An important policy implication recommends national decision-makers streamline a nursing pathway to surgical residency, leveraging internal perioperative nurses to optimise surgical capacity during face-to-face training restrictions. Future research should adopt rigorous methodologies to enhance evidence quality, and consistent language in nurse-surgeon training, education, and practice. A scoping review is suggested for capturing the full spectrum of nurse-led surgery. Standardising nurse-surgeon training and education facilitates regulated, accredited, and adaptable clinical practice. An emerging nursing practice innovation, a structured nurse-surgeon career pathway, may be pivotal for retaining young nurses, offering tailored retention strategies for millennials and the younger generation in the perioperative setting, thus future-proofing the profession. Chapter 4 will present a peer-reviewed paper that investigated the impact of nurse-surgeons on patient-centred outcomes.

Chapter 4 Impact of nurse-surgeons on patient-centred outcomes: A systematic review (Paper 3)

4.1 Introduction

Chapter 3 presented a published systematic review investigating the training and education methods employed globally for nurse-surgeons. Chapter 4 presents a peer-reviewed publication entitled "Impact of nurse-surgeons on patient-centred outcomes: A systematic review" which aimed to investigate the impact of nurse-surgeons on patient-centred outcomes. The paper identified areas of nurse-surgeon impact in patient satisfaction and experience, waiting list management, perioperative complications, and quality of surgical care. The standard of patient care was either maintained or enhanced by the inclusion of nurse-surgeons in the health team. The review was published in the International Journal of Nursing Studies Advances in 2022 (Grota et al., 2022). The journal was the preferred publisher for this research work due to its promotion of open access publishing and its commitment to promoting advanced nursing practice. Furthermore, the journal has a Q1 status and a CiteScore of 5.8 cementing its position as a platform for impactful research and visibility within the scholarly community. A copy of the published article is provided below for reference.

4.2 Journal article

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Impact of nurse-surgeons on patient-centred outcomes: A systematic review

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ABSTRACT

Background: Nurse-surgeons have been performing surgeries for decades. Yet, their impact on perioperative clinical outcomes has not been explored in detail.
Objective: To investigate the impact of nurse-surgeons on patient-centred outcomes.
Design: Systematic review
Method: The Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow diagram and checklist for systematic reviews were used as the screening and reporting guideline. CINAHL, Cochrane Library, MEDLINE, and PubMed databases were searched for articles that fit the review's eligibility criteria. A combination of Medical Subject Headings, keywords and filters for each database were used. Following screening and full text review, the Mixed Methods Appraisal Tool was used for quality assessment and the Grading of Recommendations, Assessment, Development and Evaluations framework for certainty and confidence assessment. Narrative synthesis was used to report the findings due to the design heterogeneity of the included studies.
Results: Forty-eight ($n = 48$) patient-centred outcomes were identified from 25 included studies. These outcomes were grouped into four categories: patient satisfaction and experience; waiting list; perioperative complications; and quality of surgical care. Patient satisfaction and experience was rated high to very high in 16 studies; none reported patient dissatisfaction. Waiting lists improved in eight studies. Perioperative complications were none to very low in nine studies. Mortality rates in the nurse-surgeon group were better than the physician group in three studies. The quality of care in the performance of surgeries by nurse-surgeons was either similar or better than physicians in ten studies.
Conclusions: Nurse-surgeons performed safe, satisfactory, and high-quality surgeries with minimal perioperative complications similar to physicians. The use of nurse-surgeons has significantly reduced waiting lists regardless of surgical speciality. Policies around nurse-surgeon practice needs to be developed at national and international levels to streamline the delivery of much needed surgical services amidst the coronavirus pandemic in the areas of cancer diagnostic surgeries, emergency surgeries, minor surgeries, and remote and rural health.

What is already known?

1. Nurse-surgeons have been performing surgeries worldwide for at least 70 years.

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2. Nurse-surgeons are effective in cancer diagnostic surgeries, emergency surgeries, minor surgeries, and rural and remote health.

What this paper adds

1. Nurse-performed surgeries result in positive patient-centred outcomes including high to very high patient satisfaction, significant reduction in the surgical waiting list times, minimal or similar perioperative complications to physician-performed surgeries, and similar or better quality of surgical care than physician-performed surgeries.

2. Surgical specialties of nurse-surgeons include urology, paediatric urology, gastroenterology, ophthalmology, oncology, obstetrics, gynaecology, otolaryngology, vascular, dermatology, cardiothoracic, orthopaedics, hand, trauma, neurosurgery, and general surgery.

3. There is a clear need to develop policies to regulate nurse-surgeons as a way to expand and sustain the currently overburdened surgical workforce.

1. Background

Access to surgery was a problem faced by an estimated five billion people worldwide in 2015 (Alkire et al., 2015). Of these five billion people, at least 18 million were reported to die annually from conditions that could have been treated by surgery (Reddy et al., 2020). Low to middle-income countries typically represent the majority of these mortality estimates (Bath et al., 2019) which illustrates the stark disparity in surgical care between the poor and more developed nations. However, this changed dramatically from the outset of the coronavirus pandemic in late 2019 (Wiersinga et al., 2020). Many high-income countries are now struggling to provide surgical care with millions of patients in their surgical backlogs due to the coronavirus lockdown restrictions (Carr et al., 2021; COVIDSurg Collaborative, 2020). The billions of people in low to middle-income countries, and the millions in high-income countries requiring surgery, and the adverse patient outcomes that ensued from the delays in surgery are reasons enough to consider surgical care as a priority public health issue.

Surgical care is a critical component of universal health coverage (World Health Organisation, 2014) and with the harrowing effects of the coronavirus pandemic placing the less developed nations on heightened adversity and the developed nations on serious setbacks, finding a viable innovation in the delivery of surgical services is paramount. One such candidate that has been holding promise for more than 70 years is the utilisation of nurse-surgeons (White et al., 1987).

Nurse-surgeons can be defined as nurses who perform surgeries autonomously (Grota et al., 2021; White et al., 1987). Other terms to describe this role include nurse endoscopist, nurse cystoscopist, nurse hysteroscopist, nurse biopsy, physican extender, nurse practitioner, clinical nurse specialist, perioperative specialist practitioner, and surgical care practitioner (Grota et al., 2021). These nurses emerged from the desperate need of many health systems to resolve their ballooning surgical waitlists amidst the ongoing chronic shortage and maldistribution of surgeons (Holmer et al., 2015). Recently, many first world countries have also enacted legislations to restrict the unhealthy and unreasonable hours worked by junior physicians to avoid burnout and permanent attrition in the medical workforce (Campaner, 2019). This resulted in major gaps that further aggravated surgical capacities particularly in the areas of diagnostic and cancer surgeries. Nurse-surgeons have been filling these gaps for decades.

A historical overview of the term "nurse-surgeon" dates back to the early 16th century when King Henry VIII appointed a nurse-surgeon named William Bullein (Duffin, 2017). Bullein was instrumental in the treatment of pleurisy and the "English sweating sickness" – an epidemic that killed thousands in 1517 (Furdell, 2001). The term "nurse-surgeon" has further been used to describe nurses who performed surgeries in the 1950s when African nurses were trained by an American surgeon to undertake caesarean sections, supracervical hysterectomies, and laparotomies (White et al., 1987). Three decades later, in 1983, two Stanford University physicians wrote an article entitled "Nurse Surgeons: A New Role for Nurses" where they proposed the introduction of Certified Registered Nurse Surgeon in the United States to undertake minor surgical procedures on the written order of a licensed physician (Litt and Brodsky, 1983). In 2007, the term "nurse surgeon" was used to exemplify the rapidly changing surgical practices in Europe (Mitchell, 2007; Zorn, 2005). By 2009, nurse surgeons were recognised as qualified non-medical surgeons who can practice surgery within the public health system of the United Kingdom (Mickute, 2009).

In the last decade, nurse-surgeons have been reported to perform major and minor general, vascular, orthopaedic, ophthalmological, urological, colorectal, and gynaecological surgeries (Eddy and Duffy, 2019; Judd, 2013; Marsh, 2005; Wise, 2021). These surgeries include caesarean section, lapatoromy, appendicectomy, herniorrhaphy, endoscopy, hysteroscopy, cystoscopy, biopsy, and carpal tunnel release (Grota et al., 2021; Kingsnorth, 2005). Nurse-surgeons are now employed in many countries in Europe, Africa, Asia, and North America (Grota et al., 2021; Kowalewski and Jahn, 2001; Zorn, 2005).

A 2021 study led to an understanding that the contributions of nurse-surgeons in many health systems worldwide have been positive particularly in the areas of cancer diagnostic surgeries, emergency surgeries, minor surgeries, and remote and rural health (Grota et al., 2021). Additionally, Johal and Dodd (2017); Salibian et al. (2016) and Joseph et al. (2015) described the roles and positive contributions of nurse-surgeons in many surgical specialties. However, due to the fragmentation of research data from the ambiguous nursing titles, confusing nurse-surgeon origins and timelines ensued. Therefore, a more targeted research approach should be taken to explore nurse-led surgery. "Nurse-surgeon" as an all-encompassing terminology should be utilised to encapsulate this

emerging and timely advanced nursing practice. To date, no studies have been conducted to investigate the contributions of "nurse-surgeons" in clinical outcomes. Therefore, a gap in literature exists particularly in the exploration of nurse-surgeons' impact on patient-centred outcomes – a specific set of clinical outcomes that is both "meaningful and important to patients and caregivers" (Frank et al., 2014, p. 1513).

Extant research around patient-centred outcomes recognises the importance of including end-user perspectives, such as healthcare workers and patients themselves, to enhance the quality of research and the applicability of research outcomes to decision-making, and ultimately improve the likelihood that patients achieve their desired health outcomes (Frank et al., 2014). In recognition of its importance, significant investment in the development and validation of patient-centred outcomes occurred across the many healthcare disciplines (Algurén et al., 2020; Gambling and Long, 2019; Riordain et al., 2021). Nurse-surgeons can contribute substantially to the development of patient-centred care research and exploring the impact nurse-surgeons have on patient-centred outcomes is one facet of this. In agreement with the importance of including the perspectives of patients and health providers in making relevant decisions around surgical care, the authors selected patient-centred outcomes as the group of clinical outcomes to be investigated in this review. Ergo, the aim of this systematic review is to investigate the impact of nurse-surgeons on patient-centred outcomes.

2. Methods

The Preferred Reporting Items for Systematic Reviews and Meta-analyses statement checklist (Page et al., 2021) was the reporting guideline used for this systematic review.

2.1. Definition of terms

For clarity and consistency, the authors have provided a list of terminologies below which were defined based on contemporary literature.

2.1.1. Access to surgery (variants – surgical access, patient access to surgery, patient access, access)

noun: a measure of "surgical capacity, safety, timeliness, and affordability" (Alkire et al., 2015, p. e316) in a given health system.

2.1.2. Global surgery

noun: a "rapidly developing multidisciplinary field aiming to provide improved and equitable surgical care across international health systems" (Bath et al., 2019, p. 1).

2.1.3. Surgery

noun: the authors adapted the World Health Organisation definition of surgery as any invasive procedure that is performed aseptically, and usually with the use of appropriate anaesthesia, by trained surgeons, other physicians, nurses, and other non-physicians to investigate and/or treat surgical conditions (Debas et al., 2006).

2.1.4. Waiting list (variants – waitlist, waiting times)

noun: a queue for patients requiring specific health services which indicates "excess demand over supply, unmet needs, and inadequate resources" (Amoko et al., 1992, p. 18).

2.1.5. Perioperative

adjective: "the days and weeks immediately preceding and following a surgical intervention" (McQueen et al., 2015, p. 265). It is divided into three stages, which are "preoperative (from the decision to operate to entry into the theatre suite), intraoperative (from entry into the theatre suite to leaving the recovery area), and postoperative (following transfer from the recovery area)" (Chazapis et al., 2018, p. 52 and 55)

2.2. Eligibility criteria

A set of eligibility criteria (Aromataris and Munn, 2020) was developed by the authors for this review (see Supplementary material 1), using the Population Intervention Comparison Outcome framework (Schiavenato and Chu, 2021). The population was patients undergoing surgery, and the intervention was nurse-surgeon, regardless of title or surgical speciality. The comparison was standard surgery performed by physicians, and the outcome measure was patient-centred outcomes. Settings included, but were not limited to, perioperative department, operating room, operating theatre, day surgery unit, outpatient clinic, community clinic, endoscopy unit, catheterisation laboratory or interventional radiology, and nurse-led surgical service or clinic. Articles included were quantitative, qualitative, mixed methods, and dissertation studies published in the English language without any date restrictions. Search dates were not restricted to include all data on nurse-surgeons. Grey literature and non-research papers such as systematic reviews, editorials, letters to the editor and opinions were excluded. Any surgical assisting roles were also excluded as they do not perform surgeries independently.

2.3. Search strategy

A search strategy (Aromataris and Munn, 2020) was developed by the authors and the search initiated in September 2021. A combination of Medical Subject Headings, keywords and filters for each database were used (see Supplementary material 2). Given the relatively limited use of nurse-surgeons in published research, the authors used terms that are similar to the term "nurse-surgeon". These include nurs*, nurse-led, nurse-led surg*, theatre nurs*, operating room nurs*, nurse practitioner, perioperative nurs*, surgical nurs*, nurse endoscopist, nurse hysteroscopist, nurse colonoscopist, nurse cystoscopist, perioperative specialist practitioner. The sources of information were CINAHL, Cochrane Library, MEDLINE, PubMed, and handsearching.

2.4. Selection process

The retrieved articles from the electronic databases and handsearching were imported to the online application called Covidence® to streamline the stages of the systematic review (Covidence, 2021). This application was also utilised as the automation tool for detecting any duplicate studies. One author (TG) conducted the initial title and abstract screening of all the articles. Two of four authors (TG, VB, AB, EJ) reviewed the articles for full text eligibility. Disagreements were resolved by discussion or a third reviewer (one of VB, AB, EJ) where necessary. Immediately prior to quality assessment, another layer of screening was conducted by one author (TG) to ensure that the articles fit the World Health Organisation definition of surgery (see Definition of terms), which was an eligibility criterion of this review.

2.5. Quality assessment

The Mixed Methods Appraisal Tool (Hong et al., 2018) was used to assess the quality of each study. Each remaining article that passed the full text screening was critically appraised by two of four authors (TG, VB, AB, EJ) in Covidence® (2021). The tool was also used as an inclusion criterion wherein two of the four authors (TG, VB, AB, EJ) decided to include or exclude the studies based on the screening questions of the tool. Consensus was required to complete the quality assessment and inclusion of each article. Disagreements were resolved by discussion, or a third reviewer (one of VB, AB, EJ) where necessary.

2.6. Certainty assessment

Certainty assessment was conducted in accordance with item 15 of the 2020 reporting checklist by the Preferred Reporting Items for Systematic Reviews and Meta-analyses (Page et al., 2021). While quality assessment is necessary to appraise the quality of each included article (Hong et al., 2018), certainty assessment is equally important to measure the confidence in these included articles when they are amalgamated for the purpose of answering the four specified outcomes of this review (Schünemann et al., 2013). The authors have rated patient satisfaction and experience as the critical outcomes of this review. Waiting list, postoperative complications and quality of perioperative care were rated as the important outcomes of this review.

The Grading of Recommendations, Assessment, Development and Evaluations framework was used to assess the certainty of evidence available in this review and consequently, provide a strength of recommendation in line with the result of the certainty assessment (Schünemann et al., 2013). The GRADEpro® automated software (GRADE Working Group, 2020) was used to tabulate the results of the Grading of Recommendations, Assessment, Development and Evaluations certainty assessment (Schünemann et al., 2013). Certainty assessment was done by one author (TG), which was then evaluated by a second author (one of VB, AB, EJ). Disagreements were resolved by discussion or a third reviewer (one of VB, AB, EJ) where necessary.

2.7. Data extraction and synthesis

The included studies were extracted for the following data: author/s; publication year; country; study design; aim; setting; participant; inclusion and exclusion criteria; method of participant recruitment; surgical speciality; number and type of surgeries performed by nurse-surgeons; patient-orientated outcomes; findings; peer review; and conflict of interest. Data extraction was performed by two of four authors (TG, AB, VB, EJ) in Covidence® (2021). Disagreements were resolved by discussion or a third reviewer (one of VB, AB, EJ) where necessary. The final extracted data was exported from Covidence® (2021) as a comma-separated values file and converted into an excel spreadsheet. Considering the heterogeneity in the design and characteristics of the included studies, meta-analysis was not possible (Deeks et al., 2021; Ryan and Cochrane Consumers and Communication Review Group, 2013). Therefore, all authors agreed upon narrative synthesis as the most suitable approach in reporting the findings of this review (Ryan and Cochrane Consumers and Communication Review Group, 2013). One author (TG) synthesised the final extracted data from Covidence® (2021). This was then evaluated en masse by the three remaining authors (VB, AB, EJ) throughout the extraction and synthesis stages of this review.

3. Results

3.1. Search results

Fig. 1 illustrates the search results using the Preferred Reporting Items for Systematic Reviews and Meta-analyses flow diagram (Page et al., 2021). Initial searches yielded 5878 results. Upon importation to Covidence® (2021), the application found 2026

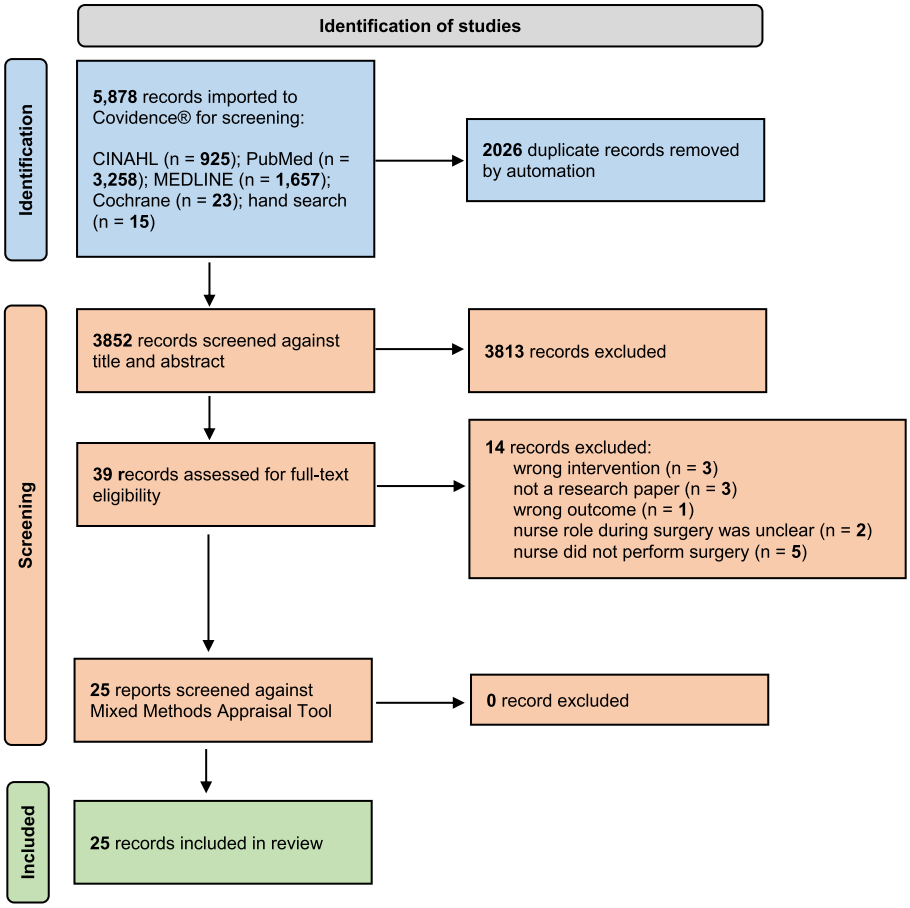

Fig. 1. . Preferred reporting items for systematic reviews and meta-analyses flow diagram.

duplicates which were immediately removed. The remaining 3852 studies were screened against titles and abstracts. A total of 3813 studies were excluded on title and abstract review. The remaining 39 studies were assessed for full-text eligibility (see Supplementary material 3). Following full text review, 14 articles were excluded due to the following reasons: wrong intervention (Alexandrou et al., 2014; Currie et al., 2004; Rochester et al., 2008); not a research paper (Pearce, 2013; Spencer and Winkels, 1978; Yalamanchi et al., 2021); wrong outcome (Grose et al., 1995); the role of the nurse during surgery was unclear (Beaulieu-Jones et al., 2020; Changole et al., 2010); and the nurse did not perform surgery (Beard et al., 2014; Moore, 2018; Pandian et al., 2011; Van Calster et al., 2019; Wagonfeld and Murphy, 2006). Twenty-five articles (Bodle et al., 2008; Bolme et al., 2020; Chan et al., 2020; Collins, 2010; Chu et al., 2011; Duncan et al., 2017; Gallagher, 2017; Giramonti and Kogan, 2018; Godsell, 2005; Hickey and Cooper, 2009; Hui et al., 2015; James and McPhail, 2008; Jejeebhoy et al., 2011; Kelly et al., 2008; Laker-Oketta et al., 2015; Lawson et al., 1999; Malata, 2018; Martin, 2002; Michelotti et al., 2014; Newey et al., 2006; Palmquist, 2010; Sapre et al., 2012; Sturgess et al., 1996; White et al., 1987; Williams et al., 2020) remained for quality assessment. Immediately, prior to quality assessment, the 25 articles were screened against the parameters of surgery as defined by the World Health Organisation (see Supplementary material 4); none of the 25 articles were removed.

3.2. *Result of quality and certainty assessment*

Twenty-five studies remained for quality assessment in Covidence® (2021) as shown in Table 1. The designs of the 25 studies were quantitative randomised controlled trials (Bolme et al., 2020; Hui et al., 2015), quantitative non-randomised controlled trials (Bodle

Table 1
Quality assessment.

Author, year	Reviewer	Overall appraisal	Category of study design																							
			1. Qualitative					2. Quantitative RCT					3. Quantitative non-RCT					4. Quantitative descriptive					5. Mixed methods				
			1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	2.5	3.1	3.2	3.3	3.4	3.5	4.1	4.2	4.3	4.4	4.5	5.1	5.2	5.3	5.4	5.5
Malata (2018)	TG, AB	Include																Y	Y	Y	C	Y					
Jejeebhoy et al. (2011)	TG, AB	Include											Y	Y	Y	C	Y										
Chan et al. (2020)	TG, AB	Include																Y	Y	Y	Y	Y					
Duncan et al. (2017)	TG, AB	Include																Y	Y	Y	C	Y					
Gallagher (2017)	TG, AB	Include																Y	Y	Y	C	Y					
Hickey and Cooper (2009)	TG, AB	Include																Y	Y	C	Y	C					
James and McPhail (2008)	TG, AB	Include																Y	Y	Y	C	Y					
Martin (2002)	TG, AB	Include																Y	Y	Y	C	C					
Giramonti and Kogan (2018)	TG, EJ	Include											Y	Y	Y	C	Y										
Michelotti et al. (2014)	TG, EJ	Include																Y	Y	Y	Y	Y					
Lawson et al. (1999)	TG, EJ	Include																Y	Y	Y	Y	Y					
Bolme et al. (2020)	TG, EJ	Include						Y	Y	Y	C	Y															
Laker-Oketta et al. (2015)	TG, EJ	Include											Y	Y	Y	Y	Y										
Chu et al. (2011)	TG, EJ	Include																Y	Y	Y	N	Y					
Sturgess et al. (1996)	TG, EJ	Include																Y	Y	Y	Y	Y					
Sapre et al. (2012)	TG, EJ	Include																Y	Y	Y	Y	Y					
Palmquist (2010)	TG, EJ	Include																Y	Y	Y	Y	Y					
Bodle et al. (2008)	TG, VB	Include											Y	Y	C	Y	Y										
Kelly et al. (2008)	TG, VB	Include											Y	Y	Y	Y	Y										
	TG, VB	Include											Y	Y	C	C	Y										

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Table 1 (*continued*)

Author, year	Reviewer	Overall appraisal	Category of study design																							
			1. Qualitative					2. Quantitative RCT					3. Quantitative non-RCT					4. Quantitative descriptive					5. Mixed methods				
			1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	2.5	3.1	3.2	3.3	3.4	3.5	4.1	4.2	4.3	4.4	4.5	5.1	5.2	5.3	5.4	5.5
White et al. (1987)																										
Hui et al. (2015)	TG, VB	Include						Y	Y	N	N	Y														
Collins (2010)	TG, VB	Include																Y	Y	Y	Y	Y				
Godsell (2005)	TG, VB	Include																Y	Y	Y	Y	Y				
Williams et al. (2020)	TG, VB	Include											Y	Y	Y	Y	Y									
Newey et al. (2006)	TG, VB	Include											Y	Y	Y	C	Y									

Y – yes, **N** – no, **C** – can't tell, **RCT** – randomised controlled trial.

1.1. Is the qualitative approach appropriate to answer the research question? **1.2.** Are the qualitative data collection methods adequate to address the research question? **1.3.** Are the findings adequately derived from the data? **1.4.** Is the interpretation of results sufficiently substantiated by data? **1.5.** Is there coherence between qualitative data sources, collection, analysis, and interpretation? **2.1.** Is randomization appropriately performed? **2.2.** Are the groups comparable at baseline? **2.3.** Are there complete outcome data? **2.4.** Are outcome assessors blinded to the intervention provided? **2.5.** Did the participants adhere to the assigned intervention? **3.1.** Are the participants representative of the target population? **3.2.** Are measurements appropriate regarding both the outcome and intervention (or exposure)? **3.3.** Are there complete outcome data? **3.4.** Are the confounders accounted for in the design and analysis? **3.5.** During the study period, is the intervention administered (or exposure occurred) as intended? **4.1.** Is the sampling strategy relevant to address the research question? **4.2.** Is the sample representative of the target population? **4.3.** Are the measurements appropriate? **4.4.** Is the risk of nonresponse bias low? **4.5.** Is the statistical analysis appropriate to answer the research question? **5.1.** Is there an adequate rationale for using a mixed methods design to address the research question? **5.2.** Are the different components of the study effectively integrated to answer the research question? **5.3.** Are the outputs of the integration of qualitative and quantitative components adequately interpreted? **5.4.** Are divergences and inconsistencies between quantitative and qualitative results adequately addressed? **5.5.** Do the different components of the study adhere to the quality criteria of each tradition of the methods involved?.

et al., 2008; Giramonti and Kogan, 2018; Jejeebhoy et al., 2011; Kelly et al., 2008; Laker-Oketta et al., 2015; Newey et al., 2006; White et al., 1987; Williams et al., 2020), and quantitative descriptive (Chan et al., 2020; Collins, 2010; Chu et al., 2011; Duncan et al., 2017; Gallagher, 2017; Godsell, 2005; Hickey and Cooper, 2009; James and McPhail, 2008; Lawson et al., 1999; Malata, 2018; Martin, 2002; Michelotti et al., 2014; Palmquist, 2010; Sapre et al., 2012; Sturgess et al., 1996). The authors of this review did not calculate an overall score for each study. This decision was based on the recommendation provided in the Mixed Methods Appraisal Tool (Hong et al., 2018).

3.2.1. Quality of the quantitative randomised controlled trials

Of the two quantitative randomised controlled trials (Bolme et al., 2020; Hui et al., 2015), both were randomised appropriately with comparable groups at baseline and participants that were adherent to their assigned intervention. One study (Bolme et al., 2020) presented a complete outcome data while the other (Hui et al., 2015) had incomplete outcome data from the 787 study participants. Blinding of the outcome assessors in both studies was either omitted or unclear.

3.2.2. Quality of the quantitative non-randomised controlled trials

Eight (Bodle et al., 2008; Giramonti and Kogan, 2018; Jejeebhoy et al., 2011; Kelly et al., 2008; Laker-Oketta et al., 2015; Newey et al., 2006; White et al., 1987; Williams et al., 2020) of the included studies were quantitative non-randomised controlled trials. All had participants that represented the target population. All had appropriate measurements regarding the study outcomes and interventions. Six (Giramonti and Kogan, 2018; Jejeebhoy et al., 2011; Kelly et al., 2008; Laker-Oketta et al., 2015; Newey et al., 2006; Williams et al., 2020) of the eight studies had complete outcome data; the other two (Bodle et al., 2008; White et al., 1987) were unclear. Four (Bodle et al., 2008; Kelly et al., 2008; Laker-Oketta et al., 2015; Williams et al., 2020) of the eight studies described the confounders in the study design and analysis; the other four (Giramonti and Kogan, 2018; Jejeebhoy et al., 2011; Newey et al., 2006; White et al., 1987) did not. All had interventions administered or outcomes occurred as intended during the study period.

3.2.3. Quality of the quantitative descriptive studies

Fifteen (Chan et al., 2020; Collins, 2010; Chu et al., 2011; Duncan et al., 2017; Gallagher, 2017; Godsell, 2005; Hickey and Cooper, 2009; James and McPhail, 2008; Lawson et al., 1999; Malata, 2018; Martin, 2002; Michelotti et al., 2014; Palmquist, 2010; Sapre et al., 2012; Sturgess et al., 1996) of the included studies were quantitative descriptive. All had relevant sampling strategies that addressed the study research question. All had samples that represented the target population. Fourteen of the 15 studies had appropriate study measurements (Chan et al., 2020; Collins, 2010; Chu et al., 2011; Duncan et al., 2017; Gallagher, 2017; Godsell, 2005; Hickey and Cooper, 2009; James and McPhail, 2008; Lawson et al., 1999; Malata, 2018; Martin, 2002; Michelotti et al., 2014; Palmquist, 2010; Sapre et al., 2012; Sturgess et al., 1996); one was unclear (Hickey and Cooper, 2009). Nine of the 15 studies had low nonresponse risk of bias (Chan et al., 2020; Collins, 2010; Godsell, 2005; Hickey and Cooper, 2009; Lawson et al., 1999; Michelotti et al., 2014; Palmquist, 2010; Sapre et al., 2012; Sturgess et al., 1996), five were unknown (Duncan et al., 2017; Gallagher, 2017; James and McPhail, 2008; Malata, 2018; Martin, 2002) and the remaining one (Chu et al., 2011) had a high nonresponse risk of bias. Thirteen of the 15 studies were deemed to have appropriate statistical analysis methods to answer the study research question (Chan et al., 2020; Collins, 2010; Chu et al., 2011; Duncan et al., 2017; Gallagher, 2017; Godsell, 2005; James and McPhail, 2008; Lawson et al., 1999; Malata, 2018; Michelotti et al., 2014; Palmquist, 2010; Sapre et al., 2012; Sturgess et al., 1996); the remaining two were unclear (Hickey and Cooper, 2009; Martin, 2002).

The overall outcome of the appraisal of all 25 studies using the Mixed Methods Appraisal Tool (Hong et al., 2018) were “include”. No studies were excluded due to low methodological quality as recommended by Hong et al. (2018). A final sample of 25 articles was included for certainty assessment, data extraction, and data synthesis.

3.3. Certainty assessment

The results of the certainty assessment are outlined in Table 2, which was downloaded from the GRADEpro® software (GRADE Working Group, 2020). The table was based on the Grading of Recommendations, Assessment, Development and Evaluations framework (Schünemann et al., 2013), which has four levels of certainty. Very low or a score of 1 means very little certainty in the available evidence. Low or a score of 2 means limited certainty in the available evidence. Moderate or a score of 3 means moderate confidence in the available evidence. High or a score of 4 means strong confidence in the available evidence.

Using the Grading of Recommendations, Assessment, Development and Evaluations approach (Schünemann et al., 2013) and the assessment scoring generated by the GRADEpro® software (GRADE Working Group, 2020), the authors’ confidence in the body of evidence available in this review for the critical and important outcomes are the following: moderate or a score of 3 for patient satisfaction and experience; low or a score of 2 for waiting list; moderate for postoperative complications; and moderate for quality of perioperative patient care. The primary factor in this decision was the lack of studies with randomised controlled trial design. Of the 25 included studies, only two were randomised controlled trials (Bolme et al., 2020; Hui et al., 2015). This markedly downgraded the level of certainty in each critical or important outcome despite the risk of bias, inconsistency, indirectness, and imprecision being generally negligible across the included studies.

3.4. Study characteristics

Table 3 outlines the characteristics of the included studies. The majority of studies were conducted in the United Kingdom (Bodle

Table 2
GRADEpro® certainty assessment (narrative table).

Certainty assessment							Narrative description	Certainty	Importance
No of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations			
Patient satisfaction and experience									
16	Mixed (1 RCT, 4 quantitative non-RCT, 11 quantitative descriptive)	not serious	not serious	not serious	not serious	publication bias strongly suspected all plausible residual confounding would reduce the demonstrated effect[a]	All studies reported high to very high patient satisfaction to surgeries performed by nurse-surgeons. None reported dissatisfaction to nurse-performed surgeries. All studies reported positive patient experience with the nurse-surgeons. None reported any negative experience with the nurse-surgeons.	⨁⨁⨁◯ Moderate	CRITICAL
Waiting list									
9	Mixed (2 quantitative non-RCT, 7 quantitative descriptive)	not serious	not serious	not serious	not serious	publication bias strongly suspected all plausible residual confounding would reduce the demonstrated effect[a]	All studies reported an improvement in the waiting list through reduction of patient waiting time to have their surgery.	⨁⨁◯◯ Low	IMPORTANT
Perioperative complications									
14	Mixed (2 RCT, 5 quantitative non-RCT, 7 quantitative descriptive)	not serious	not serious	not serious	not serious	publication bias strongly suspected all plausible residual confounding would reduce the demonstrated effect[a]	Perioperative complications were reported as adverse events in 6 studies, mortality rate in 4 studies, complication rates in 3 studies, and length of stay pre and postoperatively in 1 study. All studies indicated low or rare occurrence of adverse events.	⨁⨁⨁◯ Moderate	IMPORTANT
Quality of surgical care									
10	Mixed (2 RCT, 2 quantitative non-RCT, 6 quantitative descriptive)	not serious	not serious	not serious	not serious	publication bias strongly suspected all plausible residual confounding would reduce the demonstrated effect[a]	All studies reported that the quality of surgical care was either maintained or improved.	⨁⨁⨁◯ Moderate	IMPORTANT

RCT – randomised controlled trial.
Certainty rating.
⨁◯◯◯ very low – the true effect is probably markedly different from the estimated effect.
⨁⨁◯◯ low – the true effect might be markedly different from the estimated effect.
⨁⨁⨁◯ moderate – The authors believe that the true effect is probably close to the estimated effect.
⨁⨁⨁⨁ high – The authors have a lot of confidence that the true effect is similar to the estimated effect.
Explanations.
[a] Not reported or unclear.

Table 3
Characteristics of included studies.

Author, year	Study design/aim	Participant details, study dates (clinical setting)	Inclusion and exclusion criteria	Surgical speciality	Patient-orientated outcome	Findings	Peer review/ conflict of interest/funding sources
Bodle et al. (2008), United Kingdom	Quantitative non-RCT/to investigate the effect of the introduction of nurse hysteroscopists on patient satisfaction at an outpatient hysteroscopy clinic in the United Kingdom	139 and 102 females who underwent hysteroscopy in 2000 and 2005, respectively (University Teaching Hospital)	Inclusion: Consecutive patients were approached to complete an anonymous structured questionnaire after their hysteroscopy during the two 6-month periods in 2000 and 2005. Exclusion not stated	Gynaecology	Waiting times; Communication; Professional skills/ intervention; overall satisfaction	1. Waiting time 1.1. Median appointment waiting time fell from 8 ± 6 weeks in 2000 to 2 ± 2 weeks in 2005 ($p < 0.001$)/ 1.2. Median time waiting in the clinic decreased from 10 ± 30 min in 2000 to 2 ± 10 min in 2005 ($p = 0.005$)/1.3. Patient satisfaction with appointment waiting time increased from 64.3% in 2000 to 87.3% in 2005 ($p < 0.001$) 2. Overall satisfaction with the clinic was 94% in 2000 compared with 95% in 2005	Yes/not stated/ not stated
Bolme et al. (2020), Norway	Quantitative randomised controlled trial/to test if task shifting of intraocular injections to nurses in a real-world setting can result in similar visual function outcome with equal safety profile.	342 patients receiving anti-vascular endothelial growth factor, March – May 2016 (Tertiary ophthalmology department)	Inclusion: having either age related macular degeneration, retinal vein occlusion or diabetic macular oedema eligible for anti-vascular endothelial growth factor treatment. Both treatment-naive patients and patients earlier treated with anti- vascular endothelial growth factor. Exclusion: Not being able to give an informed consent	Ophthalmology	Primary - change in best-corrected visual acuity Secondary - adverse events, the number of intraocular injections, the length of intervals between injections and the success of masking	"Primary - Nurse-administered intraocular injections were noninferior to physician-administered injections with 0.7 and 1.6 letters gained, respectively (95% CI of the mean difference, 2.9 – 1.0; $p = 0.019$, one-sided t-test). Secondary - eleven participants died during the study period: 4 in the nurse and 7 in the physician-administered injection group. Ocular adverse events in three eyes of three different participants were registered in the nurse group. Six participants lost≥30 letters during the study and five of these belonged to the nurse-administered injection group	Not stated/none declared/Funded by St. Olavs Hospital, Trondheim, Norway
Chan et al. (2020), United States	Quantitative descriptive/ to provide an update on how Advanced Practice Providers impact healthcare delivery in the	36 paediatric otolaryngology hospital chiefs, July 2017 – July 2018 (Hospital-based paediatric otolaryngology)	Inclusion and exclusion criteria not stated	Otolaryngology	Improvement in patient care and patient access	Most academic paediatric otolaryngology chiefs found the Advanced Practice Provider model to be beneficial in improving patient care, patient access	Yes/none declared/not stated

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Table 3 (*continued*)

Author, year	Study design/aim	Participant details, study dates (clinical setting)	Inclusion and exclusion criteria	Surgical speciality	Patient-orientated outcome	Findings	Peer review/ conflict of interest/funding sources
	academic paediatric otolaryngology setting					and faculty productivity. Recognised AAP use as an opportunity for increased productivity, acknowledged onboarding processes and continuing medical education needed to support this	
Chu et al. (2011), Somalia	Quantitative descriptive/ to reduce mortality due to complications of pregnancy and childbirth and from violent and non-violent trauma.	1602 Somalian patients, October 2006 – December 2009 (Operating Room, Istarlin Hospital,)	Inclusion: Somalian patients who had surgeries grouped into the following categories: obstetric emergencies, infection, neoplasm, accidental injury, violence-related injury, and other. Exclusion not stated	Obstetrics	Perioperative mortality	Perioperative mortality was lower (0.2%, 2 cases) between 2008 and 2009 compared to 2006–2007 (1.7%, 6 cases), $P < 0.001$).	Yes/none declared/not stated
Collins (2010), United Kingdom	Quantitative descriptive/ to identify patients' experience of a bone marrow procedure performed by the lymphoma clinical nurse specialist, particularly in relation to the pain relief used and the quality of the samples obtained	The first 50 patients who required a bone marrow procedure after competency confirmation were included in the audit, February – July 2006 (Nurse-led bone marrow procedure clinic)	Inclusion: patients requiring bone marrow procedure. Exclusion not stated	Surgical oncology	Pain relief and patient satisfaction	38/50 responded to the questionnaire. Of the 38 who returned questionnaires, 37 (97 per cent) thought the staff had done everything they could to help with any pain or discomfort related to the procedure. All patients reported receiving the right amount of pain relief and $n = 37$ (97%) of patients reported receiving the right amount of information regarding pain relief."	Yes/not stated/ not stated
Duncan et al. (2017), Australia	Quantitative descriptive/ to explore Monash Health's experience with the introduction of a nurse endoscopist	40 patients requiring endoscopy, January – July 2013 (Hospital endoscopy unit)	Inclusion: Colonoscopy only, Category 1, 2, or 3 (National Bowel Cancer Screening Program - positive faecal occult blood test), Polyp recalls Surveillance -existing family history, patients younger than 80 years, no cancer follow-ups or colorectal resection follow-ups, low anaesthetic risk. Exclusion: Clinically complex patients, patient preferring a medical proceduralist	Gastroenterology	Patient experience and satisfaction, waiting list	80% of patients ($n = 32$) reported that overall, they had a very good experience with the nurse endoscopist trainee. A nurse endoscopist initiative can facilitate the expansion of endoscopy services to meet the growing need within the community. 80% of patients reported no pain or discomfort during the procedure, 95% of patients reported the personal manner of the Nurse Endoscopist trainee was very good or excellent, 80% of patients rated the	Yes/none declared/Health Workforce Australia & Victoria Department of Health

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Table 3 (*continued*)

Author, year	Study design/aim	Participant details, study dates (clinical setting)	Inclusion and exclusion criteria	Surgical speciality	Patient-orientated outcome	Findings	Peer review/ conflict of interest/funding sources
						explanation and information given by the Nurse Endoscopist trainee at the start was very good or excellent, 68% of patients rated the trainee's knowledge about their problem and medical history as very good to excellent, and 70% of patients reported not being anxious during the procedure. Waiting list - This project allowed Monash Health to successfully address the large procedural wait time through extensive audit and waitlist process redesign and instil sustainable practices for the ongoing wait-list management. In particular, the treatment of Category 2 and 3 patients by the trainee significantly eased the pressure on the service wait-lists.	
Gallagher (2017), United Kingdom	Quantitative descriptive/ to determine the patient satisfaction of 100 patients having nurse-led intravitreal therapy injections.	100 patients receiving intravitreal therapy, June – December 2015 (Princess Alexandra Eye Pavilion – National Health Service)	Inclusion and exclusion criteria not stated	Ophthalmology	Patient experience of procedure patient satisfaction	Most (99%) of patients thought that the nurse considered and respected their wishes. Significantly, all thought that the nurse took time to listen to their concerns or questions and explained the procedure as it progressed. Most significantly, all were satisfied by the service they received from the nurse, overall reflecting high-quality care. Despite a minority of concerns, all of the nurse-treated patients were satisfied with the care they received.	Yes/none declared/not stated
Giramonti and Kogan (2018),	Quantitative non-randomised controlled trial/to show that with	100 paediatric patients ages 6 months – 13 years,	Families with boys requesting either a circumcision or revision of	Paediatric urology	Surgical complications, post-operative complications and return	There were no operative complications, nor any documented emergency	Yes/none declared/none

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Table 3 (*continued*)

Author, year	Study design/aim	Participant details, study dates (clinical setting)	Inclusion and exclusion criteria	Surgical speciality	Patient-orientated outcome	Findings	Peer review/ conflict of interest/funding sources
United States	proper training an Advanced Practice Provider could safely perform a circumcision in the OR	study dates not stated (Operating Room)	circumcision were scheduled with the NP. Exclusion not stated		rates to the Operating Room	room or urgent care visits in the immediate post-operative period. There were no early returns to the OR and only 1 scheduled follow-up procedure for a penile skin bridge	
Godsell (2005), United Kingdom	Quantitative descriptive/ aim not stated but in title' The development of the nurse biopsy role'.	Nurse trained to perform biopsies, January – December 2004 (Dermatology Department, Queen's Medical Centre)	Inclusion and exclusion criteria not stated	Dermatology	Waiting time, patient satisfaction, surgical technique of nurse	The waiting time for a biopsy was reduced from 8 weeks to 0 weeks. The waiting time for a simple excision by a doctor, if the lesion turned out to be malignant, was reduced from 8 weeks to 2 weeks. A patient satisfaction survey showed that patients were happy to have their surgery performed by a nurse. An audit of the histology reports from the specimens obtained by the nurses showed that a diagnosis was obtained in 100% of the cases, indicating that the surgical technique of the nurses was good.	Yes/not stated/ not stated
Hickey and Cooper (2009), United Kingdom	Quantitative descriptive/ to assess whether a Surgical Care Practitioner operating at an advanced level could make a major contribution to day-case varicose vein surgery.	Patients requiring vascular surgery, August 2003 – July 2007 (Operating Theatre)	Inclusion and exclusion criteria not stated	Vascular	Waiting list, quality of care, patient safety	A suitably qualified and trained SCP can safely perform varicose vein surgery to an advanced level, and this had a positive effect on the efficiency of day case varicose vein lists. The SCP input was reported to improved quality of care and patient safety. Patient feedback confirmed that the SCP was more thorough than the consultant in obtaining informed consent	Not stated/not stated/not stated
Hui et al. (2015), Hong Kong	Quantitative randomised controlled trial/to test the hypothesis that trained nurse endoscopists are not inferior to medical endoscopists in finding	787 subjects volunteered to participate in a local colorectal cancer screening programme and were scheduled to receive ambulatory colonoscopy, 15-month period March	Inclusion: Asymptomatic subjects between the ages of 50 and 70 years. Exclusion: Subjects who had undergone colonoscopy in the past 5 years, prior colorectal surgery, a personal history of	Gastroenterology	Primary - colon adenoma detection rate. Secondary - caecal intubation rate, intubation time, total procedural withdrawal time, complication rate,	Nurse endoscopist group had a significantly higher adenoma detection rate per procedure (43.8% vs 32.7%) which was associated with a proportion difference of +11.1% (95% CI 4.1% –	Yes/none declared/none

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Table 3 (*continued*)

