

The Knowledge-Practice Gap: Evidence-Based Practice for Acute

Stroke Care in Ghana

This thesis is in total fulfilment of the requirements for the degree of Doctor of Philosophy (PhD)

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Declaration

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.

To the best of my knowledge, this thesis contains no material previously published by any other person except where due acknowledgement has been made in the main text of the thesis. I warrant that I have obtained, where necessary, permission to use any third-party copyright material reproduced in the thesis, and to use any of my own published work in which copyright is held by another party.

All research procedures reported in the thesis received the approval of the relevant Ethics Committees, where necessary (see Appendix for ethics approval documents).

This thesis contains three (3) original papers published in international peer-reviewed journals, one (1) accepted manuscript under review with minor revisions and another (1) manuscript prepared for submission. The ideas, development and writing of all the papers in this thesis were the principal responsibility of me, the PhD Candidate, under the supervision of Associate Professor Shawn Somerset, Dr Carina Chan, Dr Adem Sav, Dr George Mnatzaganian, Professor Ama de-Graft Aikins and Ms Judith Coombes.

I collected, analysed, reported, interpreted and integrated the data from three separate studies of which this thesis is comprised of. I however received statistical advice in analysing data for the retrospective cohort study from Dr George Mnatzaganian (Associate Supervisor). I am the lead author in all the published (3) and unpublished (2) studies included in this thesis. So, I led in the selection of topics, writing of study aims, methodological design approaches in all the manuscripts with inputs from other co-authors. The extent of contribution of co-authors is outlined in the authorship statement in Research Portfolio document in the appendix section. However, I singularly authored chapters 1, 3 and 5 including the preface provided in each chapter and sections where published, submitted or complete manuscripts are incorporated.

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Signature:

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Dedication

With love, I dedicate this work to my late mum, Madam Theresa Kawalibayi, who made great sacrifices for me and my siblings but never lived to witness me rise to this academic pinnacle.

List of Abbreviations

CDC:	Centres for Disease Control and Prevention
CT:	Computed Tomographic
HICs:	High-Income Countries
LMICs:	Low-Middle Income Countries
MRI:	Magnetic Resonance Imaging
WB	World Bank
NCDs:	Non-Communicable Diseases
SPSS:	Statistical Package for the Social Sciences
t-PA:	Intravenous Tissue Plasminogen Activator
WHO:	World Health Organisation
AMED:	Allied and Complementary Medicine Database
CINAHL:	Cumulative Index to Nursing and Allied Health Literature
ED:	Emergency department
FAST:	Facial drooping, arm weakness, speech difficulties and time
GRADE-CERQual:	Confidence in the Evidence from Reviews of Qualitative Research
ICU:	Intensive Care Unit
MeSH:	Medical Subject Heading
NINDS:	National Institute of Neurological Disorders and Stroke
PRISMA:	Preferred Reporting Item for Systematic Reviews and Meta-Analysis

Abstract

A critical global health concern in the last few decades is the widened gap between what we recognized scientifically as best practice interventions and what patients actually receive in clinical settings. Despite the fact that the past two decades has witnessed a preponderance of new and more effective interventions for acute stroke care globally, uptake of such interventions is inadequate and remains largely inaccessible to stroke patients. To be specific, uptake rates in low-middle income countries (LMICs) is pervasively slow, notwithstanding the fact that these countries bear a greater proportion of the global stroke burden. Yet, research on the application of contemporary interventions for acute stroke care in these contexts has been limited. Contextualizing this from the theoretical standpoints of evidence-based practice and knowledge translation, the overall purpose of this thesis was to advance understandings on the extent to which proven interventions for acute stroke care are implemented in standard practice in Ghanaian hospital settings This thesis aimed to 1) examine hospital-based services for acute stroke care and the extent to which such services are consistent with international best practice guidelines for acute stroke care; 2) evaluate in-hospital mortality outcomes among acute stroke patients in Ghanaian hospitals; and 3) explore acute stroke care professionals' views on the practical barriers to the provision of evidence-based care for acute stroke patients.

This thesis comprised three separate but interlinked studies. The first was a multi-site, hospitalbased survey conducted in 11 referral hospitals (regional and tertiary/teaching hospitals) in Ghana among neurologists, physician specialists and general medical officers. A structured questionnaire was used to gather data on available hospital-based acute stroke services, which were then analysed descriptively. The second study was a retrospective cohort study which evaluated in-hospital mortality outcomes among consecutive acute stroke patients admitted to six referral hospitals, comprising a sample of 300 participants selected randomly, representing about 50 patients from each site. Both descriptive and inferential statistics were used to conduct the analysis. The final study involved a multisite in-depth, semi-structured interview conducted in the retrospective study sites, comprising a purposive sample of 40 acute stroke care professionals (neurologists, emergency physician specialist, non-specialist medical doctors, nurses, physiotherapists, clinical psychologists and dietitian) to explore potential barriers to acute stroke care. Thematic and grounded theory approaches were employed to analyse the data.

Overall, the findings showed the availability of evidence-based services for acute stroke care were limited. Only one tertiary-teaching hospital had a stroke unit. Although aspirin therapy was administered in all hospitals, none of the hospitals surveyed offered thrombolytic therapy (thrombolysis). Although eight study sites reported having a brain computed tomographic (CT) scanning, only 7 were functional. Magnetic resonance imaging (MRI scan) services were also limited to only 4 hospitals (only functional in three) within the sample hospitals. Acute stroke care specialists, especially neurologists, were available in 4 of the study hospitals whilst none of the study hospitals had an occupational or speech therapists. The results further highlight inadequate health policy priority towards acute stroke care across the sample hospitals. Evidence from the retrospective study revealed that the delivery of acute stroke care remained variable and patient outcomes, mainly in-hospital mortality, were also higher and varied across the study sites by international comparisons. However, patients provided with aspirin recorded less in-hospital mortality. There was also insignificant variance in-hospital mortality across admitting wards. Hypertension was identified as a significant risk factor for in-hospital mortality. The qualitative interviews also identified four key potential barriers impeding the implementation of evidence-based acute stroke care. These included barriers at the patient (financial constraints, delays, socio-cultural or religious practices, discharge against medical advice, denial of stroke), health system (inadequate medical facilities, lack of stroke care protocol, limited staff, inadequate staff development opportunities), health professionals (poor collaboration, limited knowledge of stroke care interventions) and broader national health policy (lack of political will) levels. Perceived barriers varied across professional disciplines and hospitals.

In summary, the findings highlight evidence of only limited application of contemporary acute stroke care interventions, and relatively high in-hospital mortality and morbidity rates, which may be due to multiple barriers to provision of acute stroke care. Decisive and critical decisions are thus required to increase political support for acute stroke care by developing relevant policy to support well-targeted interventions that improve uptake of new treatment options for excellent clinical outcomes, with the ultimate goal of closing the current evidence-practice gap in Ghana and potentially other LMICs.

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CHAPTER ONE

Research Context and Rationale

1.0 Introduction

The translation of best practice guidelines and interventions from robust scientific research into standard practice has gained intensive academic and health policy interests over the past decades. However, a central concern has been the slow and limited implementation of such evidence-based interventions in clinical settings for optimal patient outcomes [1-4]. Although some attempts have been made to attenuate this problem, progress has been slow and there is no 'one-size-fits all' method of rapidly routinizing such proven interventions in clinical practice. Owing to this, it In general, the translation of research evidence into standard practice, that is, the knowledge-to practice gap can take up to 17 years to be bridged [5].