Author, year	Study design/aim	Participant details, study dates (clinical setting)	Inclusion and exclusion criteria	Surgical speciality	Patient-orientated outcome	Findings	Peer review/ conflict of interest/funding sources
	adenomas during colonoscopy	2012 – June 2013 (Combined Endoscopy Unit)	inflammatory bowel disease, colonic adenoma or CRC, a family history of familial adenomatous polyposis syndrome or familial non-polyposis syndromes, pregnant or lactating women and unable to provide consent		subject's pain score and satisfaction score.	18.1%). The nurse endoscopist had a lower caecal intubation rate (97.3% vs 100%, $p = 001$), received better post-procedural pain scores (0.6 vs 0.8, $p = 0.021$), and higher overall satisfaction (4.5 vs 4.3, $p = 0.001$)	
James and McPhail (2008), United Kingdom	Quantitative descriptive/ to describe the work involved in implementing a one-stop, nurse-led clinic for suspected prostate cancer	Male patients with suspected prostate cancer, July – December 2007 (Nurse-led clinic)	Male patients with suspected prostate cancer. Exclusion not stated	Urology	Patient satisfaction, quality, and patient safety	Patients were satisfied with the one-stop service, although some patients were surprised at the nurse-led aspect of the service. They are supportive of the nurse-led concept and would not prefer to see a doctor. Patients appreciate the rapid journey time. Cancer pickup rates (43 per cent) are at the high end of the range of published data from doctor-performed biopsies. The quality of biopsy material was judged to be excellent by the receiving pathologist. Prostatic tissue was found in 100% of samples. Complication rates were acceptable by comparison with published data. The procedure was tolerated very well by patients	Yes/not stated/ not stated
Jejeebhoy et al. (2011), India	Quantitative non-RCT/to assess the safety and efficacy of manual vacuum evacuation performed by nurses in comparison to physicians using an equivalence design.	897 pregnant women, July 2009 – January 2010 (Non-government organisation clinical settings)	Inclusion: A positive uterine pregnancy of ≤10 weeks gestational age as measured by a urine pregnancy test for human chorionic gonadotropin and a pelvic examination, haemoglobin measuring ≥ 9 g/dL, no attempts in the previous week to terminate the pregnancy, resided within an hour of the study site, willing to return 7 days later for a follow-up check-up and	Obstetrics	Assessment of abortion completeness, failure rates, complication rates, adverse symptoms, satisfaction	Results show that manual vacuum evacuation can be provided with equal safety and effectiveness, according to the study's definition of equivalence, by nurses as by physicians. Nurses were as skilled as physicians in assessing gestational age, performing manual vacuum evacuation, and assessing completed abortion status. Overall failure and complication rates were low	Yes/none declared/ David and Lucille Packard Foundation

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Table 3 (*continued*)

Author, year	Study design/aim	Participant details, study dates (clinical setting)	Inclusion and exclusion criteria	Surgical speciality	Patient-orientated outcome	Findings	Peer review/ conflict of interest/funding sources
			undergo two pelvic examinations and indicated no other contraindications for abortion. Exclusion: Women who made unsafe attempts at termination of pregnancy			and equivalent between the two provider types. 0.2% difference in failure rate (95% CI); 0.0% difference in complication rate (95% CI). Adverse symptoms were rarely experienced and client satisfaction and perceptions of quality of care were high and identical amongst both groups of providers, with all clients who underwent an MVA procedure by a nurse indicating their willingness to seek abortion from nurses in future if needed.	
Kelly et al. (2008), United Kingdom	Quantitative descriptive/ to review the outcomes of nurse specialist led flexible sigmoidoscopy in an outpatient setting between 1999 and 2004	Patients requiring flexible sigmoidoscopy, 1999 – 2004 (Nurse specialist-led flexible sigmoidoscopy outpatient clinic)	Inclusion and exclusion criteria not stated	Gastroenterology	Post op bleeding; depth of insertion of the sigmoidoscope	The depth of insertion of the sigmoidoscope was as follows: rectum in 85 patients, sigmoid colon in 595 patients, descending colon in 1969 patients, splenic flexure in 958 patients and transverse colon in 311 patients. Two patients sustained an iatrogenic rectal perforation.	Yes/not stated/ not stated
Laker-Oketta et al. (2015), Uganda & Kenya	Quantitative non-randomised controlled trial/aim not stated	Patients, January 2007 – July 2013 (Clinics - 2 in Uganda and 1 in Kenya)	Inclusion: Patients who underwent punch skin biopsy from January 2007 to July 2013. Exclusion not stated	Surgical oncology	Patient satisfaction, complication	The procedure has been both uncomplicated to perform and well tolerated by patients (statistical data not available). There were no reports of recurrent bleeding after initial haemostasis or subsequent wound infection after the biopsy	Yes/none declared/ National Institutes of Health
Lawson et al. (1999), United Kingdom	Quantitative descriptive/ to assess the feasibility of training nurse practitioners to perform bone marrow aspiration and trephine biopsy, and to compare the quality of these samples with those obtained by medical staff	30 patients, August 1996 – February 1997 (Haematology Day unit)	Inclusion and exclusion criteria not	Surgical oncology	Patient satisfaction	In the nurse practitioner group of patients, 70% would prefer a nurse to repeat the test and 30% had no preference between a nurse and a doctor. Among the patients who had the procedure carried out by a doctor, 82% favoured having a doctor again and 18% had no preference.	Not stated/not stated/not stated

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Table 3 (*continued*)

Author, year	Study design/aim	Participant details, study dates (clinical setting)	Inclusion and exclusion criteria	Surgical speciality	Patient-orientated outcome	Findings	Peer review/ conflict of interest/funding sources
Malata (2018), United Kingdom	Quantitative descriptive/ to explore the impact of the nurse led crosslinking service on patient care.	95 patients requiring crosslinking, January – December 2016 (outpatient clinic)	Inclusion and exclusion criteria not stated	Ophthalmology	Waiting times, length of stay pre and post procedure, and patient satisfaction	93% satisfied - (25% satisfied, 72% very satisfied); waiting times significantly reduced, length of stay pre and post procedure significantly reduced	Yes/ not stated/ not stated
Martin (2002), United Kingdom	Quantitative descriptive/ aim not stated	19 patients, study dates not stated (Nurse-led Clinic at National Health Service Trust)	Inclusion and exclusion criteria not stated	Dermatology	Patient satisfaction	20% had not expected the nurse practitioner to perform the procedure; 80% expected either the consultant or another doctor to perform the procedure; 100% were very satisfied to be seen by the nurse practitioner; 100% found it acceptable to be operated upon by the nurse practitioner; 89% would be prepared to see the nurse practitioner again; 100% were happy with the overall treatment received from the nurse practitioner.	Not stated/not stated/not stated
Michelotti et al. (2014), United Kingdom	Quantitative descriptive/ aim not stated	Patients requiring intravitreal therapy, June 2012 – November 2013 (Operating Theatres in two NHS hospitals)	Inclusion and exclusion criteria not stated	Ophthalmology	Waiting time, adverse events	The service improvement reduced patient waiting time. 12 minor adverse events reported (corneal abrasions, subconjunctival haemorrhage; rate 0.36%). Adverse events were recorded prospectively. There were no cases of serious adverse events (vision-threatening adverse events, such as endophthalmitis, retinal tear, retinal detachments, or vitreous haemorrhage).	Not stated/none declared/Authors received conference travel support from Novartis and Alcon
Newey et al. (2006), United Kingdom	Quantitative non-randomised controlled trial/to describe the outcome of a nurse-led service to manage patients with a presumptive diagnosis of carpal tunnel syndrome.	305 patients with diagnosis of carpal tunnel syndrome, September 1999 – September 2001 (Nurse led outpatient clinic)	Inclusion and exclusion criteria not stated	Hand	Waiting time, standard and quality of care Patient satisfaction	Waiting times improved considerably whilst the standard and quality of care was maintained	Yes/not stated/ not stated

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Table 3 (*continued*)

Author, year	Study design/aim	Participant details, study dates (clinical setting)	Inclusion and exclusion criteria	Surgical speciality	Patient-orientated outcome	Findings	Peer review/ conflict of interest/funding sources
Palmquist (2010), United States	Quantitative descriptive/ to determine if an influx of NPs is warranted and feasible by examining and comparing the roles of the providers, their productivity, and whether patient satisfaction levels are maintained	2380 patients, January 2004 – December 2007 (6 outpatient surgery clinics)	Inclusion: Patients seen in normally scheduled surgical outpatient clinics at the Veterans Administration from 2004 to 2007. Exclusion: Those patients who are acutely ill, need to be admitted for advanced treatments, are sent to the ER, or are seen as an unscheduled patient were not included in the study	Cardiothoracic, Urology, Orthopaedics, Vascular, Ear, Nose, and Throat, and General Surgery		All clinics' results for the difference were statistically significant, the MDs (n = 1376, M = 82.76, SD = 26.02) patients' satisfaction was less than NPs (n = 1004, M = 90.34, SD = 18.54), t (2376.759) = −8.289, p < 0.01	Not stated/not stated/not stated
Sapre et al. (2012), Australia	Quantitative descriptive/ to present our initial experience implementing a nurse-led flexible cystoscopy service in a Victorian tertiary hospital and our initial results from that service	272 patients, October 2009 – June 2011 (Nurse-led flexible cystoscopy service in a day surgery setting)	Inclusion: All patients undergoing surveillance flexible cystoscopy at the Royal Melbourne Hospital from October 2009 to June 2011. This included patients with non-muscle-invasive bladder cancer, upper tract transitional cell carcinoma, patients who have had radiotherapy or other bladder preservation surgery for bladder cancer, as well as patients with an augmented bladder or neobladder needing cystoscopic surveillance. Exclusion not stated	Urology	Patient satisfaction and waiting list	There was a 65% reduction in the waiting list for surveillance flexible cystoscopy after introduction of the service. Of 60 patients who completed the feedback questionnaire, 95% reported that they were given enough information by the nurses, 92% had all their questions answered satisfactorily and 97% had enough confidence and trust in the nurse. In all, 90% had a positive perception of the service overall and 93% were happy to have a flexible cystoscopy performed by a nurse rather than a doctor	Yes/none declared/not stated
Sturgess et al. (1996), United Kingdom	Quantitative descriptive/ to evaluate the success rate and complications of percutaneous endoscopic gastrostomy insertion performed with an endoscopy nurse practitioner, rather than a second doctor, carrying out percutaneous gastric puncture.	100 patients, study dates not stated (Endoscopy unit in a district general hospital - Aintree Hospitals Trust)	Inclusion: unselected routine percutaneous endoscopic gastrostomy insertions. Exclusion not stated	Gastroenterology	Successful placement; immediate complication; 30-day mortality rate, outcome at 3 months Fatality and live birth	Successful Percutaneous Endoscopic Gastrostomy placement by nurse (50/50) vs physician (49/50); immediate complication in nurse group (n = 2) vs physician group (n = 2); 30-day mortality rate was 8% in nurse group and 12% in physician group, outcome at 3 months was similar in both groups except for a slightly lower incidence of stomal infection in the nurse group	Yes/not stated/ not stated

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Table 3 (*continued*)

Author, year	Study design/aim	Participant details, study dates (clinical setting)	Inclusion and exclusion criteria	Surgical speciality	Patient-orientated outcome	Findings	Peer review/ conflict of interest/funding sources
White et al. (1987), Congo	Quantitative non-randomised controlled trial/to describe obstetric operations performed by specially trained nurses in rural areas of a developing country	390 pregnant women, January 1985 – June 1986 (Operating room)	Inclusion: Pregnant. Exclusion not stated	Obstetrics and Gynaecology		Lives saved; 326 women had surgery performed by nurses with 7 deaths.	Yes/not stated/ not stated
Williams et al. (2020), United States	Quantitative non-randomised controlled trial/to describe the outcomes of the Nurse Practitioner-led newborn circumcision clinic. Specifically, the study describes parent/family satisfaction, clinical and demographics characteristics and outcomes of patients, and charge differences between circumcision in the newborn circumcision clinic and in the operating room	234 newborns undergoing circumcision, August 2016 – April 2018 (Nurse Practitioner-led neonatal circumcision clinic)	Inclusion: Healthy infants (at least 24 h old and in a stable, healthy state) who are less than 12 weeks old and weigh less than 5.5 kg (12 pounds). Exclusion: Patients who are medically unstable or ill, evidence of infection or rash at the surgical site, a family history of bleeding anomalies, or presence of congenital anomalies of the penis including but not limited to: congenital buried penis, chordee>30, penile torsion, epispadias, or hypospadias.	Paediatric urology	Parent or family satisfaction	Results of the patient satisfaction survey revealed 89.8% of patients rated the overall quality of care as excellent or very good. The median length of procedure was 20 min. No patients experienced penile amputations, infections, strictures, intraoperative bleeding, or wounds. Ten patients (4.3%) had bleeding events during the recovery period which were treated with a topical medication (StatSeal). Two patients (0.9%) had bleeding after discharge requiring Emergency Department evaluation and application of a pressure dressing. Two patients (0.9%) required circumcision revision.	Yes/not stated/ Boston Children's Hospital Rosemary H. Grant Urology Innovation and Research Fund; USA

Table 4
Summary of surgeries performed by nurse-surgeons.

Author, year	Country	Surgical speciality of the nurse-surgeon	Surgeries performed by the nurse-surgeon	Number of nurse-performed surgeries	Title of the nurse-surgeon
Bodle et al. (2008)	United Kingdom	Gynaecology	Hysteroscopy	69	Nurse Hysteroscopist
Bolme et al. (2020)	Norway	Ophthalmology	Intravitreal therapy	1076	Nurse
Chan et al. (2020)	United States	Otolaryngology	Ear and nasal foreign body removal (96%), tongue tie lysis (58%), nasopharyngoscopy (54%), flexible laryngoscopy (50%), functional endoscopic evaluation of swallowing (15%), simple laceration repair (12%), drainage of peritonsillar abscess (8%), stroboscopy (4%) and nasal cautery (4%)	Unclear from the 2777 outpatient visits conducted	Advanced Practice Providers (Nurse practitioners and Physicians Assistants)
Chu et al. (2011)	Somalia	Obstetrics	Mostly emergency obstetrics and minor operations, Caesarean sections and uterine evacuations	314	Surgical Nurse
Collins (2010)	United Kingdom	Surgical oncology	Bone marrow aspiration and trephine biopsy	50 trephine biopsy and 22 aspirations	Lymphoma clinical nurse specialist
Duncan et al. (2017)	Australia	Gastroenterology	Colonoscopy and polypectomy	212	Nurse Endoscopist
Gallagher (2017)	United Kingdom	Ophthalmology	Intravitreal therapy	100	Nurse
Giramonti and Kogan (2018)	United States	Paediatric urology	Sleeve circumcision procedure/ revision of circumcision	100	Nurse Practitioner
Godsell (2005)	United Kingdom	Dermatology	Punch biopsy, incision biopsy, and excision biopsy	1500	Skin Cancer Nurse Specialist
Hickey and Cooper (2009)	United Kingdom	Vascular	Sapheno-femoral ligation, long saphenous vein stripping, varicose vein avulsions (phlebectomies), and independent groin wound closures	152 independent saphenofemoral disconnections, 91 independent avulsions, 191 independent groin wound closures. Total = 474	Surgical Care Practitioner
Hui et al. (2015)	Hong Kong	Gastroenterology	Colonoscopy and polypectomy	Three nurses performed 590 (prior to the study) and 364 (during the study)	Nurse endoscopist
James and McPhail (2008)	United Kingdom	Urology	Transrectal ultrasound and biopsy	Not stated	Nurse
Jejeebhoy et al. (2011)	India	Obstetrics	Manual vacuum aspiration	433	Nurse
Kelly et al. (2008)	United Kingdom	Gastroenterology	Flexible sigmoidoscopy	3956	Nurse specialist
Laker-Oketta et al. (2015)	Uganda & Kenya	Surgical oncology	Skin punch biopsy	1735 (62% of 2799)	Nurse
Lawson et al. (1999)	United Kingdom	Surgical oncology	bone marrow aspirate and biopsy	Not stated	Nurse Practitioner
Malata (2018)	United Kingdom	Ophthalmology	Corneal crosslinking	128	Nurse
Martin (2002)	United Kingdom	Dermatology	removal of minor skin lesions (suspicious moles, lipomas, sebaceous cysts, papilloma)	Over 200	Nurse Practitioner
Michelotti et al. (2014)	United Kingdom	Ophthalmology	Intravitreal therapy	3355	Ophthalmic nurse, Nurse Practitioner, Nurse Injector
Newey et al. (2006)	United Kingdom	Hand	Carpal tunnel decompressions	395	Nurse Practitioner
Palmquist (2010)	United States	Cardiothoracic, Urology, Orthopaedics, Vascular, Ear, Nose, and Throat, and General Surgery	Non-exhaustive list of category 1 basic Nurse Practitioner functions: needle aspiration of joints and bursae, joint injections, skin tag removals, punch biopsies, and skin scrapings. Incision and drainage of abscesses, removing lipomas, wound care, including (but not limited) to	Not specified from the 118,617 patient visits for the period 2004–2007 at 6 clinics	Nurse Practitioner

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Table 4 (*continued*)

Author, year	Country	Surgical speciality of the nurse-surgeon	Surgeries performed by the nurse-surgeon	Number of nurse-performed surgeries	Title of the nurse-surgeon
			debridement, irrigation, and drain removal, destruction of skin, including but not limited to lesions by cryotherapy and chemicals, pap smears. The list of category 1 basic Nurse Practitioner functions within the Veterans Health Administration system continues for ten pages. Even more broad and unlimiting is category two specific/specialized Nurse Practitioner functions which include an entire page of blank spaces in which very specialized or highly trained functions can be listed. For example, if a Nurse Practitioner works in general surgery and would like to be trained by a surgeon on removing lipomas in the outpatient clinic setting then this can be listed after training and competence is determined (usually when the surgeon demonstrates the procedure and then the Nurse Practitioner demonstrates the procedure on a patient). The guidelines are very open and determined to be at the discretion of the Nurse Practitioner, their comfort level, and the supervising surgeon		
Sapre et al. (2012)	Australia	Urology	Flexible cystoscopy	720	Nurse
Sturgess et al. (1996)	United Kingdom	Gastroenterology	Gastroscopy & percutaneous endoscopic gastrostomy insertion	50	Nurse Practitioner
White et al. (1987)	Congo	Obstetrics and Gynaecology	Caesarean section, laparotomy, and hysterectomy for ruptured uterus	326 total c-sections and laparotomies (of these, 13 laparotomies for uterine rupture (9 hysterectomies and 4 tubal ligation repair)	Nurse-surgeon
Williams et al. (2020)	United States	Paediatric urology	Circumcision	239 (234 in analysis)	Nurse Practitioner

et al., 2008; Collins, 2010; Gallagher, 2017; Godsell, 2005; Hickey and Cooper, 2009; James and McPhail, 2008; Kelly et al., 2008; Lawson et al., 1999; Malata, 2018; Martin, 2002; Michelotti et al., 2014; Newey et al., 2006; Sturgess et al., 1996) followed by the United States (Chan et al., 2020; Giramonti and Kogan, 2018; Palmquist, 2010; Williams et al., 2020) and Australia (Duncan et al., 2017; Sapre et al., 2012). India (Jejeebhoy et al., 2011), Norway (Bolme et al., 2020), Uganda, Kenya (Laker-Oketta et al., 2015), Somalia (Chu et al., 2011), Congo (White et al., 1987), and Hong Kong (Hui et al., 2015) each had one study included in this review. Eleven of the 25 studies were published in the last ten years (Bolme et al., 2020; Chan et al., 2020; Duncan et al., 2017; Gallagher, 2017; Giramonti and Kogan, 2018; Hui et al., 2015; Laker-Oketta et al., 2015; Malata, 2018; Michelotti et al., 2014; Sapre et al., 2012; Williams et al., 2020), and eleven in the past eleven to twenty years ((Bodle et al., 2008; Collins, 2010; Chu et al., 2011; Godsell, 2005; Hickey and Cooper, 2009; James and McPhail, 2008; Jejeebhoy et al., 2011; Kelly et al., 2008; Martin, 2002; Newey et al., 2006; Palmquist, 2010). The remaining three articles were published in 1999 (Lawson et al., 1999), 1996 (Sturgess et al., 1996) and 1987 (White et al., 1987).

Seventeen of the 25 studies were conducted in an outpatient clinic setting (Bodle et al., 2008; Bolme et al., 2020; Chan et al., 2020; Collins, 2010; Gallagher, 2017; Godsell, 2005; James and McPhail, 2008; Jejeebhoy et al., 2011; Kelly et al., 2008; Laker-Oketta et al., 2015; Lawson et al., 1999; Malata, 2018; Martin, 2002; Newey et al., 2006; Palmquist, 2010; Sapre et al., 2012; Williams et al., 2020), five in an operating room or operating theatre (Chu et al., 2011; Giramonti and Kogan, 2018; Hickey and Cooper, 2009; Michelotti et al., 2014; White et al., 1987), and three in an endoscopy unit (Duncan et al., 2017; Hui et al., 2015; Sturgess et al., 1996). A total of 14,629 surgeries were performed by nurse-surgeons across all the 25 studies (see Table 4). This does not include the unspecified number of surgeries performed by nurse-surgeons during the 121,394 patient visits reported in two studies (Chan et al., 2020; Palmquist, 2010). The surgeries in the included studies can be categorised into 13 surgical specialties, namely urology (Giramonti and Kogan, 2018; James and McPhail, 2008; Palmquist, 2010; Sapre et al., 2012; Williams et al., 2020), gastroenterology (Duncan et al., 2017; Hui et al., 2015; Kelly et al., 2008; Sturgess et al., 1996), ophthalmology (Bolme et al., 2020; Gallagher, 2017; Malata, 2018; Michelotti et al., 2014), oncology (Collins, 2010; Laker-Oketta et al., 2015; Lawson et al., 1999), obstetrics (Chu et al., 2011; Jejeebhoy et al., 2011; White et al., 1987), gynaecology (Bodle et al., 2008; White et al., 1987), otolaryngology (Chan et al., 2020;

Palmquist, 2010), vascular (Hickey and Cooper, 2009; Palmquist, 2010), dermatology (Godsell, 2005; Martin, 2002), cardiothoracic (Palmquist, 2010), orthopaedics (Palmquist, 2010), hand (Newey et al., 2006) and general surgery (Palmquist, 2010). Of the five studies on nurse-performed urological surgeries, two ($n = 2$ Giramonti and Kogan, 2018; Williams et al., 2020) were under the highly specialised paediatric urology subspecialty. Eight unique nurse-surgeon titles were used across the 25 studies (see Table 4). The most common titles were Nurse (Bolme et al., 2020; Chu et al., 2011; Gallagher, 2017; James and McPhail, 2008; Jejeebhoy et al., 2011; Laker-Oketta et al., 2015; Malata, 2018; Michelotti et al., 2014; Sapre et al., 2012) and Nurse Practitioner (Chan et al., 2020; Giramonti and Kogan, 2018; Lawson et al., 1999; Martin, 2002; Michelotti et al., 2014; Newey et al., 2006; Palmquist, 2010; Sturgess et al., 1996; Williams et al., 2020) followed by Nurse Specialist (Collins, 2010; Godsell, 2005; Kelly et al., 2008), and Nurse Endoscopist (Duncan et al., 2017; Hui et al., 2015). Surgical Care Practitioner (Hickey and Cooper, 2009), Nurse Injector (Michelotti et al., 2014), Nurse Hysteroscopist,(Bodle et al., 2008) and Nurse-surgeon (White et al., 1987) were also used once.

3.5. Patient outcomes

Forty-eight patient-orientated outcomes were reported across the 25 included studies (see Table 3). These outcomes were grouped by the authors (TG, VB, AB, EJ) into four categories: (1) patient satisfaction and experience; (2) waiting list; (3) perioperative complications; and (4) quality of surgical care. Of the 48 reported outcomes, 16 (33%) were around patient satisfaction and experience, 14 (29%) around perioperative complications, ten (21%) around quality of surgical care, and eight (17%) around waiting lists.

3.5.1. Patient satisfaction and experience

Of the sixteen studies that measured patient satisfaction (see Table 3), all reported high to very high satisfaction of the surgical services provided by nurse-surgeons (Bodle et al., 2008; Collins, 2010; Duncan et al., 2017; Gallagher, 2017; Godsell, 2005; Hickey and Cooper, 2009; Hui et al., 2015; James and McPhail, 2008; Jejeebhoy et al., 2011; Laker-Oketta et al., 2015; Lawson et al., 1999; Malata, 2018; Martin, 2002; Palmquist, 2010; Sapre et al., 2012; Williams et al., 2020). Six of these studies had higher overall patient satisfaction ratings of "very satisfied", "very good", and "excellent" as compared to "satisfied" (Bodle et al., 2008; Duncan et al., 2017; Jejeebhoy et al., 2011; Malata, 2018; Martin, 2002; Williams et al., 2020). None of the 16 studies reported dissatisfaction to nurse-performed surgeries. Furthermore, every study reported positive patient experience with the nurse-surgeons. Two of the 16 studies noted that the nurse-surgeons "explained the procedure well, considered and respected their wishes, and took time to listen to their concerns and questions" (Gallagher, 2017) and "had done everything they could to help with any pain or discomfort related to the procedure" (Collins, 2010). One study highlighted that the nurse-surgeon "was more thorough than the consultant in obtaining the informed consent" (Hickey and Cooper, 2009). None reported a negative experience with the nurse-surgeons. Four of the 16 studies reported patient willingness to have their surgery performed by a nurse-surgeon again (Jejeebhoy et al., 2011; Lawson et al., 1999; Martin, 2002; Sapre et al., 2012) with two of these four studies indicating patient preference on having their surgery performed by nurse-surgeons instead of physicians (James and McPhail, 2008; Sapre et al., 2012). Two comparative studies reported a higher overall patient satisfaction on nurse-surgeons than physicians (Hui et al., 2015; Palmquist, 2010).

3.5.2. Waiting list

Eight studies measured patient access to surgery through waiting lists (Bodle et al., 2008; Duncan et al., 2017; Godsell, 2005; Hickey and Cooper, 2009; Malata, 2018; Michelotti et al., 2014; Newey et al., 2006; Sapre et al., 2012). All studies reported an improvement in the waiting list through reduction of patients' waiting time to have their surgery. This resulted in the clearing of a backlog of patients needing surgeries in one Australian study (Duncan et al., 2017) that would have remained in the waiting list for several years. Another Australian study (Sapre et al., 2012) reported a 65% reduction in the list of patients requiring surveillance surgery. One British study (Bodle et al., 2008) recorded a 5-year decline in appointment waiting time from 8 ± 6 weeks to 2 ± 2 weeks ($p < 0.001$), and a 5-year decline in clinic waiting time from 10 ± 30 min to 2 ± 10 min ($p = 0.005$). Another British study (Godsell, 2005) reported a sharp decrease in patient waiting time for a biopsy from eight weeks to zero weeks, and for a simple excision procedure, usually performed by a doctor, from eight weeks to two weeks.

3.5.3. Perioperative complications

Fourteen perioperative complications were reported as adverse events (Bolme et al., 2020; Giramonti and Kogan, 2018; Jejeebhoy et al., 2011; Kelly et al., 2008; Laker-Oketta et al., 2015; Michelotti et al., 2014), mortality rate (Bolme et al., 2020; Chu et al., 2011; Sturgess et al., 1996; White et al., 1987), complication rates (Giramonti and Kogan, 2018; Jejeebhoy et al., 2011; Sturgess et al., 1996), and length of stay pre and postoperatively (Malata, 2018). Of the six studies that reported adverse events, five indicated a very low number of serious adverse events (Giramonti and Kogan, 2018; Jejeebhoy et al., 2011; Kelly et al., 2008; Laker-Oketta et al., 2015; Michelotti et al., 2014) wherein one study (Kelly et al., 2008) reported two iatrogenic adverse events in a sample of 3956 patients and another one which measured early return to theatre rates but did not report any (Giramonti and Kogan, 2018).

Of the four studies that reported patient deaths, three (Bolme et al., 2020; Sturgess et al., 1996; White et al., 1987) indicated a higher mortality rate in the physician group than the nurse-surgeon group, while one study (Chu et al., 2011) compared mortality rates in two periods where deaths were statistically lower ($p < 0.001$) between 2008 and 2009 compared to 2006–2007. Of the three studies that reported complication rates, two (Jejeebhoy et al., 2011; Sturgess et al., 1996) studies returned low and similar complications between the nurse-surgeons and physicians, while one (Giramonti and Kogan, 2018) study reported no patient complications intra-operatively and immediately after surgery. One study (Malata, 2018) reported a significant reduction in the length of stay of patients pre and postoperatively, following the introduction of nurse-performed surgeries.

3.5.4. Quality of surgical care

Ten studies (Bodle et al., 2008; Bolme et al., 2020; Chan et al., 2020; Godsell, 2005; Hickey and Cooper, 2009; Hui et al., 2015; James and McPhail, 2008; Jejeebhoy et al., 2011; Kelly et al., 2008; Newey et al., 2006) reported the quality of perioperative care provided by nurse-surgeons to patients undergoing surgery (see Table 3). All of these studies reported that the standard of care was either maintained or improved. Four studies (Bolme et al., 2020; James and McPhail, 2008; Jejeebhoy et al., 2011; Newey et al., 2006) concluded that the nurse-surgeons were as skilled as physicians in performing surgeries, with one (Bolme et al., 2020) of these four studies showing evidence of statistical significance ($p = 0.019$) in the context of nurse-surgeons' noninferiority to physician-performed surgeries. Three studies (Bolme et al., 2020; Godsell, 2005; Hui et al., 2015) reported that the quality of surgery by nurse-surgeons is better than physicians, with one (Hui et al., 2015) of these four studies indicating that nurse-surgeons had significantly higher cancer detection rates than surgeons (95% CI 4.1%–18.1%). Seven studies (Bodle et al., 2008; Bolme et al., 2020; Godsell, 2005; Hui et al., 2015; James and McPhail, 2008; Jejeebhoy et al., 2011; Kelly et al., 2008) concurred that nurse-surgeons had excellent surgical technique as evidenced by high quality tissue sampling (Godsell, 2005), successful case completion rates (Jejeebhoy et al., 2011), and better ($p = 0.021$) postoperative pain scores than physicians (Hui et al., 2015).

4. Discussion

To the authors' best knowledge, this study is the first to consolidate the evidence on the impact of nurse-surgeons on patient-centred outcomes within the perioperative continuum.

4.1. Countries of nurse-surgeon practice

The majority of the studies were conducted in the United Kingdom followed by the United States, Australia, Hong Kong, and Congo. This aligns with Grota et al. (2021) who reported similar findings of countries where nurse-surgeons practice. In addition, there are a number of other countries that surfaced in this review. These were India, Norway, Uganda, Kenya, and Somalia. One included study also mentioned the use of nurse-surgeons in Cambodia, Ethiopia, Nepal, Vietnam, and South Africa (Jejeebhoy et al., 2011). Clearly, despite the limited literature reporting nurse-surgeon outcomes, nurse-surgeons are active in many different countries.

4.2. Roles of nurse-surgeons

This review found 13 surgical specialties within which nurse-surgeons practice. These were urology, gastroenterology, ophthalmology, obstetrics, oncology, gynaecology, otolaryngology, vascular, dermatology, cardiothoracic, orthopaedics, hand, and general surgery (see Table 4).

This review reports nurse-surgeons performing the same type of surgeries identified by Grota et al. (2021), with the addition of carpal tunnel surgery, circumcision, revision of circumcision, corneal crosslinking, manual vacuum aspiration, ear and nasal foreign body removal, tongue tie lysis, nasopharyngoscopy, flexible laryngoscopy, functional endoscopic evaluation of swallowing, simple laceration repair, drainage of peritonsillar abscess, stroboscopy, nasal cautery, removal of minor skin lesions such as suspicious moles, lipomas, sebaceous cysts, papillomata, and bone marrow aspirations (see Table 4).

One study discussed the substitution of ophthalmic surgeons by nurses in yttrium aluminium garnet laser capsulotomy treatments and chalazion surgeries (Michelotti et al., 2014). One study reported a non-exhaustive list of surgeries that nurse-surgeons performed at the Veterans Health Administration in the United States (Palmquist, 2010). This list as Palmquist (2010) noted was unlimiting and highly dependent on the discretion and comfort level of the Nurse Practitioners to learn surgeries. Considering the 118,617 recorded patient visits from 2004 to 2007, it would be interesting to follow up on Palmquist (2010) study and evaluate how the list of nurse-performed surgeries and the number of patient visits in this health system have grown, well over ten years after the study concluded.

4.3. Impact of nurse-surgeons on patient satisfaction and experience

Of the 16 studies that reported patient satisfaction and experience related to nurse-surgeon intervention (see Table 3), all indicated an overwhelmingly positive or categorically high-level support for nurse-surgeons. No studies reported any dissatisfaction or bad experience with nurse-surgeons performing their surgery. The patients in two studies felt that the nurse-surgeons were more thorough in explaining the procedure and obtaining the informed consent than physicians (Hickey and Cooper, 2009), and that the nurse-surgeons "considered and respected their wishes" (Gallagher, 2017). These findings are the very essence of patient-centred outcomes research (Frank et al., 2014). The thoroughness of nurse-surgeons in explaining the procedure and obtaining consent can be attributed to the way nurse-surgeons were traditionally trained in Nursing schools to become patient advocates (Choi, 2015).

Completion of informed consent, which includes thorough explanation of the procedure to the patient, is an indicator of safe surgery as per the World Health Organisation Surgical Safety Checklist (Haynes et al., 2009). However, although systems are in place to prevent any communication-related sentinel events from occurring, they do still occur (Cramer et al., 2020). Sentinel events are a preventable subset of patient adverse events (Patra and De Jesus, 2021). A few examples include incomplete and incorrect informed consent, retention of foreign items in the patients' body, wrong site of surgery, and intraoperative medication errors (Cramer et al., 2020).

A study by Gillespie et al. (2010) found that 70% of sentinel events can be avoided by effective communication. This translates

directly to optimal patient experience and clinical outcomes as evidenced by the six studies (Bolme et al., 2020; Giramonti and Kogan, 2018; Jejeebhoy et al., 2011; Kelly et al., 2008; Laker-Oketta et al., 2015; Michelotti et al., 2014) in this review that reported marginal serious adverse events. One of these six studies study (Kelly et al., 2008) further reported two iatrogenic sentinel events in 3956 patients representing 0.05% of the sample population. However, a deeply ingrained disparity in the way surgeons and nurses were trained to communicate exists in the operating theatres. While nurses were taught to provide broad, easy-to-understand, and patient-centric narratives, surgeons on the other hand, were trained to always communicate direct to the point when describing clinical scenarios to their colleagues (Gillespie et al., 2010). This communication style of surgeons' cascades to their interaction with patients as evidenced by this review, which may explain why patients in the included studies expressed high satisfaction of nurse-surgeons, patient preference on nurse-surgeons over surgeons, and how patients felt that nurse-surgeons "considered and respected their wishes".

4.4. Impact of nurse-surgeons on the waiting lists

Waiting lists represent the timeliness of patient-centred perioperative care, and the capacity of a given surgical workforce in a health system to provide vital surgical services, in the hope that these translate to improvement in surgical access (Amoko et al., 1992). Nine studies highlighted the positive impact of nurse-surgeons on the waiting lists in 13 surgical specialties (see Table 3).

This review demonstrates that the implementation of nurse-surgeon models of care have greatly expedited patient access to surgical care in a global context. A prime example of this was the statistically significant ($p < 0.001$) reduction of appointment waiting time in an outpatient hysteroscopy clinic in the United Kingdom where hysteroscopy appointment waiting times decreased from 8 ± 6 weeks in 2000 to 2 ± 2 weeks in 2005 – a surgical capacity improvement of at least four to six weeks (Bodle et al., 2008).

4.5. Impact of nurse-surgeons on postoperative complications

The impact on postoperative complications were reported in fourteen ($n = 14$) of the 25 studies included in this review. All fourteen studies reported that complications arising from the nurse-surgeon group were either similar or less than the physician group. None reported a higher incidence of perioperative mortality in the nurse-surgeon group in comparison with the physician group. This may be due to the tight restrictions on the type of patients which nurse-surgeons see, as high-risk patients are all referred to surgeons. Despite this, these findings indicate that nurse-surgeons perform surgeries as safely as their medical counterparts, if adequate and proper training is given.

4.6. Impact of nurse-surgeons on the quality of surgical care

The quality of surgical care as an outcome was reported in nine of the 25 studies in this review. All nine studies concluded that the nurse-surgeons' quality of care in terms of surgical skills, knowledge, and technique was either similar to or better than the physicians. Similar to perioperative complications, surgical care quality is also an important indicator of safe surgery. Considering that the nurse-surgeons are predominantly trained and supervised by a highly experienced senior surgeon or consultant (Grota et al., 2021), the quality of surgeries performed by these nurse-surgeons would naturally be expected to be at a high level. In many countries worldwide, a surgeon spends thousands of rigorous clinical hours operating on patients before receiving the title of "consultant" (BMA Central Consultants and Specialists Committee, 2008), and this model of achieving expertise in performing surgery was the most sensible route for nurse-surgeon training given that this is the gold standard in surgical training for physicians since the advent of modern surgery (Bhatti and Cummings, 2007). This resulted in a high level of surgical care quality rendered by the nurse-surgeons. Accordingly, this review reinforces the direct impact of training by appropriately qualified and experienced practitioners, on the quality of surgery performed by nurse-surgeons.

4.7. Limitations of the study

The authors acknowledge the moderate to low methodological quality of the studies included in this review following quality assessment using the Mixed Methods Appraisal Tool (Hong et al., 2018), and certainty assessment using the Grading of Recommendations, Assessment, Development and Evaluations framework (Schünemann et al., 2013). Therefore, prudence should be applied when interpreting and extrapolating the findings of this review. Furthermore, the authors acknowledge the lack of studies on nurse-surgeons and their impact on patient-centred outcomes, as reported in only 25 studies in this review. This is likely due to the novelty of the review topic; however, it clearly demonstrates that nurse-surgeons are still under reported in the scientific community despite being documented as early as the 1950s (White et al., 1987).

Additionally, this review was limited by an eligibility criterion that excluded non-research papers, grey literature, and reviews. This resulted in the exclusion of articles with confirmed nurse-surgeons during the title-abstract and full text screening. Inclusion of these articles could have diversified the countries and surgical specialties of nurse-surgeons. One excluded Canadian systematic review (Johal and Dodd, 2017) discussed the presence of nurse-surgeons in the specialties of trauma, cardiac surgery, general surgery, orthopaedic surgery, urology, and neurosurgery. However, trauma and neurosurgery as specialties were not identified in this review. Furthermore, two excluded American articles (Yalamanchi et al., 2021; Salibian et al., 2016) reported nurse-performed otolaryngological surgeries. This sets otolaryngology as a relatively common surgical speciality for nurse-surgeons in the United States. The reasons for excluding Yalamanchi et al. (2021) and Salibian et al. (2016) were "non-research paper" and "did not measure

patient-centred outcomes", respectively. Finally, a further excluded study (De Bruijn-Geraets et al., 2018) reported multi-speciality surgeries that nurse-surgeons perform in Netherlands. This further expands the role and practice of nurse-surgeons in Europe. De Bruijn-Geraets et al. (2018) was excluded as it did not measure patient-centred outcomes.

4.8. Grading of recommendations, assessment, development, and evaluation

The certainty of evidence found in this review was moderate for patient satisfaction and experience (critical outcome), moderate for perioperative complications (important outcome), moderate for quality of surgical care (important outcome), and low for waiting list (important outcome). These ratings were derived from the pre-programmed calculations generated by the GRADEpro® software and the collective decisions made by the authors based on the Grading of Recommendations, Assessment, Development and Evaluations guidelines (Schünemann et al., 2013). Using the abovementioned factors, the authors' recommendation and confidence as to the strength of evidence in this review is conditional, dependent on the availability of surgical resources and the setting of the individual health system looking at adapting this review for policy development (Schünemann et al., 2013). A strong recommendation will only be achieved with the emergence of more high-quality studies in the future, particularly randomised controlled trials that will assess the impact of nurse-surgeons on patient-centred outcomes.

4.9. Implications for future research

This review found multiple low methodological quality studies on the positive benefits to patient-centred outcomes through the use of nurse-surgeons. Randomised controlled trials assessing nurse-surgeon practice should be conducted to strengthen the evidence around this unique role. This review included all research articles of quantitative, qualitative, and mixed-methods study design, which meant that in accordance with the guidelines set by the Grading of Recommendations, Assessment, Development and Evaluations, the certainty of the evidence will never be high as compared to a review that only includes randomised controlled trials (Schünemann et al., 2013). For future studies however, if the aim is to completely encompass the global nurse-surgeon impact, practice, and roles, it would be more appropriate to conduct a scoping review that will include research articles, non-research articles, and grey literature.

4.10. Implications for practice

The practice of surgery has traditionally been the "territory" of physicians. However, this review proves that nurse-surgeons can practice surgery effectively, with overwhelmingly positive patient-centred outcomes. The findings in this review can be used by hospitals without nurse-surgeons as basis to introduce or expand this emerging field of nursing practice. Doing so will have a four-fold effect. First, patients will have faster access to urgent surgery as the long and complex waiting lists will be apportioned into smaller and achievable lists. Second, surgeons will have increased capacity to perform more complicated surgeries where their skills and experience are more appropriately needed, while nurse-surgeons perform minor surgeries in the face of chronic medical workforce shortage. Third, health systems will have a cost-effective measure to provide surgical care given the known economic implications of nurse-led services (Randall et al., 2017). Fourth, nursing workforce recruitment and retention will be improved, as empowered nurses aspiring to specialise in surgery will no longer need to leave the nursing profession to do so. The nursing workforce is ageing (International Council of Nurses, 2021) and introducing innovative concepts of clinical nursing practice such as nurse-led surgery can be a way to attract the highly ambitious and challenge-seeking younger generation (Keith et al., 2021) to enter the profession.

4.11. Implications for policy

The majority of the studies included in this review developed nurse-led surgical services locally, without direct involvement from their national governments. Policies surrounding the emergence of these innovative clinical nursing practices were grounded upon the drastic need to strengthen local surgical capacity to meet specific surgical demands, namely cancer diagnostic surgeries, emergency surgeries, rural and remote health, and minor surgeries in 13 surgical specialties (see Table 4). Grota et al. (2021) suggested the same areas of surgery where nurse-surgeons could practice and be of best use in the context of productivity and value. As evidenced by the studies included in this review (see Table 3), the micro-level policies to institute nurse-led surgical services have been effective in addressing the problem of surgical capacity within local service areas.

Hence, it is logical that the next step will be macro-level negotiations through national and international platforms to explore the full potential of nurse-surgeons. This will provide opportunities for advocacy with key stakeholders when developing policies of relevance to nurse-surgeon practice regulation. Consequently, the regulation of nurse-surgeon practice on a national level would streamline care provision in cancer diagnostic surgeries, emergency surgeries, minor surgeries, and rural and remote health – the surgical areas where nurse-surgeons are most needed and most effective.

The coronavirus pandemic has further aggravated the already compromised state of global surgical care needed by billions of people pre-pandemic, with most of these patients coming from medium to low-income countries (Bath et al., 2019). However, high-income countries are now struggling as well with the backlog of surgeries reaching record-high levels caused by the multiple cancellations of surgeries across all the specialties brought about by the pandemic (Carr et al., 2021; COVIDSurg Collaborative, 2020). Cancer and trauma surgeries in particular have been heavily impacted – an area where nurse-surgeons have already been practicing (COVIDSurg Collaborative, 2020). Therefore, it is critical for national policymakers to develop recovery policies that will not just recover the pre-existing status but expand and sustain the already overburdened surgical workforce in the decades to come. This

review proves that nurse-surgeons improve access to surgery and therefore could be a viable candidate in sustaining the surgical workforce amidst the devastating effects of coronavirus to global surgery (see Definition of terms).

5. Conclusions

This systematic review aimed to investigate the impact of nurse-surgeons on patient-centred outcomes in the perioperative context. Forty-eight ($n = 48$) patient-orientated outcomes were found across the 25 included studies. These were grouped into four categories: patient satisfaction and experience; waiting list; perioperative complications; and quality of surgical care. Many studies reported high to very high satisfaction of the surgical services provided by nurse-surgeons. This was attributed to the difference in the way nurses and physicians are trained to communicate clinical scenarios, which as evidenced by this review, cascaded to physician interactions with patients. Improvement in waiting list times, and low to very low instances of adverse events were noted. Three studies identified a higher mortality rate in the physician group than the nurse-surgeon group. Many reported the standard of care experienced was either maintained or improved by nurse-surgeons. These findings indicate that nurse-surgeons perform safe and high-quality surgeries. For future research, the authors recommend development of randomised controlled trials to elevate the certainty of evidence. Implementation of nurse-led surgical services will provide patients timely access to urgent surgery, surgeons the capacity to perform more complicated cases, and nurses an expanded career pathway. National policymakers must develop policies to expand and then sustain the currently overburdened surgical workforce. This review proved that nurse-surgeons improve access to surgery and therefore could be a viable candidate in strengthening the surgical workforce amidst the devastating effects of coronavirus to global surgery.

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Registration and protocol

This systematic review was not registered

Availability of data, code, and other materials

See Supplementary material 5.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.ijnsa.2022.100086.

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4.3 Summary

This systematic review aimed to assess the impact of nurse-surgeons on patient-centred outcomes within the perioperative setting, revealing 48 patient-oriented outcomes across 25 included studies. These outcomes were categorised into patient satisfaction and experience, waiting list management, perioperative complications, and quality of surgical care. Many studies indicated high patient satisfaction with services provided by nurse-surgeons, attributed to differences in communication training between nurses and physicians. Positive outcomes included improved waiting list times, low adverse event rates, and, notably, lower mortality in the nurse-surgeon group compared to physicians in three studies. The standard of care was either maintained or enhanced by nurse-surgeons. These findings underscored the safety and quality of surgeries performed by nurse-surgeons, advocating for future randomised controlled trials to enhance evidence certainty. The implementation of nurse-led surgical services was recommended for timely access to urgent surgery, increased surgeon capacity, and expanded career pathways for nurses. Policymakers were urged to develop policies addressing the current strain on the surgical workforce. The review suggested that nurse-surgeons can enhance surgical access, positioning them as a viable solution amid the challenges posed by the global impact of the coronavirus on surgical services.

Chapter 5 Methodology and Design

5.1 Introduction

Following the review of extant literature in Chapters 2, 3 and 4 where published papers investigating the roles, training, education, and impact of nurse-surgeons worldwide have been presented, Chapter 5 outlines the aim and objectives of the study, and an explanation of mixed methods research and the decision to choose this particular methodology. Subsequently, the chapter discusses in detail the two phases of the study: a quantitative phase using a survey (Phase 1) followed by a qualitative phase using a semi-structured interview (Phase 2). The methods, study participants and data analysis for each phase are expounded along with the ethical considerations relevant to each phase of the study.

5.2 Aim

The aim of this study was to consolidate the data around the nurse-surgeon role, training, education, career prospects, and experiences in the Australian public health system.

5.3 Objectives

The specific objectives of this research were:

(1) To investigate the roles of nurse-surgeons practising in the Australian public health system (Phase 1).

(2) To examine the training and education requirements of nurse-surgeons practising in the Australian public health system (Phase 1).

(3) To assess the perceptions of nurse-surgeons practising in the Australian public health system regarding employment prospects, support received from stakeholders, and the likelihood of continuing their practice (Phase 1).

(4) To explore the experiences of nurse-surgeons practising in the Australian public health system in terms of training, education, and integration into the health system (Phase 2).

5.4 Methodology

In this section, pragmatism is explained and presented as the governing philosophical view for this study. Pragmatism is then incorporated throughout the explanation of mixed-methods research and explanatory sequential mixed methods design, and the decision to use this research methodology and design. The strengths and limitations of a mixed methods research are also explained.

5.4.1 Pragmatism

Pragmatism is a philosophical view that revolves around the practical consequences of knowledge (Dewey, 1916; James, 1907). Knowledge, in this context, can be new or old, and subjective or objective. In pragmatism, the truth always serves as a mediator in resolving disputes between empirical and *a priori* deductions. However, if the dispute does not result in a meaningful practical consequence or difference, then the dispute is pointless (Peirce, 1903). The mediation should give rise to new knowledge where objective knowledge such as new arguments, discoveries and conclusions override incompatible, subjective, and old opinions (James, 1907).

The ontology or view of reality in pragmatism is geared towards action (rather than theoretical concepts alone) where knowledge and therefore realities are justified through experiments and scientific inquiry (Peirce, 1903). The epistemology or focus of pragmatism is also centred around action where knowledge is produced and modified through actions and interactions of people (James, 1907). Therefore, in a pragmatist perspective, the processes of seeking, building, and modifying truth should be active and democratic (Dewey, 1916; James, 1907; Peirce, 1903).

Dewey (1916) further solidified the pragmatic concept of actively seeking knowledge when he established the theory of knowledge. According to this theory, knowledge should not just be accurate, but impactful as well. Hence, the concept of meaningful practical consequence or the difference the prevailing new knowledge provides in practice and life in general is emphasised. In pragmatism, the active seeking of knowledge should be focused on results, what works, and what solutions answering a specific inquiry entail (Patton, 1990).

In this research study, the “knowledge” in the context of pragmatism is nurse-surgeons. Nurse-surgeons exist in different parts of the world and have an invaluable impact on global

surgery (see Glossary of Terms). This knowledge has been existent for decades (Grota et al., 2022) and arguably for centuries evidenced through the work of the nurse-surgeon William Bullein of the early 16th century (Duffin, 2017). Pragmatism warrants active seeking and modification of knowledge in the pursuit of meaningful and impactful practical consequences. Although it is known that nurse-surgeons exist in Australia, there is now a compelling need for this old truth to be modified due to the ongoing disputes in empirical, *a priori*, and anecdotal knowledge around nurse-surgeon's existence and benefits to the health care system. This study is an initial and consolidating inquiry to challenge, modify and ultimately override the old knowledge of nurse-surgeons in Australia. This work will lay the foundation for the intended meaningful practical consequences to surgical care such as regulation of nurse-surgeon training and practice, surgical workforce and infrastructure capacity redesign to meet the growing surgical demands and yield potential international collaborations with other health systems to challenge their old truths around nurse-surgeons.

Pragmatism is a philosophical foundation for mixed methods research where pluralistic approaches are necessary to derive the richest understanding and answer to a specific research problem (Creswell & Creswell, 2018). In pragmatism, the world is not absolute, and the truth is not based on the duality of reality. Instead, truth is contemporary or what works at the time. The current "truth" around nurse-surgeons in Australia may be defined by five factors: the lack of extant literature in Australia about nurse-surgeons (Grota et al., 2022); the known existence of multi-specialty nurse-surgeons in other health systems (Grota et al., 2022); the proliferation of unregulated nurse-surgeon titles (Leary et al., 2017); the anecdotally known; and the unknown. Thus, the author decided to utilise a mixed methods research methodology rather than subscribing to only one rigid methodology to converge or "triangulate" (Jick, 1979) the available data and thence modify the known but limited knowledge around nurse-surgeons in Australia to impact a meaningful practical difference in the regulation, capacity redesign, and delivery of surgical care nationwide (Creswell & Creswell, 2018; Dewey, 1916; James, 1907).

5.4.2 Mixed methods research

Mixed methods research is a research methodology that entails the collection of both quantitative and qualitative data. Quantitative and qualitative research are two distinct and strict research approaches that represent both ends of a continuum. Within this continuum, mixed methods research resides in the middle where quantitative and qualitative research are integrated to answer a research inquiry. Mixed methods research assumes that by integrating qualitative and

quantitative research, a more in-depth understanding of a research problem can be generated as compared with the information provided separately by either quantitative or qualitative approach alone (Creswell & Creswell, 2018).

Emerging in the late 1980s, mixed methods research underwent progressive growth and development, evolving continuously. It underwent several periods of growth and development and continued to evolve over time. Mixed methods research is widely used nowadays in the social and health sciences. The variants of mixed methods include multimethod, mixed methodology and mixed research (Johnson & Onwuegbuzie, 2004).

There are five fundamental characteristics of mixed methods research (Creswell & Creswell, 2018). First, it involves collection of quantitative and qualitative data to answer a research problem. Second, it combines the rigorous methods of quantitative and qualitative research. Third, the quantitative and qualitative data are synthesised then integrated. "Synthesis" in mixed methods research means mixing of the intended practical consequences to integrate the quantitative findings with the qualitative findings, or vice versa depending on the chosen mixed methods research design (Sandelowski et al., 2007). "Integration" in mixed methods research means design analysis via merging of the quantitative and qualitative data into one database, database explanation, modification from one an old database to a new database that contains the merged data and embedding of the database within an overarching framework. Fourth, the procedures are combined into a specific mixed methods design. Finally, the procedures are informed by a philosophical view and theory (Creswell & Creswell, 2018; Tashakkori & Teddlie, 2003).

5.4.3 Data triangulation during the planning stage

Data triangulation is the combination of two or more methods to collect data and analyse a phenomenon (Braun & Clarke, 2013). According to Braun and Clarke (2013), there are three forms of triangulation. Firstly, data triangulation or the collection of data from multiple sources of information. Secondly, methodological triangulation or the combination of multiple methods to collect and analyse data. Finally, researcher triangulation or the use of multiple researchers to collect and analyse data. Mixed methods research uses methodological triangulation wherein two or more methods are used to collect and analyse data. In this explanatory sequential study, quantitative and qualitative methods are used to obtain a deeper understanding of the practising nurse-surgeons in Australia. Therefore, in this study, the first data triangulation occurred during

the early planning stage of the research where a suitable research design was sought to fully understand the research topic.

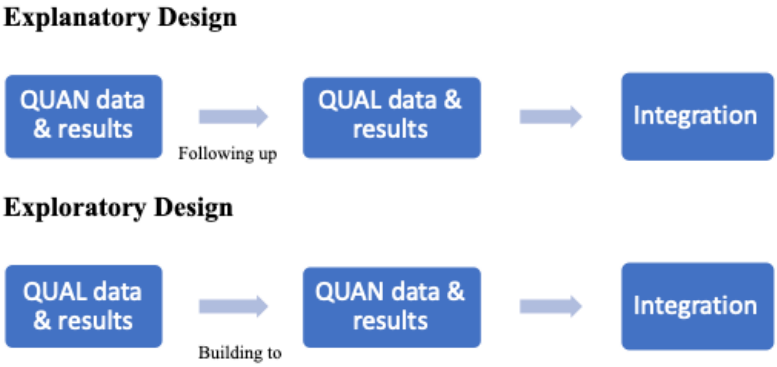
5.4.4 Research design

Research designs are strategies of inquiry (Denzin & Lincoln, 2011) within research methodologies which set the specific direction of a research study. For this mixed methods research study, the research design used was an explanatory sequential design. An explanatory sequential mixed methods approach involves two distinct phases. It begins with a quantitative phase followed immediately by a qualitative phase (Creswell & Creswell, 2018). This research design is primarily used to explain or expand quantitative results.

There are two defining characteristics that an explanatory sequential mixed methods design must have. Firstly, it should be "explanatory", which means an intention to explain in detail a specific concept. Secondly, it should be "sequential" which means it must follow a sequential order beginning with a specific quantitative instrument followed immediately by a specific qualitative instrument. The results of the quantitative phase usually inform the questions that will be used for the participants of the follow up qualitative phase. The main intention of the follow up qualitative phase is to expound the initial quantitative results. Therefore, the participants of both phases should be from the same sample, with the qualitative phase representing a subset of this sample. Typically, the procedures used in explanatory sequential mixed methods research designs involve a survey in the quantitative phase followed up with interviews in the qualitative phase (Creswell & Creswell, 2018).

Explanatory sequential designs are employed when the main concept is known but limited, necessitating an initial explanation through a quantitative instrument. This quantitative stage then informs the subsequent use of a qualitative instrument to elucidate any contradictory or unusual findings. In contrast, exploratory sequential designs involve initial exploration through a specific qualitative instrument to develop a corresponding quantitative method. Figure 1 illustrates the distinction between explanatory and exploratory designs (Bergman, 2008).

Figure 1. Explanatory and exploratory sequential mixed methods designs



5.4.5 Explanation of the author's decision to used mixed methods

The existence of nurse-surgeons in Australia is relatively new. However, similar to other international health systems, their impact in Australia has been promising. As an emerging frontier of advanced nursing practice, the topic requires multiple research methodologies to fully understand its context. Subscribing to only one rigid research methodology does not aid in producing a comprehensive understanding of the topic. Mixed methods research allows nurse-surgeons in Australia to be studied from diverse perspectives. It integrates (and neutralises the weaknesses of) each form of data collected via quantitative and qualitative approaches. This integration and convergence result in data triangulation (Jick, 1979). Thus, the author decided to utilise a mixed methods research methodology instead of only one rigid methodology to analyse and modify the known but limited knowledge around nurse-surgeons in Australia with the intention of impacting a meaningful practical difference by developing a fuller understanding of the role of nurse-surgeons and their ability to impact patient care outcomes (Creswell & Creswell, 2018; Dewey, 1916; James, 1907).

The decision to utilise an explanatory sequential mixed methods design instead of an exploratory sequential mixed methods design was based on the knowledge that nurse-surgeons already exist in Australia, representing the known pragmatic and disputed "knowledge" that needs modification. However, given that the available knowledge around nurse-surgeons in Australia is limited and scattered empirically, theoretically and anecdotally, further explanation is necessary to fully triangulate, understand and ultimately modify this truth, hence an "explanatory" design was used. An "exploratory" design is no longer needed in this instance as nurse-surgeons is already a known "knowledge" that can be studied directly using a quantitative instrument. While exploratory designs are preliminary designs used for creating and developing a truth, explanatory designs are used for modifying a known knowledge. Accordingly, the

research methods need to be in a “sequential” order for the data to transition smoothly from the quantitative phase to the qualitative phase. The quantitative phase provided the numerical and close-ended data, which was then used to frame and develop a suitable follow up qualitative instrument that will further enriched the patterns, details and contexts of the collected quantitative data (Creswell & Creswell, 2018).

5.4.6 Limitations and challenges

There are three challenges and limitations of a mixed methods research methodology (Creswell & Creswell 2018). Firstly, this methodology requires extensive and costly data collection. Secondly, with the requirement for extensive and costly data collection, mixed methods research can be lengthy and expensive during the analysis of both qualitative and quantitative data. Finally, a mixed methods research methodology requires familiarity with both quantitative and qualitative forms of research. This can be a particularly challenging and limiting aspect for researchers without prior experience in conducting and mixing quantitative and qualitative studies.

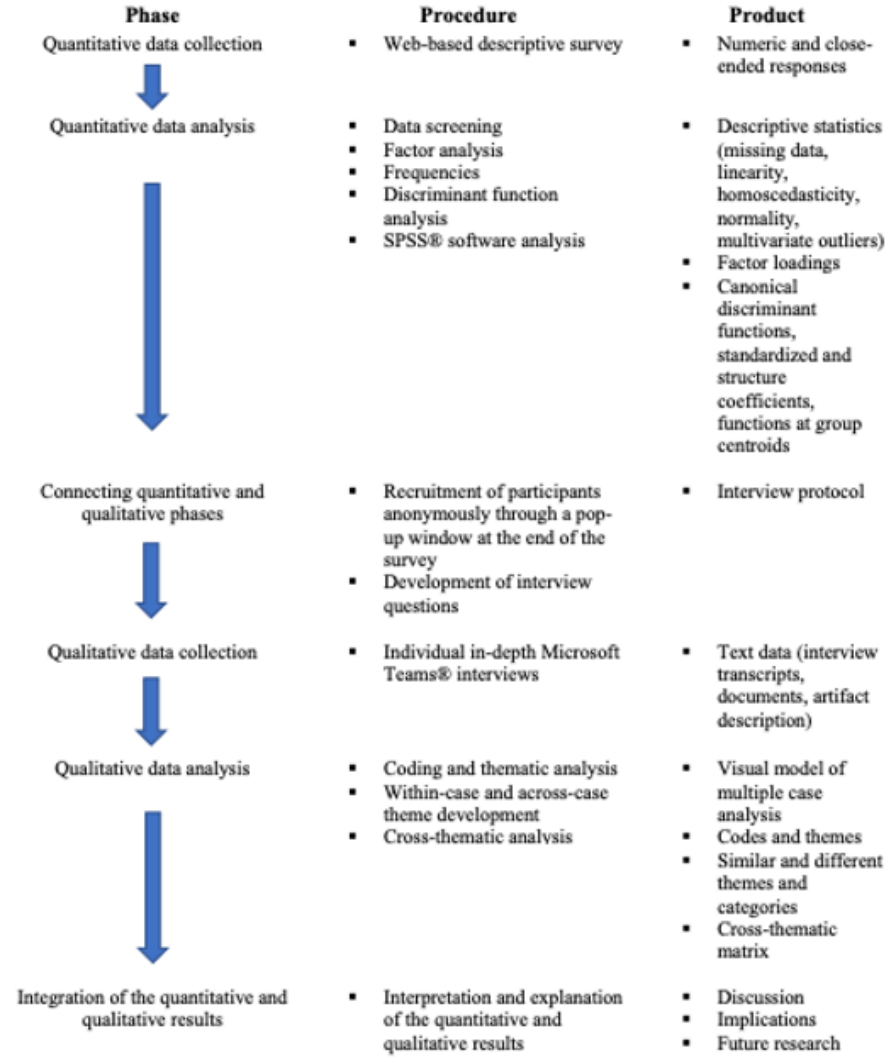
There are also three main challenges in undertaking an explanatory sequential mixed methods study (Creswell & Creswell, 2018). Firstly, it is time consuming as the quantitative phase needs to be completed and analysed first before a qualitative research method can be developed. Once the qualitative data collection has been completed, the data will need to be analysed separately before both the quantitative and qualitative results can be integrated and interpreted as one database. This makes the process at least twice time consuming as compared to a single research methodology. Secondly, it is challenging to predict and determine which quantitative data to use as follow up for the qualitative phase as this data will not be available until the quantitative data collection has been completed. Thirdly, as the qualitative instrument and phase are solely dependent on the results of the quantitative phase, it can be challenging in an academic setting to present and explain to the ethics committee or milestone panel the exact contents or questions to be asked for the qualitative phase of the study if the quantitative phase is still ongoing at the time of ethics application or progress presentation.

5.5 Overview of Methods

This research study was conducted using a mixed methods research methodology. The research design was explanatory sequential mixed methods. Figure 2 illustrates the visual model

for the procedures that were undertaken during this explanatory sequential mixed methods study. Phase 1 is the quantitative phase which used a descriptive online survey as its research method. Phase 2 is the qualitative phase which used semi-structured interviews as its research method. Figure 2 is used extensively in sections 5.6 and 5.7 to visualise the different concepts and procedures.

Figure 2. Visual model for the procedures within this explanatory sequential mixed methods study



Adapted from Ivankova et al. (2006)

5.6 Phase 1 Research

This section explains the method used for the quantitative phase of the study (Phase 1) and how this method was developed. The study participants and recruitment strategies are

identified. The section also explains the ethical considerations and how the quantitative data were collected and analysed.

5.6.1 Method

The quantitative phase (Phase 1) of this study used a non-experimental descriptive survey design. A survey research design is defined as the numeric description of patterns, behaviours or opinions of a given population by studying a sample of that population (Fowler, 2008). There are typically three types of questions that are answerable by a survey design. These are descriptive questions, variable relationships questions, and predictive variable relationships (Creswell & Creswell, 2018). The survey design that was used for this research study aimed to investigate the roles, training and education requirements, and perceptions of practising nurse-surgeons in the Australian public health system. These represent research objectives 1, 2 and 3 of this study (see Research Aim and Objectives). The survey did not focus on answering the "whys" of nurse-surgeon existence.

There were three rationales for choosing survey method as the preferred quantitative approach for this study. Firstly, surveys are economical. Secondly, the turnaround time for conducting surveys and collecting the data are rapid. Finally, given that this study constitutes Phase 1 of a two-phased research project, the time limitations inherent in mixed methods research constrained the author from pursuing more extensive and lengthy quantitative designs.

The survey was cross-sectional, which means that the data from the sample was collected at one point in time only. The form of data collection was administered online through the internet (Fowler, 2014). The survey was accessible through a link that was generated by REDCap® (https://rdcap.acu.edu.au/surveys/?s=E9YXAW7PYR). REDCap® is a secure web-based platform for developing online surveys (REDCap®, 2022). The rationales for administering the survey online were convenience for both the participants and the researcher, economy, and practicality as the expected participants of the nationwide survey were residing in different parts of Australia. The convenience for the participants to complete the survey remotely can also minimise non-response bias, which is a bias that occurs when people who are eligible to take part in a study become unwilling or unable to participate due to various factors (Prince, 2012).

5.6.2 Development of the descriptive online survey

A novel survey instrument was developed for the quantitative phase of the study using REDCap®. The decision to develop a new instrument stemmed from the distinctive context of this study, which delved into a group of nurses that, to the best of the author's knowledge, has not been previously examined, thereby highlighting a gap in existing instruments (DeVellis, 2017; Dillman et al., 2014; Fowler, 2014). The survey was divided into four sections: demographics; nurse-surgeon roles; nurse-surgeon training; and nurse-surgeon perceptions. Each section was developed to answer the three Phase 1 research objectives. The survey questions were informed by the three published literature reviews (Grota et al., 2023; Grota et al., 2022; Grota et al., 2021). Table 1 illustrates the relationships between the variables, the research objectives, and the survey items. The survey could be completed in 15 minutes. A comprehensive participant information letter (see Appendix E) was embedded in the first page of the online survey. No follow up visits were required after completion of the survey unless the participants agree to participate in Phase 2 of the study. A copy of the ACU Human Research Ethics Committee-approved online survey questionnaire is included in the Appendices (see Appendix B).

Table 1. Variables, research objectives and survey items

Variable name	Research objective	Survey item
Independent variable: Demographics	Descriptive research objective 1: To investigate the roles of nurse-surgeons practising in the Australian public health system.	Survey questions 1-4 (see Appendix B)
Independent variable: Nurse-surgeon roles	Descriptive research objective 1: To investigate the roles of nurse-surgeons practising in the Australian public health system.	Survey questions 5-14 (see Appendix B)
Independent variable: Nurse-surgeon training	Descriptive research objective 2: To examine the training and education requirements of nurse-surgeons practising in the Australian public health system.	Survey questions 15-22 (see Appendix B)
Dependent variable: Nurse-surgeon perceptions	Descriptive research objective 3: To assess the perceptions of nurse-surgeons practising in the Australian public health system regarding employment prospects, support received from stakeholders, and the likelihood of continuing their practice.	Survey questions 23-30 (see Appendix B)

5.6.2.1 Content validity

Advice from industry experts (see Table 2) was sought to ensure content validity of the survey instrument. Content validity is defined as the assessment of how well a survey or test measures the targeted population it was designed to measure (Salkind, 2010). To achieve this, industry experts in the fields of nursing research, surgery and perioperative nursing, ethics, and online survey development were recruited. The experts in nursing research were the supervisors of the author. The experts in surgery and perioperative nursing were colleagues of the main researcher whose specialty is also perioperative nursing. The experts in ethics were the ACU HREC. The expert of online survey development was the administrator of REDCap®.

5.6.2.2 Face validity

Face validity, the evaluation of whether an instrument appears to measure what it intends to measure, is often determined subjectively by potential respondents (Trochim & Donnelly, 2008). In the context of the study, face validity was not employed due to the limited number of nurse-surgeons in Australia enabling them to participate in the research.

Table 2. Overview of industry experts and their advice

Expert	Position at time of approach	Expertise	Comment
1	Professor / Head of School – Nursing	Nursing education and research	Include a field for the participants to write comments; use branching logic where needed; change geographical areas to metropolitan, regional and remote
2	Associate Professor / Deputy Head of School – Nursing	Nursing education and research	Change AHPRA to Ahpra; change gender to sex; remove the question on ethnicity this is not necessary.
3	Senior Lecturer – Nursing	Nursing education and research	Distribute the age range and experience evenly; divide the survey questions into sections - one for roles, one for training and education, one for prospects. Use REDCap instead of Qualtrics.
6	Theatre Nurse Manager	Perioperative nursing	This is a very interesting topic. Let me know once the results are up. The survey questions look good to me.
7	Theatre nurse	Perioperative nursing	I am ok with the survey. Very thorough and the right questions were asked. I am excited to hear about the results of this.
8	ACU HREC	Ethics	Use a pop-up questionnaire to recruit and record the participants of the follow up interviews so it is separate from the survey. Embed the participant information letter in the survey. Ensure that there is a button that the participants can click to confirm consent

9	REDCap® administrator	Online survey development	This project looks fine to me, but I have a couple of changes: [redacted] is the CI according to ethics. Please update in the project settings (Project setup > modify title, purpose, etc). Your second project to record email addresses for focus groups/follow-ups is good. It also needs to be moved to production before you collect data though. Please ensure the same ethics number and CI is recorded there too. Once you have done the above, I will be happy to approve.

5.6.3 Sample

The participants for Phase 1 were currently practising perioperative (see Glossary of Terms) Registered Nurses (see Glossary of Terms) and Nurse Practitioners (see Glossary of Terms) within the Australian public health system. Organisations were considered part of the Australian public health system if they were included in the publicly available list of 680 public hospitals (see Appendix L) recognised by the Department of Health and Aged Care (2022). To be eligible, these Registered Nurses and Nurse Practitioners were undertaking surgeries (see Glossary of Terms) independently at the time of the data collection.

The rationale for including public hospital Registered Nurses and Nurse Practitioners only was the time and cost constraints in recruiting the participants of (and eventually running) a nationwide survey. The settings of nurse-surgeon practice included, but were not limited to, operating theatre, day surgery unit, endoscopy unit, outpatient clinic, interventional radiology, catheterisation laboratory unit, wards, intensive care unit and emergency departments in metropolitan, regional or remote areas. All surgical specialties were considered during recruitment. Surgical assistants who performed pure surgical assisting roles were excluded from the study as they do not perform surgeries (see Glossary of Terms) independently. Surgical assistant titles include, but are not limited to, Perioperative Nurse Surgeon's Assistant, Non-Medical Surgical Assistant, Registered Nurse First Surgical Assistant, and Registered Nurse First Assistant.

As there is no known official record that clearly defines the classification of nurse-surgeons in Australia, it was difficult to ascertain the exact sample size for this study. Therefore, no sampling frame was determined, and convenience sampling was used to reach as many

participants as possible based on their ease of accessibility and willingness to participate. In the context of studying nurse-surgeons in Australia, convenience sampling can offer both advantages and limitations.

Convenience sampling was beneficial in studying nurse-surgeons in Australia due to its practicality and ease of implementation (Babbie, 2015). The healthcare sector is often characterised by busy schedules and limited time for participation in research studies. Nurse-surgeons, who already balance demanding clinical duties were expected to find it more convenient to participate in a study that did not disrupt their workflow. Additionally, the geographic dispersion of healthcare facilities and the need for specialised skills among nurse-surgeons made it challenging to gather a representative sample using random selection methods. A convenience sample could provide a quicker and more feasible way to access this specific professional group.

However, it is important to acknowledge the limitations of convenience sampling (Neuman, 2013) when studying nurse-surgeons in Australia. The approach may introduce selection bias, as participants who readily agree to participate might possess certain characteristics that differ from those who decline. This could affect the generalisability of the findings to the broader population of nurse-surgeons in the country. Furthermore, the potential lack of randomisation in convenience sampling could impact the internal validity of the study, limiting the extent to which causal relationships can be established.

5.6.4 Recruitment

Three recruitment strategies were used in Phase 1. These were crowdsourcing at a conference for perioperative nurses, emailing of Australian public hospitals, and snowballing via social media networks and professional nursing groups. The decision to use multiple recruitment strategies was to maximise the potential of recruiting nurse-surgeons which is a highly specific and hard-to-find group of nurses in Australia while at the same time neutralising any selection bias in each strategy.

5.6.4.1 Emailing of public hospitals

All public hospitals in Australia were approached through email to inquire for any nurses in their facility that fit the nurse-surgeon (see Glossary of Terms) definition. The email addresses

of these public hospitals that the author contacted were publicly available. The sampling design that was used for this recruitment strategy was multi-stage or clustered sampling design. Cluster sampling is advisable for studies where it is impossible to identify the sample in one stage (Babbie, 2015), which was the case with this study.

Multistage or clustered sampling involves three stages (Creswell & Creswell, 2018). Firstly, the researcher identifies the clusters. In this study, the clusters were identified as the specific public hospitals where nurse-surgeons practice. Secondly, the researcher obtains the names of the individuals within those clusters. In the study, this was done by contacting the public hospitals individually and asking to confirm the existence of nurse-surgeons in their facility. These were done in three email correspondences – the initial contact, initial follow up and final follow up. Appendix M provides a copy of the ACU HREC-approved email template that was sent to the public hospitals. The final stage of the multistage sampling was recruitment of the obtained individuals from the identified clusters. In the study, the identified clusters were the public hospitals which confirmed the nurse-surgeons practising in their facilities. An email containing the survey link (https://rdcap.acu.edu.au/surveys/?s=E9YXAW7PYR) with the embedded participant information letter was sent as response to the confirming public hospitals for distribution to their practising nurse surgeons. Some hospitals provided the email addresses of the nurse-surgeons in their facility. For this group, the survey link was sent directly to the nurse-surgeons' email addresses. It was impossible for the author to trace if these nurse-surgeons completed the survey.

5.6.4.2 Crowdsourcing

Crowdsourcing is the use of internet and technology to host a research opportunity to recruit participants in a short period of time (Palmer & Strickland, 2016). Its strengths involve the convenience of recruiting participants at a low cost in a short span of time, usually a day. It is also ideal for accessing hard-to-reach populations. This made crowdsourcing suitable for recruiting nurse-surgeons as these nurses are geographically dispersed across Australia. On the contrary, a limitation of crowdsourcing involves concerns about sampling bias where obtaining of the representative sample may be clouded by systematic exclusion of participants who do not have the resource to attend a crowdsourcing event.

The author conducted the crowdsourcing by presenting in a virtual conference for perioperative nurses in Australia. The event entitled "International Conference of Perioperative

Nurses: Moving to a golden future" was hosted by the Australian College of Perioperative Nurses. The Australian College of Perioperative Nurses is the peak organisation for perioperative nurses in Australia (Australian College of Perioperative Nurses, 2021). Recruitment of the participants occurred at the end of the oral abstract presentation where a Quick Response (QR) code (Appendix I) was presented from the end of the lecture until the end of the Question-and-Answer portion of the presentation. The QR code was made available during this time to be scanned by the conference attendees to access and complete the online survey.

5.6.4.3 Snowballing

Snowballing is a chain-referral recruitment technique in which the researcher begins with contacting a small number of people from within their network to participate in a study (referred to as seeding) and then asks these people to spread the study among their networks so they too can participate (Parker et al., 2019). Therefore, in analogy, the sample grows like a rolling snowball. Snowballing is ideal for study subjects with traits that are hard to find due to its networking characteristics and flexibility (Parker et al., 2019). This is the case with nurse-surgeons. However, as a network-based sampling strategy, snowballing relies on selection bias where the initial contact begins with the researcher's personal networks which might cause a distorted sample in the early stage of the research. For example, over time the sample may snowball into females only, people of the same ethnicity, or people from the same geographical location.

In this study, snowball recruitment was initiated via the author's and study supervisors' social media networks on LinkedIn®, ResearchGate® and Facebook®. Consequently, these initial seeds allowed for the study to snowball. An attempt was made to connect with perioperative nurses and researchers on the aforementioned social networks to recruit the subjects of the survey by posting an ACU HREC-approved advertisement for the study which included a link for the participants to access the online survey and read the embedded participant information letter. During recruitment, the options for commenting, sharing, or tagging people were disabled to ensure that participant confidentiality is maintained. A copy of the social media advertisement is included in the Appendices (see Appendix N).

Another snowball recruitment strategy that was used in this study was through seeding of the professional nursing groups that might have nurse-surgeon members. These were the Australian College of Perioperative Nurses and the Australian College of Nurse Practitioners.

The author approached these professional groups to form collaborations and eventually initiate the snowball recruitment effort. The author complied with any ethics and research requirements prior to the recruitment of their members.

For the Australian College of Perioperative Nurses, the advertisement to participate in the survey was seeded through an electronic direct mail which was sent to the members of the Australian College of Perioperative Nurses. Electronic direct mails are email messages that are sent to people who subscribed or opted in to receive notifications or updates from a particular website or group. The electronic direct mail contained the link to access the survey and the embedded participant information letter. A copy of the ACU HREC-approved electronic direct mail is included in the Appendices (Appendix O).

For the Australian College of Nurse Practitioners, the advertisement to participate in the survey was seeded through the group's monthly e-magazine and as a post in the research section of their website (https://www.acnp.org.au/research). The e-magazine and website advertisements contained the link to complete the online survey and read the embedded participant information letter. A copy of the ACU HREC-approved website (Appendix P) and e-magazine (Appendix Q) advertisements are included in the Appendices.

5.6.5 Data Analysis

Descriptive statistics was used to report the findings of Phase 1 which was based on the Consensus-based Checklist for Reporting Survey Studies (Sharma et al., 2021) of the EQUATOR Network. No statistical software was used to analyse the collected data. Loss to follow up was not addressed as cross-sectional surveys are designed to capture data at a single point in time precluding the ability to track participants over time (Babbie, 2015). No modification of variables occurred during data analysis.

Data that were *missing completely at random* (MCAR) or *missing at random* (MAR) were accepted and left as is. Missing Completely at Random (MCAR) refers to a situation where the missingness of data in a research study is unrelated to both observed and unobserved variables (Little & Rubin, 2019). Conversely, Missing at Random (MAR) implies that the missingness of data is dependent only on observed variables, allowing for statistical techniques to account for missing data using the observed information (Little & Rubin, 2019).

Imputation of missing data was not conducted as the study was an explorative survey of Australian nurse-surgeons which to the authors' best knowledge, have never been studied as one population. Imputation involves estimating missing values based on available data, which can lead to artificially inflating sample sizes and altering the distribution of variables, thereby compromising the integrity of exploratory analyses. Imputation of missing data is discouraged in an explorative survey of study subjects with an unknown sample size due to the potential distortion of findings and the introduction of bias (Graham, 2009). Furthermore, imputation assumes a specific pattern of missingness, which may not hold true in exploratory studies where the underlying reasons for missing data are often unknown. Therefore, the data cannot be imputed without marring the integrity of the collected data. As inferential statistical analysis was not used, sensitivity analysis was not conducted.

5.7 Phase 2 Research

This section explains the method used for the qualitative phase of the study (Phase 2) and how this method was developed. The study participants and recruitment strategies are identified. The section also explains the ethical considerations and how the qualitative data were collected and analysed.

5.7.1 Method

The research method used for the qualitative phase (Phase 2) of this study was semi-structured interviews. Semi-structured interview as a research method is recommended for exploring individuals' personal experiences (Mack et al., 2011). The personal experiences that this qualitative phase aimed to describe through semi-structured interviews were the experiences of nurse-surgeons practising in the Australian public health system in terms of training, education, and integration to the health system. This represents research objective 4/4 of this study (see Research Aim and Objectives, p.).

The semi-structured interviews were conducted face-to-face and one-on-one virtually via Microsoft Teams®, the preferred web-based communication platform of the ACU. The development of the qualitative interview questions occurred after Phase 1 data collection and analysis were completed. This is the condition of all explanatory sequential mixed methods study (Creswell & Creswell, 2018). The type of textual data that was generated from the semi-structured interviews was audio recordings only. The participants were not video recorded throughout the interview to maintain participant confidentiality. The individual interview

sessions were expected to last approximately one hour and ranged from 36 minutes and four seconds to 45 minutes and 51 seconds. No follow up visits were required following completion of the interview.

There were three rationales for choosing virtual semi-structured interviews as the preferred qualitative method for this study (Mack et al. 2011). Firstly, interviews are useful when it is impossible to directly observe the participants of the study. This was the case with this study as nurse-surgeons as geographically dispersed across Australia. Secondly, virtual interviews are economical particularly in the context of this nationwide study where in-person interviews would have been financially challenging. Finally, semi-structured interviews use open-ended questions which give the researcher flexibility in terms of the addition, omission, adjustment, modification and sequence of questions.

Like any other qualitative research methods, semi-structured interviews have limitations (Mack et al., 2011). Firstly, interviews can only generate information in a designated setting instead of the participants' natural field setting. As mentioned earlier, the interviews of Phase 2 were conducted virtually via Microsoft Teams®. Secondly, the responses of the participants may be biased due to factors specific to the presence of the researcher. This may include the researcher's disposition during the interview, how the interviewees perceive the researcher, and other factors such as the perceived age, ethnicity and other prejudices that the interviewees and interviewer may have towards each other. This is further explained in sub-section 5.7.3.2 as part of the discussion on reflexivity. Finally, another limitation of semi-structured interviews is that not everyone is articulate and discerning. This in turn limits the robustness of the collected data.

5.7.2 Development of the interview protocol

The interview protocol was developed after completion of Phase 1 data collection and analysis. In explanatory sequential mixed methods research, developing an interview protocol after completing Phase 1 data collection and analysis is often grounded in the iterative nature of the research design. After obtaining quantitative results in Phase 1, researchers use these findings to inform the development of interview questions in Phase 2, ensuring that the qualitative phase addresses gaps, clarifications, or unexpected patterns identified during the initial analysis (Creswell & Creswell, 2017).

The protocol was three pages in length that included seven sections: basic information; introduction; opening question; content questions; probing questions; closing instructions; and a separate page for the observation protocol. The interview protocol is included as Appendix R. The basic information section was for the researcher to record the date and time of the interview, the names of both the interviewer and interviewee, the length of the interview, and the file name of the audio recording and transcription. The introduction was for the researcher to introduce himself, read the purpose of the study to the participant, verbalise that the informed consent has been signed, explain the structure of the interview, ask the participants for any questions, and define the terminologies that will be used in the interview. The opening question was an ice-breaker question that asked the participant to talk about him/herself. This included follow up questions such as their role or usual tasks that they do daily. The content questions were the research-specific questions that were framed in a friendly non-formal way. The probing questions were questions that reminded the author to ask for more information or explanation of ideas reported by the interviewee. The closing instructions contained prompts for the interviewer to thank the interviewee, assure confidentiality, answer any questions, clarify certain points, and explain what happens next. The observation protocol which contained the researcher's observation was a separate page that was divided into two parts. The first part was for descriptive notes such as a description of the background, comments about sounds that were not created by the interviewee, and accounts of any specific events or activities during the interview. The second part was for reflexive notes such as the author's personal feelings, ideas, hunches and prejudices during the interview.

5.7.3 Validity

The instrument validity of the semi-structured interviews was ensured through mock interviews and the self-appraisal or reflexivity of the author as the instrument for data collection during the actual interviews.

5.7.3.1 Mock interviews

To ensure validity of the interview protocol, the author undertook mock interviews with the study supervisors prior to commencement of the interviews. Additionally, the study supervisors ensured their availability for briefing and debriefing following the interviews.

5.7.3.2 Reflexivity

Reflexivity is a self-appraisal process whereby a researcher continuously self-evaluates and acknowledges him/herself as a major factor that may affect the outcomes and processes involved in his/her own research (Berger, 2015). The concept of reflexivity argues that the validity of data collection is dependent on the person collecting it and the data being collected (Berger, 2015). For semi-structured interviews, the instrument for data collection is the researcher. Therefore, in Phase 2 of this study, reflexivity is a crucial factor that was considered an inherent part of the research to ensure the methodological quality of the research method.

The author engaged in reflexivity during the interview by using three strategies. Firstly, the author continually made notes on his computer throughout the interview about the participant's comments and the author's thoughts about this participant. Secondly, memo of the researcher's thoughts were documented as soon as each interview has been completed. Finally, the reflexive statement of the author was developed and modified from the development of the interview protocol to submission of the research thesis. A first-person reflexive statement that tells the author's personal and professional self-appraisal is included in Appendix T.

5.7.4 Sample

A hallmark of qualitative research is purposive sampling or the purposeful selection of study participants. In line with this hallmark and as dictated by the explanatory sequential research design of this mixed methods study, the sample for Phase 2 was derived from the participants of Phase 1. Therefore, there were two conditions of eligibility to participate in Phase 2. Firstly, participants were required to be Registered Nurses and Nurse Practitioners that were undertaking surgeries independently at the time of the data collection, and secondly, they must have been participants of Phase 1 of the study.

Although considered a critical marker of quality and internal validity in qualitative research, there is still an ongoing conceptual debate and uncertainty in extant literature regarding the suitability of sample size determination in qualitative research (Creswell & Poth, 2018). A systematic review of peer-reviewed qualitative studies published in influential journals with high metrics found that the most common (55% of included studies) principle and arguably the gold standard for determining sample size in qualitative research is saturation (Vasileiou et al., 2018). Saturation means repetition of data collection and analysis until no new data is observed hence the "saturation" of data (Saunders et al., 2018). A qualitative study that involved 60 semi-structured interviews from a homogenous sample reportedly reached data saturation on the twelfth interview (Guest et al., 2006). However, Braun and Clarke (2019) argued against the

necessity of data saturation in qualitative research asserting that attempts to operationalise and quantify saturation are incongruent with the values of reflexive thematic analysis, emphasising the subjective and interpretive nature of meaning generation, rendering predetermined judgments about the quantity of data items and when to conclude data collection are inherently situated and subjective. Therefore, utilising the available and most current evidence in extant literature, the author opted not to employ the concept of data saturation in Phase 2 deeming the determination of sample size unnecessary.

5.7.5 Recruitment

The recruitment strategy used in Phase 2 was through a pop-up window that appears after completion of the survey in Phase 1. The window was made separate from the survey to maintain the anonymity of the survey participants. The link for the recruitment pop-up window was created by REDCap®. The page included a Yes or No question asking the Phase 1 participant's willingness to participate in Phase 2 of the study. A "yes" opened a box where they could type their email address. An image of the pop-up window is included as Appendix S). No incentives were given to Phase 1 participants to agree to participate in Phase 2. This was to maintain the confidentiality as Phase 1 participants. All participants who agreed to the interview through the survey were contacted via email. Eleven of the 16 nurse-surgeons who originally agreed to take part in the interview remained non-responsive after contacting them via email thrice.

5.7.6 Transcription

Data transcription is the process of transcribing the collected data into a textual form (Oluwafemi et al., 2021). In the past, data transcription was viewed as an irrelevant mechanical part of data management (Davidson, 2009). However, in recent years, the view of data transcription has changed as it is now considered a vital step in data analysis where interpretations can be generated from the act of transcribing. For this reason, the author utilised the integrated transcription service on Microsoft Teams to transcribe the audio recordings from the semi-structured interviews of Phase 2, and subsequently verified the transcriptions for accuracy.

5.7.7 Data Analysis

The data collected during Phase 2 was reported using the Consolidated criteria for reporting qualitative research (COREQ) checklist of the EQUATOR Network (Tong et al., 2007). The data was analysed inductively based on the six phases of reflexive thematic analysis

(Braun & Clarke, 2022). Microsoft Word® comment feature was used for coding the data. No automated coding software was used. The author familiarised himself with the data by listening to the audio recordings and reading the interview transcripts. During crosschecking of the interview transcripts, all identifiable participant information was removed, and the participants were given identification numbers. Data were stored in OneDrive®.

Participants did not provide feedback on the findings. In Heideggerian phenomenology, refraining from seeking participant feedback in qualitative studies, as proposed by McConnell-Henry et al. (2011), is justified as member checking may be viewed as redundant, aligning with the philosophy that the essence of human experience eludes complete capture through external perspectives, preserving the authenticity of phenomenological inquiry.

The data analysis of this study involved five stages (Denzin & Lincoln, 2017; Nowell et al., 2017; Braun & Clarke, 2006). First, the collected data was prepared for analysis. This included transcription of the audio recordings, tying up of notes from the observation protocol, and arrangement of data by source of information. Second, the prepared data was read and examined to obtain a general sense of the tone, depth, and credibility of the information from the audio recordings and the author's notes. Third, all data were coded into categories or themes. This is the first step of thematic analysis. Thematic analysis is the process of identifying, organising, and analysing themes in a given data set (Braun & Clarke, 2006). Themes are categories in qualitative studies that appear as major findings and are used as the headings in the discussion of findings in a thesis or dissertation (Nowell et al., 2017). Fourth, themes were generated for analysis. Lastly, themes were represented in the form of detailed discussion of subthemes or interconnecting themes. These five stages were based on the 15-point thematic analysis checklist developed by Braun and Clarke (2006) which involved the processes of transcription, coding, analysis, overall and written report. Table 3 illustrates this checklist.

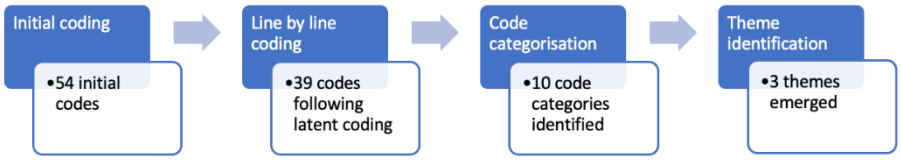
Table 3. Braun and Clarke 15-point thematic analysis checklist.