In the context of acute stroke care, although there has been a proliferation of scholarship on evidence-based acute stroke care interventions over the last two decades [6-10], a fundamental and a consistent challenge in both high income counties (HICs) and low-middle income countries (LMICs) is the slow translation of research evidence into routine clinical practice for optimal patient outcomes. Furthermore, a common theme across the international literature indicates this specific problem is more pervasive in LMICs, notwithstanding the fact that these countries bear a greater proportion of the global stroke disease. Stroke care within such contexts is characterised by widespread variations and less likely to conform to international best practice recommendations [11, 12]. This challenges global equity in access to evidence-based acute stroke care. Importantly, scholarship on the provision of best practice care for stroke patients within such contexts has attracted inadequate attention than its imperativeness warrants.

Against the backdrop of such knowledge gaps, and adopting the theoretical standpoints of evidence-based practice and knowledge translation, this thesis examines the extent to which proven interventions for acute stroke care are implemented in standard practice. Because translating evidence into practice is a complex, unpredictable task, this thesis employed a tripartite approach to understanding the extent to which current interventions for evidence-based acute stroke care are translated in Ghana, a LMIC setting.

The first approach explored the availability of stroke care services in acute settings and consequently evaluated whether such services comply with international best practice guidelines for acute stroke care. The second approach investigated the extent to which such existing services are effective and improve patient outcomes. Given that the delivery of evidence-based stroke care does not occur in isolation, but within a specific context actioned by multiple acute stroke care providers, the third approach assessed the underlying practical barriers impeding the provision of optimal patient care. Although these investigations were conducted in Ghana, a LMIC according to the World Bank classification [13], regular reference is made to other LMICs where this paradoxical situation also exists; regions where the current global stroke burden is highest, and also seen with health systems that are highly underfunded, yet the uptake of contemporary stroke care interventions remains far from optimal.

Within this context, this opening chapter sets the stage by presenting an overview of the research background that contextualise the study. First, it provides an overview of stroke epidemiology, exploring the disease burden as a public health concern within both global and the study setting contexts (African region and Ghanaian contexts). Next, the research problem is outlined by providing three key rationales underpinning the present thesis. Following this, the theoretical and conceptual underpinnings of this thesis and how it is operationalised are explored. The subsequent sections in this chapter discuss the overarching study purpose,

research questions and study aims. The chapter also summarises the research methodology utilised in the study. Definitions of key terms used in the study, the scope and delimitation of the thesis are then presented. An outline for the entire thesis is thereafter summarized to conclude the chapter.

1.1 Research Background

1.1.1 Definition of Stroke

Stroke is a non-communicable disease of global health importance. It is widely recognised as a medical emergency which can result in permanent neurological impairment or immediate loss of life [14, 15]. A stroke occurs when blood flow into the brain is slowed or stopped abruptly, that is, when there is an interruption or blockage in the supply of blood to the brain or bleeding into or around the brain due to a rupture in the artery [16, 17]. According to WHO standard clinical definition, a stroke is reported when there is a sudden neurological disorder of vascular origin caused by an acute focal injury of the central nervous system lasting more than 24 hours or leading to death [18].

Following this long standing definition by WHO, concerns have been expressed about the 24 hour limit for such medical symptoms prior to being declared a stroke. As a result, attempts have been made to reframe this definition to reflect current understandings of stroke from technological advancements in brain imaging. This movement for a new definition led by the American Heart/Stroke Association has challenged the 24 hour inclusion criterion for stroke as outdated and unreflective of current knowledge [19]. In their view, permanent injury of the brain can set in much earlier. Other researchers have further posited that the 24 hour inclusion criterion is misleading and undermines the medical urgency required for responding to transient ischemic attack, which has similar medical symptoms as stroke but mostly controlled within 24 hours [20]. Thus, the new proposed definition notes symptoms can be longer than 24 hours

or any duration provided a brain scan (CT/MRI) suggest ischemic or haemorrhagic features [21]. Despite the exposition of the limitations inherent in the global standardised definition of stroke, the WHO definition still remains valid and widely applied in many stroke clinical and epidemiological studies to date.

1.1.2 Classification of Stroke

Two types of stroke are known globally; ischemic and haemorrhagic [20, 22]. Making a distinction between the main stroke subtypes is essential to ensure appropriate treatment is provided to acute stroke patients [20]. Specialist skills are required to make such accurate distinctions and clinical epidemiological data show that 20% of suspected stroke cases are misdiagnosed [17].

Over the past decades, stroke epidemiological studies have shown consistency in the dominance of ischemic stroke subtype which constitute about 80% of all stroke cases, whilst the remaining proportion constitute haemorrhagic stroke subtypes [22-24]. However, the majority of stroke-associated mortalities and disabilities are of haemorrhagic origin [22, 24]. Research suggests that the recurrence of ischemic stroke is 2% within the first seven days of stroke and 29% within the first 5-years after a stroke [25]. Major distinctions exist in case fatality rates for ischemic stroke between HICs and LMICs. Evidence from an earlier review suggest early case fatality in LMIC is comparatively 25% higher than HIC settings, with the differences attributed primarily to improved care for acute stroke [25]. Although the literature does not show clear support for any risk factor as a dominant cause of haemorrhage stroke, some epidemiologic research has implicated hypertension [26, 27] and high cholesterol levels [28, 29].

In Africa and other LMIC regions, although ischemic stroke prevalence exceeds that of haemorrhagic stroke, the proportion of haemorrhagic strokes is higher compared to most high

income regions [22, 30, 31]. For instance, a study reported that whilst the prevalence of haemorrhagic stroke in Africa was 34%, high income countries recorded only 9% as haemorrhagic strokes [32]. In Ghana however, there is mixed evidence related to which subtype is predominant. Whilst some studies reported a higher prevalence of ischemic strokes [33-35], others indicated haemorrhagic strokes are more common [36-38].

1.1.3 Risk Factors for Stroke

Global efforts to control or prevent stroke have been hampered by unclear identification of its main risk factors. Hence, the need to accurately identify the risk factors and how they contribute to the present stroke burden. Stated risk factors for stroke vary [16]. However, evidence from the INTER-STROKE provides a wide-ranging overview of the main stroke risk factors [31], showing that ten main risk factors contribute to 90% of all stroke cases globally. They include hypertension, smoking, obesity, physical inactivity, psychosocial factors, diabetes mellitus, excess alcohol intake and apolipoproteins. However, others have argued that five key risk factors are of significant population health interest namely hypertension, diabetes, lack of physical exercise, atrial fibrillation and smoking [17, 20]; which collectively contribute to about two-thirds of the global stroke cases [39]. In Ghana and other African countries, common identified stroke risk factors comprised hypertension, smoking, diabetes, physical inactivity and high cholesterol intake [40]. Among these risk factors, hypertension predominates, contributing 60%-70% of stroke cases globally [20, 25, 31]. It is calculated that individuals with hypertension are predisposed to stroke by an odds ratio of 2.6 [41]. Yet, few people are aware of their hypertensive state and many remain undiagnosed [42]. This is more common in LMICs such as Ghana where recent studies indicate low awareness of hypertension [43, 44].