Process	No.	Criteria	Response
Transcription	1	The data have been transcribed to an appropriate level of detail, and the transcripts have been checked against the tapes for 'accuracy'	Both focus group transcripts transcribed to an appropriate level of detail and checked against tapes.
Coding	2	Each data item has been given equal attention in the coding process	We reviewed all quotations to generate coding.
	3	Themes have not been generated from a few vivid examples (an anecdotal approach), but instead the coding process has been thorough, inclusive and comprehensive	Themes, and the findings described herein, were developed from a complete coding process of the entire dataset. The coding process was thorough, inclusive and comprehensive, as all quotations were used to generate codes, and develop themes. Each theme was developed based on numerous codes gathered across a range of articles and participants quotations.
	4	All relevant extracts for all each theme have been collated	Yes.
	5	Themes have been checked against each other and back to the original data set	Yes.
	6	Themes are internally coherent, consistent, and distinctive	Yes.
Analysis	7	Data have been analysed- interpreted, made sense of- rather than just paraphrased or described	Yes, evident from the results.
	8	Analysis and data match each other- the extracts illustrate the analytic claims	The analysis and findings from it closely match the data set.
	9	Analysis tells a convincing and well-organised story about the data and topic	Yes.
	10	A good balance between analytical narrative and illustrative extracts is provided	Yes. Illustrative extracts have been used within the results section.
Overall	11	Enough time has been allocated to complete all phases of the analysis adequately, without rushing a phase or giving it a once-over-lightly	Yes.
Written report	12	The assumptions about, and specific approach to, thematic analysis are clearly explicated	Yes, stated in the methods section.
	13	There is good fit between what you claim you do, and what you show you have done- i.e. described method and reported analysis are consistent	Yes.

	14	The language and concepts used in the report are consistent with the epistemological position of the analysis	Yes
	15	The researcher is positioned as active in the research process; themes do not just emerge	Yes

Coding was systematic, iterative, and cyclical. Initial coding and line-by-line coding were conducted throughout the coding process. During initial coding, 54 codes were semantically created. No new codes emerged after the third interview. These 54 codes were narrowed down to 39 codes following latent coding. The researcher then organised the final set of 10 codes to derive any preliminary themes. Themes were reviewed, revised as necessary, and finalised during fortnightly discussions with the study supervisors. These discussions also provided the opportunity for the researcher to reflect on their prior assumptions and knowledge of practising nurse-surgeons in Australia. A report of the data analysis was then produced through elaboration of the identified themes and usage of direct quotes in relation to the research question. The coding tree outlining the codes from initial coding to identification of three themes are illustrated in Figure 1.

Figure 1. Coding tree



Data analysis in qualitative research may occur concurrently with the other parts of a given qualitative study. For example, while interviews are ongoing, the researcher may at the same time analyse a prior interview, write notes that can be included in the discussion of findings, or commence the writing of final report (Creswell & Creswell, 2018). Moreover, as information gathered from qualitative research such as texts and images can be compact and abundant, not all data can be preserved, and some parts of the collected qualitative data may need to be discarded. This is called winnowing of data (Guest et al., 2012). In Phase 2, the data analysis occurred simultaneously with the other stages of the study and the collected data was winnowed to avoid overloading of information.

5.8 Ethical considerations

5.8.1 Ethical review

Approval to conduct the mixed-methods study was obtained from the ACU HREC on the 15th of March 2022 and was allowed to proceed until the 30th of August 2023. A copy of the ACU HREC application (see Appendix C) and approval letter (see Appendix D) are included in the Appendices section.

ACU was the primary HREC of this study. However, in recognition of the National Statement on Ethical Conduct in Human Research (National Health and Medical Research Council, 2018), the author acknowledged that non-HREC approvals and permissions may be required prior to the study. The author complied with any ethics and research requirements of the participants' organisation. These non-HREC approvals were obtained prior to study.

5.8.2 Peer review

The ACU HREC required evidence of peer review to be submitted to ensure the appropriateness of the study's research design and merit. Evidence of peer review was submitted by the author to the ACU HREC in the form of international peer-reviewed articles (see Actual and Potential Published Refereed Papers) that were published throughout the duration of this study. The study was also peer reviewed by an experienced researcher at the university as part of the HREC process.

5.8.3 Type of research

In line with the National Statement on Ethical Conduct in Human Research set by the National Health and Medical Research Council (2018) of the Australian government, the quantitative phase of the study adhered to National Statements 3.2 and 4.3. National Statement 3.2 covers research using quantitative methods, population level data or databanks. The qualitative phase of the study followed National Statements 3.1 and 4.3. National Statement 3.1 covers research using qualitative measures. National Statement 4.3 covers research on workplace practices or possibly impacting on workplace relationships.

5.8.4 Risk of Social, Mental or Physical Harm

The study acknowledged the potential risk of mental harm to the participants as specified in the National Statement 2.1 (National Health and Medical Research Council, 2018) as the performance of any acts which might diminish self-esteem or cause embarrassment of distress. This is in recognition of the psychological distress that the participants may experience when answering the survey and interview questions about the support they have or have not received from their nursing and medical colleagues and the management during their nurse-surgeon training and independent practice. The participants were informed that they could decide to take a break or completely withdraw from the survey or interview. Moreover, the participants were encouraged to contact Lifeline or their organisation's Employee Assistance Program (EAP) in the event that they experience discomfort or distress. Lifeline (2022) is a not-for-profit organisation that provides free crisis support in Australia. An EAP is a work-based program that aims to identify and resolve professional and personal problems such as distress that may impact employee performance (Employee Assistance Professional Association of Australasia, 2022).

The study did not involve access to groups that the National Statement on Ethical Conduct in Human Research (National Health and Medical Research Council, 2018) specified as vulnerable such as: prisoners; people in other countries; elderlies, welfare recipients and other people who may be unable to provide full informed consent; minors; and anyone at risk of criminal or civil liability, damage to financial, social standing and employability. Only one group of participants (nurse-surgeons) is involved in the study and the data being collected was non-identifiable. Therefore, the level of risk for the participants completing the survey was low (National Health and Medical Research Council, 2018).

5.8.5 Benefits of the research

The author reported no immediate benefits to the participants of the survey. However, upon completion of the study, the author indicated a potential long-term benefit to the participants and the wider nursing community through national and international discussions around regulation of nurse- surgeon training, credentialing, and practice.

5.8.6 Participant confidentiality and anonymity

Due to the expected small number of Phase 1 participants, the author acknowledged that there may be some negligible risks that the participants' anonymity may be breached during their participation in the survey. As a risk mitigation strategy to ensure protection of participant anonymity, the survey responses were encrypted and stored in a secure cloud-based repository

(ACU OneDrive®). Any personal identifiers were removed as soon as the data had been collected and the collected data was reported in aggregate form only.

The author informed participants of the intention to publish the survey results in international nursing journals. The participants were advised via the participant information letter (see Appendix E) that survey results would be published in aggregate form to maintain participants' anonymity. Pseudonyms were applied to the participants during data analysis of the interviews and during publication. The identity of the participants was not disclosed to anyone other than the researcher. Copies of published papers were provided to the participants' organisational affiliations upon request.

The author informed participants that some confidentiality risks may arise from participation in Phase 2. During recruitment, the anonymity of the interview participants was maintained through the development and use of a separate pop-up invitation to participate in the follow-up interview at the end of the survey.

The ACU-recommended Microsoft Teams® was used as the audio-recording medium for the interviews. ACU did not recommend Zoom® for recording sensitive or identifiable information due to security concerns and the deletion of Zoom® files at the end of every academic semester. The audio-recordings were encrypted and stored in a secure cloud-based repository (ACU OneDrive®). The participants were not photographed throughout the interview. Hence, no permission was sought for use of any identifiable images. The interviews did not involve deception of participants. During data analysis, participant confidentiality was maintained through the use of pseudonyms for the participants' names, places of work, and any potentially identifying issues that may emerge during the interview. Any personal identifiers were removed as soon as the interview data had been collected and transcribed.

5.8.7 Perception of coercion

Throughout the recruitment stage of the quantitative phase, the author did not have any direct contact with the prospective participants to avoid any perception of coercion or undue influence.

5.8.8 Conflicts of interest

In line with the National Statement on Ethical Conduct in Human Research (National Health and Medical Research Council, 2018), the author acknowledged that any students, patients, and clients associated with the author were not used. The study was not undertaken in the author's place of work or in any area where the author has financial or commercial interest. No incentives, payments, vouchers, or reimbursements were offered to the participants of the study.

5.8.9 Informed consent

All Phase 1 participants were asked to give consent prior to participation in the survey and were aged 18 years and over. A radio button was present on the first page of the online survey along with an embedded participant information letter (see Appendix x) which comprehensively explained the study. The participants were required to click this radio button to confirm their consent to participate and that they have fully read the content of the embedded participant information letter. The survey was designed in a way that the participants could not continue to the next page of the survey until the radio button was clicked.

All Phase 2 participants were asked to give written consent prior to participation in the interview and were aged 18 years and over. A consent form (see Appendix F) and participant information letter (see Appendix G) were emailed to the participants' nominated email address prior to the date of their interview. The participant information letter contained a comprehensive explanation of the qualitative study. The participants were required to sign and return by email the consent form to the author to confirm their consent to participate and acknowledge that they have fully read the content of the participant information letter.

5.8.10 Data Management

The survey was developed using the ACU-recommended REDCap® software. The survey data was downloaded from the REDCap® website and converted to .xlsx format. To ensure the security of the electronic data from misuse, loss, or unauthorised access during and upon completion of the survey, the following measures were taken. During the study, the electronic survey data was password-encrypted and stored in ACU OneDrive®. Following completion of the survey, the electronic survey data was archived in ACU OneDrive®. In line

with ACU's Records Retention and Disposal policy, the electronic survey data will be destroyed 15 years after the results of the study are published.

The interview data was audio-recorded and saved in ACU OneDrive®. The audio data was then transcribed in .docx format. The completed consent forms for the interviews were converted to .pdf format, zipped and then stored in ACU OneDrive®. To ensure the security of the interview data from misuse, loss, or unauthorised access during data collection and data analysis, and upon completion of the interviews, the following measures were taken. During the study, the audio recordings and transcriptions were password-encrypted and stored in ACU OneDrive®. During data analysis, any personal identifiers were removed through the use of pseudonyms and codes. Following completion of the interviews, the audio recordings and transcripts were archived in ACU OneDrive®. In line with ACU's Records Retention and Disposal policy, all data collected from the interviews will be destroyed 15 years after the results of the study are published.

5.9 Data integration

The integration stages in a sequential mixed methods study unfold across the design, methods, interpretation, and reporting levels of the research process (Fetters et al., 2013). At the design level, emphasis is placed on meticulous planning, involving the formulation of research questions, the selection of suitable methods for each phase, and the strategic timing and sequence of qualitative and quantitative components. The methods level underscores the necessity for rigor in executing both qualitative and quantitative methods independently. This entails the collection and analysis of quantitative data in the initial phase, followed by a dedicated phase for the collection and analysis of qualitative data, with each phase adhering to the respective principles and standards of qualitative and quantitative research.

Moving to the interpretation and reporting level, Fetters et al. (2013) advocated for separate interpretation of findings from the qualitative and quantitative phases. This requires researchers to contextualise results within the framework of each method, offering a nuanced understanding of the research questions. Reporting transparency is crucial, highlighting the distinctive contributions of each phase.

The final integration level involves synthesising findings from both phases to draw comprehensive conclusions. Fetters et al. (2013) emphasised a thoughtful discussion that acknowledges the complementary insights derived from qualitative and quantitative methods,

ultimately leading to a holistic understanding of the research problem that surpasses the individual capacities of either method alone. This approach encourages researchers to integrate both components judiciously, leveraging the strengths of qualitative and quantitative paradigms for a more robust and nuanced exploration of the research topic.

In the study, the process of data integration unfolded across various key stages, including design, methods, interpretation, and reporting levels. Following these individual integrations, a final integration was conducted, utilising a joint display methodology through a meta-inference table as outlined by Younas et al. (2023). This involved visually consolidating the data, creating a comprehensive joint display that facilitated the extraction of novel insights beyond what could be derived from the distinct findings obtained through quantitative and qualitative analyses (Fetters et al., 2013; Younas et al., 2023).

5.10 Summary

Chapter 5 discussed mixed methods research as the methodology of this study and explanatory sequential as its research design, with pragmatism was presented as the underpinning philosophical view. The chapter then discussed in full detail the quantitative (Phase 1) and qualitative (Phase 2) phases of the study. Data integration was noted to have occurred across various levels of the study and the final integration in mixed methods research was explained. Chapter 6 will present a peer-reviewed paper that reported the findings of Phase 1.

Chapter 6 Phase 1 Results (Paper 4)

6.1 Introduction

In Chapter 5, the methodology and research design of the study were discussed, outlining the aim and objectives, along with the rationale for employing an explanatory sequential mixed-methods research design. The study comprised two phases: Phase 1, a quantitative stage involving the development and nationwide dissemination of a survey via RedCAP®; and Phase 2, a qualitative phase using a semi-structured interview instrument conducted via Microsoft Teams® to gain deeper insights into the results of Phase 1. The chapter also addressed ethical considerations and the approach to data integration.

In Chapter 6, the outcomes of Phase 1 are disclosed in the form of a submitted paper entitled Nurse-surgeons in the Australian public health system: A descriptive quantitative survey. This paper is presently undergoing peer review for potential publication in the International Journal of Nursing Studies Advances. The decision to submit the paper to this journal was influenced by its esteemed standing as a Q1 journal with a CiteScore of 5.8, underscoring its recognition as a platform for impactful open access research in the field of advanced practice nursing, aligning well with the author's aim of disseminating the findings from the study. A copy of the submitted journal article is provided below.

6.2 Journal article

Title

Nurse-surgeons in the Australian public health system: A descriptive quantitative survey

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Abstract

Background: With over five billion people worldwide lacking access to surgery, innovative solutions are vital to address the global surgical crisis. Nurse-surgeons present a promising innovation. Considering their contribution worldwide and impact on surgical care in Australia, an exploration of these advanced practice nurses is timely.

Objective: To investigate the roles, training, education, and perceptions of career prospects and support received by practicing nurse-surgeons in the Australian public health system.

Design: Non-experimental descriptive national survey

Methods: The target population was nurse-surgeons practicing within the Australian public health system. The survey questionnaire comprised of four sections containing questions on nurse-surgeon demographics, roles, training, and perceptions of career prospects and support received. Data collection was conducted through emailing of public hospitals, crowdsourcing, and snowballing. Descriptive analysis was used to report the findings.

Results: Twenty-eight nurse-surgeons participated in the study, 22 females and six males. Most commonly, participants (n = 10) held master's degrees and trained to become nurse-surgeons for an average of 2·27 years (95% CI [1·47,3·07]). Training programs varied but were all surgical specialty-specific, and usually included a practical component, theoretical component, and competency assessment prior to independent practice. Participants rated employment prospects for nurse-surgeons as poor to average due to limited work opportunities, politics, and strong pushbacks from Australian medical societies. The support received from nurses, surgeons and management was rated by participants as good providing reasons such as supportiveness, value recognition, jealousy, and resentment. The participants were very likely (95% CI [7.436 – 9.364] to continue practicing due to positive job satisfaction but recommended the standardising of training and practice to ensure role futureproofing.

Conclusions: Nurse-surgeons have been practicing in Australia for decades, yet no standard training and credentialing pathway exist for them. This study identified the various roles, non-standard training, and perceptions of nurse-surgeons in the Australian public health system. The findings of this study will have an impact on policymakers and stakeholders to develop standard national credentialing pathway for nurse-surgeons in Australia to enhance clinical practices and ensure a consistent framework for recognition and development of these advanced practice nurses.

Keywords

Advanced Practice Nursing; Nurse Practitioners; Nurse-surgeon; Surgical Procedures, Operative; Surveys and Questionnaires; Universal Health Care; Waiting Lists.

What is already known?

- Modern nurse-surgeons have been practicing globally since the 1950s.
- Nurse-surgeon implementation in many local systems around the world has led to surgical waitlist reduction, timely patient access to essential surgeries in remote and rural communities, and prevention of mortalities.

What this paper adds?

- Nurse-surgeon practice in Australia may have started in the late 1970s to early 1980s.
- This study found Australian nurse-surgeon roles spanning across diverse specialties such as endoscopic and general surgeries and engaging in supplementary roles, including research and nurse-led clinic consultations.
- There is a need for a standard national credentialing pathway for nurse-surgeons in Australia.

1 Background

Surgery, as defined by the World Health Organization, refers to any invasive procedures involving major, minor, open, and minimally invasive laparoscopic and endoscopic techniques performed by surgical providers such as physicians, nurses, and other healthcare professionals to diagnose and or treat surgical conditions (Debas et al., 2006). Millions of people undergo surgery every year which is oftentimes their last resort to avoid disease progression or death (World Health Organization, 2022). Access to surgery is a fundamental element of universal health care (World Health Organization, 2014). However, surgery continues to be widely disregarded as a health agenda of global concern even with data suggesting that 62% of the world's population or at least five billion people have no access to surgery (Alkire et al., 2015; Chamie, 2020; Meara et al., 2015) resulting in more than 18 million preventable deaths annually from surgically treatable conditions (Reddy et al., 2020).

Limited access to surgery disproportionately affects developing countries, highlighting global inequities in surgical care (Bath et al., 2019). This disparity extends to countries without universal health care (Reddy et al., 2020). The COVID-19 pandemic strained even advanced health systems, exacerbating surgical challenges (Muralidar et al., 2020; Wiersinga et al., 2020). Ongoing restrictions and lockdowns amplified the impact, leading to a surge in elective surgery cancellations and worsening pre-existing surgical waiting lists (Carr et al., 2021; COVIDSurg Collaborative, 2020).

The factors that affect timely patient access to surgery are numerous. Regardless, the billions of people globally that require surgery, and the debilitating clinical outcomes arising from surgical delays, imply that surgical care be considered a priority global health issue and therefore, innovation in surgical care delivery should be upheld to alleviate the global surgical burden. One promising innovation in surgical care provision is the emergence of nurse-surgeons or nurses who undertake surgeries independently (Grota et al., 2022). Despite possessing expert knowledge and clinical competencies for surgery, some nurse-surgeons lack master's degrees - a recommendation by the International Council of Nurses (2008) to be considered an advanced practice role. Therefore, as a group, nurse-surgeons do not fit these criteria. Nurse-surgeon titles and trainings are unregulated and are usually based on their area of surgical specialty which include nurse endoscopist, nurse cystoscopist, nurse

hysteroscopist, physican extender, nurse practitioner, surgical care practitioner, clinical nurse specialist, and perioperative specialist practitioner (Grota et al., 2021).

Nurse-surgeons emerged from supply and demand whereby the demand for surgeries is extremely high, but the supply of trained surgeons is critically low (Grota et al., 2022). In developing countries where timely patient access to surgery is dire, the World Health Organization's (2008) Task Shifting strategy extended the scope of practice of differently educated healthcare providers to perform complex clinical duties that used to be performed by clinicians historically assigned those tasks. Task shifting may have been pivotal in recognising the value of nurse-surgeons even though modern nurse-surgeons have been documented to be performing surgeries such as c-sections and laparotomies since the 1950s (White et al., 1987). Similarly, in developed countries such as Australia, surgical capacities needed to be innovated to meet the growing surgical demands amidst the ageing medical workforce (OECD iLibrary, 2019), junior physicians being restricted from working unsafe hours (Philibert et al., 2002), the longstanding uneven geographical distribution of surgeons (Phillips, 2022), and specialist surgeons managing multimorbid patients who are now living longer than average due to modern technology and healthcare (Vivekanantham & Gnanappiragasam, 2014).

The earliest known use of the term "nurse-surgeon" dates back to the 1500s when King Henry VIII named William Bullein his private nurse-surgeon (Duffin, 2017). However, the earliest known document that described "nurse-surgeons" as nurses capable of independently performing surgeries was published in the 1980s when due to the shortage of surgeons and the demand for emergency obstetric and gynaecological surgeries, a need to train a group of African nurse-surgeons to perform surgery arose (White et al., 1987). Physicians and nurses campaigned for the standardisation of nurse-surgeons throughout the 1980s (Judy 1985; Litt & Brodsky, 1983). However, this momentum declined in the 1990s until publications about nurse-surgeons resurfaced in the 2000s (Kingsnorth, 2005; Kowalewski & Jahn, 2001; Marsh, 2005; Zorn, 2005) where nurse-surgeons were recognised as qualified non-physician surgeons in the United Kingdom (Mickute, 2009). Nowadays, nurse-surgeons practice different types of surgeries such as general, plastics, orthopaedics, cardiovascular, obstetrics, gynaecology, and orotolaryngology in Europe, Africa, Asia, and North America (Grota et al., 2021; Kowalewski & Jahn, 2001; Zorn, 2005). Some of these surgeries include (but

are not limited to) caesarean section, laparotomy, hysterectomy, appendicectomy, herniorrhaphy, endoscopy, hysteroscopy, cystoscopy, biopsy, and carpal tunnel release (Grota et al., 2021).

The impact of nurse-surgeons in global surgical care delivery has been crucial in saving at-risk women who are pregnant and require emergency caesarean sections and hysterectomies, patients with life-threatening blood clots requiring angiograms and percutaneous thrombectomies, and other patients requiring essential gynaecologic, endoscopic, and urological surgeries in remote and urban settings (Bodle et al., 2008; Dryer, 2006; Gidlow et al., 2000; Redwood, 2009; White et al., 1987; Wright, 2000). Nurse-surgeon implementation in many parts of the world has led to surgical waitlist reduction (Grota et al., 2022), timely patient access to essential surgeries both in remote and rural communities (Johal & Dodd, 2017; Redwood, 2009) and prevention of mortalities that could have been added to the 18 million preventable surgical access-related deaths (Reddy et al., 2020).

In Australia, the earliest documented use of nurse-surgeons was in 2004, when a group of South Australian nurse-surgeons performed endoscopies in recognition of the goal of the National Bowel Screening Program of the Australian government to prevent deaths of Australians from bowel cancer, a type of cancer that is easily treatable if detected early. Bull et al. (2006) reported a 96.2% success rate of nurse-surgeon performed endoscopies without any documented mortalities, complications, and serious adverse events. Beck (2013), Duncan et al. (2017), and Cusack et al. (2018) conducted their own studies of nurse-surgeons undertaking endoscopies and concluded similar positive outcomes.

In 2012, Sapre et al. (2012) explored the potential of nurse-surgeons in easing the burden of delivering urological surgical services while aiding in decreasing the workload of urologists. The study reported a reduction in the flexible cystoscopy waitlist by 65%. The five studies (Cusack et al., 2018; Duncan et al., 2017; Beck, 2013; Sapre et al., 2012; Bull et al., 2006) on nurse-surgeons are currently the only known published literature on nurse-surgeons in Australia. However, taking into account the international data on nurse-surgeons, it can be assumed that there might be other nurse-surgeons practicing in Australia yet to be studied.

Given the significant role of nurse-surgeons globally and their potential to enhance surgical services in Australia, this study addresses the absence of an Australian quantitative research on nurse-surgeons. The lack of standardised nursing titles, highlighted by Duffield et al. (2011), poses challenges, necessitating the use of the term “nurse-surgeon” as an overarching designation. Standardising this language is crucial for accurate data consolidation. The study explores the roles, training, education, and perceptions of career prospects and support received by nurse-surgeons within the Australian public health system.

2 Methods

This study is the first phase of a two-phased research project exploring currently practicing nurse-surgeons in Australia.

2.1 Aim

To investigate the roles, training, education, and perceptions of career prospects and support received by practicing nurse-surgeons in the Australian public health system.

2.3. Design

This study utilised a cost-effective non-experimental descriptive survey design using REDCap® (2022) for data collection among geographically dispersed nurse-surgeons. The cross-sectional survey, designed with input from surgical and perioperative nurses, covered demographics, roles, training, and perceptions. The instrument underwent expert validation and pre-testing for usability, ensuring robust data collection (Prince, 2012). The participant information letter (see Supplementary material 1) was included in page one of the survey. The final survey instrument details are available in Supplementary Material 2.

2.4 Inclusion and/or Exclusion Criteria

The participants of this study were currently practicing nurse-surgeons within the Australian public health system with active Registered Nurse or Nurse Practitioner Australian Health Practitioner Regulation Agency registration. Due to time and cost constraints in data collection of a nationwide survey, only those working in public

hospitals recognised by the Australian Department of Health and Aged Care (2022) were included. All surgical specialties and settings were considered. Nurse surgical assistants such as Perioperative Nurse Surgeon's Assistant, Registered Nurse First Assistant, Registered Nurse First Surgical Assistant, and Non-Medical Surgical Assistant were excluded as they do not perform surgeries independently, only under the direct instruction and supervision of a surgeon or nurse-surgeon.

2.5 Sampling

As there is no known official record that clearly defines the classification of nurse-surgeons in Australia, it was difficult to ascertain the exact sample size for this study. Therefore, no sampling frame was determined, and convenience sampling was used to reach as many participants as possible based on their ease of accessibility.

2.6 Data collection

To maximize recruitment of hard-to-reach nurse-surgeon participants and address potential bias, three strategies were employed (Palmer & Strickland, 2016; Parker et al., 2019). Public hospitals across Australia were contacted in stages, and those responding were sent the survey link to distribute, ensuring participant anonymity. Crowdsourcing involved the first author presenting at the 2022 Australian College of Perioperative Nurses' International Conference, where a Quick Response code facilitated convenient and cost-effective recruitment. Snowballing, suitable for elusive subjects like nurse-surgeons, utilised the authors' professional LinkedIn®, ResearchGate® and Facebook® accounts and involved seeding nursing groups, such as the Australian College of Perioperative Nurses and the Australian College of Nurse Practitioners, to disseminate the survey link through various channels such as electronic direct mail, e-magazine and as a post in the research section of their website.

2.6.1 Emailing of public hospitals

The initial contact stage, starting in March 2022, involved reaching out via email to 636 public hospitals out of the 680 recognised by the Department of Health and Aged Care (2022). Subsequent follow up emails were sent in April and June to non-responding hospitals. Overall, 247 (39%) of the 620 public hospitals responded, with 30 confirming nurse-surgeon/s, 208 reporting none, and nine declining to participate.

Figure 1 illustrates the respondent flow at initial contact, initial follow-up, and final follow-up.

2.6.2 Crowdsourcing and snowballing

The snowballing recruitment commenced in June 2022 while the crowdsourcing event occurred in one day on 23 July 2022. It was impossible to trace the number of respondents during the crowdsourcing event and the snowballing recruitment as the survey was designed to ensure anonymity of the participants.

2.7 Data analysis

Descriptive statistics was used to report the findings. No statistical software was used to analyse the collected data. As a cross-sectional survey, loss to follow up was not addressed. No modification of variables occurred during data analysis. Data that were *missing completely at random* or *missing at random* were accepted and left as is. Imputation of missing data was not conducted as the study was an explorative survey of a limited number of study subjects who have diverse characteristics and to the authors' best knowledge, have never been studied as one population. Therefore, the data cannot be imputed without marring the integrity of the collected data. As inferential statistical analysis was not used, sensitivity analysis was not conducted.

2.8 Ethical considerations

The study was approved by the Australian Catholic University Human Research Ethics Committee prior to recruitment, and the study was conducted in accordance with the National Statement on Ethical Conduct in Human Research (National Health and Medical Research Council, 2018). All participants provided consent to participate prior to accessing and completing the survey. Survey responses were encrypted and stored in a secure cloud-based repository. Personal identifiers were removed as soon as data were collected, and only aggregated data were reported.

3 Results

3.1 Characteristics of the study participants

A total of 38 unique visitors clicked the survey link. Thirty-three consented to complete the survey while five did not consent. Of the 33 that consented, five did not continue and left all the succeeding fields blank. The data sets of these five visitors were removed leaving 28 study participants who completed or partially completed the survey. As all the missing data were *missing completely at random*, missingness was handled by acceptance and any missing data were left as is. As this study was exploratory, no response rate was calculated.

3.2 Nurse-surgeon demographics

The demographics of the study participants are shown in Table 1. Twenty-two of the participants were females and six were males. The most common age range was 35 to 44 years (n = 12). The state where most of the participants practiced was Victoria (n = 14) followed by Queensland (n = 6). None practiced in the Australian Capital Territory and Tasmania. Most participants were working permanent part time hours (n = 15) followed by permanent full timers (n = 9), self-employed (n = 3) and one casual employee.

3.3 Nurse-surgeon roles

Participants were practicing as Registered Nurses (n = 16), Nurse Practitioners (n = 6) and those with both Registered Nurse and Nurse Practitioner registrations (n = 5). Predominant clinical settings included the operating theatre or perioperative department (n = 14), endoscopy unit (n = 13), day surgery unit (n = 12), and hospital outpatient clinic (n = 8). Ten participants had over a decade of nurse-surgeon experience, with a mean of 18.13 years for those with 10 or more years (95% CI [7.48, 28.77]). Surgical specialties encompassed endoscopy (n = 10), general surgery (n = 6), urology (n = 6), gynaecology (n = 4), plastic surgery (n = 4), cardiac (n = 3), and obstetrics (n = 3). Common endoscopic surgeries included colonoscopy (n = 11), flexible sigmoidoscopy (n = 10), gastroscopy (n = 6), flexible cystoscopy (n = 4), endoscopic vein harvesting (n = 3) and rigid cystoscopy (n = 3). Non-endoscopic nurse-surgeon performed surgeries included biopsy across different specialties (n = 8), open vein harvesting (n = 3), circumcision (n = 1), carpal tunnel release (n = 1), and inguinal hernia repair (n = 1). Beyond nurse-surgeon roles, the majority (n = 19) engaged in additional work like

clinical nurse consulting, outpatient clinic appointments, and surgical assisting. The roles of the study participants are detailed in Table 2.

3.4 Nurse-surgeon education and training

Participant education and training revealed ten with master's degrees, six with bachelor's degrees, and one holding a Doctor of Philosophy degree. Fourteen underwent postgraduate studies before practicing as nurse-surgeons, while seven did not require postgraduate studies. Twelve participants had a blend of formal and informal practical training, and an equal number had a mix of formal and informal education. During practical training, 15 participants were supervised by surgeons, four by both surgeons and nurse-surgeons, and one by a nurse-surgeon alone. Twenty participants underwent competency assessments before independent practice, with approval decisions made by clinical supervisors (n = 6) or a joint approval from various stakeholders (n = 13). Eight participants reported two or more years of comprehensive nurse-surgeon training, eight reported one to two years, and five reported less than one year. The mean training duration for those specifying years was 2.27 years (95% CI [1.47, 3.07]). The education and training of participants are shown in Table 3.

3.5 Nurse-surgeon perceptions

Participants' perceptions of career prospects and support during training and practice were assessed on a 5-point scale with 1 being terrible and 5 being excellent (see Table 4). For employment prospects, three participants rated as excellent (rating of 5), eight as good (rating of 4), five as average (rating of 3), five as poor (rating of 2), and four as terrible (rating of 1), resulting in a mean of 2.62 or poor to average (95% CI [2.11, 3.13]). Regarding support during training, ratings were six excellent, five good, five average, four poor, and one terrible, with a mean of 3.52 or good (95% CI [2.95, 4.09]). Support during independent practice received ratings of 11 excellent, seven average, two good, and one terrible, resulting in a mean of 4.05 or good (95% CI [3.52, 4.58]). From surgeons' support during training, ratings included 13 excellent, four average, two terrible, one good, and one poor, with a mean of 4.05 or good (95% CI [3.41, 4.69]). During independent practice, seven participants rated surgeons' support as excellent, six as average, five as good, and two as poor, with a mean of 3.85 or good (95% CI [3.36, 4.34]). Management support during training received 10 excellent, four good, four average, and two poor ratings, leading to a mean of 4.1 or good (95% CI [3.6, 4.6]).

After training, ratings for management support were seven excellent, six average, five good, and two poor, resulting in a mean of 3.85 or good (95% CI [3.36, 4.34]). Participants' likelihood of continuing as nurse-surgeons was scored on a 10-point likert with 10 being extremely likely and 0 being extremely unlikely. This question had a mean rating of 8.4 or likely (95% CI [7.52, 9.28]), with most participants (n = 10) indicating a likelihood of 10 or extremely likely. Additional participant comments emphasised the need for formal training recognition, challenges in acceptance, and recognition of nurse-surgeons, as well as concerns about governing bodies and political aspects in nursing roles. More detailed comments can be found in Table 4.

4 Discussion

4.1 Interpretations

The findings of this study indicate that nurse-surgeons exist in a variety of roles within the Australian public health system. One participant with nurse-surgeon experience of 42 years indicates that nurse-surgeon practice in Australia may have started in the late 1970s to early 1980s. Although the first documented nurse-surgeon performed surgeries in the 1950s (White et al., 1987), it was not until the 1980s (Judy 1985; Litt & Brodsky, 1983) when active campaigns to develop nurse-surgeon roles in Western countries proliferated. This was around the same decade when one of the study participants started practicing as a nurse-surgeon in New South Wales.

Most of the study participants had at least 20 years of experience as scrub/scout nurses prior to becoming nurse-surgeons. The majority were master’s degree holders who underwent nurse-surgeon training for two years and three months, which was surgical-specialty specific and included practicum, educational preparation, and competency assessment. They were required to pass a competency assessment and an approval from the clinical supervisor and/or external the hospital management, hospital quality team and external credentialing committee prior to independent practice. These findings are similar to an international review (Grota et al., 2021) which found that nurse-surgeons undergo a surgical-specialty specific training program that includes a theoretical component and a practical component that is supervised by surgeons before being assessed for competency to practice independently. The study participants stated the surgeries they performed independently including biopsy, inguinal hernia repair,

circumcision, colonoscopy, gastroscopy, cystoscopy, and hysteroscopy. These were surgeries documented to have been performed independently by nurse-surgeons globally (Grota et al., 2022).

Participants rated the employment prospects for nurse-surgeons in Australia as poor to average due to four primary reasons. First, the role is dependent on hospital approvals hence limited mobility and work opportunities for nurse-surgeons exist, as the role is currently highly uncoordinated and hospital specific and may not carry across networks and states. Second, politics within hospitals arise from factors such as nurse-surgeons being seen as taking away training opportunities for junior surgeons and some physicians believing that nurses should not have this role. Third, strong pushbacks from Australian medical societies against implementation of a nurse-surgeon role. Fourth, the inability of nurse-surgeons to access Medicare Benefits Schedule rebates and associated payment issues. Innovation and change can always be clouded by fear of the unknown (Newton, 2019) and arising from this fear is the failure of stakeholders such as physicians and hospital management to recognise the value of such clinical practice innovation. The benefits of nurse-surgeons in improving surgical capacity and the timely delivery of surgical care greatly outweigh and therefore justify challenging these barriers.

The support that the nurse-surgeons received from their nursing colleagues during training and independent practice was good. Although some participants highlighted jealousy or tall poppy syndrome as the reasons why their nursing colleagues refuse to accept the concept of nurses performing surgeries and needing surgical assistance, most were supportive and recognised the value of nurses in advanced practice roles. This also creates career growth opportunities for experienced nurses wanting to expand their career without leaving clinical practice. Similarly, the support that nurse-surgeons received from surgeons was good during training and independent practice. The surgeons who supervised the participants were supportive, encouraging and available for feedback and discussion when required. However, other surgeons who are not involved with their training, have not been exposed to nurse-surgeons, or new to surgery were not as supportive. The hospital management's support on the participants during their training and independent practice was also good. This was evidenced by the continually supportive management and the appreciation of the value nurse-surgeons add to theatre capacity. However, as with their nursing colleagues, the

participants believed that management lacked the insight to fully understand the role leading to payment issues. Support was subjective as seen in the contradicting participant responses even though the ratings were the same. Disputes and resistance in professional role boundaries in the health sector are well documented and longstanding particularly when the established or assumed to be protected roles of a specific healthcare professional is being threatened in the course of another healthcare professionals' scope of practice expansion and evolution (King et al., 2015). This is similar to the plight of Nurse Practitioners in the United States wishing to gain title recognition and standardisation of the scopes of advanced practice receiving continued strong resistance from medical societies (Poghosyan et al., 2018).

With an average of 8.4 (95% CI [7.436 – 9.364] on a scale of 0 to 10, the participants were very likely to continue their nurse-surgeon practice mainly due to job satisfaction. However, as the role is not recognised by medical and nursing disciplines, the participants believed that there are still factors to consider for the futureproofing of the role such as practice standardisation through formal training, fellowship program from the Australian College of Nurse Practitioner, allowing nurse-surgeons to access Medicare Benefit Schedule, and gathering support from governing bodies and nursing unions.

4.2 Limitations

This study faces a potential confounder due to the lack of a standard for nurse-surgeon practice in Australia, resulting in blurred scopes of practice with nurse surgical assistants. Despite explicit eligibility criteria, some nurse-surgeons working as non-medical surgical assistants introduced uncontrollable variables, evident in outlier responses like participant ID 20, who claimed to independently perform surgeries typically beyond the documented scope of nurse-surgeons, raising questions about accuracy and adherence to eligibility criteria.

Another limitation of this study is the number of survey responses received which could have been higher if the email addresses of the public hospitals' appropriate contact person were gathered. The first author searched for email addresses by visiting the websites of each public hospital and many of the email addresses retrieved were generic. An attempt was made to gather the correct email addresses of these public

hospitals by contacting the Australian Institute of Health and Welfare but due to cost constraints, this data was not secured.

A final limitation of this study is the uncontrollable and unpredictable responses from the public hospitals during recruitment. For example, a Director of Nursing of one hospital confirmed on the initial contact the existence of nurse-surgeons in their facility. However, when this Director of Nursing consulted with the head of their research department who happened to be a surgeon, the public hospital retracted their statement and stated that no nurse-surgeons exist in the facility. Consequently, practicing nurse surgeons that may have provided useful data may have been missed from the study.

4.3 Recommendations for Further Research

The findings of this study present many opportunities for future research. First, this study provides an emerging evidence base to support deeper exploration of the benefits nurse-surgeons provide to healthcare delivery in Australia and overseas. Second, international research on the standardisation of nurse-surgeon practice and their potential in easing the global surgical burden should be undertaken. Third, investigation of methods to confront and negate barriers to the utilisation of nurse-surgeons practice in Australia should be implemented as part of a national strategy to address the ongoing and deteriorating health workforce situation. Finally, a government-supported national database tracking nurse-surgeons and their practice areas would aid future research.

4.4 Implications for policy and practice

Stakeholders and policymakers in Australia such as the Department of Health and Aged Care, Australian Health Practitioner Regulation Agency, local health systems, Australian College of Perioperative Nurses, Australian College of Nurse Practitioner, Australian College of Nursing, and Australian Medical Council can use the findings from this study to collaboratively develop a formal and standard national credentialing pathway for nurse-surgeons. Therefore, innovative and difficult conversations addressing the persistent health workforce challenges may need to be initiated with the government, surgical healthcare professionals such as physicians and nurses, and local health

systems to develop sustainable and collaborative solutions to enhance the surgical capacity across Australia.

5 Conclusion

Nurse-surgeons have existed within the Australian public health system performing surgeries for many decades. This study has unearthed the current roles of nurse-surgeons in surgical care, the non-standard trainings nurse-surgeons encounter prior to independent practice, their perceptions on employment prospects, the support received from nursing colleagues, surgeons and management, and the perceived likelihood of continuing to practice as nurse-surgeons in Australia. More high-quality research is necessary to further understand and help define nurse-surgeons scope of practice. Policymakers must consider the findings of this study to develop a standard national credentialing pathway for nurse-surgeons as part of the broader health workforce strategy.

Conflict of interest
None

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Figure 1
Number of respondents at initial contact, initial follow up and final follow up

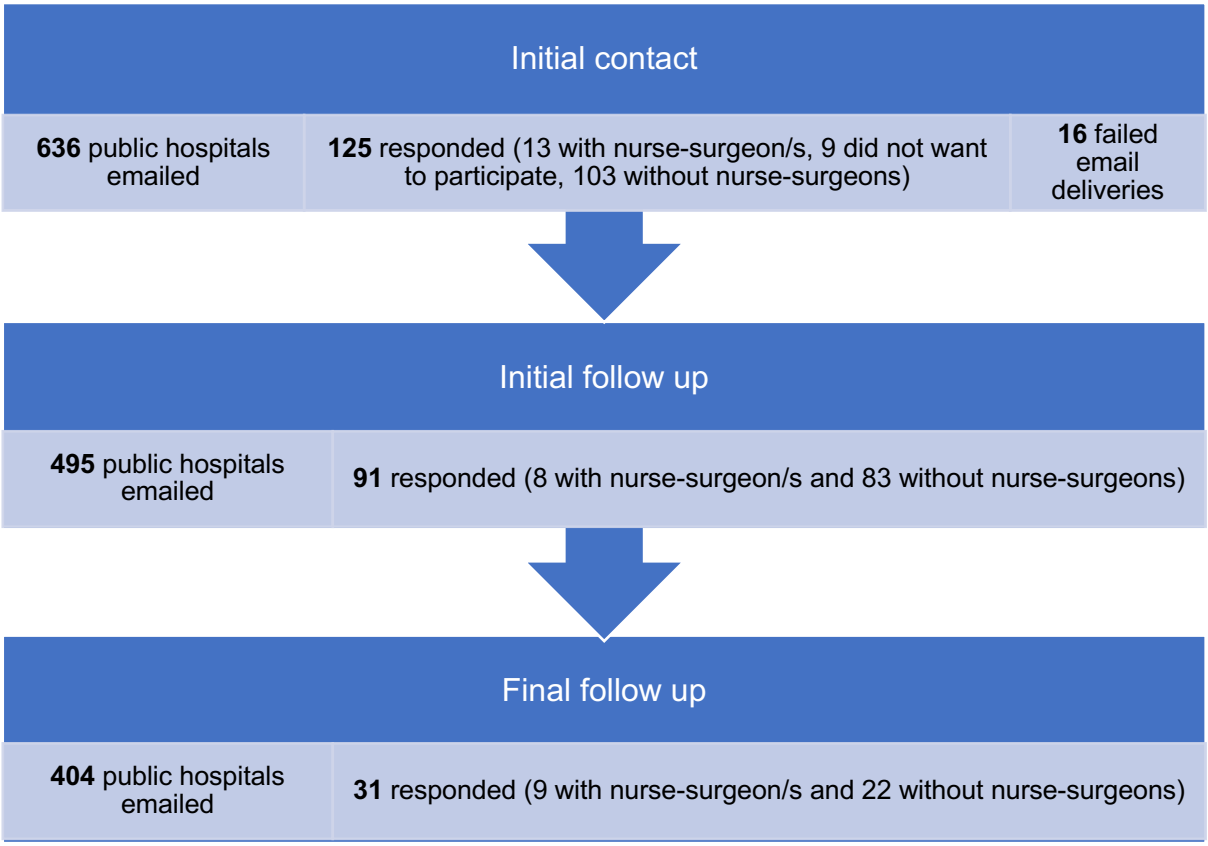

Table 1

Nurse-surgeon demographics

	n	%
Sex		
Female	22	78.6
Male	6	21.4
Total	**28**	**100**
Age group		
65 and older	1	3.6
55-64	5	17.9
45-54	7	25.0
35-44	12	42.9
25-34	2	7.1
18-24	1	3.6
Total	**28**	**100**
Employment status		
Casual	1	3.6
Permanent full time	9	32.1
Permanent part time	15	53.6
Self-employed	3	10.7
Total	**28**	**100**

Table 2

Nurse-surgeon roles grouped by geographical area of practice

	Metropolitan		Regional		Total	
	n	%	n	%	n	%
Current Ahpra registration						
Registered Nurse	11	61.1	5	50.0		
Nurse Practitioner	4	22.2	1	10.0		
Both	3	16.7	3	30.0		
Other	0	0.0	1*	10.0		
Total	18	100	10	100	28	100
Clinical practice setting						
Hospital	17	94.4	8	80.0		
Community / primary health service	1	5.6	0	0.0		
Own Nurse Practitioner clinic	0	0.0	2	20.0		
Total	18	100	10	100	28	100
Experience as nurse-surgeon						
10 years or more	7	38.9	3	30.0		
7 years but less than 10 years	2	11.1	2	20.0		
4 years but less than 7 years	3	16.7	2	20.0		
1 year but less than 4 years	5	27.8	2	20.0		
Less than a year	0	0.0	0	0.0		
Missing data	1	5.5	1	10.0		
Total	18	100	10	100	28	100
Previous experience as nurse						
10 years or more	8	44.4	3	30.0		
7 years but less than 10 years	1	5.6	4	40.0		
4 years but less than 7 years	4	22.2	0	0.0		
1 year but less than 4 years	1	5.6	1	10.0		
Less than a year	1	5.6	0	0.0		
Missing data	3	16.7	2	20.0		
Total	18	100	10	100	28	100
Main role before becoming a nurse-surgeon						
Theatre nurse / scrub scout nurse	5	27.8	5	50.0		
Clinical Nurse Consultant	3	16.7	1	10.0		
Practice nurse	2	11.1	0	0.0		
Endoscopy nurse	2	11.1	2	20.0		
Nurse manager	2	11.1	0	0.0		
Research	1	5.6	0	0.0		
Missing data	3	16.7	2	20.0		
Total	18	100	10	100	28	100
Surgical speciality as a nurse-surgeon						
Endoscopy	5	27.8	5	50.0		
General	0	0.0	3#	30.0		
Urology	4	22.2	-	-		
Gynaecology	1	5.6	-	-		
Plastic surgery	1	5.6	-	-		
Cardiothoracic	3	16.7	0	0.0		
Missing data	4	22.2	2	20.0		
Total	18	100	10	100	28	100
Other roles besides being a nurse-surgeon						
Surgical assistant	1	5.6	1	10.0		
Perioperative nurse	3	16.7	4	40.0		
Research	2	11.1	0	0.0		
Nurse Practitioner clinic consultations	2	11.1	3	30.0		
Did not specify	2	11.1	0	0.0		
No other roles	4	22.2	0	0.0		
Missing data	4	22.2	2	20.0		
Total	18	100	10	100	28	100
Percentage of work as a nurse-surgeon						
100%	2	11.1	0	0.0		
75% or less than 100%	3	16.7	4	40.0		
50% or less than 75%	2	11.1	1	10.0		
25% or less than 50%	6	33.3	1	10.0		
Less than 25%	1	5.6	1	10.0		
Missing data	4	22.2	3	30.0		
Total	18	100	10	100	28	100

***** Advanced Practice Nurse Endoscopist; **#** combination of general, urology, gynaecology, plastics and orthopaedics

Table 3
Nurse-surgeon education and practical training

	n	%
Education		
Master	10	47.6
Bachelor	7	33.3
Postgraduate diploma	2	9.5
Doctor of Philosophy	1	4.8
Attended university but did not complete	1	4.8
Total	21	100
Required to undertake postgraduate study prior to independent practice as a nurse-surgeon	6	28.6
Yes, at university	3	14.3
Yes, program organised by the State	3	14.3
Yes, but did not specify	2	9.5
Yes, in house training not at university	7	33.3
No		
Total	21	100
Received practical training prior to independent practice as a nurse-surgeon		
Yes, formal training	13	61.9
Yes, a combination of formal and informal practical trainings	4	19.0
Yes, informal training	3	14.3
No	1	4.8
Total	21	100
Received theoretical teaching prior to independent practice as a nurse-surgeon		
Yes, a combination of formal and informal education	9	42.9
Yes, formal education	5	23.8
Yes, but did not specify	4	19.0
Yes, informal education	2	9.5
Other	1	4.8
Total	21	100
Supervisor during practical training and education		
Surgeon	15	71.4
Both surgeon and nurse-surgeon	5	23.8
Nurse-surgeon	1	4.8
Total	21	100
Required to pass a competency assessment prior to independent practice as a nurse-surgeon	13	61.9
Yes, formal competency assessment	4	19.0
Yes, a combination of formal and informal competency assessments	2	9.5
Yes, informal competency assessment	1	4.8
Yes, but did not specify	1	4.8
No		
Total	21	100
Final decision to perform surgeries independently		
Surgeon clinical supervisor	6	28.6
Joint approval from the surgeon, nurse-surgeon clinical supervisors, and hospital management	2	9.5
Joint approval from the surgeon, nurse-surgeon clinical supervisors, hospital management and hospital quality team	2	9.5
Joint approval from the surgeon, nurse-surgeon clinical supervisors, hospital management, hospital quality team, and the representative from the public health system of the state	2	9.5
Hospital management	1	4.8
Joint approval from the surgeon and nurse-surgeon clinical supervisors	1	4.8
Joint approval from surgeon clinical supervisor, hospital management, quality team	1	4.8
	1	4.8
	5	23.8

Representative from the public health system of the state		
Other		
Total	21	100
Length of training (inclusive of practical training, educational preparation and competency assessment)		
Two years or more ([n=8]	8	38.1
One year but less than two years (n=7]	7	33.3
Less than 1 year [n=3]	3	14.3
Did not specify [n=3]	3	14.3
Total	21	100

Table 4

Nurse-surgeon perceptions (ratings: excellent, good, average, poor, terrible)

	Excellent		Good		Average		Poor		Terrible		Total	
	n	%	n	%	n	%	n	%	n	%	n	%
Employment prospects in Australia	1	4.8	3	14.3	8	38.1	5	23.8	4	19.0	21	100
Support received from nursing colleagues at work during training	7	33.3	5	23.8	4	19.0	4	19.0	1	4.8	21	100
Support received from nursing colleagues at work as a practising nurse-surgeon	11	52.4	2	9.5	7	33.3	0	0	1	4.8	21	100
Support received from surgeons at work during training	13	61.9	1	4.8	4	19.0	1	4.8	2	9.5	21	100
Support received from surgeons at work as a practising nurse-surgeon	11	55.0	1	5.0	6	30.0	1	5.0	1	5.0	20	100
Support received from management during training	10	50.0	4	20.0	4	20.0	2	10.0	0	0	20	100
Support received from management as a practising nurse-surgeon	7	35.0	5	25.0	6	30.0	2	10.0	0	0	20	100

6.3 Summary

Chapter 6 reported the longstanding presence of nurse-surgeons within the Australian public health system and revealed crucial insights into their current roles, training experiences, employment perceptions, and the support they received from various stakeholders. The findings indicated the need for additional high-quality research to comprehensively define the scope of practice for nurse-surgeons. Policymakers were urged to consider the outcomes of this study, emphasising the importance of developing a standardised national credentialing pathway for nurse-surgeons as an integral component of a broader health workforce strategy. This approach is crucial for fostering a well-defined and regulated role for nurse-surgeons within the Australian healthcare system. Chapter 7 will present the results of Phase 2 as a submitted paper currently undergoing peer review in the International Nursing Review.