1.1.4 Global Burden of Stroke

The recent global burden of stroke disease data indicates a considerable increase in strokerelated deaths by 26% between 1990 to 2010 [45]. The report further documented that about 6.7 million stroke deaths were reported in 2013, and an additional 25.7 million stroke survivors were burdened with multiple disabilities over the same time period. However, it is important to emphasise that the current global stroke burden is inequitably distributed as more of this burden is disproportionately found in LMICs compared to HICs [25, 45]. In fact, about 80% of the stroke burden worldwide resides in LMICs [25, 32, 46, 47]. Furthermore, although HICs have witnessed a substantial decrease in stroke incidence of about 42% over the last four decades, LMICs recorded over 100% increase over the same time [25]. This inequitable stroke burden is further evident in comparing the stroke survival rates in these two regions: that is, 84% for HICs against 16% for LMICs within the first three years after a stroke [30].

Stroke has a major impact on the patient, families and carers, economic development and the health care system [48]. Contemporary research suggests that the increasing stroke burden globally poses a substantial burden on the economic development of a country [48-51]. A study in Sweden estimates that the total excess cost of treating and managing stroke per annum stands at 629 million (ϵ 69 million) [52]. A study in the USA also reported that the overall cost of stroke to the economy stood at \$65.5 billion dollars in 2008 [48]. Within the Australian context, stroke is ranked as the second highest cause of mortality and disability and cost the government about \$49.3 billion dollars in 2012 [53]. The impact of stroke is also extended to the carers and family members. Carers and other family members of stroke survivors are affected psychologically with an increased risk of depression, anxiety and exhaustion [54, 55]. For example, in a cohort study of 105 stroke informal carers in a UK community, the investigation showed that carers were almost three times more likely to be distressed psychologically relative to the non-carers control group [56].

1.1.5 Burden of Stroke in Africa and Ghana

In Africa, stroke has become a great public health concern over the last two decades [47, 57-59]. In 2002, the Global Burden of Disease study identified three countries from the African continent (Liberia, Angola and Sierra Leone) as recording some of the highest stroke death rates globally [60]. Added to this, more than 90% of stroke-related disorders were associated with hypertension complications [61]. Yet the continent is still characterised by low awareness, poor diagnosis and poor treatment for hypertensive patients [32, 59, 62, 63], an indication that stroke incidence is likely to rise. In Ghana, despite scant reliable data, recent data from some hospital-based studies and reports [33, 38, 64, 65] suggest stroke is an increasing public health issue. The WHO indicates that cardiovascular diseases contribute to about 18% of the total deaths in Ghana [66]. Further, the United States of America Centers for Disease Control and Prevention (CDC) rated stroke was the second highest cause of mortality in the country in 2012 [67], a significant rise from the fourth position in 2010 [68]. Stroke-related mortalities during hospital admissions have been reported to be 43%-46% [33, 69]. This is relatively higher compared to some HICs such as France, where stroke case fatality has been reported to be as low as 8% [25]. Such disparities in stroke burden have been attributed to HICs' unrestricted access and use of interventions to reduce risk factors and a relatively higher application of current best practice therapies [20].

There is currently limited evidence on the exact impact of stroke in LMICs. In Togo, research suggested that the cost involved for single stroke care is \notin 936 for expenses incurred within 17 days, which is over 100% of the average annual cost of health expenditure for an average Togolese [70]. Furthermore, evidence suggests the burden of stroke, heart disease and diabetes was expected to cost Tanzania and Nigeria a total amount of \$2.5 billion and \$7.6 billion respectively [71]. In the Ghanaian context, research on the impact of stroke is underexplored.

Only one single study exists on the impact of a stroke [72]. This study reported stigma and depression as predominant impacts of stroke on patients. There are also indications that the cost of treatment of Non-Communicable Diseases (NCDs) such as a stroke is high. An analysis on the cost of treating diabetes in Ghana noted that the daily cost involved is more than the average Ghanaian's monthly salary [73]. In this analysis, the author argued that the cost involved in treating diabetes ranges between \$106 and \$638; whilst cases of complicated diabetes treatment cost \$1,383. This estimate accordingly, far exceeds the minimum daily wage of \$2 and average monthly salary of \$213 per a civil servant in 2007 when the study was reported. Though unknown, from this analysis, it is possible to argue that the health cost especially the out-of-pocket payment for acute stroke care will pose a major catastrophic financial burden on the patient or family in Ghana.

Even with the growing burden of stroke in LMICs such as Ghana, and with projections of further increases underpinned by the epidemiological transition caused by the aging populations, increased rates of unplanned urbanization and modifiable risk factors for stroke [74, 75], it stands to reason that more people are likely to experience stroke, as already warned by the World Stroke Society (that one in six will experience a stroke in their life) [76]. In light of this, a key public health question is whether the current health systems of LMICs are prepared to sufficiently address this problem. It is not known if such countries have the capacity to respond to WHO's recommendation on the need to ensure that quality and standardised stroke care is provided to stroke patients in order to moderate the current relatively high rates of stroke mortality and morbidity in LMICs points to systemic deficiencies in current acute stroke care services, exacerbated by inadequate health policy support for evidence-based acute stroke care.

1.2 Study Rationales

This research project is based on three key rationales:

Rationale 1

The need for clearer understanding of acute stroke care interventions/services in Ghana and how these align with global best practice recommendations

To date, despite great advancements in developing best practice guidelines and interventions for acute stroke care to support optimal patient care, research evidence has consistently highlighted that the spate of implementation of such interventions in LMICs is very slow, compared to HICs [78-81]. The World Stroke Society's prioritisation of the need for increased access to evidence-based stroke care in its 2016 global campaign, underscores the centrality of this issue.

Acute stroke care has witnessed considerable revolution over the past few decades due to advancements in medical neurological research and technology. To date, many acute stroke care interventions, services and guidelines exist. However, and based on pooled analysis, stroke scholars have often recognised four key interventions which have been demonstrated by level 1 scientific evidence to be most effective in acute settings namely; stroke unit care of all stroke sub-types, sex and severity [82], thrombolysis using tissue plasminogen activator (t-PA) within 4-5 hours of an acute ischemic stroke [9, 83], aspirin within 48 hours of an acute ischemic stroke [84] and decompressive surgery within 48 hours of an acute ischemic stroke [8, 85]. In recent times, there has been a surge in evidence of optimal patient outcomes using endovascular therapy (mechanical thrombectomy to be specific) for acute ischemic stroke [86, 87]. Despite, global uptake of the above interventions has been sub-optimal. To illustrate this point, two proven interventions for acute stroke care: stroke unit care and thrombolysis for acute ischemic

stroke are presented as case examples. Since the publication of the original evidence about the efficacy of stroke unit care compared to normal care in general medical wards in 1993 [6], the world has not kept pace in establishing more stroke units to maximise the clinical benefits of this service for stroke patients. This research established that those treated in stroke units have a 28% increased chance of survival and are generally associated with reduced length of stay, dependency and disability. Subsequent trials have consistently reproduced similar results of improved patient outcomes [82, 88-90]. As a result, the emergence of stroke units has revolutionised modern stroke care services, with some authors regarding it as the 'core' of modern stroke care services [91]. Stroke unit care is also reported to be cost effective relative to other therapies [92-94].

Notwithstanding such evidence, the published literature still reveals that stroke units are not widely prevalent across the world. For instance, the National Stroke Foundation of Australia reported that only 58% of patients have access to stroke units in Australia [95]. Interestingly, compared to HICs, the uptake of stroke unit care is relatively lower in LMICs [96, 97]. Evidence from an earlier study by Langhorne and colleagues suggested stroke units were relatively limited in LMICs [81]. However, since then, an extensive literature review found no inter-country or intra-country study in any LMIC in recent times to systematically profile the availability of stroke unit care and other best practice interventions.

Beyond stroke unit care, thrombolytic therapy using tissue plasminogen activator (t-PA) to treat acute ischemic stroke patients within 4.5 hours is currently the most effective pharmacological therapy for acute ischemic stroke [9, 83]. This therapy is proven to significantly reduce patients' mortality and morbidity, compared to conventional care [9, 98]. Despite the net health benefits associated with this therapy, global uptake is slow, necessitating increased translational research interest to enhance uptake levels [99-101]. A recent worldwide

systematic review for example, found that 3% of the studies reported evidence of t-PA in lowincome countries, 19% in LMICs, 33% in upper-middle-income countries and 50% in HICs [78]. Another study by Pandian and other researchers reviewing evidence of the uptake of thrombolysis in developing countries reported limited uptake of this intervention [102], further highlighting the limited comparative uptake of thrombolysis in LMICs relative to HICs.

Internationally, published studies on evidence-based acute stroke care services and interventions in hospitals are currently reported from HICs as such as Australia [103], UK [104], Canada [105] and some western European countries [106, 107]. Conversely, studies to specifically clarify the range of these interventions in hospital settings located in most LMICs remain limited. This implies that such services remain limited in LMICs, and the nature of stroke care in such contexts is suboptimal and less likely to conform to international best practice guidelines [11, 80, 96].

Like many LMICs, there is inadequate data on the nature of acute stroke care in Ghana. Most studies on stroke pertain only to its incidence, risk factors, awareness and mortality outcomes [33, 36-38, 64, 108]. No attempt has been made to further our understanding of acute stroke care, the different acute stroke services in hospitals and how such services align with best practice guidelines in Ghana. Such information has the potential to provide the first baseline data on acute stroke services and how such services are consistent with global best practice guidelines. It further has the potential to identify important intellectual, public health and policy gaps for the attention of researchers, practitioners, health managers, consumer advocates and policy makers. The gaps identified could also inform the development of context-specific interventions to improve uptake of current best practice guidelines/interventions for acute stroke care to optimise patient outcomes.

Rationale 2

The need to understand the extent of effectiveness of current acute stroke care interventions in Ghana

In addition to the limited evidence on acute stroke care interventions in Ghana and other LMICs, it is argued that the low uptake of evidence-based practice results in high case fatality rates [77, 109]. This is demonstrated by the fact that stroke patients in HICs have a better chance of survival compared to their counterparts in LMICs [25, 47]. Similar evidence of such inequity reported a 30 day case fatality rate in Ghana of 43% compared to 8% in France within a similar period [25].

Previous evidence suggests that patients' medical history, socio-demographic characteristics, economic conditions, severity, complications, and the kinds of care provided following a stroke determine stroke patients' survival [110-113]. Importantly, whilst the stroke literature from Ghana and most African countries focus more on the epidemiology of stroke, emphasising the burden of the disease, its risk factors, incidence and mortality [32, 36, 37, 60, 64, 114], little information is offered on the processes of care or efficacy levels of available acute stroke care services to support optimal patient care. This notwithstanding, some efforts have been made to illuminate our understanding of the efficacy levels of some acute stroke care interventions in a few African countries. Evidence from South Africa and Morocco demonstrates improved patient clinical outcomes following a multidisciplinary care in a stroke unit and t-PA [115, 116]. Yet, there is no research in Ghana which has sought to advance understandings on the efficacy of current acute stroke care interventions.

Arguably, the current knowledge deficit on acute stroke care and clinical outcomes in Ghana and most parts of Africa is attributable to the overly focused attention on profiling the prevalence, incidence and stroke risk factors. Due to this, there is uncertainty about the nature of in-patient stroke care especially efficacy of the available services used to support in-patient care. This thesis intends to address this gap. There is a clear need for such information because the paucity of such data limits the opportunity to critically evaluate the effectiveness of the acute stroke therapies prevalent in the Ghanaian hospital settings. This information will also contribute to the global discourse on the implementation feasibility of contemporary acute stroke care interventions and insights on the disparities in stroke outcomes vis-à-vis acute stroke care between LIMCs and HICs. Overall, such information could further support the formulation of policy and clinical interventions to improve optimal stroke care in Ghana.

Rationale 3

Insights on practical barriers that inhibit stroke care professionals' ability to provide optimal patient care

Globally, the application of best practice guidelines in routine clinical practice is not instantaneous or linear. In fact, it is postulated that the gap between research evidence and its actual implementation in routine clinical practice can take decades [5]. As a result, it is often not the case that clinicians apply current scientific evidence to support clinical practice [117]. There are currently no 'magic bullets' to narrow this delay. It is therefore overly simplistic to assume that the existence of evidence-based treatments such as stroke unit care or t-PA for acute stroke care in clinical settings provides adequate grounds to expect concurrent uptake and usage by stroke care providers. For instance, despite robust scientific evidence on ways of providing optimal diabetes care globally, only 10% of diabetes patients receive evidence-based care, despite the fact that the USA continues to spend close to USD132 billion per annum on diabetes care [118]. Although the issue of ensuring that the best research evidence is translated into standard care has consistently been a recurrent concern over the past two decades, the importance of this topic has recently gained currency in the wake of the Lancet series on Right

Care [119], a movement which seeks to bring to the world's attention the systemic underuse of proven medical interventions for optimal patient benefits.

For acute stroke care, despite the increases in best practice interventions and guidelines, global uptake is less than optimal, and particularly in LMICs [78, 96]. Current research suggests that multiple factors influence the low uptake and adherence to these best practice interventions including; health-system/organisational identified barriers, physician-identified barriers, patient-identified barriers and socio-political barriers [120-124]. Although some evidence exists to enhance understandings of these barriers, a more balanced and holistic understanding is lacking. I have shown in a recent systematic review that existing scholarship to date only presents a one-sided viewpoint on these barriers, solely reported from HICs such as Australia, Netherlands and USA, and such evidence is also reported more on the barriers to thrombolysis [125]. It is unclear what these barriers are in settings other than HIC settings. Research on these barriers from LMICs is important since such settings currently bear a greater proportion of global stroke burden and yet, record the poorest uptake of current best practice recommendations. Importantly, LMICs also have different geographical, political, social, economic and health system contexts and so may have uniquely different barriers compared to what is known in HICs. Research to shed light on the barriers to optimal acute stroke care is imperative in LMICs for the development of contextualised and well-targeted interventions to improve uptake of best practice guidelines by stroke care professionals, hence the rationale for this study.

In order to provide clearer philosophical, epistemological and analytical frameworks to contextualise these three rationales and how they interconnect, the next section outlines the theoretical and conceptual contexts of the thesis.

1.3 Theoretical Contexts of the Study

Two main theoretical frameworks were employed to operationalise this study: the concepts of evidence-based practice and knowledge translation.