Chapter 7 Phase 2 Results (Paper 5)

7.1 Introduction

In Chapter 6, Phase 1 outcomes were presented as a paper currently under review for publication in the International Journal of Nursing Studies Advances. The results offered insights into the nurse-surgeons' roles, training, employment perceptions, and stakeholder support. The findings indicated the need for additional high-quality research and a standardised national credentialing pathway for nurse-surgeons to establish regulation of nurse-surgeon roles within the Australian healthcare system.

In Chapter 7, the results of Phase 2 are discussed. A manuscript detailing Phase 2 results was submitted to the International Nursing Review and is presently undergoing the peer-review process. The paper reports on the challenges and successes encountered by nurse-surgeons working in Australia and outlined the factors influencing their integration into healthcare. The importance of fostering a collaborative healthcare environment that recognises the unique contributions of nurse-surgeons to patient care is explored. The selection of the International Nursing Review as the submission venue was motivated by its Q1 journal ranking with a CiteScore of 7.9, with a specific emphasis on nursing policy and open access research. A copy of the submitted paper is available below.

7.2 Journal article

Title

Nurse-surgeons' experiences working in the Australian public health system: A qualitative exploration

Running title

Australian nurse-surgeons' experiences

Type of manuscript

Original research

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Conflict of Interest

The authors declare no known conflicts of interest that could have appeared to influence the work reported in this paper.

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ABSTRACT

Aim: To explore the experiences and perceptions of nurse-surgeons practicing in the Australian public health system.

Background: Nurse-surgeons occupy a unique and innovative role within perioperative healthcare, yet their integration is often complex and under-explored in existing literature.

Sources of Evidence: This qualitative study adhered to the Consolidated criteria for reporting qualitative research checklist of the EQUATOR Network, involving five semi-structured interviews analysed inductively through reflexive thematic analysis. Ethical approval was obtained prior to the study.

Discussion: Participant interactions with supervisors were positive, while relationships with other nurses and physicians evolved from initial antagonism to mutual recognition of value. Facilitators for integration included awareness of the role, collaboration, a standardised national credentialing pathway, and government involvement. Barriers consisted of geographical limitations, obstructive medical associations, financial challenges, tall poppy syndrome within nursing, and superiority complex among physicians.

Conclusion: The study offers valuable insights into the nurse-surgeons' experiences and perceptions, highlighting essential barriers and facilitators to their integration in the healthcare system.

Implications for Nursing Practice: Findings may guide healthcare institutions in fostering collaborative interprofessional interactions and implementing standardised credentialing pathways for nurse-surgeons.

Implications for Health Policy: The insights may inform nursing associations and government bodies in addressing systemic barriers and advocating for policy changes to enhance surgical delivery in Australia and globally.

Keywords: Australia, nurse-surgeon, perioperative nursing, qualitative research, surgery, thematic analysis

1 Introduction

Global surgical disparities leave over five billion people without adequate access to essential surgeries (Grota et al., 2023). Despite being a critical aspect of universal healthcare (World Health Organization, 2014), surgery remains underrepresented on the global health agenda. Each year, millions undergo surgery to prevent disease progression or death (World Health Organization, 2022), yet over 18 million die from conditions treatable by surgery (Reddy et al., 2020). This highlights the urgent need for equitable surgical care. Recognising surgery as a global health priority is essential, and nurse-surgeons—trained to perform surgeries independently (Grota et al., 2021; White et al., 1987)—offer a promising solution to healthcare disparities through collaboration and specialised skills. Integrating nurse-surgeons into healthcare could enhance access to surgical care and reshape the future of healthcare.

2 Background

Nurse-surgeons, first mentioned vaguely in the early 1500s (Duffin, 2017), began independently performing surgeries in the 1950s to address surgical shortages in Africa (White et al., 1987). Although efforts to standardise their role declined in the 1990s, nurse-surgeon practice expanded globally into the 21st century (Kingsnorth, 2005; Marsh, 2005; Zorn, 2005). In 2009, they were recognised as qualified non-physician surgeons in the UK (Mickute, 2009) and now perform various surgeries, including appendicectomy, caesarean section, herniorrhaphy, hysterectomy, laparotomy, biopsy, carpal tunnel release, colonoscopy, cystoscopy, gastroscopy, and hysteroscopy in Africa, Asia, Europe, Oceania, and North America (Grota et al., 2021).

Nurse-surgeons have improved surgical outcomes by increasing access, reducing errors, and enhancing patient satisfaction, especially in underserved areas. In developing countries, the World Health Organization's (2008) Task Shifting strategy boosted their role, while in developed nations like Australia, they emerged to address surgical demand and workforce challenges,

including an aging medical workforce and uneven surgeon distribution (OECD iLibrary, 2019; Phillips, 2022).

In Australia, the first documented nurse-surgeons performed successful endoscopies in 2004 as part of a national bowel cancer initiative, achieving a 96.2% success rate with no complications (Bull et al., 2006). Subsequent studies by Beck (2013), Duncan et al. (2017), and Cusack et al. (2018) confirmed these results, including a 65% reduction in waitlists for urological surgeries (Sapre et al., 2012). However, these five studies are the only known literature on nurse-surgeons in Australia and are all quantitative.

Qualitative research is crucial for understanding the complex role of nurse-surgeons. This study is the first qualitative exploration of Australian nurse-surgeons which followed Phase one – a national quantitative study on their roles and training. Phase two focused on exploring further their experiences and perspectives.

3 Aim of study

To explore the experiences and perceptions of nurse-surgeons practicing in the Australian public health system.

4 Methods

Design

This study adhered to the Consolidated criteria for reporting qualitative research checklist (Tong et al., 2007) from the EQUATOR Network. Semi-structured interviews were conducted one-on-one and remotely via Microsoft Teams® due to the geographic dispersion of Australian nurse-surgeons, making direct observation unfeasible. This virtual approach was both cost-effective for a nationwide study and allowed flexibility in using open-ended questions. The interview protocol, informed by Phase one findings and the study's explanatory sequential mixed

methods design requirements, was developed by the first author (TG) with input from co-authors (AB, VB & EJ).

Sample and setting

Phase two focused on participants from Phase one, utilising purposive sampling (Campbell et al., 2020). Recruitment occurred from April to June 2022, with all Phase one participants invited via an anonymous pop-up window on REDCap® to opt in for interviews. Out of 28, 16 responded affirmatively, leading to six consents and five completed interviews (see Table 1). To qualify, participants needed to be Australian Health Practitioner Regulation Agency-registered Nurse Practitioners or Registered Nurses performing surgeries independently during data collection and must have completed the Phase one survey. All surgical specialties were included, while those in purely assisting roles were excluded.

Data collection

From November 2022 to December 2022, the first author (TG) conducted all the interviews, with only the participant and TG present during each session. An interview guide (see Supplementary material 1), organised into seven sections, was developed after Phase one analysis, including demographics, introduction, questions, probing, closing, observation, and field notes (Creswell, 2016). TG's field notes and ideas from each interview partly guided subsequent ones. All five interviews were audio-recorded, with live transcription enabled via Microsoft Teams® and saved in OneDrive®. TG manually cross-checked and verified the Microsoft Teams®-generated transcripts. The transcripts were not returned to participants for comments. Interview durations ranged from 36 to 46 minutes. No follow-up interviews were required.

Data Analysis

The data were analysed inductively using reflexive thematic analysis (Braun & Clarke, 2022), with coding conducted in Microsoft Word®. No automated coding software was used. Familiarisation with the data involved reviewing audio recordings and transcripts while maintaining participant anonymity. Coding was iterative and collaborative, incorporating feedback throughout the process. In line with Braun and Clarke's (2019) recommendations, data saturation was not employed, rendering further participant follow-up unnecessary after one individual did not respond. Initial coding yielded 54 semantic codes, which were refined to 39 through latent coding. Themes were developed through discussions that encouraged reflection on preconceptions about nurse-surgeons in Australia. A report detailing themes and direct quotes was produced, and a coding tree illustrating the process is shown in Figure 1. To validate the interview protocol, pilot testing was conducted, and support was provided throughout the interviews. Reflexivity was maintained through spontaneous notes, immediate documentation of reflections, and the development of a reflexive statement.

Ethical considerations

Prior to recruitment, the study received approval from the Australian Catholic University Human Research Ethics Committee to be conducted from March 2022 to August 2023, with ethics register number 2022-2426E. All participants were required to provide consent prior to the interview. None of the authors (TG, AB, VB, EJ) had any personal connections with the participants.

5 Findings

Three main themes emerged from the research, highlighting the experiences and perceptions of nurse-surgeons regarding their training, education, support, and integration into the Australian health system: (1) nurse-surgeon interactions, (2) facilitators for integration, and

(3) barriers to integration. Exemplary quotes supporting each theme and subtheme can be found in Table 2.

Theme 1: Nurse-surgeon interactions

This theme explores how nurse-surgeons interacted with other health professionals, divided into two subthemes. The first subtheme examines nurse-surgeon interactions within the surgical team, while the second focuses on engagements with broader healthcare organisations.

Subtheme 1: Interactions with healthcare professionals

Interactions within the surgical team were influenced by colleagues' professional backgrounds. Participant 1 reflected, "*There was definitely a head-to-head with the nurses... quite challenging... I was almost stepping on their toes... It was quite stressful... threatening for them*." Participant 3 noted support from a colorectal surgeon: "*It was entirely collaborative... I was really supported in that environment.*" Participants also faced challenges like "tall poppy syndrome," where Participant 2 mentioned, "*Until I said, guys, you need to come to me... I'm the one that's in charge here.*"

The context of these interactions, whether during training or independent practice, also affected experiences. Participant 5 remarked, "*The surgeons that I knew well... probably didn't change over... my experience.*" Participant 5 shared, "*They were a bit reserved... but gave me the leeway... they often say, thanks for your help.*"

Familiarity with colleagues impacted interactions as well. Participant 4 stated, "*They [junior physicians] don't understand what we do... There's a superiority complex regarding that.*" This led to initial role confusion, highlighted by Participant 2, who said, "*It's not*

something that we're taught... giving a diagnosis... that's not something that we're trained to do."

As participants acclimated to their roles, confusion diminished, leading to greater recognition of nurse-surgeons' value. Participant 1 noted, "*And now the nurses are grateful for... communication.*" Participant 2 stated, "*I think they now see me as that role model within the nursing profession.*" Participant 3 observed, "*A lot of the nurses were inspired... I think half our unit went and did... postgraduate training.*"

Subtheme 2: Organisational interactions

Participants faced challenges in their interactions with administrators due to a lack of understanding of the nurse-surgeon role. Experiences were influenced by management figures who decided whether this role would be implemented. Participant 5 stated, "*Hospital admin was confused... they didn't really understand the role. Depending on how progressive the director of nursing was... some hospitals I'm credentialed as a nurse practitioner... others as a perioperative nurse surgeon assistant... one as an allied health professional because they didn't know where to put me.*" This inconsistency highlighted the impact of administrative attitudes, with Participant 2 noting, "*...it all depends on how passionate the directors of nursing... are towards these senior roles. Some are very passionate... some quite obstructive...*"

Interactions with external organisations complicated the landscape for nurse-surgeons. Participants viewed medical associations as antagonistic, often resisting changes that could threaten traditional medical roles. Participant 5 remarked, "*The Australian Medical Association has been extremely obstructive... do not want the erosion of medical practitioners' roles.*" In contrast, nursing organisations offered passive support or indifference. Participant 4 reflected, "*The Nursing and Midwifery Board of Australia... realised that it was within the nurses' scope of*

practice... supportive, but... not going out there and batting for you..." This dichotomy illustrates the complexities nurse-surgeons faced in seeking recognition and support within the healthcare system.

Theme 2: Facilitators for nurse-surgeon integration to Australian health system

This theme highlights factors facilitating the integration of nurse-surgeons into the Australian health system, divided into two subthemes. The first, advocating for recognition and integration, emphasises proactive measures to legitimise the role. The second, capacity building and professional development, focuses on equipping nurse-surgeons with the skills and support needed to succeed. Together, these subthemes reflect a comprehensive approach to integrating nurse-surgeons in the healthcare system.

Subtheme 1: Advocating for Recognition and Integration

This subtheme highlights efforts to raise awareness of the nurse-surgeon role, establish a standardised national credentialing pathway, engage with government bodies, and create a dedicated organisation for nurse-surgeons. Participants emphasised the importance of education in alleviating suspicion about the role. Participant 4 stated, "*I think more education around what the role is... a lot of people are suspicious about what they don't understand.*" Effective communication is also crucial, as noted by Participant 5: "*You have to become unbelievably good at communication... to bring that around to a positive situation.*"

Participants stressed the need for standardised national credentialing as a means to validate the training and practice of nurse-surgeons. A consistent accreditation process is vital for maintaining high standards and fostering trust. Participant 4 highlighted, "*There's no overarching nationwide accreditation... that is absolutely imperative.*" This external validation process helps reassure others regarding the quality of nurse-surgeons' training.

Participants also pointed out the necessity of government involvement and the establishment of a dedicated professional organisation for nurse-surgeons. Government support is seen as essential for the role's sustainability, particularly outside large public hospitals. Participant 2 remarked, "*There needs to be some organisations set up that actually fights for our ability to practice.*"

Recognition at the government level is crucial to overcoming political opposition from organisations like the Australian Medical Association. Participant 5 noted, "*Until the government sees that nurses can add value... it's not going to happen... I think we are making inroads into getting recognition at that high government level.*" This recognition is fundamental for securing the nurse-surgeon's place within the healthcare sector.

Subtheme 2: Capacity Building and Professional Development

This subtheme focuses on collaboration to build the nurse-surgeon workforce and develop the profession. Key elements include nursing representation in high-level health discussions, effective communication, ongoing learning, acquiring relevant clinical experience, and facilitating on-the-job training. Participant 3 emphasised the need for nursing representation, stating, "*I think having an office of the Chief Nurse role... having a nurse at the table is always very important... nurses should be at those meetings so that they're having a say about nurses in strategic development.*"

Executive support is essential for successful nurse-surgeon roles. Participant 5 remarked, "*Practice roles have got to come from the top down," while Participant 3 noted, "Set it up with executive support right from the beginning... I have seen it fall apart when it hasn't come from*

the executive level." This support ensures that nurse-surgeons receive the recognition and backing they need to thrive in their roles.

Effective communication is crucial for fostering a positive atmosphere within the surgical team. Participant 5 highlighted, "*You have to become unbelievably good at communication... to bring that around to a positive situation.*" Additionally, continuous learning and maintaining open relationships with consultants are vital for nurse-surgeons' development, as stated by Participant 3: "*I had a very supportive environment... I was brought along and encouraged.*"

Relevant clinical experience is also critical for independent practice. Participant 5 shared, "*I had an advantage that I had 25 years of cardiac surgery behind me before I started doing it myself*." On-the-job training mirrors surgical fellowship models, emphasising practical experience. Participant 2 noted, "*As I said, we had to have exactly the same outcomes as my medical trainees before we could practice independently*," while Participant 5 added, "*A lot of fellowship training is on-the-job training... training that you do in the hospital on patients.*"

Theme 3: Barriers to Nurse-Surgeon Integration in the Australian Public Health System

This theme highlights the barriers nurse-surgeons face in the Australian healthcare system. Participants identified several challenges, including geographical limitations that restrict service locations. Participant 4 stated, "*I cannot move my service elsewhere. I'm accredited internally and that's the only place I'm accredited*."

Political obstruction from medical associations also poses a significant hurdle. Participant 3 noted, "*I feel that they [Australian Medical Association] are a medical association, and they have no role in stating what a nurse can and cannot do*." Additionally, regulatory challenges create disparities between public and private practices. Participant 2 explained, "*As a nurse*

practitioner I can do exactly the same thing in the public... but I don't have access to item numbers to do it in private. So, it's just the disparity is really quite substantial."

Finally, a superiority complex among physicians hampers collaboration and recognition of nurse-surgeon expertise. Participant 4 remarked, "*They [other consultants] can't get their heads around that [nurses performing surgeries], and there is somewhat a superiority complex in regard to that.*" This reflects the need for attitudinal changes within the medical community to facilitate integration.

6 Discussion

This study demonstrates strengths such as credibility, transferability, dependability, and confirmability. The detailed contextual information on nurse-surgeon experiences enhances transferability, enabling readers to assess relevance in similar contexts. Consistency in data collection and analysis ensures dependability, fostering confidence in the findings' reliability. Confirmability is achieved through transparent data interpretation, contributing to the robustness of the study's outcomes. However, several limitations also affected the results. Potential bias from researcher-specific factors, such as demeanour and interviewee perceptions, could lead to incomplete or skewed data, impacting the findings' accuracy and validity. Additionally, the focus on individual experiences may overlook broader systemic issues affecting nurse-surgeons. The limited number of participants (five) reflects the small population of nurse-surgeons in Australia, which, combined with the participants' varying abilities to articulate their experiences, may further affect the richness and robustness of the data collected. Together, these strengths and limitations shape the overall trustworthiness and applicability of the study's findings.

This study examined the experiences and perceptions of nurse-surgeons in the Australian public health system, highlighting initial resistance from nurses, junior physicians, and other

consultants due to concerns about competence, role conflicts, and resistance to change (Carroll & Quijada, 2004). The introduction of nurse-surgeon roles challenged established norms and created uncertainty among surgical staff. Concerns about nurse-surgeons' surgical capabilities, despite their specialised training, also contributed to this apprehension. However, as attitudes shifted over time, addressing these concerns and fostering open communication proved essential for the successful integration of nurse-surgeons within the healthcare system (Schraeder et al., 2005).

Initially, nurse-surgeons faced resistance from nurses, junior physicians, and consultants. However, participants reported strong support from their physician supervisors, which can be attributed to several factors. First, supervisors value mentoring nurse-surgeons, contributing to the development of skilled professionals and safer patient outcomes. Second, this support helps expand the surgical workforce, improving access to care. Third, nurse-surgeons are cost-effective, performing surgeries at lower salaries than specialised surgeons. Finally, their involvement allows specialised surgeons to focus on complex cases, improving healthcare efficiency and timely access to surgeries (Falender et al., 2014; Grota et al., 2022).

Participants noted that prior exposure to nurse-surgeons positively influenced support from physician-supervisors and other surgical team members. Direct experience with nurse-surgeons' skills and professionalism, gained through collaboration, enhances understanding and appreciation of their contributions. Successful teamwork between surgeons and nurse-surgeons builds trust in a team-based approach to patient care. This firsthand experience encourages advocacy for nurse-surgeons among physicians and healthcare team members, highlighting their role in achieving optimal surgical outcomes (Huber, 2022).

The integration of nurse-surgeons into the Australian healthcare system depends on several factors, including awareness of the role, recognition of its value, advocacy, collaboration, a standardised national credentialing pathway, on-the-job training, relevant clinical experience, continuous learning, effective communication, nursing representation, a top-down approach, a dedicated organisation for nurse-surgeons, and government involvement. These factors are essential for improving patient outcomes by creating a framework that supports the effective inclusion of nurse-surgeons in surgical healthcare (Chappell et al., 2021; Uvhagen et al., 2018).

Raising awareness of nurse-surgeon roles is essential and can be achieved through educational programs, collaborative campaigns, media engagement, sharing success stories, addressing concerns, and advocating for a supportive environment (Brunton & Matheny, 2009). Implementing a standardised national credentialing pathway for nurse-surgeons would establish consistent criteria for education and training, promote workforce mobility and patient safety, and facilitate integration and career advancement (Chappell et al., 2021). A top-down approach led by senior leadership can help navigate challenges, allocate resources, and align with organisational goals (Uvhagen et al., 2018). Creating a dedicated organisation for nurse-surgeons would provide a platform for collaboration, professional growth, training, and research to enhance surgical practice (Matthews, 2012). Additionally, involving nurses in the strategic development of nursing practices and collaborating with the Australian government would strengthen the healthcare workforce and improve the overall healthcare system (Anders, 2021).

The integration of nurse-surgeons into the Australian healthcare system faces several barriers. Geographical limitations restrict the distribution of surgical services and career mobility, complicating workforce planning (Markowitz et al., 2017). Nurse-surgeons face challenges similar to those of nurse practitioners, particularly in rural areas, where regulatory restrictions limit their scope of practice (Smith, 2022). Both roles confront barriers that hinder

workforce mobility and access to essential healthcare services. Addressing these challenges is crucial for effectively utilising advanced nursing roles in the healthcare system. Developing a national credentialing pathway could help alleviate these issues by standardising training and addressing workforce shortages.

Political opposition from influential medical associations hinders the recognition advanced nursing roles (Pittman & Williams, 2012). Collaboration between nurses and physicians is vital for addressing workforce shortages and improving patient access to surgical services. This requires open dialogue and evidence-based advocacy to effectively utilise nurse-surgeons' skills. Resistance to change can also impede acceptance of nurse-surgeons (Glasper, 2018). Overcoming this requires a cultural shift that fosters professional growth and innovation. Additionally, some surgeons' superiority complex can create barriers to collaboration and teamwork (Kirby, 2017). Promoting mutual respect and acknowledging the contributions of all healthcare team members is essential for breaking down these barriers.

Recommendations for Further Research

This qualitative study highlights several recommendations for future research. First, examining the experiences of nurse-surgeons across various regions and healthcare settings would provide a more complete understanding of the challenges and successes they encounter, helping to identify specific barriers and facilitators. Second, conducting longitudinal studies to track nurse-surgeons' career paths could reveal the long-term impact of their roles on professional growth, job satisfaction, and patient care. Lastly, exploring the perceptions of other healthcare professionals about nurse-surgeons would offer insights into their acceptance and integration within surgical teams. Understanding these perspectives could help address barriers and foster collaboration, enhancing the implementation of nurse-surgeons in the Australian public health system and beyond.

Implications for policy and practice

Identifying the facilitators and barriers faced by nurse-surgeons can inform targeted policies to support their integration into the healthcare workforce and address systemic issues. Insights from this study can guide policymakers in promoting collaboration between nurse-surgeons and other professionals, as well as highlight the need for a national credentialing pathway and tailored continuing education programs. Recognising nurse-surgeons in healthcare organisations and at executive levels can also foster a culture that values their expertise. Additionally, the study reveals areas for professional growth, guiding the development of support programs and mentorship opportunities. Understanding factors that enhance job satisfaction—such as collaboration, value recognition, and advocacy—can help improve retention rates and create a resilient surgical workforce, benefiting all healthcare practitioners in building effective teamwork.

7 Conclusion

This study highlights significant policy implications for the integration of nurse-surgeons into the Australian healthcare system. By identifying key facilitators and barriers, the research informs public policy aimed at enhancing collaboration between nurse-surgeons and other healthcare professionals. Developing a national credentialing pathway is essential for standardising training and promoting workforce mobility, ultimately improving patient access to surgical care. Social policy should prioritise recognition and representation of nurse-surgeons within healthcare organisations, fostering a culture that values their contributions. Organisational policies must emphasise mentorship and professional development programs to support nurse-surgeons and improve job satisfaction, retention, and workforce sustainability. Management models and frameworks can benefit from integrating nurse-surgeons into strategic discussions, ensuring their skills are utilised effectively. Additionally, education models should focus on

tailored continuing education programs for nurse-surgeons, aligning with accreditation standards that reflect their unique role in healthcare. Overall, these policy recommendations can significantly enhance the effectiveness of nurse-surgeons, contributing to improved surgical outcomes and access to care across diverse settings.

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Table 1

Participant characteristics

ID	Sex	State	Specialty	Surgery performed independently	Other role
1	Female	Victoria	Cardiothoracic	Open and endoscopic saphenous vein harvesting, radial artery harvesting	Surgical assistant
2	Female	Queensland	Gastroenterology	Colonoscopy	Clinic, Quality and safety
3	Female	Queensland	Gastroenterology	Colonoscopy	Clinic
4	Female	Victoria	Urology	Flexible cystoscopy	Clinic
5	Female	Queensland	Cardiothoracic	Radial artery harvesting, saphenous vein harvesting	Surgical assistant

Figure 1.

Coding tree

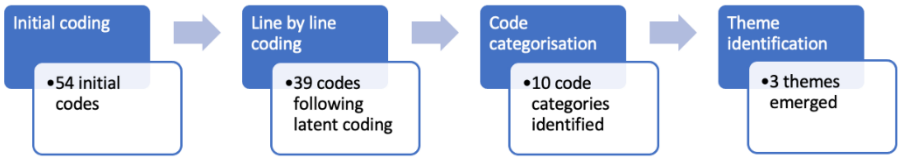

Table 2.

Themes, subthemes and quotes

Theme	Subtheme	Quotes (Participant ID)
Nurse-surgeon interactions	**Interactions with healthcare professionals**	"It was hard for us as well because we wanted to, as experienced scrub scouts, we wanted to help out in that role too. So, we were kind of torn between learning cardiac and as a scrub scout, which we didn't need to do." (Participant 1) "It's not something that we're taught to do, and you know, giving a diagnosis cause nurses don't diagnose. The first patient that I had found bowel cancer, I had to sit there and tell them that you've got cancer. So again, that's not something that we're trying to do but it was something that I had to learn. And another thing that I found quite difficult was that transition from the nurse to then being the person that's managing the theatre, this is my theatre. This is how it's going to be run and that includes, you know, giving direction to the anaesthetist." (Participant 2) "There was definitely a head-to-head with the nurses. That was actually quite challenging dealing with the backlash from the nurses. When I first started, I think everyone was a little bit hesitant because they weren't sure how it was working, like I was almost stepping on their toes in a way. They were nurses who had been there for 20 years or more than that, and so they were very experienced. And then I came in not knowing anything of the specialty but doing a more senior role. It was quite stressful and, you know, threatening for them." (Participant 1) "It was quite challenging because obviously it's a new role. It's a pioneering role. Umm, there's lots of pushback from both medical and nursing." (Participant 2) "In the beginning they couldn't get their heads around. They were, they didn't understand it. They didn't view us as lone accredited clinicians. We will walk into a flexi room. Ready to do a list and they'll say oh, the nurses have called in sick so you're gonna have to set up your own trolley. And I question, would you do that to a medical doctor? No, we just cancelled the list. And I said, well, that's what you do here, we are the primary physician here. We have to focus on the clinical side of doing the flexi for the patient and they just don't understand it" (Participant 4) "And now the nurses are grateful for our communication." (Participant 1)

		"I think they now see me as that role model within the nursing profession." (Participant 2) "In the unit where I worked, a lot of the nurses were inspired and so a lot of them did more formal postgraduate training, a lot of them. Like I think half our unit went and did a postgraduate course in gastroenterology like that was just such a high number of nurses moving into postgraduate training and a few have gone on to do masters. Maybe not as nurse practitioners, but they value what that opportunity gives them." (Participant 3) "But when we finally got in there, they were all in awe that we could do this. By the end, we kind of had won them over" (Participant 4) "Surgeons who have us are appreciative of us and so encouraging of us the whole time." (Participant 1) "When I started up the rectal bleed clinic, I did that under a colorectal surgeon's tutorage. So, he had his clinic sitting alongside mine and he supported that clinic. If I had questions, he'd come in and review patients with me. So entirely collaborative. He was very supportive. I think my role was rather unique, though I was really supported in that environment." (Participant 3) "I had a terrible complication, and it wasn't because of the harvest. It was because the patient had already had an injury in their forearm that they hadn't disclosed, that they had some neurological events after that. Umm, that took a long time to resolve and as a resolve of me operating on their forearm and it could have been any operation on being told they got a sympathetic reflex dystrophy, which is quite a catastrophic complication. And the patient had to have fasciotomies of their forearm and their hand, and it was all extremely traumatic. And I nearly walked away from me, you know, participating in that more invasive role, but I got excellent support from the surgeon." (Participant 5) "So, the surgeons that I knew well were great and probably didn't change over the course of me getting experience." (Participant 5) "It was not a backlash, but just more of an irritation from the junior registrars" (Participant 1) "They don't understand what we do. They don't understand our service. They don't understand our capabilities and the fact that HMO, who has seen one done one, you know, teach one. What does it do?

		They aren't as good as someone who has done, you know, we probably did 10,000 flexis and they can't get their heads around that and there is somewhat a superiority complex in regard to that. At the moment we could do better than what some of the registrars and fellows are doing." (Participant 4) "The doctor presented data and didn't even acknowledge us. He absolutely took our figures and twisted them with wrong information yet was lauded as this great piece. A great poster and you know, won prize. And it's like this is r– . This is inaccurate information." (Participant 4) "There was a small population of medical surgical assistants who didn't think I should be doing the role." (Participant 5) "I think that over time they have accepted my capabilities, and I think that they probably respect it, to be perfectly honest. If that role can help the surgeon, then they'll support it. But if they feel that the role is going up against their role well obviously there's going to be pushback. And that's I think with my role, it was more taking their job of doing exactly what they're doing, not they're doing the procedure and then they're allowing you to close up or you know what I mean? Like I'm doing exactly what they're doing. I think it it's a lot of that fear factor of you know, the nurses are going to take over." (Participant 2) "It's not you, it's the fact that it's a nurse doing this advanced thing. And anytime I had that negativity, that's what I would say. It's not me. It's not me they dislike, it's what I'm doing." (Participant 3) "I went door knocking because I wanted to move to this area and I'm supported fully by only two members of the gastroenterology team of about 10 gastroenterologists and the others really don't want to have much to do with me, which is a little bit disappointing. But you know the surgeons appear to appreciate the work and I refer on to them. However, there's not a lot of collaboration. I'm not invited to meetings, so that ongoing training that you need in your workplace is missing." (Participant 3) "So if we have any issues from the registrars and fellows that is soon worked out by the consultant and the deputy head and the head of the unit." (Participant 4) "I picked up a couple of surgeons who didn't know me and I think that they were a bit reserved about having a nurse doing those very invasive procedures initially but gave me the leeway to actually do the job that I could do, and they've come to a point now where, you know, they will often say, oh, thanks very much for your help. I'm not sure I could have done that without you. I had a surgeon say that just

		a couple of months ago, we did a really complicated case and they're very quick to ask for suggestions because I've worked with lots and lots and lots of cardiac surgeons. You know, if we get into a situation that's particularly difficult, they will go oh what do you think I should do here? It's like, well, I think you should do this, this and this. And sometimes they take your advice and sometimes they don't. But they ask. So, yeah. So, I'm now at a position I've been doing it long enough that there's not many surgeons that still have that or I'm not sure if I should use you because you're a nurse. And I think there's some surgeons that actually prefer it because they know that nurses know how operating theatres work." (Participant 5) "We got better, and we became more useful that they kind of became more accepting." (Participant 1) "Some would not put me down personally but make me feel as though I was taking their job." (Participant 2) "There was lots of pushbacks from anaesthetics as well." (Participant 2) "The people who are most negative about my practice are the ones, as they tend to be younger consultants who straddle that divide in the public and private domain with a view to being more private." (Participant 3) "The consultant surgeons took a while to come around, but the new ones are very for it. They see the benefits to it." (Participant 4) "The other urologists, being quite antsy about us. What if they miss it and they miss the tumour, you know, how can we trust them? You know, what's their training? Is it going to be sufficient enough?" (Participant 4)
	Organisational interactions	"I think management is definitely the hardest part of it because we are employed as a nurse, but we are working for the surgeons. It's very challenging because they don't see what we do, they don't know what is required for us. So, I think management, it's definitely challenging" (Participant 1) "We laugh, but it did take a toll on us, and it still does. We would get harassed because our theatre list was 10 minutes over, you know, the nurse unit manager would march in and say right, out everyone

		out. We're done and be really aggressive and harass us and every now and then someone tries it again. Again, it could be our personality, but we feel that we need to justify ourselves and we are continually justifying ourselves and we'll continue till the day we resign from this place." (Participant 4) "Hospital admin was confused. You know, they didn't really understand the role. Depending on how progressive the director of nursing was depended on how the hospital reacted to my application for credentialing. So, some hospitals I'm credentialed as a nurse practitioner. Some hospitals. I'm credentialed as a perioperative nurse surgeon assistant and one hospital I'm credentialed as an allied health professional because they didn't know where to put me." (Participant 5) "I was lucky that I was in an environment that was fully supported, the nurse unit manager, D– at L– hospital is a real motivator. She's a, you know, a first adopter of new ideas. She's always been that way. She's moved on now she's retired, but she was certainly instrumental in getting the whole thing happening at L–, the director of Gastroenterology, Dr C– M– was also used to working with advanced practice nurses in the US, so with that, she easily adopted training a nurse endoscopist." (Participant 3) "My current nursing supervisor is very supportive. And the supervisor above that nursing supervisor is supportive. The nurse unit manager is supportive and the nurses that I work with are really lovely and supportive and they enjoy working with me." (Participant 3) "I feel we do have the hospital support, and I certainly know that I have my direct manager support. She absolutely supports us and expects our clinical decisions. Umm. And I certainly have the head of the unit support" (Participant 4) "The managers try and baffle us with quote unquote b– and tell us that, oh yes, we're highly paid nurses and that you know, oh we we're equivalent to the doctors as well. I call b– on that. There's no way, you know, even with two Grade 5 nurses you're paying less than a surgeon like guaranteed. So, you're making money from us because you're getting patients through, yet you don't come back and give us anything back." (Participant 4) "Little involvement from management in terms of support for my role it was I just walked into the position and that was it." (Participant 2) "I mean, obviously they get financed to have that role within the organisation and it all depends on how passionate the directors of nursing within the organisations are towards these senior roles. Some

		are very passionate. Some quite obstructive. So, I think that's probably where most of that lies." (Participant 2) "The Australian Medical Association has been extremely obstructive and do not like the role and do not want the erosion of medical practitioners' roles." (Participant 5) "I think the Royal Australian College of Surgeons, acknowledges us" (Participant 1) "The Royal College of Surgeons has been supportive to a point, so they will support nurse surgical assistance, but they won't support nurses as primary operators." (Participant 5) "GESA, which is the Gastroenterological Society of Australia, is very anti nurse endoscopist because their membership base is very much the private gastroenterologists, and they make a lot of money out of doing day-to-day diagnostics and nurses certainly threatened that practice for them. And there is a statement on the GESA website, which is very unfriendly about nurse endoscopists. It's a position statement and I have asked them to take it down and they've not done that." (Participant 3) "I didn't find much support there [Ahpra] at all." (Participant 2) "Ahpra, they, you know signed me off and registered me as a nurse practitioner but apart from that I don't seek their support. Ahpra appreciating that there are those different groups of nurses that need more support. (Participant 3) "The ANMF have been promising for a very long time to look into advanced practice nurses, that there is a deficit between those accredited to do a particular task or run a particular service like us, but who are not nurse unit managers. I have been holding hope that the ANMF will do something, but I haven't seen anything." (Participant 4) "I then had to get onto the Nursing and Midwifery Board. I know I wasn't operating outside my scope of practice, but to then get clarification and have the person from the nursing and midwifery board ring the person from the Department of Veterans Affairs and tell them that I wasn't operating outside my scope of practice." (Participant 5)

		"The Nursing and Midwifery Board of Australia was good. They realised that it was within the nurses' scope of practice to do this role, and they were supportive, but in a very passive way, so they weren't going out there and batting for you. But if you came to them with an issue, they would help you with it." (Participant 4) "I had issues with the Department of Veterans Affairs. They rang one of the surgeons I worked with and told him that I was operating outside of my scope of practice. The health funds and DVA have been very unsupportive and obstructive to some point." (Participant 5) "That's been challenging but I think they're [accreditors] slowly starting to understand and appreciate that we are competent" (Participant 1)
Facilitators to nurse-surgeon integration to Australian health system	**Advocating for recognition and integration**	"It's probably a lack of understanding about their roles." (Participant 3) "I think more education around what the role is, a lot of people are suspicious about what they don't understand. That was a lesson to me to actually offer lots of opportunities for training and talking to people about what that is" (Participant 4) "I think it was inspiring to them to see that you can remain in a clinical role and advance, which is a big difference to the old way of thinking about getting along in life. As a nurse, you don't have to be an administrator, you can be a clinician." (Participant 3) "So, there is confusion in the healthcare system about nurse surgical assistants and nurse surgeons for the surgery like cardiac surgery" (Participant 5) "I think nurse surgeons should be definitely doing exactly what I'm doing. I'm doing this stuff in saphenous veins and the radial arteries. And mostly because it's not a very interesting part for them." (Participant 1) "You've gotta be good. You know, only the good will survive. You know, if you're a good surgeon, you're gonna survive the bad ones. Kind of all get filtered out somehow. Yeah, I don't know, just the right people have to do it, I guess." (Participant 1)

		"So, I know that this is about public hospitals. In the public hospitals, the registrars and residents, they all change every three months, every six months, two years. And there's you need the continuity of care, and you need the experience and that's what we provide because we don't have any desire to become a surgeon or to change specialty. You know it's just experience. The experience that we have and benefits the team, and that's what secures our job, I think as well." (Participant 1) "I am aware that I have not got that medical knowledge, and I work within the parameters of my practice. However, if I had or someone had the ability, and I had approached it through a competence-based training program. I really do believe the sky's the limit." (Participant 3) "The more of them that are there and practicing and doing good, the better the role would be appreciated." (Participant 3) "Quickly being able to be performed, make a difference to the patient's life, and remove them from the waiting lists." (Participant 5) "I think they just kind of have to have someone to push to kind of get it and then once it's through the door, it's kind of done." (Participant 1) "It's just fighting, pushing through those barriers and pushing through those political views within the organisation." (Participant 2) "You gotta have competencies signed off. If a surgeon wants you to do a certain thing then you have to have a structured competency. I think there definitely needs to be a credentialing pathway. Something where you have a provider number" (Participant 3) "The doctors have credentialing and pathways, and we basically had to do exactly the same training that they did. However, we have to be recredentialed every few years and there is no recredentialing body in terms of the safety standards and so forth for us" (Participant 2) "I believe it is the suspicion that your practice is going to be substandard. And that's why I think in training, it needs an external process where people can say oh if you were taught by this medical staff member or something. That validation that comes with expertise in your training." (Participant 3)

	"There's no overarching nationwide accreditation. Accreditation across the state. Uh Australasia. That is absolutely imperative." (Participant 4) "I think the practice at the moment is kind of like a little bit in limbo" (Participant 1)
Capacity building and professional development	"The government and the Department of Health can assist in making these roles happen outside the big public hospitals. Then, unless that infrastructure and that financial infrastructure is in place, then there is no way that these roles can be sustainable. Nurse practitioners who are trying to work in primary healthcare clinics, you know their rebate is so low that they just can't make a living. So, it would be the same. I operate on a number of funding models, as I said, and it's difficult. You know, it's difficult to make a living. I'm OK now I'm established, but setting out you really can't rely on it as your sole income because it's really hard to get yourself established and get enough work to actually pay the bills. So, until the government comes around to seeing that nurses can add value to the healthcare sector. Until the government can embrace the notion that nurses can work independently, be that in surgery, or be that in general practice. And until the government can override the political views of people like the AMA, then it's not going to happen. I think that we are making inroads into getting recognition at that high government level." (Participant 5) "More support for nurses that are practicing at such high levels because up until now I've been doing this well for 10 years and no one has approached me. No one has said, oh my God, what have you done? No one from AHPRA. I mean, obviously I have to submit all my documentation, but you know more interests need to be paid towards such high practicing nurses because there aren't many of us. And you know, we're doing a stellar job and there's no recognition. That's probably the word that I'm looking for. That like recognition. They don't promote us in any way. So, there's no promotion." (Participant 2) "There needs to be some organisations set up that actually fights for our ability to practice." (Participant 2) "Some collegiality and support maybe even." (Participant 3) "We should actually have, you know, a professional organisation." (Participant 4) "It's gotta be down to surgeons' support and collaboration with the nursing team." (Participant 1)