1.3.1 Evidence-based practice

The concept of evidence-based practice or medicine evolved as a significant facet of delivering healthcare following the seminal publication by the renowned Scottish medical physician, Archibald L. Cochrane [126]. The evidence-based practice movement was subsequently invigorated by researchers at McMaster University, Canada, to reframe the practice of medicine and how evidence from medical research could be utilised optimally [127]. Prior to this, the provision of clinical care was mainly guided by medical manuals, textbooks and guidance from senior medical professionals [128]. However, this process was fraught with variations in clinical care, associated with unnecessary health costs, use of ineffective therapies and incorrect health management or clinical decisions [129, 130]. Half a century since the seminal work by Cochrane, the challenges remain unabated as evident in recent calls on the need for evidence-based care in clinical settings [3, 4, 119, 131].

The most widely acknowledged definition of evidence-based practice is by Sackett et al: '*the conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual patients, as well as individual clinical expertise with the best available external clinical evidence from systematic research in accordance with the needs and values of the patients*' [130, 132]. The evidence-based practice movement advocates the need for health interventions to be backed by unequivocal evidence underpinned by systematic reviews from randomised control trials. Despite prominence gained by this movement, critiques remain. Some have questioned the evidence-based practice idea and have consequently described it as flawed [133], a paradigm currently saddled in crisis [134, 135], challenged as dogmatic and

merely a tool to limit the autonomy and judgement of clinicians or to control medical spending [127, 134] and inadequate to address all clinical or medical problems [136].

However, a critical issue which characterises contemporary discourses on evidence-based practice and remains relevant to the present thesis, is the extent to which evidence-based practice should be expected or applied in settings with less developed health systems such as those in Africa. Within this context, the evidence-based practice paradigm has further been criticised as paying little attention to the processes characterised in clinicians' uptake of such evidence [137]. As will be contended in the next section, the implementation and uptake of evidence-based practice and interventions are complex and non-linear, yet this process seems to have been ignored by the early postulates of the evidence-based movement, as evidenced by widespread variations in medical practice. This unaddressed issue is still an essential topic of discussion in medical practice [2, 4] and in research on translating evidence-based interventions for stroke care [101]. The limited uptake of such interventions in LMICs has led to questions about the relevance of evidence-based practice in LMICs [138].

Overall, despite the widespread acceptance of the evidence-based practice paradigm (though not without challenges and criticisms), a very important aspect is that inadequate attention has been given to the translation process of evidence-based practice interventions and guidelines. This is regarded as essential to successful implementation of research evidence for improved health outcomes [1, 2, 4], as will be discussed next.

1.3.2 Knowledge Translation

In recent times, the concept of knowledge translation (implementation science) has gained increased interest from practitioners, academics and policy makers. As a consequence, the field of knowledge translation has many diverse conceptualisations and understandings [2, 139-

141]. However, in simple terms, knowledge translation according to the WHO encompasses the processes, science and practices aimed at bridging the gap between what we consider as best practice or evidence and the actual use of such evidence [142]. Of the many definitions and conceptualisations of knowledge translation, what stands out is the emphasis on the actual use of the accumulated evidence in standard practice.

The translation of research evidence in healthcare settings has become a topic of great interest in the medical literature. This has consequently attracted widespread scholarship, theoretically and conceptually, to discover and explore optimum ways to bridge the current 'know-do gap' to achieve the goal of rapid translation of best practice guidelines for optimal patient outcomes. Yet, the translation of such interventions is still slow, limited, complex and unpredictable [141, 143]. Hence, a plethora of theoretical conceptualisations, perspectives and frameworks have been developed to shed light on the current evidence-practice gap, provide a clearer explanation of the translation process, illuminate our understanding of the underlying drivers of the change process in clinical settings and to guide policy efforts in closing this gap [141, 144-150].

The earliest work, which has spurred great interest in this subject, is attributed to Rogers' work on the diffusion of innovations in 1962 [149]. According to Rogers, diffusion of innovation is a process made possible through different mediums over time within a social context. These innovations could take the form of a practice, idea or product. For a successful diffusion of an innovation, he posited five factors in knowledge translation namely: the complexity of the innovation, trialability, relative advantage, compatibility and observability.

Firstly, in the perspective of Rogers, for an innovation or acute stroke care intervention, in this case, to be widely adopted, such an intervention should be perceived by its users as a better option compared to what is currently known and used. This component is perceived within the context of its cost-effectiveness, social prestige, and increased satisfaction by users and the

convenience of adopting such an intervention. Without a positive perception of an intervention within these contexts by the users, uptake could be slow or unpredictable according to Rogers. Another element espoused by Rogers was the extent of the ease with its usage. If users perceive an intervention to be difficult, complex and cumbersome to apply in routine practice, it is less likely to be adopted compared to an innovation perceived to be simple and straightforward to use. The third component of Rogers' theory on the diffusion of innovation talks about the triability of an innovation. To this end, an intervention which could easily be rolled out without any risk or additional tasks for the users stands the chance of faster adoption. Another element emphasised by Rogers is the extent to which an innovation is consistent with or able to integrate well with already existing structures, practices, beliefs or values of its users. Any innovation which seems to be at odds with any of the above risks low levels of uptake or a complete desertion by users. The last element deals with the observability of results of the new innovation. Users are likely to welcome and implement new interventions once they are able to observe immediate results following its usage in the early stages as this rules out any uncertainly about conflicting interests or harms. These five elements postulated by Rogers determine the extent to which users of new interventions will potentially welcome, integrate or apply a new intervention into their routine works and account for about 49% to 87% of variations in new interventions uptake [151].

Following Rogers, the field of knowledge diffusion or translation in healthcare has grown significantly. As a result, different and diverse terminologies have been used to describe knowledge translation. They include; bench-to-bedside research, translational medicine, knowledge utilisation, implementation science, implementation research, knowledge transfer, knowledge exchange or diffusion of knowledge. In fact, a previous study reported that about 90 terminologies exist relating to the field of knowledge translation [152]. Despite increased interest in and research on translating research evidence into practice, a unified global

framework to facilitate a comprehensive understanding of the field is lacking. However, a number of frameworks within the field of knowledge translation have been reported [145, 153, 154].

For example, the "Promoting Action on Research Implementation in Health Services" framework is one of the widely recognised works within the knowledge translation literature [155, 156]. This framework proposes that efforts to translate evidence into practice in healthcare delivery is contingent on the following: the nature of the research evidence (suitability to clinicians' experiences and expectations and patients' needs), the context of clinical settings (organisational support, receptivity of new knowledge, etc.) and how research evidence is translated into the clinical setting. The framework acknowledges the role of facilitation of research evidence as a key element in assessing and appreciating the extent to which effective interventions can be designed to bring about change in routine clinical practice. Despite the widespread consideration of this framework, it lacks clarity across its elements, pays little attention to the role of context and external factors to influencing change, overemphasises the facilitation component of the translation and lacks clarity on what a successful translation process represents [157-159]. The above limitations inevitably limit its applicability to adequately understand the knowledge translation process and how change happens in healthcare settings.

Another insightful framework relevant for reflections on processes underpinning the translation of evidence into routine clinical practice is the '*framework for improvement*' by Cabana et al [145]. The framework emerged from a systematic review to provide further understanding on why clinicians do not use proven interventions. The review recommended six key drivers of paramount importance to health managers and policy makers to understand what influences clinical adherence to best practice guidelines or to design interventions to drive change in clinical practice for best patient outcomes. The factors consist of physicians' inadequate

knowledge of evidence-based interventions, their agreement with available evidence, their level of self-efficacy, the extent of motivation to use the guideline, outcomes expected from an intervention and the influence of factors external to the clinical setting[145]. The authors emphasised that these factors are context-specific and so cannot be generalised or applied to all clinical settings. However, a key limitation of this framework is its exclusive focus on physicians, thus questioning its wider applicability to other healthcare professionals, especially with stroke where a multidisciplinary care team is recommended.