		"Things are a lot smoother now. I do my job and enjoy it. I have good working relations with my colleagues, both medical and nursing." (Participant 2) "I don't think nurse surgeons who don't work closely with the surgeon are going to have any joy in the next 10 years." (Participant 5) "We have an opportunity to operate with a range of surgeons. So, I operate with six surgeons so I can give advice to them about how other people do it. You know, like you're struggling there, oh, I've seen this person do it this way. I've seen this person do it that way and that's really advantageous for them." (Participant 1) "I think for me I found that the more I pitched in and helped with the changeovers and helped clean up and made it clear that I wasn't an elitist member of the team. That I was just gonna sit over here in the corner and do nothing until it was my turn to operate. And I think you really have to demonstrate to the nurses who don't know you how committed you are to being a member of the team." (Participant 5) "The surgeons that I work with were amazing, so they would definitely enablers." (Participant 5) "I would provide more support because doctors have the support, whereas I didn't. I didn't have support from my nursing colleagues. I was meant to have a like a mentor who was one of the divisional directors of nursing. And I met with her twice but the whole training, because she was always too busy and that not taking not saying anything bad about that about her which she was busy. I think that they could have managed that part of it a lot better." (Participant 2) "I think having an office of the Chief Nurse role that has a place at parliamentary or within federal politics is very important. Having a nurse at the table is always very important. And then within, you know, take it down to the micro of within your own hospital facility, I think having nurse practitioners attend general meetings that look at the way strategic development of a hospital is going is very important, right down to within a department and nurses should be at those meetings so that they're having a say about nurses in strategic development to roles that they could potentially fulfill." (Participant 3) "If the person on the top doesn't support, no one's gonna support you." (Participant 2)

		"Set it up with executive support right from the beginning rather than a ground up approach. They sought the support from the executive and had them give direction downwards, which I thought was a really valuable thing. I have seen it fall apart when it hasn't come from the executive level of the hospital, nursing and medical. I think it really requires that level of commitment from higher up. I would say that executive really needs to support it and it needs to be a top-down approach so that those nurses are more supported in those roles, particularly when they're doing something a little bit different from what is normally within the scope of a nurse or even a nurse practitioner. So, I think it really does need executive to sort of say this is what we're doing, and we support it fully." (Participant 3) "Practice roles have got to come from the top down." (Participant 5) "It was just basically talking, and I suppose building the confidence within myself to be able to do something like that." (Participant 2) "You have to become unbelievably good at communication and convincing the nurses that you are there to add to their experience and the patients experience. I think it's how you use your communication skills to bring that around to a positive situation than a negative situation" (Participant 5) "I think you know you have to be open to always learning and even now 12 years down the track, we see things in the bladder we've never seen. So we bring the consultant up. What do we do? You know? So, we have a very open relationship and an ongoing learning relationship with the consultants, and I think that's really important." (Participant 4) "We don't get any conference support. We don't get that. That would be another thing. You know if you know you want us to present, you want us to do research, yet you don't provide us with any resources you know we can't even get a database going." (Participant 4) "I guess that I had an advantage that I had 25 years of cardiac surgery behind me before I started doing it myself. I think that it would be a different experience for a nurse who hadn't worked in cardiac surgery for an extended period of time. Because I had seen all the things that could go wrong, and I'd seen the way the surgeons, they had them go wrong, had dealt with those problems. So, I guess I had a real depth of knowledge for problem solving before I started having to do it myself." (Participant 5)

		"I think a public hospital really is the best place to be training. And better, more opportunities." (Participant 1) "I think it was adequate. I think it was very detailed. As I said, we had to have exactly the same outcomes as my medical trainees before we could practice independently." (Participant 2) "It was adequate. I really enjoyed the training. I had a very supportive environment, and I had. Opportunities like I was treated as a trainee endoscopist. I went to meetings. I went to information sessions. I went to education meetings that were in house for the medical trainees. I was brought along and encouraged. So, I felt that was really good." (Participant 3) "But what you gotta remember is the training that medical students get for surgery isn't to set them up as a surgeon. It's to give them a taste and some very basic skills. So, the training for the, you know, invasive role of harvesting conduit is really more in line with a surgical fellowship. That level of training where you're actually training to a position where you can do it independently. So, I guess, and a lot of fellowship training is on the job training. So, it's actually training that you do in the hospital on patients." (Participant 5) "I think I had all stars aligned and it would been the perfect start. I didn't have any cardiac experience at the time, but I was able to secure the job. So, I think luck was most of that." (Participant 1) "I was lucky that I was in an environment that was fully supported. I was lucky, one of the surgeons was my trainer and he was the director of surgery." (Participant 3) "And I think it's also down to, you know who you are as a person, whether you can be strong. So, it's about being the right personality for the job. You've gotta be strong. You've gotta be driven. You've gotta go out of your way to find things." (Participant 1) "I think that it depends on the person who is doing the role." (Participant 5)
Barriers to nurse-surgeon integration to the	**No subtheme**	"I cannot move my service elsewhere. I'm accredited internally and that's the only place I'm accredited." (Participant 4)

Australian public health system		"I have to call on the nurses because they're the ones that approve any kind of leave, but then it's the surgical side of things that actually require not the approval, but they, they're the ones that are kind of making the shots. So, I have to call my cardiac boss to call the nursing boss to then approve something for me. So, it's just a massive triangle and it would be a lot easier if we were actually employed under the surgical side of things." (Participant 1) "I feel that they are a medical association, and they have no role in stating what a nurse can and cannot do." (Participant 3) "I think the Australian Medical Association is becoming having less of a stranglehold on what happens in the Department of Health, but they are politically very strong. So, I was recently at a cardiac conference, and they were talking about workforce planning, and you know how all these junior registrars are and senior registrars and do we need more cardiac surgeons? And what's gonna happen at these people? Are they just going to be senior registrars forever and the person that was chairing the conference actually said, what about advanced practice nurses like, you know, they could do the job of the senior registrar both in the wards and in the operating theatre. And that was completely shut down. It was interesting that it just that wasn't even going to be discussed in that open forum. So yeah. It is. It's always extremely disappointing, I thought." (Participant 5) "But there is also issues with you know payment, if I was to go public, MBS item numbers, all that kind of stuff is not accessible" (Participant 1) "I think there are a lot of kind of financial issues with that. There's a lot of insurance I'm sure involved so financially as well, how much do you pay them?" (Participant 1) "Because as a nurse practitioner I can do exactly the same thing in the public. I can do colonoscopy in public, but I don't have access to item numbers to do it in private. So, it's just the disparity is really quite substantial." (Participant 2) "There definitely needs to be more money and particularly when the original idea behind at least the nurses cystoscopist was to free up the doctor's time to actually go into main theatres to actually do you know, more, more training for within because they weren't doing enough training, enough operating time because there was thousands of flexis that they had to do." (Participant 4) "I don't think there's gonna be enough money in the world to keep them within nursing. Because you know, a lot of the networks really haven't been treating us as well as they could have been. And. Yeah,

		so I think. COVID has sullied the waters in a lot of ways and people just aren't interested anymore. In focusing on nursing as a career and advancing their practice." (Participant 4) "I think once we get a rebate for the patients, it will make a huge difference." (Participant 5) "The legislation has to be in place to support the financial ability of nurses to work in the role." (Participant 5) "And then, of course, there was the tall poppy syndrome from my nursing colleagues as well where they would, if there was any questions, they would bypass me and go to the doctor that was working next door. Until I said guys, you need to come to me. If there's anything that you need to know. Any grievances, anything that's going on, you need to ask me because I'm the one that's in charge here and I'm responsible in the end". (Participant 2) "I do think it's a tall poppy syndrome that does exist within nursing." (Participant 4) "There will always be an element of tall poppy syndrome as an Australian cultural thing and if you are trying to do something new and broaden the scope of practice of nurses, there are always going to be nurses that will cut you down." (Participant 5) "They [other consultants] can't get their heads around that and there is somewhat a superiority complex in regard to that." (Participant 4) "I don't think you'd need to watch as many like I don't think you'd need to observe as many [surgeries]." (Participant 4) "I think that size of the institution, the healthcare institution and the. The other properties of the healthcare institution. So, if you're talking a major public training hospital, then yeah, there's gonna be a lot of processes that you have to work through which could be seen as obstructive. To getting a role like this off the ground. If you're talking a small private. Umm, facility that's owned by a couple of surgeons then. Yeah, they're gonna want to get this off the ground because they can see that it's gonna benefit them. So I think you know, you need to look at what area of the healthcare sector you're looking at and. In what particular circumstance you're trying to bring the role in, yeah." (Participant 5)

7.3 Summary

Chapter 7 presented results from Phase 2 of the study, which has been submitted to the International Nursing Review for peer review and publication. The qualitative interviews with nurse-surgeons provided valuable insights into the challenges and successes they encounter, offering a nuanced understanding of the factors influencing their integration into healthcare. The findings underscore the importance of fostering a collaborative healthcare environment that recognises the unique contributions of nurse-surgeons to patient care. This knowledge is essential for developing evidence-based policies and practices to support the ongoing growth and recognition of nurse-surgeons within the healthcare workforce. Addressing identified challenges and capitalising on the strengths of nurse-surgeons offers an opportunity for the Australian public health system to enhance surgical care, improve outcomes, and promote resilience in healthcare. Chapter 8 will present the discussion of the integrated findings and meta-inferences from Phase 1 and 2.

Chapter 8 Discussion

8.1 Introduction

Chapter 6 (Phase 1 Results) presented a detailed investigation into the roles, training, education, and perceptions of nurse-surgeons within the Australian public health system. Comprising a nationwide survey with 28 participants, Phase 1 unveiled the challenges and diverse perspectives encountered by nurse-surgeons. The quantitative study revealed the need for a standardised training and credentialing pathway, emphasising the need for a unified approach. The data revealed the employment prospects, support systems, and intrinsic motivations of nurse-surgeons, offering critical insights that can influence the establishment of a standardised national credentialing pathway in the future.

Chapter 7 (Phase 2 Results) described the experiences and perspectives of nurse-surgeons practising within the Australian public health system. Through qualitative interviews with five participants, Phase 2 revealed that participant interactions within the surgical team shifted from initial antagonism to recognition of the nurse-surgeon's value over time. The study outlined the facilitators, such as raising awareness, collaboration, and the necessity for standardised national credentialing pathways, while identifying barriers like geographical constraints, political opposition, financial challenges, internal resistance within nursing, and physician-related attitudinal barriers. The findings highlighted the significance of these insights to inform policies and practices supporting nurse-surgeon recognition and growth within the Australian healthcare system and beyond.

Chapter 8 presents a comprehensive discussion of the integrated findings obtained from Phase 1 and Phase 2. The study's research objectives (see Research Objectives, p. 33-34) were addressed, providing valuable insights into the roles, training and education requirements, perceptions, and experiences of nurse-surgeons in the Australian healthcare context. The chapter begins by introducing the meta-inference table, which encapsulates the amalgamated findings from Phase 1 and Phase 2. Subsequently, a thorough discussion of these amalgamated findings unfolds. The chapter concludes with a detailed discussion of limitations inherent in this study.

8.2 Meta-inferences from Phase 1 and Phase 2 findings

Employing a mixed methods research methodology guided by a pragmatic worldview rather than adhering to a singular rigid approach allowed this study to integrate available data and thereby refine the limited knowledge about nurse-surgeons in the Australian public healthcare (Creswell & Creswell, 2018; Dewey, 1916; James, 1907). The process of data integration unfolded across various key stages, including design, methods, interpretation, and reporting. After these individual integrations, a final integration and meta-inferences occurred, utilising a joint display methodology. This process consolidated the data, creating a comprehensive display that facilitated extracting novel insights beyond the distinct findings obtained through separate quantitative and qualitative analyses (Fetters et al., 2013; Younas et al., 2023). The meta-inference display table (see Table 4) presents an amalgamation of significant themes derived from the two distinct study phases of this explanatory sequential mixed methods study.

Table 4. Meta-inference table of integrated study findings

Themes	Phase 1 Findings	Phase 2 Findings	Meta-Inferences
Roles of nurse-surgeons	• Nurse-surgeons were predominantly female with the most common age range of 35 to 44 years. • Most practised in the state of Victoria and worked part-time. • Most were engaged in additional work beyond nurse-surgeon roles.	• Nurse-surgeons interacted with various healthcare professionals, facing challenges with nurse colleagues. • Interaction dynamics evolved over time, transitioning from initial hesitation to recognition. • Nurse-surgeons played a role in inspiring colleagues to pursue postgraduate training.	Nurse-surgeon demographics and characteristics shaped by gender, age, and work settings influence interaction dynamics. Evolution from initial challenges to recognition suggested a positive shift. Inspiring colleagues for postgraduate training indicated a potential ripple effect, influencing broader nursing practice.

Themes	Phase 1 Findings	Phase 2 Findings	Meta-Inferences
Education and Training	• Diverse educational backgrounds, with 10 having master's degrees. • Varied durations of nurse-surgeon training, with mean training duration of 2.27 years. • Competency assessments before independent practice. • Approval decisions involved clinical supervisors or joint approval from stakeholders. • Varied perceptions of employment prospects and support during training.	• Advocacy for standardised national credentialing for nurse-surgeons. • Government involvement and support deemed essential. • Continuous learning, executive support, and effective communication highlighted. • Relevant clinical experience and on-the-job training crucial for expertise.	Education and training diversity among nurse-surgeons highlighted the need for standardised credentialing and government support. Continuous learning, executive support, and communication were pivotal for successful integration. Emphasis on relevant clinical experience and on-the-job training underscored the practical aspects shaping nurse-surgeon expertise.
Perceptions and Experiences	• Mixed perceptions of career prospects and support during training. • Surgeons' support highly rated during training and practice. • Management support rated positively.	• Nurse-surgeon interactions were categorised into interactions with healthcare professionals and organisational interactions. • Challenges with administrators' understanding of the nurse-surgeon role.	Nurse-surgeons' mixed perceptions during Phase 1 contrasted with the identified challenges in nurse-surgeon interactions and organisational interactions during Phase 2. The positive likelihood of continuing as nurse-surgeons suggested resilience. Identified barriers emphasised the importance of addressing misunderstandings and gaining recognition at various levels.

Themes	Phase 1 Findings	Phase 2 Findings	Meta-Inferences
	• Overall likelihood of continuing as nurse-surgeons scored high. • Varied comments emphasised the need for formal training recognition and concerns about acceptance.	• External organisations, especially medical associations, perceived as resistant.	
Nurse-surgeon integration to the Australian public health system	No specific integration themes in Phase 1.	Two nurse-surgeon integration themes identified in Phase 2: • Facilitators for integration. • Barriers to integration.	The absence of integration themes in Phase 1 highlighted a gap filled by Phase 2. The emergence of facilitators and barriers to integration in Phase 2 indicated a comprehensive exploration, providing a foundation for understanding the complexities of nurse-surgeon integration.

The emergence of themes in explanatory sequential mixed methods studies during the systematic multi-level integration of qualitative and quantitative data allow for a comprehensive exploration of the research objectives (Creswell & Creswell, 2017). This aligns with the core principles of mixed methods research, where the integration of diverse data types enhances the overall understanding of the research problem (Tashakkori & Teddlie, 2003).

The main findings from the integration of the data included the following themes: roles of nurse-surgeons in the Australian public health system; training and education requirements of nurse-surgeons in Australia; perceptions and experiences of nurse-surgeons in the Australian public health system; and nurse-surgeon integration to the Australian public health system. These will be discussed below.

8.2.1 Roles of nurse-surgeons in the Australian public health system

Initial findings from Phase 1 outlined the characteristics of the study participants, revealing a predominantly female cohort (n = 22) engaged in performing surgeries across diverse surgical specialties including endoscopy, general surgery, urology, gynaecology, plastic surgery, cardiac, and obstetrics. additional work beyond their nurse-surgeon roles. Additionally, beyond their nurse-surgeon roles, the majority (n = 19) were involved in supplementary activities such as clinical nurse consulting, outpatient clinic appointments, and surgical assisting. Furthermore, Phase 1 revealed the introduction of the nurse-surgeon role in Australia may have occurred in 1981 with participants' perioperative nursing backgrounds contributing to the development of specialised roles in surgery.

Phase 2 expanded this understanding of nurse-surgeon roles, introducing the crucial theme of nurse-surgeon interactions. Initially, nurse-surgeons faced challenges in their interactions with both nurse and physician colleagues, marked by hesitancy and a perceived threat to established roles. However, over time, this tension transformed into recognition and appreciation, leading to a positive shift in the perception of nurse-surgeons among their colleagues. This evolution reached a point where nurse-surgeons became a source of inspiration, motivating some nursing colleagues to pursue postgraduate training in the field. Simultaneously, physicians who were initially hesitant transitioned to seeking advice from nurse-surgeons for surgeries requiring additional clinical expertise. The theme of nurse-surgeon interactions thus highlights the transformative journey from initial challenges to a positive and influential role within the healthcare team.

These findings reflect that the evolution of nurse-surgeon roles in the Australian public healthcare was shaped by a multitude of factors spanning historical context, gender dynamics, organisational culture, and interactions with colleagues. Historical factors emerged as pivotal contributors, with the inception of the nurse-surgeon role in Australia dating back to early 1980s, marking a significant historical shift in nursing practices (Johnson & Bayley, 2018). Globally, the broader historical context revealed the emergence of nurse-surgeons in Western countries during the 1970s (Spencer & Ready, 1977). Gender dynamics also played a role, as the study participants predominantly consisted of females engaged in diverse surgical specialties, aligning with the well-documented feminisation of the nursing profession (Buerhaus et al., 2008). In comparison, the scope of practice for nurse-surgeons in low-income countries often remains limited due to resource constraints and varying regulatory frameworks, highlighting disparities in healthcare delivery and professional recognition between high- and low-income nations (Grota et al., 2023).

Organisational culture and structure wielded considerable influence, as rigid hierarchies and traditional role expectations within healthcare organisations posed challenges in accommodating innovative roles such as nurse-surgeons (Cameron & Quinn, 2011). Similarly, nurse practitioners have faced similar obstacles in reshaping their role within the healthcare system. In many healthcare settings, nurse practitioners have had to navigate hierarchical structures that traditionally prioritised physician-led care models (Hamric et al., 2014). This rigid organisational culture often limited the autonomy and scope of practice for nurse practitioners, hindering their ability to fully utilise their skills and contribute effectively to patient care. However, through advocacy, education, and collaboration with other healthcare professionals, nurse practitioners have worked to challenge and change these entrenched organisational norms (Hamric et al., 2014). By demonstrating their value through evidence-based practice, quality patient outcomes, and cost-effective care delivery, nurse practitioners have gradually influenced organisational culture and structure to better accommodate their role within the healthcare system (Hamric et al., 2014). This evolution reflects a broader trend towards recognising the importance of interdisciplinary collaboration and leveraging the diverse skills of healthcare professionals to meet the complex needs of patients.

The extensive background of participants as perioperative nurses before adopting nurse-surgeon roles emphasises the significance of clinical training and experience, indicating a transformative growth in nursing practices (Brown et al., 2017; Clarke & Smith, 2019). Perioperative nurses possess a wealth of specialised knowledge and skills acquired through hands-on experience in surgical settings (Association of periOperative Registered Nurses [AORN], 2020). This includes proficiency in surgical procedures, patient care within the operating room environment, and the coordination of perioperative care. Such expertise forms a solid foundation for nurses transitioning to nurse-surgeon roles, as it instils a deep understanding of surgical techniques, patient safety protocols, and interdisciplinary collaboration. Moreover, the confidence and competence gained through clinical experience enable nurse-surgeons to effectively navigate the complexities of surgical procedures and manage perioperative care challenges with proficiency and poise. Therefore, harnessing the extensive clinical experience of perioperative nurses not only enhances the quality of care delivered by nurse-surgeons but also ensures safer and more efficient surgical practices, ultimately advancing patient outcomes and elevating the standard of healthcare delivery (AORN, 2020).

Interactions with colleagues within the perioperative setting form a dynamic element, evolving from initial challenges to eventual recognition and inspiration for postgraduate training among nurse-surgeons' junior nursing peers. This positive shift signifies the transformative journey of nurse-surgeons within the healthcare team. Resistance to change is a common initial reaction among healthcare professionals, driven by concerns about altered power dynamics and threats to established norms (Ford et al., 2002). Physicians may resist changes due to concerns about autonomy, tradition, and time constraints. Nurses may resist changes that challenge their role identity, impact staffing levels, or result from a lack of resources. Allied health professionals, such as physical therapists and occupational therapists, may resist changes that expand their scope of practice or alter interprofessional dynamics. Administrators and managers may resist changes due to budget constraints, risk aversion, or the prevailing organisational culture (Cameron & Quinn, 2011; Grol et al., 2013; Shortell & Kaluzny, 2006).

Effective communication and stakeholder engagement are crucial for overcoming resistance to new roles, emphasising the importance of transparent communication and involvement of all stakeholders, including nurses, physicians, other perioperative care professionals, and administrators, in the implementation process (Grol et al., 2013). As nurse-surgeons demonstrate their competence and contribution to patient care, they gradually earn recognition and validation from their colleagues, further fostering acceptance over time. Grol et al. (2013) and Shortell and Kaluzny (2006) discuss the importance of professional recognition in facilitating the integration of new roles in healthcare settings. Moreover, evidence of positive impact, such as improved patient outcomes or enhanced efficiency in surgical procedures, can help alleviate initial scepticism and promote acceptance among colleagues (Greenhalgh et al., 2004).

Additionally, the diversification of nursing roles is evident as participants engage in supplementary activities like clinical nurse consulting, outpatient clinic appointments, and surgical assisting beyond their primary nurse-surgeon roles, showcasing the integration of nurse-surgeons into various facets of surgical care (Grol et al., 2013). The age distribution of nurse-surgeons further contributes to nurse-surgeon roles, with older participants boasting over a decade of nurse-surgeon experience, providing historical context, and emphasising the longevity and sustainability of these roles.

8.2.2 Training and education requirements of nurse-surgeons

The examination of training and education requirements of nurse-surgeons within the Australian public health system provided the diverse educational backgrounds and training durations among study participants. Phase 2 highlighted critical data contributing to successful nurse-surgeon integration, notably the advocacy for standardised national credentialing, government involvement, and continuous learning. These elements underscored the importance of standardising the training and accreditation process to ensure high-quality and consistent nurse-surgeon practice across regions. The meta-inference suggests that diversity in education and training is inherent among nurse-surgeons in the Australia public health system, reinforcing the need for a standardised credentialing pathway to establish a benchmark for quality and competence.

Standardising of training and credentialing are crucial aspects of healthcare regulation, aimed at ensuring clinical practice meets established standards and benchmarks for quality and competence. Standardising training plays a vital role in enhancing patient safety by ensuring that healthcare providers receive consistent and comprehensive education. By offering uniform training programs, healthcare organisations can minimise variations in clinical practice, reducing the likelihood of errors and adverse events that could jeopardise patient outcomes (Epstein et al., 2014). This standardisation contributes to a safer healthcare environment and promotes better clinical outcomes for patients.

Training standardisation promotes effective communication and collaboration among healthcare team members, facilitating interprofessional collaboration (Price et al., 2019). When all professionals share a common understanding of best practices and protocols, it enhances teamwork and coordination, ultimately benefiting patient care and outcomes. Lastly, compliance training standards is often mandated by regulatory bodies and accreditation agencies to ensure legal and regulatory compliance (American Nurses Credentialing Center, 2020). By adhering to these standards, healthcare organisations demonstrate their commitment to upholding the highest levels of quality and safety in patient care.

The integration of a national standardised curriculum tailored for nurse-surgeons is essential. This curriculum should encompass foundational knowledge, clinical skills, and continuous professional development, ensuring that all nurse-surgeons possess a uniform competency level. Collaborations with academic institutions and healthcare organisations can facilitate the development of educational resources and training programs that align with clinical practice requirements. Additionally, ongoing professional development opportunities should be

incorporated to encourage lifelong learning and adaptation to advancements in medical practices and technologies, ultimately enhancing the overall quality of healthcare delivered in Australia (Nursing and Midwifery Board, 2024).

8.2.3 Perceptions and experiences of nurse-surgeons in the Australian public health system

The assessment of perceptions and experience of nurse-surgeons in the Australian public health system revealed their career prospects, support systems, and the likelihood of continuing practice. The mixed perceptions in Phase 1 were contrasted with the challenges identified in nurse-surgeon interactions and organisational interactions in Phase 2. The positive likelihood of continuing as nurse-surgeons indicated resilience amidst perceived challenges.

These findings hold significant relevance across various domains. Investigating nurse-surgeons' perceptions offered invaluable insights into their career trajectories and the support mechanisms available within the healthcare framework. Such understanding is pivotal for ensuring the retention and contentment of nurse-surgeons in their respective roles, as emphasised by McGowan et al. (2013), who stressed the critical role of supportive work environments in fostering job satisfaction and curbing turnover among healthcare practitioners.

The identification of contrasting perceptions in Phase 1, alongside the challenges uncovered in nurse-surgeon interactions and organisational dynamics in Phase 2, highlighted the need to address communication barriers, role ambiguities, and other hindrances that may impede effective collaboration. Grol et al. (2013) underscored the significance of mitigating interpersonal conflicts and enhancing organisational culture to bolster teamwork and ultimately enhance patient care outcomes.

The positive inclination of nurse-surgeons to persist in their practice, despite encountering challenges, signifies resilience and dedication to their profession (Lu et al., 2021). Studies have shown that job satisfaction and personal fulfillment are significant predictors of healthcare professionals' intention to stay in their practice (Lu et al., 2021). When individuals find meaning and satisfaction in their work, they are more likely to persevere through challenges and remain committed to their profession. Understanding the factors underpinning nurse-surgeons' decisions to persevere can inform strategies aimed at bolstering their professional development and well-being. There is also a need for fostering resilience and

addressing burnout among healthcare practitioners to sustain a competent workforce capable of delivering quality care (Dyrbye et al., 2018).

8.2.4 Nurse-surgeon integration in the Australian Public Health System

This mixed methods research of nurse-surgeon within the Australian public health system unravelled two critical themes: facilitators for and barriers to nurse-surgeon integration in the Australian public health system. These themes provided a holistic understanding of the factors influencing the integration of nurse-surgeons into the healthcare system.

The facilitators for integration emphasised the proactive measures needed to legitimise and institutionalise the nurse-surgeon role, including standardisation of practice, government support, and continuous learning. These facilitators pointed towards a multifaceted approach necessary for successful nurse-surgeon integration.

Standardisation of practice may be needed to establish uniform standards to assess the qualifications and competencies of nurse-surgeons to not only ensure consistency but also provide a benchmark for evaluating clinical proficiency and promoting patient safety (Epstein et al., 2014). Standardisation of practice is a widely accepted approach in healthcare, extending beyond nurse-surgeons to various professions. Physicians benefit from standardised residency training programs, ensuring graduates meet predefined competencies and maintain high-quality care (Nasca et al., 2012). Similarly, advanced practice nurses, like nurse practitioners, adhere to Standards of Practice, establishing benchmarks for clinical proficiency and enhancing patient safety (Ahpra, 2024). Pharmacists also utilise standardisation through medication therapy management protocols, ensuring consistent patient care and optimal outcomes (American Pharmacists Association, 2017). Dental professionals implement standardised training and assessment to uphold patient safety standards, providing consistent, high-quality care (American Dental Association, 2019).

Regulation of Advanced Practice Nursing in Australia focuses on establishing clear governance frameworks that define scope, education, and professional standards. This ensures that Advanced Practice Nurses enhance patient safety and care quality. Regulatory bodies should continue to develop practice standards that support nursing competencies in the evolving healthcare landscape (Chief Nursing and Midwifery Officers Australia, 2020). However, it is important to clarify that nurse-surgeons, despite their advanced skills, are not classified as

Advanced Practice Nurses (International Council of Nurses, 2020). Their practice overlaps with that of other surgical providers within the healthcare industry, raising governance and accountability concerns. Implementing distinct regulatory measures for nurse-surgeons is essential to ensure they meet specific surgical standards of practice, maintaining the integrity of nursing roles and fostering collaboration among healthcare professionals.

Effective governance of nurse-surgeon professional practice in Australia may be achieved by establishing clear regulatory frameworks that define the roles and responsibilities of nurse-surgeons. This governance should include ongoing performance evaluations and mechanisms for feedback, allowing nurse-surgeons to maintain high standards of clinical practice. Engaging stakeholders, such as healthcare administrators, regulatory bodies, and professional organisations, in the development of these frameworks will ensure that they are relevant, comprehensive, and adaptable to changing healthcare needs (Nursing and Midwifery Board, 2024). By fostering a culture of accountability and transparency, the governance model can enhance public trust and promote the ultimate goal of patient safety and quality care.

Government support is required to provide policy and regulatory frameworks for facilitating the integration of innovative healthcare practices. Government involvement is essential for providing resources, advocating for regulatory changes, and fostering collaboration among stakeholders to address systemic barriers and promote the adoption of new roles like nurse-surgeons (Lewin et al., 2017). For example, government agencies have played a significant role in the integration of nurse practitioners into the healthcare workforce. Through funding initiatives and grants, governments have provided resources to support Nurse Practitioner education, training, and practice (American Association of Nurse Practitioners, 2020). Additionally, government agencies have advocated for regulatory changes to expand the scope of practice for Nurse Practitioners, allowing them to provide a wider range of healthcare services independently (American Association of Nurse Practitioners, 2020). This regulatory support has been essential for the successful integration of Nurse Practitioners into various healthcare settings, improving access to primary care services and enhancing patient outcomes.

Similarly, in the field of pharmacy, government involvement has been instrumental in facilitating the integration of new roles such as clinical pharmacists into healthcare teams. Government-funded initiatives have supported the development of advanced training programs for pharmacists, enabling them to assume expanded roles in patient care, medication management, and therapeutic decision-making (American Pharmacists Association, 2016).

Furthermore, government agencies have worked collaboratively with professional organisations and healthcare institutions to advocate for policy changes that recognise and reimburse pharmacists for their clinical services, promoting their integration into interdisciplinary healthcare teams (American Pharmacists Association, 2016).

In the case of Physician Assistant roles, Hooker et al. (2016) emphasised the role of government support and regulatory frameworks in promoting the integration of this new role into healthcare teams. Government agencies have played a significant role in supporting their education, training, and practice through funding initiatives and grants aimed at expanding PA programs and increasing their capacity to meet the growing demand for healthcare services (American Academy of Physician Assistants, 2020). Additionally, government involvement has been instrumental in advocating for legislative changes to recognise and expand the scope of practice for Physician Assistants, enabling them to practise to the full extent of their education and training and work autonomously in various healthcare settings (American Academy of Physician Assistants, 2020). This regulatory support has been essential for the successful integration of PAs into healthcare teams, enhancing access to care and improving patient outcomes.

The National Strategic Framework for Nurse Practitioners in Australia, developed by the Australian Government Department of Health, underscores the importance of advanced practice nursing roles, including nurse-surgeons, in meeting the healthcare needs of the population (Australian Government Department of Health, 2020). This framework provides strategic guidance for the integration of nurse-surgeons into the healthcare system, emphasising the need for comprehensive training programs to equip them with the necessary skills and competencies.

The Australian Nursing and Midwifery Accreditation Council plays a crucial role in setting standards and criteria for the accreditation of nursing and midwifery courses leading to registration and endorsement in Australia (Australian Nursing and Midwifery Accreditation Council, 2021). Government involvement in accrediting educational programs ensures that nurse-surgeon training meets established quality benchmarks. By adhering to these standards, educational institutions can design rigorous curricula that address the diverse educational backgrounds and training durations among nurse-surgeons, as identified in research studies (Commonwealth of Australia, 2018).

Furthermore, the National Registration and Accreditation Scheme for Health Professions, overseen by the Commonwealth of Australia, provides a regulatory framework to uphold professional standards and ensure public safety (Commonwealth of Australia, 2018). Through this scheme, the government works collaboratively with relevant stakeholders to establish guidelines for the training and accreditation of healthcare professionals, including nurse-surgeons. By aligning training pathways with National Registration and Accreditation Scheme requirements, educational institutions can demonstrate compliance with national standards, thereby enhancing the credibility and quality of nurse-surgeon training programs. Continuous learning underscored the importance of lifelong learning and professional development in healthcare. This was recognised by participants which ensures that healthcare professionals remain abreast of advancements in their field, maintain competency in their practice, and adapt to evolving patient needs and healthcare delivery models (Price et al., 2019). Facilitating continuous learning and professional development for nurse-surgeons requires a comprehensive approach, including provisions for time and financial support built into their positions. Numerous studies emphasise the significance of continuous learning in healthcare, highlighting its role in maintaining competency and adapting to evolving patient needs and healthcare delivery models (Finkelman & Kenner, 2019).

One approach to support continuous learning for nurse-surgeons is through the provision of dedicated time within their work schedules for educational activities and professional development. This may involve allocating time for attending conferences, workshops, and continuing education programs relevant to surgical nursing practice (Daly et al., 2019). By allowing nurse-surgeons to engage in lifelong learning activities during work hours, healthcare organisations demonstrate their commitment to supporting professional growth and enhancing clinical practice.

Financial support is also essential to facilitate continuous learning for nurse-surgeons. Governments and healthcare institutions can provide funding for educational opportunities, such as tuition reimbursement for advanced training or certification programs in surgical nursing (Patterson & Krouse, 2019). Additionally, financial incentives, such as bonuses or salary increases linked to attainment of specialised skills or professional certifications, can motivate nurse-surgeons to pursue ongoing education and training (Patterson & Krouse, 2019).

Furthermore, leveraging technology can enhance access to continuous learning resources for nurse-surgeons. Online platforms, webinars, and virtual learning modules offer flexibility and

convenience, allowing nurse-surgeons to engage in self-directed learning activities at their own pace and convenience (Daly et al., 2019). By investing in digital learning tools and platforms, healthcare organisations can expand access to educational resources and support continuous learning initiatives for nurse-surgeons.

Comparatively, similar instances of proactive measures to legitimise and institutionalise new roles can be observed in the integration of other advanced practice roles, such as nurse practitioners and physician assistants. For example, research by Hamric et al. (2014) highlighted the importance of standardised education and certification processes for nurse practitioners to establish their credibility and ensure consistency in practice.

The study also identified barriers to nurse-surgeon integration in the Australian public healthcare, ranging from geographical limitations to political opposition from medical associations. Geographical constraints highlighted the need for strategic planning to address disparities in access to nurse-surgeon services across diverse regions, ensuring equitable healthcare delivery. This implies that without strategic initiatives aimed at overcoming geographical limitations in practice, certain populations may face challenges in accessing the surgical care provided by nurse-surgeons, potentially exacerbating existing healthcare disparities (Evans et al., 2014).

Similarly, political opposition, particularly from established medical associations, posed significant challenges to the advancement of nurse-surgeon roles. Nurse-surgeon representation at strategic decision-making platforms, advocacy efforts and creation of a dedicated organisation for nurse-surgeons are essential to navigate these barriers and foster collaboration between different healthcare stakeholders, ultimately facilitating the acceptance and integration of nurse-surgeons into the broader healthcare sector. This highlights the importance of engaging in collaborative efforts with policymakers and influential healthcare organisations to garner support for the expansion of nurse-surgeon roles and mitigate opposition from vested interests (Brown et al., 2017; Spetz & Fraher, 2015).

This parallels instances in other healthcare systems where regulatory and political hurdles have impeded the expansion of advanced practice roles, emphasising the need for strategic advocacy and policy interventions to promote workforce diversity and enhance patient care. By drawing parallels with similar challenges faced by other advanced practice nursing roles, such as nurse practitioners, the study underscored the importance of leveraging evidence-based advocacy

strategies and coalition-building efforts to overcome barriers to practise expansion, future-proof the nurse-surgeon roles and promote the integration of nurse-surgeons into the Australian public healthcare workforce (Ku et al., 2020; Schober et al., 2016).

8.3 Limitations of the study

Similar to other mixed methods studies, this research possessed several limitations. One limitation pertains to sample representativeness in both Phase 1 and Phase 2, where potential sample bias may have hindered a comprehensive representation of the entire population of nurse-surgeons in Australia. This could result in an incomplete capturing of variations in experiences and perspectives among nurse-surgeons across different regions or healthcare settings.

Another limitation involves recall and reporting bias, as both phases of the study incorporated elements of recall. Participants provided historical accounts in Phase 1 and shared their perceptions in Phase 2, introducing the possibility of recall bias and social desirability bias, which might impact the accuracy of the data. Temporal context represents another limitation, as the study's findings may not have fully reflected the most current views, practices, or challenges associated with nurse-surgeon roles in the Australian healthcare system. The dynamic nature of healthcare delivery and the evolving policies could have surpassed the study's timeframe.

The study is also limited by focusing primarily on the experiences and perceptions of nurse-surgeons themselves, neglecting input from other stakeholders such as patients, hospital administrators, or nursing unions. This exclusion may have hampered a more comprehensive view of nurse-surgeon role integration. Furthermore, generalisability was restricted, as the findings may have limited applicability beyond the Australian healthcare system. The unique context, policies, and cultural factors in Australia may not align with international settings, limiting the broader generalisation of the study's conclusions.

The evolving nature of healthcare was not fully accounted for, as the study could not reflect recent developments or emerging challenges related to the integration of nurse-surgeon roles. The dynamic healthcare sector continues to evolve beyond the study's purview. Limited data sources constituted another limitation, as both phases relied primarily on participant accounts. Supplementing these with additional data sources, such as historical records or external evaluations, could have provided a more comprehensive perspective. The study was also affected by single-source experiential bias, primarily reflecting the experiences and perceptions of nurse-

surgeons. Including input from a more diverse set of stakeholders could have yielded a more holistic understanding of the integration of nurse-surgeon roles.

The potential implications of changing healthcare policies and practices that could impact the recognition and acceptance of nurse-surgeon roles in the future may not be fully addressed by the study. Moreover, the study exhibited qualitative dominance in both phases, which could lead to an emphasis on narrative data at the expense of quantitative data. A more balanced approach between qualitative and quantitative data could have yielded additional insights.

8.4 Summary

Chapter 8 presented a discussion of the integrated findings and meta-inferences from Phase 1 and 2 thereby addressing the objectives of this research. This integration of findings facilitated a holistic exploration of the roles, training, education, perceptions and experiences of nurse-surgeons practising in the Australian public health system. While acknowledging study limitations, such as potential biases, this research can contribute significantly to the perioperative field by addressing facilitators and barriers to integration and advocating for nurse-surgeon recognition and support. Overall, the study underscored the importance of nurturing nurse-surgeons to ensure a skilled surgical workforce capable of meeting evolving patient needs effectively. Chapter 9 will outline the recommendations derived from this study for policy, practice, and future research along with a conclusion that will encapsulate the entirety of this research.

Chapter 9 Recommendations and Conclusion

9.1 Introduction

In Chapter 8, a comprehensive discussion unfolded, presenting an integrated analysis of the data through a meta-inference table that encapsulated the findings from both Phase 1 and Phase 2. This juxtaposition of data aimed to explain the overarching patterns and insights derived from the combined quantitative and qualitative perspectives. Concurrently, the chapter transparently addressed the inherent limitations of the study, offering a reflective examination of the boundaries that may influence the interpretation and generalisability of the research outcomes.

In Chapter 9, the culmination of the study is marked by the presentation of insightful recommendations drawn from the comprehensive exploration conducted throughout the research. These recommendations serve as valuable guidelines for addressing the challenges and leveraging the strengths identified in the integration of nurse-surgeon roles within the Australian healthcare system. Additionally, the chapter encapsulates the essence of the entire thesis, providing a succinct yet impactful conclusion that synthesises the key findings, implications, and contributions of the research journey.

9.2 Recommendations for future research

In advancing the understanding and integration of nurse-surgeon roles within the Australian healthcare system, several avenues for future research can be explored. First, longitudinal studies can track the evolving roles of nurse-surgeons over time, examining changes in perceptions, policies, and integration practices both domestically and internationally. Comparative analysis offers another promising avenue, allowing for an assessment of nurse-surgeon integration in Australia compared to other countries with similar or different healthcare systems, thereby providing insights into best practices and potential challenges.

Moreover, investigating patient perspectives on receiving surgical care from nurse-surgeons is crucial for understanding patient satisfaction, outcomes, and preferences, thereby offering a patient-centric view of nurse-surgeon roles. Similarly, exploring the perspectives of various stakeholders within the healthcare system, including hospital administrators, nursing

unions, and physicians, can provide invaluable insights into the implications of nurse-surgeon roles for healthcare delivery.

Conducting in-depth policy analysis is also essential to understand the legal and regulatory frameworks, funding mechanisms, and their impact on the acceptance and integration of nurse-surgeons. Furthermore, fostering international collaboration with researchers and organisations can facilitate knowledge exchange and comparative studies on nurse-surgeon roles, offering a broader context for understanding their integration.

Economic analysis is another critical aspect, as assessing the financial implications of nurse-surgeon roles in the Australian healthcare system can address concerns related to payment issues and financial viability. Additionally, evaluating the effectiveness of nurse-surgeon training programs and exploring strategies for overcoming cultural and attitudinal barriers within the healthcare system are vital for fostering a culture of collaboration and acceptance of nurse-surgeons.

Moreover, assessing factors contributing to the job satisfaction and retention of nurse-surgeons within the healthcare system is crucial, as is studying the impact of nurse-surgeon roles on workforce planning and the distribution of surgical services across different regions of Australia. Analysing government initiatives and policies in promoting or hindering the recognition and integration of nurse-surgeon roles, as well as investigating the standardisation of nurse-surgeon practice through the establishment of national guidelines and standards, are essential components of future research efforts in this area. Overall, these recommendations provide a roadmap for future research endeavours, contributing to the ongoing development of the specialised field of nurse-surgeon integration within the Australian healthcare system and beyond.

9.3 Recommendations for policy

In addressing the policy implications derived from the study's findings, recommendations are presented for policymakers to consider, aiming to foster the recognition and integration of nurse-surgeon roles within the Australian healthcare system. Policymakers should actively consider formal recognition and regulation of nurse-surgeon roles, involving the creation of clear guidelines and standards governing their training, certification, and practice. Additionally, developing standardised national credentialing pathways for nurse-surgeons, outlining requisite

qualifications, competencies, and oversight procedures, ensures a consistent and high-quality standard of practice across the nation.

Policy changes should specifically address payment issues, including the accessibility of Medicare Benefits Schedule rebates for nurse-surgeon services. This financial support enhances the viability of nurse-surgeon roles and encourages their seamless integration. Policymakers can also contribute by supporting the development and accreditation of specialised educational postgraduate programs at the master's or doctoral levels tailored for nurse-surgeons, ensuring alignment with the evolving needs of the healthcare system and equipping them with necessary skills.

Launching targeted public awareness campaigns to educate patients, healthcare professionals, and the public about the capabilities and benefits of nurse-surgeon roles can address resistance and foster broader acceptance within the community. Encouraging policies that foster interprofessional collaboration and open communication among different healthcare stakeholders enhances teamwork and contributes to the seamless integration of nurse-surgeons within the broader healthcare framework. Additionally, policymakers should support a culture of innovation and change management within the healthcare system to overcome resistance to new roles, including those of nurse-surgeons.

Developing policies and incentives focused on enhancing the job satisfaction and retention of nurse-surgeons, along with recognising and rewarding their contributions, can play a significant role in promoting career longevity and job stability. These policy recommendations collectively aim to create an environment that not only recognises the valuable contributions of nurse-surgeons but also actively supports their integration within the Australian healthcare system.

9.4 Recommendations for practice

In light of the study's findings, several key recommendations are proposed to enhance the practice of nurse-surgeons within the Australian healthcare system. Hospitals and healthcare institutions are advised to invest in the continuous training and professional development of nurse-surgeons, encompassing ongoing education, skill enhancement, and career growth opportunities to keep them updated on evolving practices and standards. The implementation of robust quality assurance and continuous improvement practices within surgical departments is

imperative, with regular assessments and feedback mechanisms integral to upholding the highest standards of quality and safety in surgical care provided by nurse-surgeons.

Emphasis on patient-centered care should be a cornerstone of nurse-surgeon practice, prioritising patient needs, providing comprehensive information, and offering support to enhance the overall patient experience, fostering a patient-centric approach to healthcare delivery. Healthcare teams are encouraged to foster interdisciplinary collaboration, promoting open communication and cooperation among various stakeholders, including nurse-surgeons, surgeons, nurses, and other healthcare professionals, essential for comprehensive and cohesive patient care.

Active engagement in research and innovation related to nurse-surgeon roles is paramount, aligning practices with a culture of evidence-based care and continuous improvement in surgical services, allowing nurse-surgeons to contribute to advancements in the field. The creation of dedicated support networks for nurse-surgeons within healthcare institutions is crucial, implementing mentorship programs and encouraging peer support to significantly enhance professional development and overall well-being.

Nurse-surgeons are urged to actively advocate for their roles and engage in policy discussions, contributing significantly to the recognition and acceptance of nurse-surgeon positions within the broader healthcare landscape. Efforts should also be made to provide patient education, helping patients better understand the roles of nurse-surgeons, as educated patients are more likely to accept and benefit from the care provided by nurse-surgeons, contributing to improved healthcare outcomes. These recommendations collectively aim to fortify the practice of nurse-surgeons, ensuring they are equipped with the necessary skills, support systems, and recognition to provide high-quality, patient-centric care within the Australian healthcare system.

9.5 Conclusion

This explanatory sequential mixed methods study provided valuable insights into the practice of nurse-surgeons within the Australian public health system. By integrating diverse data from both Phase 1 and Phase 2, the study deepened understanding, revealing key findings regarding nurse-surgeon roles, training needs, perceptions, experiences, and integration into the Australian public health system. These findings highlighted the transformative journey of nurse-

surgeons within healthcare teams, from initial challenges to recognition and appreciation among nursing, medical and other perioperative colleagues.