However, recognising the limitations of the above and other existing frameworks, this thesis draws upon and discusses one framework, considered more applicable and relevant to the present research: '*The comprehensive, integrated checklist of determinants of practice (the TICD)*' [146]. This framework explicitly acknowledges the complexities and intricacies which characterise the translation of evidence into practice, and incorporates the factors suggested in the aforementioned frameworks [145, 153, 154]. This work is unique as it pushes beyond the elements outlined in the other frameworks to present an extensive, multi-factored and in-depth discussion of the known factors likely to influence change in clinical practice or support the uptake of health innovations. Developed from the 'Tailored Implementation for Chronic Diseases Project [160], the framework demonstrates logical consistency and precise interconnections embedded in the concepts it proposes. It also potentially plays a key binary role of either informing the design of well-targeted interventions to improve clinical practice for the best health outcomes or could be used to evaluate any intervention essential to improving clinical practice.

Reflecting most of the drivers reported in other frameworks, seven important domains were proposed as essential to understanding what drives change in healthcare practice. As will be discussed below, these comprised factors at the guideline level, patient level, individual health professional's levels, professional interaction factors, resources and incentives to make change.
The framework also includes the capacity of the health system to activate a change via social, political or legal factors. The key factors of this framework are discussed below:

- First, the guideline factors include the intervention characteristics such as its userfriendliness, wide applicability, accessibility, cost-effectiveness, evidence of effectiveness, its complexity, adaptability and compatibility. The existence of these in any intervention could influence uptake levels in real practice.
- Second is the capacity of the health care system to engineer or adopt a change. The authors noted that for change in practice to happen, it is imperative to consider the organisation capacity to have policies or structures supportive of change and be receptive to changing practice or new innovations. This component also stresses the need for a strong organisational leadership, with structures and resources, such as guidelines, protocols, adequate staff numbers, infrastructure to support any change process or the uptake of any new intervention.
- Third is the extent and quality of professional interactions within a healthcare setting.
 The existence of quality and positive professional and peer interaction, communication, networks and support systems can propel or dispel the use of innovations [146].
- Fourth is the availability of resources and incentives. This refers to the availability of medical facilities to support evidence-uptake. These include CT scan availability, specialist stroke nurse or a physician, time, funding issues and availability of incentives for staff among others.
- Fifth in the framework comprised the patient level factors. These include patients' willingness to comply with a particular therapy, patient-health professional interactions, ability to pay for an intervention and delays in seeking care.
- The role of individual health professionals was the sixth factor. This is characterised by the knowledge and skill levels of health professionals to use a particular intervention,

how their beliefs and values conform to new interventions and the extent to which they perceive an intervention to be effective.

• The seventh in the framework include the social, political and legal contexts within which a change or new intervention is to be adopted. This encompasses regulatory and legal frameworks or policies supporting or against evidence uptake.

Overall, it is clear that diverse conceptual and theoretical models and frameworks are available to further understanding of health professional's uptake of evidence-based interventions. However, most of the key concepts postulated by these frameworks or models overlap with some fluidity. It is also evident the frameworks above were considerably inspired by the initial work of Rogers on the diffusion of innovation. Nevertheless, the comprehensive integrated checklist of determinants of practice (TICD)' checklist considered in this thesis is more current, comprehensive and encapsulates the essential drivers to contextualise healthcare providers' adherence to evidence-based interventions. The framework also has a greater potential of informing the design of interventions to improve evidence-uptake or in evaluating the usefulness of targeted interventions to improve uptake of evidence-based interventions.

1.4 Study Purpose

The overarching purpose of the thesis is to advance understanding on the extent to which evidence-based interventions for acute stroke are translated into optimal clinical outcomes in the Ghanaian hospital setting.

1.5 Research Questions

Following the highlighted knowledge gaps, three thematic questions are put forward for critical interrogation:

- 1. Which hospital-based services and therapies are available for acute stroke care in Ghanaian hospitals and to what extent are these consistent with international best practice recommendations?
- 2. What is the extent to which acute stroke services and therapies are effective in Ghanaian hospitals?
- 3. What are the practical barriers identified by stroke care professionals as inhibiting their ability to deliver evidence-based care for stroke patients in Ghanaian hospitals?

1.6 Study Aims

To address these research questions, the following study aims will be contextualised:

 To identify hospital-based services for acute stroke care and examine the extent to which such services are consistent with international best practice guidelines for acute stroke care

- To evaluate in-hospital mortality outcomes among acute stroke patients in Ghanaian hospitals
- 3. To explore acute stroke care professionals' views on the practical barriers to the provision of evidence-based care for acute stroke patients

1.7 Research Methodology

This thesis employs three interrelated studies to address the study aims. These comprise a survey, a retrospective cohort study and a qualitative study. This approach is inspired by the pragmatic epistemological strand which draws from both objective and subjective knowledge, using contemporary scientific methods to address the study questions.

1.8 Study Setting

This study was undertaken in Ghana, West Africa. According to the 2015 data by the World Bank [161], Ghana has a population of about 27,409,598 million, with an estimated Gross Domestic Product (GDP) of US\$ 37.543 billion. The life expectancy at birth for both sexes in 2014 stood at 61.3 years [161] which is a significant improvement from 46 in 1960 [162]. Ghana is ranked as a LMIC with a human development index position of 138th, out of the 187 countries [163], an increase from 135 in 2011 [164]. Table 1 presents a summary of selected health and economic indicators of Ghana and her neighbours according to the World Bank [165]

Table 1: Selected health and economic indicators of Ghana and her neighbours
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Indicators	Ghana	Cote d'Ivoire	Togo	Burkina-Faso
World Bank Income Groups (2013)	LMI	LMI	LI	LI
Population (millions)	28.21	23.70	7.61	18.65
Population growth (%)	2.2	2.5	2.5	2.9
GNI per capita (\$)	4,150	3,610	1,370	1,680
GDP (Billions)	42.69	36.16	4.40	12.12
GDP growth (annual %)	3.6	8.8	4.9	5.9
Health expenditure, total (% of GDP)	3.55	5.71	5.24	4.96
Health spending per capita (current US\$)	57.89	88.37	33.89	35.19
Out-of-pocket health expenditure	26.84	50.81	46.24	39.09
(% of total expenditure on health)				
Hospital beds (per 1,000 people) 2011	0.9	-	0.7	-
Nurses and midwives (per 1,000) 2010	0.926	0.483	0.274	0.565
Physicians (per 1,000 people) 2010	0.096	0.144	0.052	0.047
Life expectancy	61	52	60	59
Maternal deaths (2015)	2800	5400	940	2700
Under-5 mortality (per 1,000 live births)	62	93	78	89
Deaths from NCDs (% of overall deaths)	43.9	35.9	36.6	32.7
Cardiovascular diseases (18%)	18	11	11	12
Prevalence of raised blood pressure 2010 (%)	29.1	30.0	31.3	32.9

1.8.1 Organisation of healthcare in Ghana

Similar to other countries, Ghana has a multi-healthcare system which includes formal medical services, faith-based health care services and ethno-medical services [40]. However, challenges remain to delivering equitable and quality health services, such as low allocation of GDP to healthcare expenditure. The World Bank estimates that Ghana allocated 3.5% of GDP allocation means Ghana is currently failing to meet the minimum 5% GDP allocation set by the UN to achieve Universal Health Coverage by 2030 [166]. This is relatively lower compared to her immediate neighbouring countries (See table 1) with similar per capita incomes. Also, the health expenditure per total GDP of other African countries includes 6.5% in Angola, 9.8% in Uganda, 7.5% in Rwanda and 11.1% in Sierra Leone [161]. This corresponds to Ghana having fewer hospital beds per capita, compared with other countries with similar per capita incomes in Africa [167].

Government delivery of healthcare services is largely organised and administered through the Ministry of Health (MOH) and its main implementing agency, the Ghana Health Service (GHS). The latter overseas the delivery of health care services whilst the former is responsible for health policy-making, funding and oversight of all health care implementation by the GHS. The main providers of health care services under the administration of the GHS comprise Health Centres and Clinics, District Hospitals, Regional Hospitals and Tertiary Hospitals [167]. The GHS has three levels: national, regional and district. At the national level, the GHS is headed by the Director General, whilst the MOH is led by the State Minister for Health. According to GHS, there are about 2,441 health facilities comprising 358 hospitals and 2,083 health centres and clinics [168]. Community-based health planning and services facilities (CHPS compounds) provide health services in the most deprived areas of Ghana. The CHPS

compound policy, inspired by the Alma Atta Declaration, was introduced to improve access to health services by the rural populace and to ensure services corresponds to the needs, values and preferences of the communities [169]. On the other hand, the public healthcare system is decentralised into 10 regions (See Figure 1 below).





Ghana has five specialists care centres or tertiary hospitals; the Korle Bu Teaching Hospital in the capital of Ghana, Accra, Cape Coast Teaching Hospital and the Komfo Anokye Teaching Hospital in Kumasi and the Tamale Teaching Hospital located in Tamale, northern Ghana. There is also a military/tertiary hospital located in the national capital. The tertiary-teaching hospitals dispense specialist care with adequately equipped state of the art healthcare infrastructure and specialists.

The healthcare system is also characterised by a long-standing development gap between the northern regions and the rest of Ghana. This gap tends to pattern the availability and distribution of health resources and infrastructure. As a result, the hospitals in the northern regions tend to be less endowed compared to their counterparts in southern Ghana. Such disparities translate into poorer clinical and health outcomes [167, 170-172].

On healthcare financing, Ghana has a social health insurance policy called the National Health Insurance Scheme (NHIS). This was established in 2003 in response to calls by the World Bank, Civil Society Organisations (CSOs) and WHO to replace the cash and carry system with the aim of working towards universal health care coverage [173, 174]. The NHIS introduction was widely acclaimed by many as a financial relief on individual healthcare expenditure. However, although the scheme's implementation has significantly improved access to healthcare [175, 176], it is currently challenged by widespread mismanagement, moral hazards, the high cost of premiums and low subscription rates [177-181]. As a result, out of pocket payment for healthcare is still common. Due to the current challenges of the scheme, the World Bank and some Civil Society Organisations have expressed doubt about its sustainability [173, 181]. In addition, despite the existence of the NHIS, there remain significant disparities in healthcare access and equitable health care resource distribution [182, 183]. This has led to recent policy discourses on alternative health financing options such as the capitation model of health financing to sustain the current scheme [184]. In terms of disease burden in Ghana, communicable diseases remain highly prevalent [185]. Associated with the problem of communicable diseases, NCDs such as stroke are increasing and have also become a growing public health and policy concern [73]. NCDs account for about 42% of total deaths in the country, of which cardiovascular diseases alone represent about 18%, which is higher than most African countries [66]. As reported previously, stroke, an important category of cardiovascular disease, was ranked the second highest cause of death in Ghana in 2012 [67]. There is evidence to suggest stroke incidence is increasing in Ghana [36, 38]. The main risk factor for stroke in Ghana is hypertension, which is also rising consistently. It is estimated that hypertension prevalence among adults 15 years and above was 3.5million in 2008 [43]. Regardless, like many LMIC, Ghana has limited evidence-based guidelines or protocols to manage stroke and other major NCDs [167, 185]. This raises questions about the country's level of preparedness to respond to the growing prevalence of stroke and other NCDs.

1.9 Definition of key terms

The following are certain key fundamental terms used in this thesis.

Stroke: A sudden neurological disorder caused by an acute focal injury of the central nervous system lasting more than 24 hours or leading to death and of vascular origin [18].

High Income Countries, Low-Income Countries and Middle-Income Countries: For the purpose of this study and per the World Bank classifications [186], low-income countries represent countries with a Gross National Income (GNI) per capita of \$1,025 or less; counties with economies between \$1,026 and \$4,035 of GNI per capita are categorized as LMICs. HICs consist of those with \$12,476 or more as GNI per capita.

Evidence-based medicine: Also described as evidence-based practice according to Sackett et al. refers to 'the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients'' [132].

Evidence-based acute stroke care interventions: Refer to 'those interventions which are guided by sound scientific evidence, are consistent with the clinical judgment and expertise of the individual clinician and meet the needs of patients for improved clinical outcomes' [97].

Stroke unit: Refers to a designated medical ward or physical space where care is routinely provided exclusively to stroke patients by a coordinated multidisciplinary medical team of doctors, nurses and therapists with a specialty in stroke care [187].

Thrombolysis: A term used interchangeably with thrombolytic therapy, t-PA, or alteplase is a blood thinning, clot busting or dissolving treatment injected into the blood vessels or arteries to facilitate the flow of blood. The removal of the clots can be facilitated by an intravenous (IV) line which transports the drugs directly to the location of the clot [10].

Aspirin: Also called Acetylsalicylic Acid refers to a medication which prevents blood clots from forming or dissolves formed blood clots following a stroke or heart attack [188].

Decompressive surgery: A surgical procedure where a portion of the human skull is removed to create sufficient space for a swelling brain from being suppressed, control intracranial pressure and prevent further damage to the brain tissues [189].

1.10 Scope and Delimitation

First, although this thesis explores the continuum of care for stroke patients, it is limited to care at the acute stage and not long term and out-patient rehabilitation. This implies care provided in the early hours, days and weeks of acute stroke during in-patient care. The focus of investigating acute stroke care services comprises hospital-based services, which support the diagnosis and treatment of acute stroke patients.

Additionally, the practical barriers faced by acute stroke care professionals only focuses on those barriers encountered during the delivery of acute care. The efficacy levels of the hospitals-based interventions for stroke care were evaluated following review of patient clinical data during hospitalization of first index stroke and this excludes data from recurrent stroke patients and outpatient care.

The health system in Ghana is pluralistic comprising both public and private sectors, traditional herbal practice and faith-based or religious health systems. However, the present research was conducted across only public regional and tertiary hospitals in all administrative regions. District, sub-district hospitals and private non-state owned hospitals were not enlisted.

1.11 Thesis Outline

This thesis is structured into five separate chapters.