Policy implications are clear: it is crucial to recognise, regulate, and establish a standardised nationwide credentialing pathway for nurse-surgeons. This entails advocating for specialised educational postgraduate programs and raising public awareness. Practice should focus on continuous training and quality assurance, with an unwavering commitment to patient-centred care and interdisciplinary collaboration.

Future research must explore the evolving roles of nurse-surgeons through longitudinal studies, engage patients for their insights, and investigate the economic aspects of integration. Comparative international studies and an analysis of policy dynamics can also be instrumental in shaping the future of these roles. Addressing these dimensions can pave the way for an inclusive, innovative, and patient-focused healthcare system, with nurse-surgeons playing a vital role in the delivery of surgical services in Australia and internationally.

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Appendices

Appendix A. Statement of contribution of others

Publication	Contributor	Statement of contribution
Grota, T., Betihavas, V., Burston, A., & Jacob, E. (2023). Roles of nurse-surgeons in global surgical care: A scoping review. *Journal of Advanced Nursing, 00*, 1–31. https://doi.org/10.1111/jan.15906	Tenber Grota (candidate)	Conducted literature review – 75% Analysed and synthesised data – 75% Wrote the paper – 90% Edited the paper – 75%
	Dr Adam Burston	Conducted literature review – 25% Analysed and synthesised data – 25% Wrote the paper – 25% Edited the paper – 25%
	Professor Vasiliki Betihavas	Conducted literature review – 25% Analysed and synthesised data – 25% Wrote the paper – 25% Edited the paper – 25%
	Professor Elisabeth Jacob	Conducted literature review – 25% Analysed and synthesised data – 25% Wrote the paper – 25% Edited the paper – 50%
Grota, T., Betihavas, V., Burston, A., & Jacob, E. (2022). Impact of nurse-surgeons on patient-centred outcomes: A systematic review. International Journal of Nursing Studies Advances, 4, 100086. https://doi.org/10.1016/j.ijnsa.2022.100086	Tenber Grota (candidate)	Conducted literature review – 75% Analysed and synthesised data – 75% Wrote the paper – 90% Edited the paper – 75%
	Dr Adam Burston	Conducted literature review – 25% Analysed and synthesised data – 25% Wrote the paper – 25% Edited the paper – 25%
	Professor Vasiliki Betihavas	Conducted literature review – 25% Analysed and synthesised data – 25% Wrote the paper – 25% Edited the paper – 25%
	Professor Elisabeth Jacob	Conducted literature review – 25% Analysed and synthesised data – 25% Wrote the paper – 25% Edited the paper – 50%
Grota, T., Betihavas, V., Burston, A., & Jacob, E. (2021). Current methods of nurse-surgeon training and education: Systematic review. *International Journal*	Tenber Grota (candidate)	Conducted literature review – 75% Analysed and synthesised data – 75% Wrote the paper – 90% Edited the paper – 75%

of Nursing Studies Advances, *3*, 100048. https://doi.org/10.1016/j.ijnsa.2021.100048	Dr Adam Burston	Conducted literature review – 25% Analysed and synthesised data – 25% Wrote the paper – 25% Edited the paper – 25%
	Professor Vasiliki Betihavas	Conducted literature review – 25% Analysed and synthesised data – 25% Wrote the paper – 25% Edited the paper – 25%
	Professor Elisabeth Jacob	Conducted literature review – 25% Analysed and synthesised data – 25% Wrote the paper – 25% Edited the paper – 50%
Grota, T., Burston, A., Betihavas, V., & Jacob, E. (submitted). Nurse-surgeons in the Australian public health system: A descriptive quantitative survey. *International Journal of Nursing Studies Advances.*	Tenber Grota (candidate)	Designed experiment – 75% Collected data – 90% Statistical analysis of data – 75% Wrote the paper – 90% Edited the paper – 75%
	Dr Adam Burston	Designed experiment – 25% Collected data – 25% Statistical analysis of data – 25% Wrote the paper – 25% Edited the paper – 25%
	Professor Vasiliki Betihavas	Designed experiment – 25% Collected data – 25% Statistical analysis of data – 25% Wrote the paper – 25% Edited the paper – 25%
	Professor Elisabeth Jacob	Designed experiment – 50% Collected data – 25% Statistical analysis of data – 25% Wrote the paper – 25% Edited the paper – 50%
Grota, T., Burston, A., Betihavas, V., & Jacob, E. (submitted). Nurse-surgeons' experiences working in the Australian public health system: A qualitative exploration. *Journal of Advanced Nursing.*	Tenber Grota (candidate)	Designed experiment – 75% Collected data – 90% Statistical analysis of data – 75% Wrote the paper – 90% Edited the paper – 75%
	Dr Adam Burston	Designed experiment – 25% Collected data – 25% Statistical analysis of data – 25% Wrote the paper – 25%

		Edited the paper – 25%
	Professor Vasiliki Betihavas	Designed experiment – 25% Collected data – 25% Statistical analysis of data – 25% Wrote the paper – 25% Edited the paper – 25%
	Professor Elisabeth Jacob	Designed experiment – 50% Collected data – 25% Statistical analysis of data – 25% Wrote the paper – 25% Edited the paper – 50%

Appendix B. Survey questionnaire

You are invited to participate in our national survey of the roles, training, education, and career prospects of nurse-surgeons in the Australian public health system. Nurse-surgeons are nurses trained to perform surgeries independently. For the purpose of this survey, we have adapted the World Health Organisation definition of surgery as any invasive procedures that is performed aseptically, and usually with the use of appropriate anaesthesia, by trained surgeons, other physicians, nurses, and other non-physicians to investigate and/or treat surgical conditions. Please note that Surgical Assistant roles are not considered nurse-surgeons as they do not perform surgeries independently. This survey will take approximately 15 minutes to complete. Your personal information and responses will be anonymous and the data from this research will be reported only in the aggregate. A "Participant Information Letter" is attached below for a comprehensive explanation of this study. Please contact Mr. Tenber Grota on tenber.grota@myacu.edu.au if you have any questions about the survey. Thank you for your time and support.

Please click "I consent" to confirm that you have fully read the "Participant Information Letter" attached below and you are providing your consent to participate in this survey.

Demographics
What is your sex?
- Male
- Female
- Other (please specify below)

What is your age?
- 18 – 24
- 25 – 34
- 35 – 44
- 45 – 54
- 55 – 64
- 65 or older

Which state are you currently residing and practising?
- Australian Capital Territory
- New South Wales
- Northern Territory
- Queensland
- South Australia
- Tasmania
- Victoria
- Western Australia

What is your current employment status?
- Permanent full time
- Permanent part time (please specify below)
- Casual
- Agency
- Self-employed

Nurse-surgeon roles
The next set of questions will be about your role as a practising nurse-surgeon. This information will help us understand your practice setting and duration, surgical specialty, and the surgeries you have performed independently. When answering the questions, please consider the time when you have actually started performing surgeries independently (excluding surgical assisting and traditional perioperative nursing roles).

What is your current Ahpra registration?
- Registered Nurse
- Nurse Practitioner
- Both Registered Nurse and Nurse Practitioner Other (please specify below)

What geographical area are you currently practising in?
- Metropolitan

- Regional
- Remote

What clinical setting do you currently work in? Select all that apply.
- Operating theatre / perioperative department
- Day surgery unit
- Outpatient clinic (hospital)
- Outpatient clinic (standalone / independent practice)
- Interventional radiology / catheterisation laboratory unit
- Endoscopy unit
- Intensive care unit
- Emergency department
- Community / primary health service
- Other (please specify below)

How long have you been practising as a nurse-surgeon?
- less than a year
- 1 year but less than 4 years
- 4 years but less than 7 years
- 7 years but less than 10 years
- 10 years or more (please specify below)

How long did you practise as a nurse before becoming a nurse-surgeon?
- less than a year
- 1 year but less than 4 years
- 4 years but less than 7 years
- 7 years but less than 10 years
- 10 years or more (please specify below)

What was your main role before becoming a nurse-surgeon?
- Theatre nurse / scrub scout nurse
- Endoscopy nurse
- Practice nurse
- Emergency nurse
- Critical care nurse
- Nurse manager
- Other (please specify below)

What is your surgical speciality as a nurse-surgeon? Select all that apply.
- Endoscopy
- General surgery
- Gynaecology
- Interventional radiology
- Obstetrics
- Ophthalmology
- Plastic surgery
- Urology
- Other (please specify)

Below are surgeries that are known to have been performed independently by nurse-surgeons worldwide. Which of these surgeries have you performed independently? Select all that apply.

- Angiogram
- Biopsy
- Caesarean section
- Carpal tunnel release
- Circumcision
- Colonoscopy
- Flexible sigmoidoscopy
- Gastroscopy
- Hysterectomy
- Hysteroscopy
- Inguinal hernia repair

- Intravitreal therapy
- Laparotomy
- Percutaneous thrombectomy
- Rigid cystoscopy
- Trauma surgeries (please specify below)
- Other (please specify below)

Do you have other roles at your workplace besides being a nurse-surgeon?
- Yes (please specify below)
- No

Yes (please specify below)

What percentage of your work is allocated to being a nurse-surgeon?_____

Nurse-surgeon training

The next set of questions will be about your practical training and educational preparation to become a nurse-surgeon. This information will help us understand the specific components of your practical training and the studies you undertook to practise as a nurse-surgeon.

What is the highest academic degree that you have completed?
- Bachelor's degree (please specify below)
- Associate degree (please specify below)
- Attended university but did not complete Master's degree, (please specify below)
- Doctorate or professional degree (please specify below)
- Other (please specify below)

Were you required to undertake postgraduate study before you were allowed to practise as a nurse-surgeon?
- Yes (please specify below)
- No

Did you receive any practical training before you were allowed to practise independently as a nurse-surgeon?
- Yes - formal training (please specify below)
- Yes - informal training (please specify below)
- Yes - a combination of formal and informal practical trainings (please specify below)
- No practical training
- Other (please specify below)

Did you receive any theoretical teaching or foundation before you were allowed to practise independently as a nurse-surgeon?
- Yes - formal education (please specify below)
- Yes - informal education (please specify below)
- Yes - a combination of formal and informal education (please specify below)
- No education
- Other (please specify below)

Who was your supervisor during your nurse-surgeon practical training and education?
- Surgeon
- Nurse-surgeon
- Both surgeon and nurse-surgeon
- Other (please specify below)

Were you required to pass a competency assessment before you were allowed to practise independently as nurse-surgeon?
- Yes - formal competency assessment (please specify below)
- Yes - informal competency assessment (please specify below)
- Yes - a combination of formal and informal competency assessments (please specify below)
- No competency assessment
- Other (please specify below)

Following competency assessment, who made the final regarding your competence to perform surgeries independently?

- Surgeon clinical supervisor
- Nurse-surgeon clinical supervisor
- Hospital management Hospital quality team
- Representative from the public health system of the state
- Joint approval from the surgeon and nurse-surgeon clinical supervisors
- Joint approval from the surgeon, nurse-surgeon clinical supervisors, and hospital management
- Joint approval from the surgeon, nurse-surgeon clinical supervisors, hospital management, and hospital quality team
- Joint approval from the surgeon, nurse-surgeon clinical supervisors, hospital management, hospital quality team, and the representative from the public health system of the state
- Other (please specify below)

How long was your nurse-surgeon training (inclusive of practical training, educational preparation and competency assessment)?
- Less than 1 year, please specify (please specify any below)
- One year but less than two years (please specify below)
- Two years or more (please specify below)

Nurse-surgeon perceptions
The next set of questions will be about your perceptions as a practising nurse-surgeon in Australia in terms of career prospects, support received from stakeholders, and the likelihood of continuing your practice.

How would you rate the employment prospects for nurse-surgeons in Australia? Please provide a brief reason for your choice.
- Excellent
- Good
- Average
- Poor
- Terrible

How would you rate the support you received from your nursing colleagues at work during training as a nurse-surgeon? Please provide a brief reason for your choice.
- Excellent
- Good
- Average
- Poor
- Terrible

How would you rate the support you received from your nursing colleagues at work as a practising nurse-surgeon? Please provide a brief reason for your choice.
- Excellent
- Good
- Average
- Poor
- Terrible

How would you rate the support you received from surgeons at work during training as a nurse-surgeon? Please provide a brief reason for your choice.
- Excellent
- Good
- Average
- Poor
- Terrible

How would you rate the support you received from surgeons at work as a practising nurse-surgeon? Please provide a brief reason for your choice.
- Excellent
- Good
- Average
- Poor
- Terrible

How would you rate the support you received from management during training as a nurse-surgeon? Please provide a brief reason for your choice.

- Excellent
- Good
- Average
- Poor
- Terrible

How would you rate the support you received from management as a practising nurse-surgeon? Pleas provide a brief reason for your choice.

- Excellent
- Good
- Average
- Poor
- Terrible

How likely are you to continue practising as a nurse-surgeon? Please provide a brief reason for your choice.

- 0 Extremely unlikely
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10 Extremely likely

Please provide any additional comments about the nurse-surgeons in the Australian public health system.

When you're finished, please click "Submit" to complete the survey. Clicking "Submit" indicates consent and the inability to withdraw the data due to the anonymous nature of the research.

After clicking "Submit", a separate page will appear which will ask about your interest in participating in the second phase of our study. The invitation page is separate to ensure the anonymity of your responses in this survey.

Appendix C. ACU HREC application

ACU
AUSTRALIAN CATHOLIC UNIVERSITY

Human Ethics Application

Application ID :	2022-2426E
Application Title :	Nurse-surgeons in the Australian public health system: A mixed methods study
Date of Submission :	16/02/2022
Primary Investigator :	Professor Beth Jacob (Chief Investigator)
Other Personnel :	Tenber Grota (Doctoral Student)
	Assoc. Prof. Vasiliki Betihavas (Chief Investigator)
	Dr Adam Burston (Chief Investigator)

Overview

Introduction

Introduction

The purpose of this form is to encourage you to think about the ethical dimensions of your research.
Questions are designed to determine that you have considered and addressed the risks associated with your research. The questions are derived from the National Statement on Ethical Conduct in Human Research which is the primary guiding document for ethical research in Australia.

The help icon () provides help / examples to relevant questions / page.

You may save your progress at any point by opening the Toolbar menu on the right side of the window and clicking the save button

Please click on the Next (Next page >>) below-right to continue

Contact

If you have any questions regarding your Ethics application, please contact the ETHICS TEAM on:
Phone: (02) 9739 **2646**
Email: res.ethics@acu.edu.au

If your questions relate to difficulties with the form itself or the system, please contact RESEARCH SYSTEMS:
Phone: (03) 9953 **3674**
Email: res.systems@acu.edu.au

References

- ACU Ethics website
- NHMRC ethics page
- National Statement on Ethical Conduct in Human Research
- Australian Code for the Responsible Conduct of Research
- ACU Code of Conduct for Research

Section A: Administrative Section

A.1: Title and Summary of Project

A.1.1 **Application ID**
The system will automatically generate a numerical ID code (eg: 000001234). Following submission, the Ethics Team will alter the numeric code to an alpha-numeric code. This code will include the year, a sequential number and a reference code denoting the type of application. Eg

- *C - Clinical Trial;*
- *E - Expedited Review;*
- *H - Full Committee Review;*
- *I - Indigenous Research Ethics Assessment Process (IREAP);*
- *N - Non-identifiable data;*
- *T - Transfer;*
- *R - Registration.*
- *W - Waiver.*

Please quote your new alpha-numeric code in all communications with the Ethics Secretariat (eg: 2017-1234HI).

2022-2426E

A.1.2 Application Date (to be filled by Orion)

16/02/2022

A.1.3 Category *

ACU Human Ethics Project

A.1.4 What is the formal title of the research project?*

Nurse-surgeons in the Australian public health system: A mixed methods study

A.1.5 Plain language title to be used on information letter and consent form (if different)

A mixed methods study of nurses who perform surgeries in the Australian public health system

A.1.6 School*

Nat Sch of Nursing, Midwifery and Paramedicine

A.1.7 Description of the project in plain language (National Statement, 2007, s.1.2).
In addition, please attach a 2-4 page research proposal outlining the research design, objectives and methodology.*

The project is a two-phased mixed-methods study that will investigate nurse-surgeons. These are nurses who are trained to perform surgeries independently. The first phase is a quantitative survey that will aim to explore the role, training, education, and career prospects of nurse-surgeons in the Australian public health system. The second phase is a follow-up semi-structured qualitative interview that will aim to explore the experiences of nurse-surgeons in the Australian public health system.

A.1.8 Do you intend to publish this research in a peer reviewed publication?*

(●) Yes ( ) No

You have entered an project start date in the past / of today's date, are you sure this is correct?

A.1.9 Anticipated Start Date (project)*

01/03/2022

A.1.10 Anticipated Finish Date (project)*

04/05/2022

Data Collection must **NOT** commence until Ethics approval has been granted,
Please ensure your Anticipated Start Date for data collection is at least 28 days in the future to allow sufficient time for the Ethics approval process.

You have entered an data collection start date in the past / of today's date, are you sure this is correct?

A.1.11 Anticipated Start Date (data collection)*

01/03/2022

A.1.12 Anticipated Finish Date (data collection)*

30/08/2023

A.2: Types of Research

Tick as many of the following 'types of research' as applicable to this project Your answers will assist the HREC in considering this proposal. A tick in some of these boxes will generate additional questions relevant to your proposal (mainly because the National Statement requires additional ethical matters to be considered).

A.2.1 This project involves: (Please refer to details in help for items with an asterisk next to them)*

- [ ] Clinical Trial
- [ ] Research involving gametes or use or creation of embryos ART guidelines
- [ ] Research involving ionising radiation APRANSA guidelines
- [ ] Research involving participants and located / conducted overseas (NS 4.8)
- [x] Research on workplace practices or possibly impacting on workplace relationships (NS 4.3)
- [ ] A cellular therapy (NS 3.6)
- [ ] Genetic testing/research (NS 3.5)
- [ ] Research involving collection and/or use of human samples, body tissues or fluid samples (NS 3.4)
- [x] Research using quantitative methods, population level data or databanks (NS 3.2)*
- [x] Research using qualitative measures (NS 3.1)
- [ ] None of the above

A.2.2 Will your research involve access to any of the following?

a. Research is conducted on Defense members, ex-serving personnel or other Defence personnel, their information or tissue.*

( ) Yes (●) No

b. Participants are to be recruited, either directly or indirectly, through a service provided by Defence or the Department of Veterans' Affairs (DVA)*

( ) Yes (●) No

c. Research is conducted by Defence or DVA personnel.*

( ) Yes (●) No

d. Research is conducted on/in a Defence establishment.*

( ) Yes (●) No

e. Research is sponsored, endorsed or funded in any part by Defence or DVA.*

( ) Yes (●) No

A.3: Risk of Social, Mental or Physical Harm

A.3.1 Please check the applicable boxes: (Please refer to details in help for items with an asterisk next to them)*

- ☐ Potentially unpleasant stimuli, tasks, investigations or procedures, during / following procedures**
- ☐ Use of non-treatment or placebo control conditions
- ☑ Performance of any acts which might diminish self-esteem or cause embarrassment or distress
- ☐ Access to confidential data* without the participant's written consent
- ☐ Intended contact with persons with infectious diseases (e.g. measles, hepatitis, TB, whooping cough)
- ☐ Use of injections which may result in the transmission of disease
- ☐ Contact with electrical supply (eg electrical stimulation)
- ☐ Treatments or techniques with unpleasant or harmful side effects
- ☐ Any possibility of cardio-pulmonary difficulties***
- ☐ Other
- ☐ None of the above

A.4: Vulnerable Groups

A.4.1 Does your research involve access to any of the following groups: (Please refer to details in help for items with an asterisk next to them)*

- ☐ Anyone who is a prisoner or ward of the state
- ☐ People in other countries*
- ☐ Elderly people who may be vulnerable or unable to give fully informed consent
- ☐ People who may be vulnerable or unable to give fully informed consent
- ☐ Welfare recipients who may be vulnerable
- ☐ Anyone at risk of criminal/civil liability, damage to financial/social standing or to employability
- ☐ Minors (anyone under the age of 18, eg students or children)
- ☐ Other
- ☑ None of the above

A.5: Level of Risk

A.5.1 Does the research involve any foreseeable harm to the participants?*

○ Yes ◉ No

A.5.2 Does the research involve only the inconvenience of completing a short, simple survey? (for example, no more than 30 minutes total time commitment)*

○ Yes ◉ No

A.5.3 Is there only one group of participants?*

◉ Yes ○ No

A.5.4 Is the data being collected non-identifiable?*

○ Yes ◉ No

This research cannot be negligible risk and you must select either the "Low Risk" or "More than Low Risk" category below

A.5.5 Please indicate the level of risk to the participant in this research:*

- ○ More than Low Risk
- ◉ Low Risk
- ○ Negligible Risk

Section B: Research Design

B.1: Description of Procedures

B.1.1 Provide a brief description of your project and the methodology involved (e.g. method of data gathering, use of questionnaires, focus groups, interviews, and indicate any procedure/s that may have adverse effects)*

> The project will be an explanatory sequential mixed methods study with two phases. First phase will be a quantitative survey that will use the RedCap survey software. The survey will take around 15 minutes to complete. The PIL for the survey will be attached along with the interview link on the email that will be sent to the perioperative managers who have confirmed the presence of practicing nurse-surgeons in their hospitals. No follow up visits are required unless the participants agree to participate in the second phase of this study. The survey participants will only be contacted once. Second phase will be a semi-structured qualitative interview. The participants will need around one hour to complete the semi-structured interview. No follow-up visits are required following completion of the interview. The PIL for the interview will be emailed to the participants' preferred email addresses at least a week before their scheduled virtual interview session. The interview participants will be contacted twice via email. First, when the PIL, consent and available meeting dates are sent. Second, upon confirmation of the meeting date and receipt of their signed consent form.

B.1.2 Will you be photographing or digitally recording participants?
ACU e research does not recommend using Zoom for recording of sensitive or identifiable information as it is not secure.
The recommendations for recordings are: Recording to your local computer, or Microsoft Teams (please note that Microsoft Teams can transcribe data)
If you use Zoom as your audio-recording medium, please ensure these recordings are saved to an alternative password protected location such as Cloudstor or OneDrive.
Zoom files are AUTOMATICALLY deleted by ACU IT Services at the end of each semester. *

◉ Yes ○ No

B.1.3 Please provide details and explain how confidentiality of the identifiable images will be maintained, or whether permission is being sought for use of images.*

Participants will not be photographed. Zoom or Microsoft Teams will be used as the audio-recording medium only and the recordings will be transcribed by Pacific Transcription and stored on ACU OneDrive. Confidentiality will be maintained by using pseudonyms for the participants' names, places of work, and any potentially identifying issues that will emerge during the interview.

B.1.4 Does your research involve deception of participants?*

○ Yes ◉ No

B.2: Specific Risks

Does your research involve any of the following:
(if you answer yes to any of the questions in this section your research project must be reviewed by the **full HREC**)

Interventions and Therapies, including clinical and non-clinical trials and innovations (National Statement, 2007, s.3.3)

Does your research involve:

B.2.1 Administration of any substance or agent*

○ Yes ◉ No

B.2.2 A treatment or diagnostic procedure*

○ Yes ◉ No

B.2.3 A surgical procedure?*

○ Yes ◉ No

B.2.4 Any other therapeutic procedure or devices, preventative procedure or diagnostic device or procedure*

○ Yes ◉ No

Human Genetics (National Statement, 2007, s.3.4)

Does your research involve:

B.2.6 Study of single or multiple genes, gene-gene interaction or gene-environment interaction*

○ Yes ◉ No

B.2.7 Acquired somatic variation or inherited gene sequences*

○ Yes ◉ No

B.2.8 Gene expressions or genes of individuals, families or populations*

○ Yes ◉ No

B.2.9 Epigenetics or use of informatics and genetic information or clinical phenotypes*

○ Yes ◉ No

Stem Cell Research (National Statement, 2007, s.3.6)

Does your research involve:

B.2.11 Use of embryonic or somatic stem cells or those derived from primordial germ cells*

○ Yes ◉ No

Women who are pregnant and/or the human foetus (National Statement, 2007, s.4.1)

Does your research involve:

B.2.13 Research on a woman who is pregnant and the foetus in *utero**

○ Yes ◉ No

B.2.14 Research on the separated human foetus or on foetal tissue*

○ Yes ◉ No

People highly dependent on medical care who may be unable to give consent. (National Statement, 2007, s.4.4)

Does your research involve:

B.2.16 People who are highly dependent on medical care*

○ Yes ◉ No

B.2.17 People in terminal care, emergency care or intensive care*
○ Yes ◉ No

B.2.18 People who are unconscious or in a state of post-traumatic coma unresponsiveness *
○ Yes ◉ No

People with a cognitive impairment, an intellectual disability or a mental illness. (National Statement, 2007, s..4.5)

Does your research involve:

B.2.20 Anyone who is intellectually, mentally or physically impaired*
○ Yes ◉ No

People who may be involved in illegal activities (National Statement, 2007, s.4.6)

Does your research involve:

B.2.22 Study that intends to expose illegal activity*
○ Yes ◉ No

B.2.23 The likelihood of discovering illegal activity, even if not intended*
○ Yes ◉ No

B.2.24 The inadvertent and unexpected discovery of illegal activity*
○ Yes ◉ No

Aboriginal and Torres Strait Islander Peoples

Does your research involve:

B.2.26 Aboriginal and Torres Strait Islander Peoples*
○ Yes ◉ No

Section C: Researchers / Investigators

C.1: Researcher Details

C.1.1 Is this a student application?*
◉ Yes ○ No

C.1.2 This application is created by:*
◉ Student ○ Supervisor

C.1.3 Researchers / Investigators:
The ACU staff member is the Chief Investigator for the purposes of the application because all correspondence will be directed to the ACU staff member.
Please search by surname.
If you can't find an ACU student or sessional academic, please download and complete this form.

VOLUNTEERS – The addition of volunteers to ACU research projects is possible. The Chief Investigator must adhere to the ACU Work Experience and Volunteers policy and ensure that volunteers are covered by appropriate University insurance and their appointment must be approved by the relevant Executive Staff member.
https://policies.acu.edu.au/human-resources/recruitment_and_selection/work_experience_and_volunteers*

1	Order	1
	Person Type	Internal
	Title	Professor
	Given Name	Beth
	Surname	Jacob
	Full Name	Professor Beth Jacob
	Gender	Female
	Work Number	03 9230 8218
	Mobile Number	0474935464
	Home Number	
	Email Address	Elisabeth.Jacob@acu.edu.au
	AOU	School of Nursing, Midwifery and Paramedicine (VIC)
	Managing Unit	Faculty of Health Sciences
	Primary?	Yes

	Position	Chief Investigator
	Qualifications	Head, School of Nursing, Midwifery and Paramedicine Australian Catholic University - Melbourne
	Expertise relevant to this project	Nursing research and education
2	Order	2
	Person Type	HDR Student
	Title	Not Specified
	Given Name	Tenber
	Surname	Grota
	Full Name	Tenber Grota
	Gender	Male
	Work Number	
	Mobile Number	0411647350
	Home Number	
	Email Address	tenber.grota@myacu.edu.au
	AOU	Nat Sch of Nursing, Midwifery and Paramedicine
	Managing Unit	Faculty of Health Sciences
	Primary?	No
	Position	Doctoral Student
	Qualifications	1. Bachelor of Science in Nursing (Lyceum of the Philippines University, graduated in 2008) 2. Postgraduate Diploma in Health Sciences, major in Advanced Nursing (University of Auckland, graduated in 2016) 3. Master of Management, major in Health Services Management (Massey University, graduated in 2021)
	Expertise relevant to this project	1. Operating Theatre Coordinator, 2020 to present 2. Nurse Unit Manager - Operating Theatres, 2019 (fixed term) 3. Director of Nursing, 2018 to 2019 4. Perioperative Services Manager, 2017 to 2018 5. Operating Theatre Registered Nurse, 2009 to 2017
3	Order	3
	Person Type	Internal
	Title	Assoc. Prof.
	Given Name	Vasiliki
	Surname	Betihavas
	Full Name	Assoc. Prof. Vasiliki Betihavas
	Gender	Female
	Work Number	
	Mobile Number	0404910908
	Home Number	
	Email Address	Vasiliki.Betihavas@acu.edu.au
	AOU	Nursing (North Sydney)
	Managing Unit	Faculty of Health Sciences
	Primary?	
	Position	Chief Investigator
	Qualifications	Deputy Head, School of Nursing, Midwifery and Paramedicine Australian Catholic University - NSW
	Expertise relevant to this project	Health education and research
4	Order	4
	Person Type	Internal
	Title	Dr
	Given Name	Adam
	Surname	Burston
	Full Name	Dr Adam Burston
	Gender	Male
	Work Number	
	Mobile Number	
	Home Number	
	Email Address	adam.burston@acu.edu.au

	AOU	Nursing (Brisbane)
	Managing Unit	Faculty of Health Sciences
	Primary?	No
	Position	Chief Investigator
	Qualifications	Lecturer, School of Nursing, Midwifery and Paramedicine Australian Catholic University - Brisbane
	Expertise relevant to this project	Health education and research

C.1.4 Primary Contact

Tenber Grota

C.1.5 Student's enrolled degree level?*

Research Higher Degree

C.1.6 At which campus is the Principal Investigator based?*

Melbourne

C.2: Certification of Researchers

C.2.1 Are there any certification, accreditation or credentialling requirements relevant to the conduct of this research?*

○ Yes ◉ No

Section D: Resources

D.1: Project Funding / Support

D.1.1 Which of the following characterises the type(s) of funding being utilised *

- ☐ External Grant(s)-A PRoF (Project Registration online Form) should have already been completed
- ☐ Internal Grant(s)-Competitive
- ☐ Sponsor(s) - A PRoF (Project Registration online Form) should have already been completed
- ☐ Employer / organisation funding (external to ACU) - A PRoF (Project Registration online Form) should have already been completed
- ☐ ACU Department / school funding
- ☑ Other
- ☐ Still seeking funding
- ☐ No funding

D.1.4 Please provide details of funding (or proposed funding)*

RTP Fees Offset Scholarship
RTP Stipend Scholarship

Section E: Other Reviews

E.1: Ethical Reviews

E.1.1 Is ACU the primary HREC?*

◉ Yes ○ No

E.2: Permissions from External Organisations

E.2.1 Do you require any other non-HREC approvals/permissions? (National Statement, 2007, s.2.2.13)*

◉ Yes ○ No

E.2.2 Please provide details of other approvals*

We will comply with any internal ethics or research requirements of the public hospitals.

Please note approvals / permissions not available at the time of submission must be forwarded to ACU HREC on receipt

E.3: Peer Review

E.3.1

The ACU Ethics Committee requires evidence of peer review to ensure that research design is appropriate. The Ethics Committee will only review research where evidence of peer review is attached. Please note that funded research that has undergone a recognised peer review process (e.g. ARC/NHMRC, ACURF etc) does not require additional evidence of peer review.
- HDR students should provide evidence of successful completion of Confirmation of Candidature. Where an HDR student has not yet undergone Confirmation of Candidature, justification from the Supervisor should be provided as to why they are seeking ethics approval at this stage, together with written support from their Head of School attesting to the research merit of the proposal
- non-HDR students should provide evidence of approval from the faculty/school (e.g. Honours Co-ordinator, Research Committee, Head of School, Course co-ordinator)
- where research does not fit into any of the above categories, an email from a colleague (who is not a member of the research team) along the following lines would be sufficient:

- Name of Researcher
- Title of Project
- Statement:
  - I have read the research proposal for the abovenamed project and I consider that:
    - the research methods are appropriate;
    - the sample size supports the research methods, or the sample size is sufficient for the study; and
    - the project has research merit.
  - The statement should also include any editorial comments made, comments about the aims and hypothesis, procedures and protocols and any other suggestions made to the researchers.
- Name of Reviewer
  - Title
  - Qualifications/experience
  - Relationship to researcher

Has the research proposal, including design, methodology and evaluation undergone a peer review process?
Written evidence of peer review must be attached.*
(●) Yes ( ) No

E.3.2 Was the peer review process an ACU process or External process?*

ACU Process

E.3.3 What was the ACU peer-review process?

- Candidature - Please attach evidence of your confirmation
- Thesis Rev - The template may assist the chair
- All other - We strongly recommend the use of the peer review template as shown above

*

Candidature confirmation panel

E.3.4 What date was your Review / Confirmation of Candidature process completed?*

18/08/2021

E.3.8 Was the project deemed to have research merit?*
(●) Yes ( ) No

Section F: Project

F.1: Benefits / Risks

F.1.1 What are the expected benefits (if any) of the project to participants? (National Statement, 2007, s.1.1)*

There are no immediate benefits to the participants of this survey.

F.1.2 What are the expected benefits (if any) of the project to the wider community or in general? (National Statement, 2007, s.1.1)*

Upon completion of this project, the research team hopes that the long-term benefit of this survey will be national discussions around standardisation of nurse-surgeon credentialing and practice regulation in Australia.

F1.3 HREC is of the view that there are always some risks in research even if minor. These risks should be identified at F.1.4. The Committee wants to know that you have thought about the risks to participants.

F.1.4 Describe the possible/potential risks and burdens associated with your research and how they would be managed (outline the risks / burdens not only to the participants, but also to the researchers and any other non-participants.) For applications with higher risk profiles, a risk management plan may be required. Please attach this document at Section M.*

There may be some negligible risks of anonymity breach for participation in this survey. As a risk mitigation strategy to ensure protection of participant anonymity, the collected data will be encrypted and stored in a secure cloud-based repository, and any personal identifiers will be removed as soon as the data has been collected. Should the participant agree to participate in the second phase of this study, some confidentiality risks may arise from participation in the interview. The research team will ensure that participant confidentiality will not be breached by using pseudonyms for the participants' names, places of work, and any potential identifying issues that will emerge during the interview. The student researcher will be educated on the processes by his supervisors who are experts in the area. The supervisors will undertake mock interviews with the student prior to commencement of the interviews and be available for briefing and debriefing following the interviews.

F.1.5 Please identify an organisation / person to whom participants might be referred for counselling, medical or other appropriate support*

LifeLine

F.1.6 Are there any other risks involved in this research? (e.g. to the research team, the organisation, others)*

○ Yes ◉ No

Section G: Conflicts of Interests

G.1: Conflicts of Interests

The following questions relates to National Statement, 2007, s.5.4, s.5.2.10 and s.5.2.11

G.1.1 Are any of the researchers intending to use their own students, patients, clients etc?*
○ Yes ◉ No

G.1.3 Are any of the researchers intending to undertake research in their place of work or in an area where they have a financial or commercial interest?*
○ Yes ◉ No

G.1.5 Will there be any proposed incentive/payment (eg movie tickets, food vouchers) or reimbursement (travel expenses) offered to participants? (National Statement, 2007 s.2.2.9, s.2.2.10)*
○ Yes ◉ No

Section H: Location of Study

H.1: Location, Overseas sites and permissions

H.1.1 Where will the research be conducted?*

External Sites

H.1.3 Please provide names, addresses and contact details of all sites where research will be conducted*

The 671 public non-psychiatric hospitals in Australia will be approached via email. Snowballing will provide the survey to participants in their own homes.

Section I: Participants

I.1: Informed Consent of Participants

I.1.1 Will participants aged 18 and over be asked to give consent? (National Statement, 2007, s.4.2)*
◉ Yes ○ No

I.1.2 How will consent be obtained?

Your response should indicate how consent is being obtained eg: verbal consent (can be used in special circumstances), a consent form, an online process. This response should outline what process is in place for the return or indication of how consent is being provided by participants.
It is consider a minimum standard that written consent be obtained and a copy of the consent form should be attached in the "Attachments" section.
Anonymous surveys may not require a consent form and the information letter would state that return of the non-identifiable survey is consent to participate and that responses cannot be withdrawn as they are not identifiable.

Consent form templates are available on the Human Research Ethics page.*

First phase (anonymous survey) - a radio button will be present on the first page of the survey that the participants will need to click to confirm consent
Second phase (semi-structured interview)- a consent form will need to be signed by the participants prior to the commencement of the study.

I.2: Participant Description

* Surveys involving ACU students must be registered and approved by the University in accordance with the ACU Survey Governance Framework.
The following questions relates to National Statement, 2007 s.1.4

I.2.1 Please provide a brief description of your participants - group 1: (e.g. year 11 students in public schools, childless couples who have been married for 10 or more years, nurses who have been working for at least 5 years, etc...)*

Ahpra-licenced Registered Nurses in the public hospitals of Australia who perform surgeries independently. The survey will expect to have 50 participants (10% males and 90% females). The interviews will expect to have 10 participants (1 male and 9 females). This is based on the fact that 10% of nurses in Australia are male.

I.2.2 Please provide a brief description of your participants - group 2 (if applicable):

This question is not answered.

I.2.3 Please provide a brief description of your participants - group 3 (if applicable):

This question is not answered.

I.2.4 Please provide a brief description of your participants - group 4 (if applicable):

This question is not answered.

I.2.6 Do you intend to include both males and females in this study?*
(●) Yes ( ) No

I.2.8 How many **male** participants are involved in your study? (enter 0 if none)*
5

I.2.9 How many **female** participants are involved in your study? (enter 0 if none)*
45

I.2.10 Since there is a gender imbalance, please explain why this approach is valid:*
Workforce distribution of nurses in Australia is 10% male and 90% female.

I.2.11 Please provide the age range for **male** participants*
20-67

I.2.12 Please provide the age range for **female** participants*
20-67

I.2.13 Participants' state of health:*
(●) Normal ( ) Other

I.3: Recruitment

The following questions relate to National Statement, 2007, s.1.4

I.3.1 What processes will be used to identify potential participants?*
1. Oral abstract presentation of the student researcher at a well-known international conference for perioperative nurses.
2. Emailing of the perioperative managers of all the public hospital in Australia
3. Snowballing via professional networks, social media such as LinkedIn and ResearchGate

I.3.2 Describe how initial contact will be made with potential participants*
1. A QR code will be attached on the presentation slides and poster
2. A RedCap survey link will be posted on the researcher's professional social media platforms
3. An email will be sent to the perioperative nurse manager of each public hospital containing the survey link and professional networks

I.3.3 Is an advertisement, email, website, letter or telephone call proposed as the form of initial contact with potential participants?*
(●) Yes ( ) No

I.3.4 Please provide details of the initial contact. Please also attach a copy of the text/script in the "Attachments" section.*
1. QR code
2. RedCap survey link
3. Email template

I.3.5 How will potential participants indicate their agreement to participate in the research?*
For the anonymous survey, a radio button will be present on the first page of the survey. This will need to be ticked by the participants before proceeding with the survey to confirm consent.

For the semistructured interview, the participants will be provided with a consent form that needs to be signed before proceeding with the interview

I.5: Other Special Groups

I.5.1 Will participants be selected specifically based on cultural or community groups to which they belong (e.g. Refugees or Migrant Groups)?

Aboriginal and Torres Strait Islander Peoples are covered in a separate section*
( ) Yes (●) No

Section J: Overseas Research

J.1: Overview

J.1.1 Will your research be conducted overseas?*
( ) Yes (●) No

J.1.2 Will you be recruiting participants from other countries but conducting your research from Australia

Note: In relation to overseas travel please note the following:
a. STUDENTS: All student international travel must be approved by the DVCR;
b. STUDENTS and STAFF: The travel must comply with ACU travel policy and be booked through Campus Travel;
c. STUDENTS: Overseas travel will require a Variation to Candidature form be submitted requesting approval by the PVCR to do fieldwork overseas;
d. STUDENTS and STAFF: Subject to the above approvals you should ensure that all relevant entry requirements are met.
*

○ Yes ◉ No

Section K: Data Management

K.1: Data Recording and Storage

K.1.1 In what format will the data be stored during the research project? (e.g. paper copy, computer file, USB, audiotape, videotape? What types of computer files will be generated, .doc.xls,PDF?)
If you require further assistance regarding managing your data please contact eresearch@acu.edu.au, or visit ACU Research Data Management Toolkit - for assistance in completing the Data Management component of your application. *

The survey will be developed using RedCap. Survey data will be stored in .xls format. The semistructured interview data will be audiotaped. The audio data and transcription will be in .doc format stored on ACU OneDrive. The completed interview consent forms will be a collection of .pdf files in zipped format which will be stored on ACU OneDrive.

K.1.2 In which room and at which campus of ACU will the primary data be stored during the study? (If electronic data, please specify how it will be stored)*

During the study, the electronic data will be password-encrypted and stored on ACU OneDrive.

K.1.3 In which room and at which campus of ACU will the primary data be stored following completion of the study? (If electronic data, please specify how it will be stored)*

Following completion of the study, the electronic data will be archived on ACU OneDrive server.

K.1.4 Specify the measures to be taken to ensure the security of information from misuse, loss, or unauthorised access while stored during and after the research project? (e.g. will identifiers be removed and at what stage? Will the information be physically stored in a locked cabinet?)*

All electronic data will be password-encrypted and stored on ACU OneDrive.

K.2: Disposal of Data

K.2.1 How are the data to be disposed of after complying with the requirement to retain data for a minimum of fifteen (15) years?
Please refer to the ACU Records Retention and Disposal Schedule (part 13) for full details.

Please refer to the ACU Research Data Management Toolkit for a guide to retaining and archiving your data.*

The data will be destroyed after 15 years, from the time that the results of the research are published.

K.3: Dissemination of Results

K.3.1 Is it intended that the results of the study be published?*

◉ Yes ○ No

K.3.2 Please explain where the results are likely to be published*

International nursing journals will be approached for publication

K.3.3 Do you intend to use the results of your study in publications or in other communications with colleagues?*

◉ Yes ○ No

You have indicated 'Yes' to this question. Participants must be advised both in the *Information Letter to Participants* and on the *Consent Form*, if applicable, that the results from the study may be summarised and appear in publications or may be provided to other researchers in a form that does not identify the participants in any way.

K.3.5 Is it intended that the results of the research that relate to a specific participant be reported to that participant?*

○ Yes ◉ No

K.3.8 Justify why results will not be communicated to participants*

The collected data will be identifiable. Pseudonyms will be applied during data analysis and publication. Copies of published papers will be provided to the participating public hospitals upon request.

K.3.9 Is it intended that results that relate to a specific participant be reported to anyone other than that participant?*

○ Yes ◉ No

K.3.13 Will the confidentiality of participants and their data be protected in the dissemination of research results?*

◉ Yes ○ No

K.3.15 Explain how confidentiality of participants and their data will be protected in the dissemination of research results*

The collected data will be non-identifiable and the results will be reported in aggregate form only or pseudonyms for individual participants.
Interview participants will be reported using psuedonyms to protect personal identities.

Section L: Confidentiality / Privacy

L.1: Access to Personal Information

L.1.1 Will the project involve access to personal information, student files, computerised records or other data banks, human pathology or diagnostic specimens provided by one or more institutions or government departments?*

○ Yes ◉ No

L.2: Identifiability of Participants

The following questions relates to National Statement, 2007, s.3.2

L.2.1 In what format will the data be **collected**?*

☑ Individually identifiable data
☐ Re-identifiable data
☑ Non-identifiable data

L.2.2 Will the identity of any participant be disclosed to anyone other than the researcher/s?*

○ Yes ◉ No

L.3: Confidentiality of Participants' Responses

L.3.1 What measures will be taken to protect the confidentiality of the personal information gathered in this project? (e.g. removal of names and other identifiers either before, during or after analysis of data; reporting aggregated data only)*

Anonymous survey - the collected data will be non-identifiable and reported in aggregate form only
Semi-structured interview - removal of identifiers through the use of pseudonyms and codes after analysis of qualitative data

L.3.2 In this project are there any particular risks to the confidentiality of personal information (e.g. reporting non-aggregated data or descriptive data from small samples)? If so, how is it proposed to minimise them? *

There may be some confidentiality risks for the participants of the follow-up qualitative interview. The research team will ensure that participant confidentiality will not be breached by using pseudonyms or codes for the participants' names, places of work, and any other potentially identifying issues that will emerge during the interview.

L.4: Privacy

Researchers should be familiar with the existence of relevant Commonwealth, State and Territory legislation regarding privacy. Of special note are the Australian Privacy Principles and the Privacy Act 1988.

L.4.1 Are you aware of any privacy issues that may impact on participants?*

○ Yes ◉ No

Section M: Attachments

M.3: Other documents

M.3.1 Please attach the relevant documents listed below (please use ZIP file if there are more than 1 document per item).
If you are submitting a new version of a previously uploaded document, please use the "Add" button and leave the original file as-is to allow Res.Ethics team to track the changes.

Applications created by students will require the Supervisor sign off. Once submitted the Orion application will be forwarded to the Supervisor for completion of the "Supervisor Checklist".
Applications that involve Co-investigators should ensure that the **signature document** is completed by all researchers to acknowledge their participation in this project. *

1	Document type	Soft copy
	Reference (Document Title)	Proposal 01Feb22EJ.docx
	Name	Research Proposal
	Description	Research Proposal
2	Document type	Soft copy
	Reference (Document Title)	QUAL Participant information letter020322.docx
	Name	Participant Information Letter (Revised letters must contain suitably highlighted changes)
	Description	Qualitative Phase - Participation Information Sheet
3	Document type	Soft copy
	Reference (Document Title)	Investigator signatures ethics_080222.pdf
	Name	Investigators' Signatures**

	Description	Investigators' signatures
4	Document type	Soft copy
	Reference (Document Title)	Consent formEJ.doc
	Name	Consent Form (Revised forms must contain suitably highlighted changes)
	Description	Consent Form
5	Document type	Soft copy
	Reference (Document Title)	Email script and advertisement 040322.docx
	Name	Advertisement text / script
	Description	
6	Document type	Soft copy
	Reference (Document Title)	Confirmation_of_Candidature_Form_Grota.docx
	Name	Peer Review
	Description	Confirmation of candidature
7	Document type	Soft copy
	Reference (Document Title)	Quant questionnaire.docx
	Name	Questionnaires / Interview Questions
	Description	Quantitative survey questionnaire
8	Document type	Soft copy
	Reference (Document Title)	
	Name	Ethics approval from overseas research sites
	Description	
9	Document type	Soft copy
	Reference (Document Title)	
	Name	Non-HREC Review Approval letters
	Description	
10	Document type	Soft copy
	Reference (Document Title)	
	Name	External HREC Approval letters
	Description	
11	Document type	Soft copy
	Reference (Document Title)	
	Name	Other approvals / permissions from overseas research sites
	Description	
12	Document type	Soft copy
	Reference (Document Title)	
	Name	Proforma for gaining the consent of the person responsible*
	Description	
13	Document type	Soft copy
	Reference (Document Title)	QUANT Participant information letter020322.docx
	Name	Embedded Participant Information Letter 2 (Revised letters must contain suitably highlighted changes)
	Description	Quantitative Phase - Participant Information Sheet
14	Document type	Soft copy
	Reference (Document Title)	Semi-structured interview questions.docx
	Name	Interview questions
	Description	
15	Document type	Soft copy
	Reference (Document Title)	Quant questionnaire 150322.docx
	Name	Updated survey
	Description	
16	Document type	Soft copy

	Reference (Document Title)	QUAL Participant information letter150322.docx
	Name	Updated Interview PIL
	Description	

Please ensure you have attached the advertisement text / script, as you have indicated advertising is used in the Participants: Recruitment section

Further information on how to respond to comments and upload documents is available from the Researcher Amendment Guidelines document available under the heading Introduction / Overview.

For ethics team: Show Documents Uploaded with Date

Section N: Office Use Only

N.1: Ethics Officer Review

N.1.1 Risk Assessment Outcome

Show Documents Uploaded with Date *

Low Risk

N.1.2 Workflow Branch*

Low Risk Branch

Date Approved

15/03/2022

Status

Approved

Section O: Checklist

O.2: Checklist - For Supervisor

Approvals

O.2.1 I/we declare that until written approval has been received from HREC and any external approvals:*

- ☑ Data collection will not commence
- ☑ Participants will not be approached
- ☑ Participants' records/files/specimens will not be accessed

Research Project

O.2.2 I attest that:*

- ☑ I have provided a step by step description of participant recruitment
- ☑ I have read and adhered to ACU Guidelines for Applicants to Human Research Ethics Committee (HREC)
- ☑ The Principal Investigator is accountable for the conduct of the research
- ☑ The project has been articulated in clear, concise, lay language
- ☑ I have checked the application and its attachments
- ☑ This research has been peer-reviewed and has been deemed to be methodologically sound

O.2.3 I accept responsibility for:*

- ☑ The conduct of this research in accordance with any other conditions specified by the HREC of ACU
- ☑ The conduct of this research in accordance with NHMRC principles

O.2.4 Please acknowledge you have a statement from a medical practitioner/psychologist/counselor to provide professional assistance, if you have specified your project as:
- More than low risk (in "Administrative Section : Level of Risk") *and*
- Have procedures which might have an adverse effect on a participant's wellbeing

(Select "(N/A)" if not applicable)*

◉ (N/A) ○ I have such a statement

Documents

O.2.5 I have attached all supporting documents (where appropriate):

- ☐ Ethics approval from external institutions (e.g. hospitals, schools) if available/applicable
- ☐ Approval letter(s) from any external organisation(s) involved in your research (if applicable)
- ☐ Letter of support from the Centre of Indigenous Education and Research (CIER) (if applicable)
- ☑ Copies of all questionnaires and interview schedules**
- ☑ Letter and consent forms follow the recommended format and wording on the ACU website*
- ☑ Information letter and consent forms are free from spelling, typographical and grammatical errors
- ☑ Information letter and consent forms are on current ACU letterhead
- ☑ The Information Letter to Participants and Consent Form(s)
- ☑ Research Proposal (as requested at the "Attachments : Other documents" section)

You must notify the Human Research Ethics Committee immediately of any variation to this project e.g. Changes to the number or mix of participants, to research procedures, to the survey instruments or questionnaires.

Continue

Next

Please click the Submit Application button below to submit your application to the Office of Research Services.

Submit Application

Appendix D. ACU HREC approval letter

Friday, April 1, 2022 at 17:45:59 Australian Eastern Daylight Time

Subject: [2022-2426E] - Ethics application approved!
Date: Tuesday, 15 March 2022 at 3:06:20 pm Australian Eastern Daylight Time
From: Leanne Stirling on behalf of Res Ethics
To: Elisabeth Jacob
CC: Tenber Grota, Vasiliki Betihavas, Adam Burston, Res Ethics

Dear Applicant,

Chief Investigator: Professor Beth Jacob
Assoc. Prof. Vasiliki Betihavas, Dr Adam Burston
Student Researcher: Tenber Grota,
Ethics Register Number: 2022-2426E
Project Title: Nurse-surgeons in the Australian public health system: A mixed methods study
Date Approved: 15/03/2022
End Date: 30/08/2023

This is to certify that the above human ethics application has been reviewed by the Australian Catholic University Human Research Ethics Committee (ACU HREC). The application has been approved for the period given above.

Continued approval of this research project is contingent upon the submission of an annual progress report which is due on/before each anniversary of the project approval. A final report is due upon completion of the project. A report proforma can be downloaded from the ACU Research Ethics website.

Researchers are responsible for ensuring that all conditions of approval are adhered to and that any modifications to the protocol, including changes to personnel, are approved prior to implementation. In addition, the ACU HREC must be notified of any reportable matters including, but not limited to, incidents, complaints and unexpected issues.

Researchers are also responsible for ensuring that they adhere to the requirements of the National Statement on Ethical Conduct in Human Research, the Australian Code for the Responsible Conduct of Research and the University's Research Code of Conduct.

Any queries relating to this application should be directed to the Ethics Secretariat (res.ethics@acu.edu.au). Please quote your ethics approval number in all communications with us.

We wish you every success with your research.

Kind regards,

Leanne Stirling
on behalf of ACU HREC Chair, Assoc Prof. Michael Baker

Research Ethics Officer | Research Services | Office of the Deputy Vice-Chancellor (Research)
Australian Catholic University
T: +61 2 9739 2646 E: res.ethics@acu.edu.au

THIS IS AN AUTOMATICALLY GENERATED RESEARCHMASTER EMAIL

Page 1 of 1

Appendix E. Participant Information Letter for the quantitative survey

PARTICIPANT INFORMATION LETTER

PROJECT TITLE: Nurse-surgeons in the Australian public health system: A mixed-methods study – Quantitative phase
APPLICATION NUMBER: 2022-2426E
PRINCIPAL SUPERVISOR / CHIEF INVESTIGATOR: Professor Elisabeth Jacob
STUDENT RESEARCHER: Mr Tenber Grota
STUDENT'S DEGREE: Doctor of Philosophy

Dear Participant,

You are invited to participate in the research project described below.

What is the project about?
The research project is investigating nurse-surgeons practicing in the Australian public health system. Nurse-surgeons are nurses who are trained to perform surgeries independently. The aim of this survey is to explore the role, training, education, and career prospects of nurse-surgeons in the Australian public health system. This survey will be the first of its kind to investigate and analyse nurse-surgeons in Australia. The research team hope that this project will form the foundation for future research and national policy developments around nurse-surgeon credentialing and practice regulation in Australia.

Who is undertaking the project?
This survey is being conducted by Mr Tenber Grota, and will form the basis for the degree of Doctor of Philosophy at the Australian Catholic University under the supervision of Professor Elisabeth Jacob (Head, School of Nursing, Midwifery and Paramedicine – Australian Catholic University), Associate Professor Vasiliki Betihavas (Deputy Head, School of Nursing, Midwifery and Paramedicine – Australian Catholic University) and Dr Adam Burston (Senior Lecturer, School of Nursing, Midwifery and Paramedicine – Australian Catholic University). Tenber Grota has a strong background in perioperative nursing with 13 years of experience as a Director of Nursing, Perioperative Services Manager, Nurse Unit Manager, Theatre Floor Coordinator, and Registered Nurse in Australia, New Zealand, and the Philippines.

Who can take part in the project?
Currently employed Registered Nurses and Nurse Practitioners who are undertaking surgical procedures independently will be eligible to participate in this survey. These nurses must be registered with the Australian Health Practitioner Regulation Agency. The research team is looking for participation from nurse-surgeons practicing within the public health system. The settings of nurse-surgeon practice include, but are not limited to, operating theatre, day surgery unit, outpatient clinic, interventional radiology, catheterisation laboratory unit, endoscopy unit, emergency department, and intensive care unit. All surgical specialties will be considered. Surgical assistants who perform pure surgical assisting functions are excluded from this survey as they do not perform independent surgeries independently. Surgical assistant titles include, but are not limited to, Perioperative Nurse Surgeon's Assistant, Non-Medical Surgical Assistant, Registered Nurse First Surgical Assistant, and Registered Nurse First Assistant.

What will I be asked to do?
As a participant, you will be asked to complete an online survey that was developed using the RedCap® software. The survey will take approximately 15 minutes to complete. The survey will have three sets of questions in close-ended and short open-ended formats relating to your role, training and education, and perceptions as a nurse-surgeon. There will be an "I consent" button on the first page of the survey to confirm your consent to participate. You will also be provided with a prompt at the end of the survey stating that clicking "Submit" indicates consent and the inability to withdraw the data due to the anonymous nature of the research.

How much time will the project take?
You will need at least 15 minutes to complete this online survey.

Are there any risks associated with participating in this project?
As the survey is anonymous there is no risk to your personal details being released. The survey does ask for your email address if you would like to participate in the second phase of this research project, which will be a semi-structured interview. Your email address will be kept separate from the survey via a link that will open a new window. Despite the anonymity of the survey, due to the expected small number of nurses who practice in this area in Australia, there is some risk that individual comments may be identifiable to persons who know the participants. Please refrain from writing anything that will identify you, as all personal identifiers will be removed as soon as the data has been collected. There is a possibility that you may experience some distress if you experienced lack of support from your workplace. You can decide to skip the short open-ended questions, take a break, or withdraw completely from the survey by simply closing the browser. Please note however, that you cannot withdraw after you have submitted your survey, as surveys are non-identifiable. If you feel that you experienced distress, please contact LifeLine using the details below or your employee assistance programme.

Lifeline contact details:
Website: https://www.lifeline.org.au/
Phone: 13 11 14

What are the benefits of the research project?
There are no immediate benefits to the participants of this survey. However, upon completion of this project, the research team hope that the long-term benefit of this survey to the participants will be national discussions around standardisation of nurse-surgeon credentialing and practice regulation in Australia.

Can I withdraw from the study?
Participation in this survey is completely voluntary. You are not under any obligation to participate. If you agree to participate, you can also withdraw from the survey without adverse consequences.

Will anyone else know the results of the project?
Your personal information and responses will be strictly confidential and the data from this survey will be reported only in the aggregate. The research team will be publishing the results from this study which may be summarised and appear in publications or may be provided to other researchers in a form that does not identify you as a participant in any way. Once published, the results will be publicly available.

Will I be able to find out the results of the project?
The results or a summary of the results will be made available to the public upon completion of this study. Because the data will be non-identifiable, the research team will not be able to provide you a personal copy of the results. However, the public hospitals in Australia will be informed once the results have been published.

Who do I contact if I have questions about the project?
Please contact Mr Tenber Grota on tenber.grota@myacu.edu.au if you have any questions about the survey.

What if I have a complaint or any concerns?
The study has been reviewed and approved by the Human Research Ethics Committee at the Australian Catholic University (review number 2022-2426E). If you have any complaints or concerns about the conduct of the project, you may write to the Manager of the Human Research Ethics and Integrity Committee care of the Office of the Deputy Vice Chancellor (Research).

Manager, Ethics and Integrity
c/o Office of the Deputy Vice Chancellor (Research)
Australian Catholic University
North Sydney Campus
PO Box 968
NORTH SYDNEY, NSW 2059
Ph.: 02 9739 2519
Fax: 02 9739 2870
Email: resethics.manager@acu.edu.au

Any complaint or concern will be treated in confidence and fully investigated. You will be informed of the outcome.

Yours sincerely,

PROFESSOR ELISABETH JACOB (PRINCIPAL SUPERVISOR / CHIEF INVESTIGATOR)
ASSOCIATE PROFESSOR VASILIKI BETIHAVAS (CO-SUPERVISOR)
DR ADAM BURSTON (ASSISTANT SUPERVISOR)
MR TENBER GROTA (STUDENT RESEARCHER)

Appendix F. Consent form for the qualitative interview

School of Nursing, Midwifery and Paramedicine
Faculty of Health Sciences

CONSENT FORM

TITLE OF PROJECT: Nurse-surgeons in the Australian public health system: A mixed-methods study – Qualitative phase

APPLICATION NUMBER: 2022-2426E

(NAME OF) PRINCIPAL SUPERVISOR: Professor Elisabeth Jacob

(NAME OF) STUDENT RESEARCHER: Mr Tenber Grota

I ..... *(the participant)* have read (*or, where appropriate, have had read to me)* and understood the information provided in the Participant Information Sheet. Any questions I have asked have been answered to my satisfaction. I agree to participate in the interview phase of the research project entitled "Nurse-surgeons in the Australian public health system: A mixed-methods study"*,* realising that I can withdraw my consent at any time prior to publications without adverse consequences. I agree that research data collected for the study may be published or may be provided to other researchers in a form that does not identify me in any way.

NAME OF PARTICIPANT: .....

SIGNATURE: ..... DATE: .....

SIGNATURE OF PRINCIPAL SUPERVISOR: .....

DATE: .....

(and, if applicable)

SIGNATURE OF STUDENT RESEARCHER: .....

DATE: .....

Appendix G. Participant Information Letter for the qualitative interview

AUSTRALIAN CATHOLIC UNIVERSITY

PARTICIPANT INFORMATION LETTER

PROJECT TITLE: Nurse-surgeons in the Australian public health system: A mixed-methods study - Qualitative phase
APPLICATION NUMBER: 2022-2426E
PRINCIPAL SUPERVISOR / CHIEF INVESTIGATOR: Professor Elisabeth Jacob
STUDENT RESEARCHER: Mr Tenber Grota
STUDENT'S DEGREE: Doctor of Philosophy

Dear Participant,

You are invited to participate in the research project described below.

What is the project about?
The research project is investigating nurse-surgeons practicing in the Australian public health system. Nurse-surgeons are nurses who are trained to perform surgeries independently. The aim of this project is to explore the experiences of nurse-surgeons in the Australian public health system. This project will be the first of its kind to investigate and analyse nurse-surgeons in Australia. The research team hope that this project will form the foundation for future research and national policy developments around nurse-surgeon credentialing and practice regulation in Australia.

Who is undertaking the project?
This project is being conducted by Tenber Grota, which will form the basis for the degree of Doctor of Philosophy at the Australian Catholic University under the supervision of Professor Elisabeth Jacob (Head, School of Nursing, Midwifery and Paramedicine – Australian Catholic University), Associate Professor Vasiliki Betihavas (Deputy Head, School of Nursing, Midwifery and Paramedicine – Australian Catholic University) and Dr Adam Burston (Senior Lecturer, School of Nursing, Midwifery and Paramedicine – Australian Catholic University). Tenber Grota has a strong background in perioperative nursing with 13 years of experience as a Director of Nursing, Perioperative Services Manager, Nurse Unit Manager, Theatre Floor Coordinator, and Registered Nurse in Australia, New Zealand, and the Philippines.

Who can take part in the project?
Currently employed Registered Nurses and Nurse Practitioners who are undertaking surgical procedures independently will be eligible to participate in an interview. To participate, nurses must be registered with the Australian Health Practitioner Regulation Agency. The research team is looking for participation from nurse-surgeons practicing within the public health system. The settings of nurse-surgeon practice include, but are not limited to, operating theatre, day surgery unit, outpatient clinic, interventional radiology, catheterisation laboratory unit, endoscopy unit, emergency department, and intensive care unit. All surgical specialties will be considered. Surgical assistants are excluded from this survey as they do not perform surgeries independently. Surgical assistant titles include, but are not limited to, Perioperative Nurse Surgeon's Assistant, Non-Medical Surgical Assistant, Registered Nurse First Surgical Assistant, and Registered Nurse First Assistant.

What will I be asked to do?
As a participant in a virtual interview, you will be asked to log in to Zoom® or Microsoft Teams® via a secure link that will be sent to the email address that you have nominated during the quantitative survey phase of the study. This interview will be semi-structured which means that the questions will be open-ended and can be further expanded on to explore concepts of interest. The interview will take approximately one hour to complete. The interviews will be determined by appointment. The interview will be audio recorded for transcription purposes. After the interview and upon completion of the transcription of your interview, you will be sent an email containing the transcript which will provide you an opportunity to review the document and make corrections. The recordings will be transcribed by Pacific Transcription and stored on the Australian Catholic University OneDrive®.

How much time will the project take?
You will need at least one hour to complete the semi-structured interview. No follow-up visits are required following completion of the interview.

Are there any risks associated with participating in this project?
There may be some confidentiality risks for your participation in the interview. The research team will ensure that participant confidentiality will not be breached by using pseudonyms for the participants' names, places of work, and any potential identifying issues that will emerge during the interview. There is a possibility that you may experience some distress if you experienced lack of support from your workplace. During the interview, you will be allowed to take a break where necessary or terminate and withdraw from the interview completely by exiting the meeting session. If you feel that you experienced distress, please contact LifeLine using the details below or your employee assistance programme.

Lifeline contact details:
Website: https://www.lifeline.org.au/
Phone: 13 11 14

What are the benefits of the research project?
There are no immediate benefits to the participants of this interview. However, upon completion of this project, the research team hopes that the long-term benefit of this survey to the participants will be national discussions around standardisation of nurse-surgeon credentialing and practice regulation in Australia.

Can I withdraw from the study?
Participation in this interview is completely voluntary. You are not under any obligation to participate. You can withdraw from the project at any time prior to publication without adverse consequences.

Will anyone else know the results of the project?
The research team will be publishing the results from this study which may be summarised and appear in publications or may be provided to other researchers in a form that does not identify you as a participant in any way. Once published, the results will be publicly available.

Will I be able to find out the results of the project?
The results or a summary of the results will be made available to the public through publication once the project is completed. All perioperative nursing managers of the participating public hospitals in Australia will be informed once the results have been published.

Who do I contact if I have questions about the project?
Please contact Mr. Tenber Grota on tenber.grota@myacu.edu.au if you have any questions about the interview.

What if I have a complaint or any concerns?
The study has been reviewed by the Human Research Ethics Committee at Australian Catholic University (review number 2022-2426E). If you have any complaints or concerns about the conduct of the project, you may write to the Manager of the Human Research Ethics and Integrity Committee care of the Office of the Deputy Vice Chancellor (Research).

Manager, Ethics and Integrity
c/o Office of the Deputy Vice Chancellor (Research)
Australian Catholic University
North Sydney Campus
PO Box 968
NORTH SYDNEY, NSW 2059
Ph.: 02 9739 2519
Fax: 02 9739 2870
Email: resethics.manager@acu.edu.au

Any complaint or concern will be treated in confidence and fully investigated. You will be informed of the outcome.

I want to participate! How do I sign up?
Please contact tenber.grota@myacu.edu.au to schedule you an interview.

Yours sincerely,

PROFESSOR ELISABETH JACOB (PRINCIPAL SUPERVISOR / CHIEF INVESTIGATOR)
ASSOCIATE PROFESSOR VASILIKI BETIHAVAS (CO-SUPERVISOR)
DR ADAM BURSTON (ASSISTANT SUPERVISOR)
MR TENBER GROTA (STUDENT RESEARCHER)

Please retain a copy of this information letter

Appendix H. Pop-up invitation

Confidential

Follow-up interview

We will be conducting a qualitative follow up interview to further understand our findings in the survey that you have just completed. Would you be willing to participate in the follow up interview?	◯ Yes ◯ No
Thank you for selecting "Yes". We will be in contact soon. Please provide your email address below.	_____

Appendix I. Survey QR code

Appendix J. HREC-approved email template

This project receives financial support from the **Australian Government through the Research Training Program Scholarship of the Department of Education, Skills, and Employment.*

To whom it may concern,

We are currently conducting a study of the roles, training, education, and perceptions of practicing nurse-surgeons in the Australian public health system. The study is being conducted by Mr. Tenber Grota, a current Doctor of Philosophy (Nursing) candidate, under the supervision of Professor Elisabeth Jacob, Associate Professor Vasiliki Betihavas and Dr. Adam Burston.

Nurse-surgeons are nurses trained to perform surgeries independently (Grota et al., 2021; White et al., 1987). For the purpose of this study, we are using the World Health Organisation's definition of surgery as *any invasive procedures that is performed aseptically, and usually with the use of appropriate anaesthesia, by trained surgeons, other physicians, nurses, and other non-physicians to investigate and/or treat surgical conditions* (Debas et al., 2006). To be eligible for participation, the nurse should be currently practicing and performing surgeries independently. Some of the documented nurse-performed surgeries include (but is not limited to) caesarean section, hysterectomy, laparotomy, carpal tunnel surgery, circumcision, yttrium aluminium garnet laser capsulotomy treatments, chalazion surgeries, laceration repair, removal of skin lesions, biopsy, sigmoidoscopy, hysteroscopy, colonoscopy, and cystoscopy. Nurse-surgeons can practice in different settings. Below are some of the most common settings:

1. A Registered Nurse or Nurse Practitioner with an elective surgical list in an operating theatre.
2. A Registered Nurse or Nurse Practitioner performing minor surgeries in the emergency department, intensive care unit or ward.
3. A Registered Nurse or Nurse Practitioner performing emergency surgeries and/or cancer diagnostic procedures such as endoscopies and cystoscopies in a rural, regional, or remote setting.
4. A Registered Nurse or Nurse Practitioner with hybrid roles. For example, in a given day, this nurse functions as 30% theatre (scrub/scout) nurse, 50% surgical assistant and 20% nurse-surgeon.
5. A Nurse-Practitioner in an outpatient clinic performing surgeries.

We are now recruiting participants for Phase 1 of the study and are asking for your assistance in identifying practicing nurse-surgeons.

Once you confirm the presence of nurse-surgeons in your facility, we will seek appropriate ethical approval from your facility, and then send the survey link with the participant information letter to you for distribution to your nurse-surgeons.

If you would like further details of the study, please contact Mr Tenber Grota tenber.grota@myacu.edu.au or Professor Elisabeth Jacob Elisabeth.jacob@acu.edu.au

Thank you for your assistance and we look forward to hearing from you soon.

Appendix K. Developed and developing countries.

Developed Countries		
Andorra	Iceland	Portugal
Australia	Ireland	Puerto Rico
Austria	Israel	San Marino
Belgium	Italy	Singapore
Canada	Japan	Slovak Republic
Cyprus	Korea	Slovenia
Czech Republic	Latvia	Spain
Denmark	Lithuania	Sweden
Estonia	Luxembourg	Switzerland
Finland	Macao SAR	Taiwan Province of China
France	Malta	
Germany	Netherlands	United Kingdom
Greece	New Zealand	United States
Hong Kong SAR	Norway	

Developing Countries		
Afghanistan	The Gambia	Paraguay
Albania	Georgia	Peru
Algeria	Ghana	Philippines
Angola	Grenada	Poland
Antigua and Barbuda	Guatemala	Qatar
	Guinea	Romania
Argentina	Guinea-Bissau	Russia
Armenia	Guyana	Rwanda
Aruba	Haiti	Samoa
Azerbaijan	Honduras	São Tomé and Príncipe
The Bahamas	Hungary	
Bahrain	India	Saudi Arabia
Bangladesh	Indonesia	Senegal
Barbados	Iran	Serbia
Belarus	Iraq	Seychelles
Belize	Jamaica	Sierra Leone
Benin	Jordan	Solomon Islands
Bhutan	Kazakhstan	Somalia
Bolivia	Kenya	South Africa
Bosnia and Herzegovina	Kiribati	South Sudan
	Kosovo	Sri Lanka
Botswana	Kuwait	St. Kitts and Nevis
Brazil	Kyrgyz Republic	St. Lucia
Brunei Darussalam	Lao P.D.R.	St. Vincent and the Grenadines
Bulgaria	Lebanon	
Burkina Faso	Lesotho	Sudan
Burundi	Liberia	Suriname
Cabo Verde	Libya	Syria
Cambodia	Madagascar	Tajikistan
Cameroon	Malawi	Tanzania
Central African Republic	Malaysia	Thailand
	Maldives	Timor-Leste
Chad	Mali	Togo
Chile	Marshall Islands	Tonga
China	Mauritania	Trinidad and Tobago
Colombia	Mauritius	Tunisia
Comoros	Mexico	Turkey
Democratic Republic of the Congo	Micronesia	Turkmenistan
	Moldova	Tuvalu
	Mongolia	Uganda
Republic of Congo	Montenegro	Ukraine
Costa Rica	Morocco	United Arab Emirates
Côte d'Ivoire	Mozambique	
Croatia	Myanmar	Uruguay
Djibouti	Namibia	Uzbekistan

Dominica	Nauru	Vanuatu
Dominican Republic	Nepal	Venezuela
Ecuador	Nicaragua	Vietnam
Egypt	Niger	West Bank and Gaza
El Salvador	Nigeria	
Equatorial Guinea	North Macedonia	Yemen
Eritrea	Oman	Zambia
Eswatini	Pakistan	Zimbabwe
Ethiopia	Palau	
Fiji	Panama	
Gabon	Papua New Guinea	

Adapted from the International Monetary Fund, 2022

Appendix L. Commonwealth declared public hospitals in Australia

Appendix M. Email template to public hospitals

Sunday, July 17, 2022 at 16:15:28 Australian Eastern Standard Time

Subject: Request for assistance in undertaking a nationwide Nursing survey
Date: Friday, 22 April 2022 at 1:32:18 pm Australian Eastern Standard Time
From: Tenber Grota
To: YHinfo@yh.org.au
CC: Tenber Grota
Attachments: image002.png

This project receives financial support from the **Australian Government through the Research Training Program Scholarship of the Department of Education, Skills, and Employment.*

To whom it may concern,

We are currently conducting a study of the roles, training, education, and perceptions of practicing nurse-surgeons in the Australian public health system. The study is being conducted by Mr. Tenber Grota, a current Doctor of Philosophy (Nursing) candidate, under the supervision of Professor Elisabeth Jacob, Associate Professor Vasiliki Betihavas and Dr. Adam Burston.

Nurse-surgeons are nurses trained to perform surgeries independently (Grota et al., 2021; White et al., 1987). For the purpose of this study, we are using the World Health Organisation's definition of surgery as *any invasive procedures that is performed aseptically, and usually with the use of appropriate anaesthesia, by trained surgeons, other physicians, nurses, and other non-physicians to investigate and/or treat surgical conditions* (Debas et al., 2006). To be eligible for participation, the nurse should be currently practicing and performing surgeries independently. Some of the documented nurse-performed surgeries include (but is not limited to) caesarean section, hysterectomy, laparotomy, carpal tunnel surgery, circumcision, yttrium aluminium garnet laser capsulotomy treatments, chalazion surgeries, laceration repair, removal of skin lesions, biopsy, sigmoidoscopy, hysteroscopy, colonoscopy, and cystoscopy. Nurse-surgeons can practice in different settings. Below are some of the most common settings:

1. A Registered Nurse or Nurse Practitioner with an elective surgical list in an operating theatre.
2. A Registered Nurse or Nurse Practitioner performing minor surgeries in the emergency department, intensive care unit or ward.
3. A Registered Nurse or Nurse Practitioner performing emergency surgeries and/or cancer diagnostic procedures such as endoscopies and cystoscopies in a rural, regional, or remote setting.
4. A Registered Nurse or Nurse Practitioner with hybrid roles. For example, in a given day, this nurse functions as 30% theatre (scrub/scout) nurse, 50% surgical assistant and 20% nurse-surgeon.
5. A Nurse-Practitioner in an outpatient clinic performing surgeries.

We are now recruiting participants for Phase 1 of the study and are asking for your assistance in identifying practicing nurse-surgeons.

Once you confirm the presence of nurse-surgeons in your facility, we will seek appropriate ethical approval from your facility, and then send the survey link with the participant information letter to you for distribution to your nurse-surgeons.

If you would like further details of the study, please contact Mr Tenber Grota tenber.grota@myacu.edu.au or Professor Elisabeth Jacob Elisabeth.jacob@acu.edu.au

Thank you for your assistance and we look forward to hearing from you soon.

Kind regards,

Ten Grota
RN, PGDipHSc(AdvNurs), MMgt(HSM), PhD(cand)
Sessional Academic

School of Nursing, Midwifery and Paramedicine
Faculty of Health Sciences
Australian Catholic University

E: tenber.grota@myacu.edu.au
W: www.acu.edu.au

I acknowledge the Traditional Owners of Country throughout Australia and their continuing connection to land, sea, and community. I honour our Elders past, present and emerging.

Appendix N. Social media advertisement

Social media advertisement

We are now recruiting participants for Phase 1 of our study, which aims to explore the roles, training, education, and perceptions of practicing nurse-surgeons in the Australian public health system. Nurse-surgeons are nurses trained to perform surgeries independently (Grota et al., 2021; White et al., 1987). For the purpose of this study, we are using the World Health Organisation's definition of surgery as *any invasive procedures that is performed aseptically, and usually with the use of appropriate anaesthesia, by trained surgeons, other physicians, nurses, and other non-physicians to investigate and/or treat surgical conditions* (Debas et al., 2006). To be eligible for participation, the Registered Nurse or Nurse Practitioner should be currently practicing and performing surgeries independently within the Australian public health system. Please click the link below to access the participant information letter and complete the survey.

https://rdcap.acu.edu.au/surveys/?s=E9YXAW7PYR

Appendix O. Electronic direct mail to members of the Australian College of Perioperative Nurses

Sunday, July 31, 2022 at 18:53:51 Australian Eastern Standard Time

Subject: Nurse-surgeons in the Australian public health system: A mixed methods study
Date: Monday, 27 June 2022 at 6:06:57 pm Australian Eastern Standard Time
From: Bronwyn Weeks
To: Tenber Grota

ACORN My Membership

Hi Tenber,

ACU
AUSTRALIAN CATHOLIC UNIVERSITY

We are currently conducting a study of the roles, training, education, and perceptions of practicing nurse-surgeons in the Australian public health system. The study is being conducted by Mr. Tenber Grota, a current Doctor of Philosophy (Nursing) candidate, under the supervision of Professor Elisabeth Jacob, Associate Professor Vasiliki Betihavas and Dr. Adam Burston.

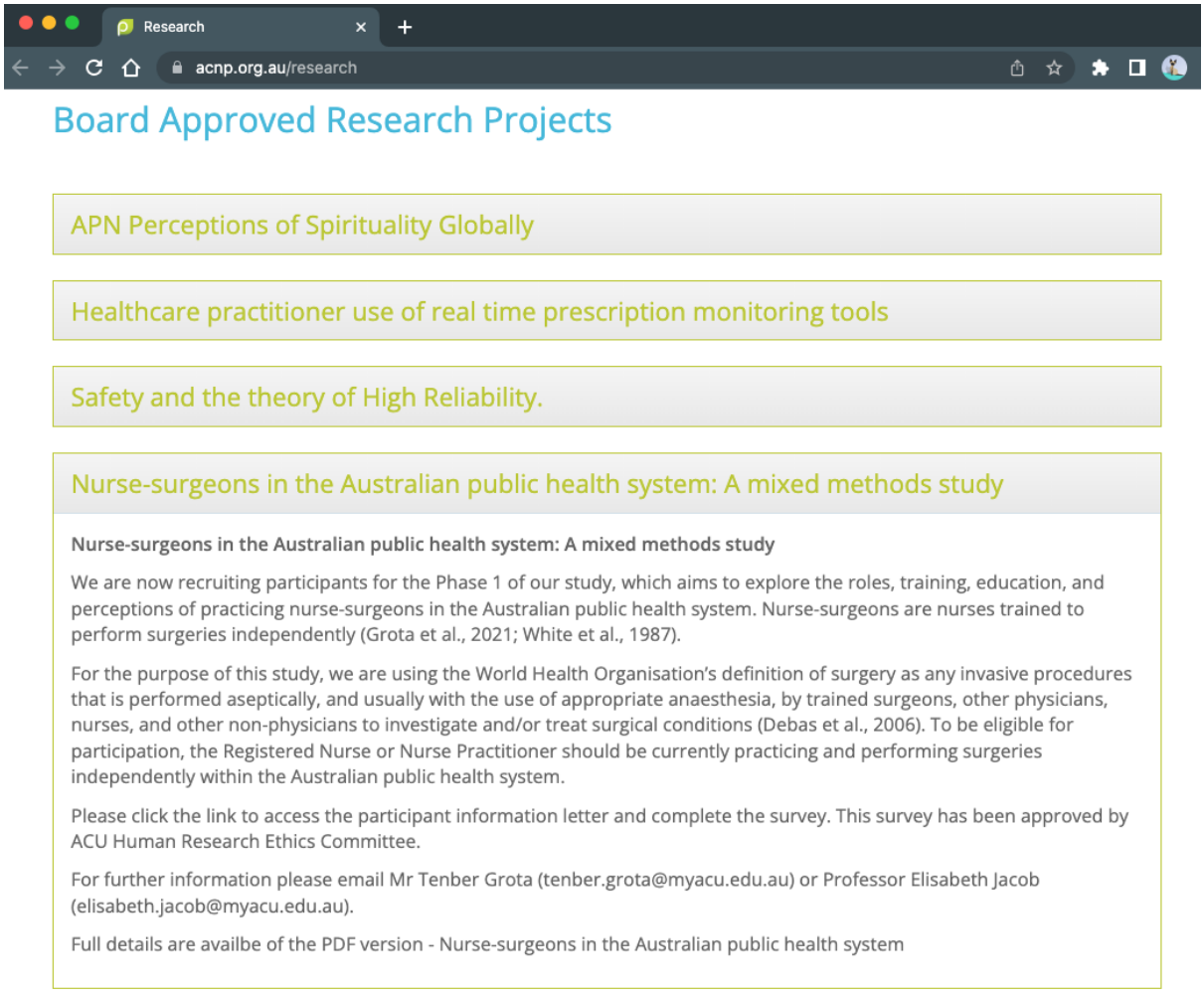
Nurse-surgeons are nurses trained to perform surgeries independently (Grota et al., 2021; White et al., 1987). For the purpose of this study, we are using the World Health Organisation's definition of surgery as *any invasive procedures that is performed aseptically, and usually with the use of appropriate anaesthesia, by trained surgeons, other physicians, nurses, and other non-physicians to investigate and/or treat surgical conditions* (Debas et al., 2006).

To be eligible for participation in our study, the nurse should be currently practicing and performing surgeries independently in a public health service in Australia. Some of the documented nurse-performed surgeries include (but is not limited to) caesarean section, hysterectomy, laparotomy, carpal tunnel surgery, circumcision, yttrium aluminium garnet laser capsulotomy treatments, chalazion surgeries, laceration repair, removal of skin lesions, biopsy, sigmoidoscopy, hysteroscopy, colonoscopy, and cystoscopy. Nurse-surgeons practice in different settings. Below are some of the most common settings:

1. A Registered Nurse or Nurse Practitioner with an elective surgical list in an operating theatre (i.e endoscopy list, cystoscopy list, chalazion list, etc).
2. A Registered Nurse or Nurse Practitioner performing minor surgeries in the emergency department, intensive care unit or ward.
3. A Registered Nurse or Nurse Practitioner performing emergency surgeries and/or cancer diagnostic procedures such as endoscopies and cystoscopies in a rural, regional, or remote setting.
4. A Registered Nurse or Nurse Practitioner with hybrid roles. For example, in a given day, this nurse functions as 30% theatre (scrub/scout) nurse, 50% surgical assistant and 20% nurse-surgeon.
5. A Nurse-Practitioner in an outpatient clinic performing surgeries.

We are now recruiting participants for Phase 1 of the study, for research purposes. If you are currently practicing as a nurse-surgeon within the Australian public health system, please click the link below to read the full participant information letter and complete the

Appendix P. Website advertisement from the Australian College of Nurse Practitioners



Appendix Q. E-magazine advertisement from the Australian College of Nurse Practitioners

Research: Nurse-surgeons in the Australian public health system: A mixed methods study

The ACU are conducting a study of the roles, training, education, and perceptions of practicing nurse-surgeons in the Australian public health system. The study is being conducted by Mr. Tenber Grota, a current Doctor of Philosophy (Nursing) candidate, under the supervision of Professor Elisabeth Jacob, Associate Professor Vasiliki Betihavas and Dr. Adam Burston.

To find out more about the study go to: https://www.acnp.org.au/research

Appendix R. Interview protocol

Interview protocol

Research study title: Nurse-surgeons in the Australian public health system

Phase 2 (qualitative phase): Semi-structured interview

Section 1. Basic information

Date of the interview:	
Time of the interview:	
Location of the interview:	
Name of the interviewer:	
Name of the interviewee:	
Actual length of the interview:	
File name of the audio-recording:	
File name of the transcription:	

Section 2. Introduction

Interviewer checklist:

1. Introduce yourself
2. Discuss the purpose of the study and the structure of the interview
   2.1 To explore the experiences of nurse-surgeons in the Australian public health system
   2.2 The interview will take approximately one hour to complete
3. Show the interviewee's signed informed consent
4. Explain the following terminologies:
   Surgery, nurse-surgeon
5. Ask the interviewee for any questions before starting

Interviewee question/s:

Section 3. Opening question

Tell me about yourself (i.e., job, what the job entails, what your usual day at work looks like)

Section 4. Content questions

This will emerge after completion of Phase 1

1. How did you become a nurse-surgeon?
2. Can you describe the beginning of your career as a nurse-surgeon? What were the enablers, drivers, motivators, disablers, etc.
3. What were your memorable experiences being a nurse doing a physician's role
4. How did you work out your training and education? Who were the key players in the decision-making stage of the training programme?
5. What do you think about the training you received in terms of preparation for the role?

6. If you were to redo your nurse-surgeon training, what would you do differently?
7. How did your nursing colleagues view your role at the beginning of your career? Was there a change over the years?
8. How did the surgeons view your role at the beginning of your career? Was there a change over the years?
9. How did the management view your role at the beginning of your career? Was there a change over the years?
10. We generally received survey responses indicating good to excellent support from **nurses** but there are some as well who responded that they received poor or terrible from their organisations, what do you think are the cause of this?
11. We generally received survey responses indicating good to excellent support from **management** but there are some as well who responded that they received poor or terrible from their organisations, what do you think are the cause of this?
12. We generally received survey responses indicating good to excellent support from **surgeons** but there are some as well who responded that they received poor or terrible from their organisations, what do you think are the cause of this?
13. Can you describe the support you receive from nursing unions? Ahpra? Accreditors? Medical societies and organisations?
14. Survey responses indicate that there are many limitations in the scope of practice of nurse-surgeons due to the role being not widely recognised. What do you think needs to be done for nurse-surgeons to be recognised fully in Australia?
15. Politics was provided by survey respondents as one of the main drivers of the role's acceptance in the organisation, what do you think of this statement?
16. What do you think are the surgeries that nurse-surgeons should be trained to perform within your specialty and why do you think so?
17. In other countries, nurse-surgeons perform surgeries such as caesarean sections, hysterectomies, laparotomies, hernia repair, appendicectomies. Do you think in the future, this will be implemented in Australia as well?
18. What could be done to ensure the security of your role within your organisation, and in the Australian public health system?
19. What do you think is the future of nurse-surgeons in Australia?
20. What do you think needs to be done to futureproof the roles and practice of nurse-surgeons in Australia?

Section 5. Probing questions

A reminder to ask for more information or further explanation of ideas

Tell me more…
I need more detail…
Could you explain your response more?
What does that mean?

Section 6. Closing instructions

Interviewer checklist

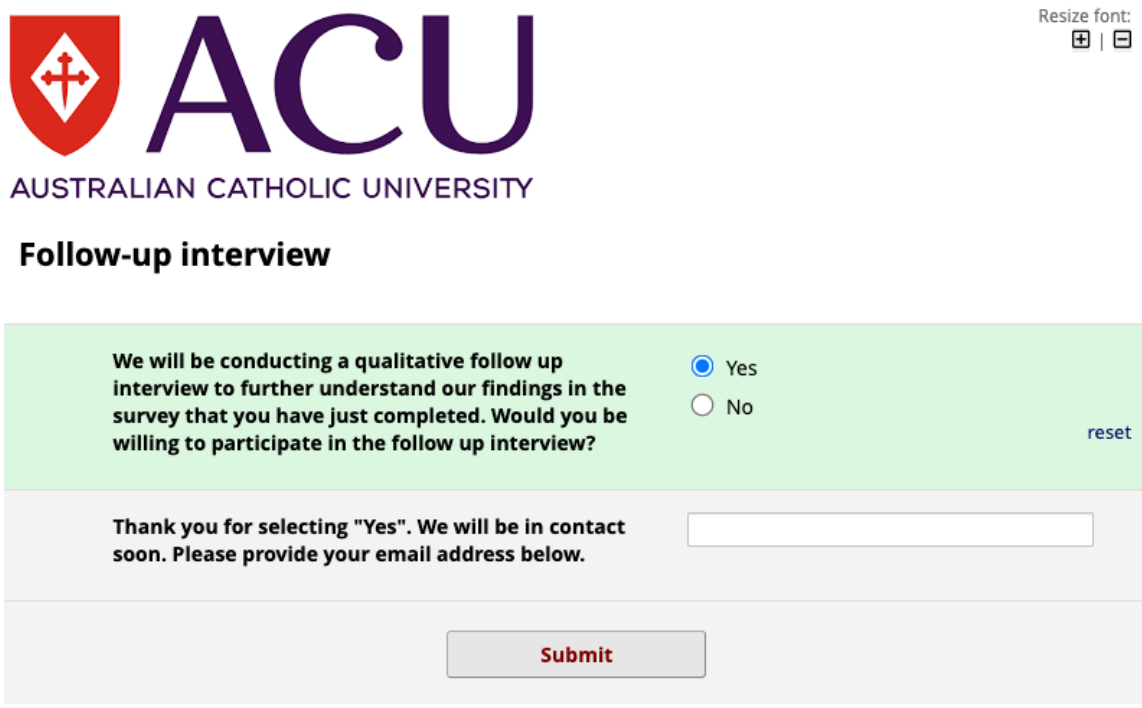
1. Thank you for your time.
2. Assure the interviewee of the confidentiality of the interview
3. Explain that the results will be publicly available once the study has been published. Assure the interviewees that the publication will not identify them in any way.
4. Offer to send the abstract of the final study
5. Explain what happens next.
6. Answer any questions.

Section 7. Researcher observations

Descriptive notes (*for example, description of the background, comments about sounds that were not created by the interviewee, and accounts of any specific events or activities during the interview.*

Reflexive notes (*for example, author's personal feelings, ideas, hunches and prejudices during the interview.*

Appendix S. Pop-up window to recruit Phase 2 participants.



Appendix T. Reflexive statement of the author

"*I am a Filipino cisgendered male Registered Nurse with 14 years' combined experience in perioperative nursing, perioperative service management and research. I have worked as a Theatre Registered Nurse (Philippines, New Zealand, Australia), Theatre Nurse-in-Charge (New Zealand), Perioperative Nurse Educator (Australia), Theatre Floor Coordinator (Australia), Nurse Unit Manager – Operating Theatres (Australia), Perioperative Service Manager (New Zealand), and Director of Nursing (Australia). My credentials are Bachelor of Science in Nursing completed in the Philippines, Postgraduate Diploma in Health Sciences (major in Advanced Nursing) completed with merit in New Zealand, Master of Management (Health Service Management) completed with distinction in New Zealand, and an ongoing Doctor of Philosophy currently being completed in Australia. At the time of the interviews, my occupation was part-time Community Manager – Asia Pacific Region for a non-profit organisation that focuses on scientific evidence synthesis. I did not establish a professional relationship with any of the participants prior to the study commencement. However, I introduced myself to the participants via the participant information letter and at the beginning of each interview. The participants were made aware of my experience, credentials, as well as the reasons for conducting the research as a requirement to complete my Doctor of Philosophy study. As an experienced perioperative nurse, I have a good grasp of the material and human resources needed for optimal perioperative service delivery. However, considering that I was trained and had initial clinical experience overseas, I may be biased in perceiving the differences in clinical practice between Australia and overseas. As English is my second language and I did not grow up in Australia, I assumed that I may have some difficulty in understanding the subtleties, nuances and cultural references in the Australian English language.*