The First Chapter presents a general overview and a roadmap for the entire thesis. This chapter situates the study within the context of the stroke disease burden (the main public health issue under investigation) extending from a global to the study context perspectives. The key rationales for the thesis are presented. The chapter also explores the theoretical and conceptual frameworks in the literature related to evidence-based practice and knowledge translation. The study questions and key aims framing the present thesis, the research methodology and study design employed, the scope and delimitation of the study are also discussed. Lastly, a general overview of the study setting, the nature and organization of the healthcare delivery within which the thesis was conducted is presented.

Chapter Two comprised two sections; both based on systematic reviews of the evidence on the uptake of evidence-based interventions/services for acute stroke care. The first section specifically evaluated the current evidence on evidence-based acute stroke care interventions and their level of efficacy within the African region. The extent of efficacy of such interventions was measured based on patients' morbidity and mortality outcomes. The second section reports a systematic review from a global perspective, and explores the barriers and enablers inhibiting stroke care professionals' ability to provide evidence-based acute stroke care. This section highlights the main barriers or enablers to the currently low uptake levels of such interventions. Through these two systematic reviews and syntheses of the evidence, the essential gaps necessitating the present thesis were highlighted.

Chapter Three describes the research methodology and design. The Chapter commences with the ontological and epistemological paradigms of the research approaches employed in the thesis. A rationale for the choice of the epistemological paradigms used, the study designs, settings, target participants, sampling approaches, participants' recruitment, data collection, quality control approaches and the types of analytical approaches employed are also reported.

Chapter Four presents results from the empirical fieldwork component of the thesis. This is presented in three separate manuscripts. The first reports findings of a descriptive survey on hospital services for acute stroke care. The data on such interventions were then mapped against the World Stroke Organization guidelines on best practice recommendations for acute stroke care. In reporting the findings, the chapter highlighted the existing gaps in evidence-uptake and key considerations for health policy makers towards the improvement of patient care. The second manuscript quantitatively evaluates the efficacy levels of current care for acute stroke patients in Ghana. This was done through a multi-site retrospective cohort study to show how the third manuscript, findings from a qualitative study on the perceived practical barriers inhibiting acute stroke care professionals from providing optimal care are reported. Such findings contextualise the extent to which evidence-based acute stroke care is provided in Ghana. By this, possible reasons why acute stroke care professionals fall short of providing optimal care for patients are proffered and also provide a plausible explanation underlying the prevailing mortality rates as shown in the second manuscript.

The final chapter integrates and presents the overall thesis findings into a single scientific body of evidence. It first presents an overall synthesis of the thesis findings, specifically, an outline of the key findings comparable to pre-existing literature, their implications for clinical and public health practice, health policy and future research agendas. Key recommendations for the translation of current evidence-based interventions for acute stroke care for health policy consideration within the Ghanaian context were made. The main strengths and limitations of the study are also reported here. Following this is a conclusion which comprises an overall summary of the key findings, gaps for future research, clinical and public health implications of the study findings and areas for the attention of health managers and policy makers towards evidence-based acute stroke care in LMICs such as Ghana.

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CHAPTER TWO

Literature Review

2.0 Introduction

This section frames the thesis within the context of earlier academic scholarships on the translation of evidence-based interventions for acute stroke care, patient clinical outcomes associated with the provision of acute stroke care and the factors underpinning the provision of optimal acute stroke care. The section expands the scope of the three key study rationales reported in chapter one which necessitated the present research. This chapter is made up of two sections, each constituting a systematic review manuscript. The findings of the first review is submitted to BMC Systematic Reviews and has been accepted with minor revisions currently under review. This is reported in Section A of this chapter. The second systematic review on the other hand has been published in BMC Implementation Science as presented in Section B

SECTION A

Interventions for acute stroke management in Africa: a systematic review

of the evidence

Leonard Baatiema, Carina K.Y. Chan, Adem Sav, Shawn Somerset

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2.1.1 Overview and rationale

This first section reports a systematic review of the evidence on key evidence-based acute stroke care interventions for the management of acute stroke care and their extent of efficacy on patient clinical outcomes within the African region where a growing body of evidence indicate that there is inadequate uptake of evidence-based stroke care interventions. The paper provides a background for the first and second study aims and subsequently the conduct of study one and two as will be reported in chapter four of this thesis. Overall, the paper sought to examine the scope of implementation of contemporary interventions for acute stroke care and their extent of clinical efficacy. First, the findings points largely to a dearth of knowledge on the implementation of the four recommended interventions for acute stroke care. Despite, the few identified studies showed improved patient outcomes highlighting the need to expand the current uptake of these interventions. The dearth of knowledge in the implementation of contemporary acute stroke care interventions and notable methodological gaps (e.g. small sample sizes and with limited provisions to control the effect of confounding factors) in the eligible studies which limited definitive conclusions about the efficacy of the acute stroke care interventions, thus advanced the case for the first two studies of this thesis. Given the limited evidence, this review highlights the need for future studies to comprehensively report on the kinds of acute stroke care interventions currently available in the hospital settings of Africa and other LMICs. It also emphasized the need for robustly designed studies to clarify the efficacy levels of current acute stroke care interventions across Ghana and other resource poor settings in Africa. As shown in the ensuing section, the manuscript in Section A of this chapter presents the findings of this study.

Abstract

Background

The past decades have witnessed a rapid evolution of research on evidence-based acute stroke care interventions worldwide. Nonetheless, the evidence-to-practice gap in acute stroke care remains variable with slow and inconsistent uptake in low-middle income countries (LMIC). This review aims to identify and compare evidence-based acute stroke management interventions with alternative care on overall patient mortality and morbidity outcomes, functional independence and length of hospital stay across Africa.

Methods

This review was conducted according to the preferred reporting items for systematic reviews and meta-analyses (PRISMA) guideline. An electronic search was conducted in six databases comprising Medline, Embase, Cumulative Index to Nursing and Allied Health Literature (CINAHL), Web of Science, Academic Search Complete and Cochrane Library for experimental and non-experimental studies. Eligible studies were abstracted into evidence tables and their methodological quality appraised using the Joanna Briggs Institute checklist. Data were analysed and presented narratively with reference to observed differences in patient outcomes, reporting p-values and confidence intervals for any possible relationship.

Results

Initially, 1896 articles were identified and 37 fully screened. Four non-experimental studies (three cohort and one case series studies) were included in the final review. One study focused on the clinical efficacy of a stroke unit whilst the remaining three reported on thrombolytic therapy. The results demonstrated a reduction in patient deaths attributed to stroke unit care and thrombolytic therapy. Thrombolytic therapy was also associated with reductions in Symptomatic IntraCerebral Haemorrhage (SICH). However, the limited eligible studies and

methodological limitations compromised definitive conclusions on the extent of and level of efficacy of evidence-based acute stroke care interventions across Africa.

Conclusion

Evidence from this review confirms the widespread assertion of low applicability and uptake of evidence-based acute stroke care in LMICs. Despite the limited eligible studies, the overall positive patient outcomes following such interventions demonstrate the applicability and value of evidence-based acute stroke care interventions in Africa. Health policy attention is thus required to ensure widespread applicability of such interventions for improved patients' outcomes. The review findings also emphasises the need for further research to unravel the reasons for low-uptake.

Systematic Review registration: PROSPERO 2016: CRD42016051566

Keywords: Stroke, Organised care, Stroke Service, Africa, Evidence-Based Practice, Implementation

Background

Stroke is a major public health concern worldwide. Despite major advances in medical research and technology for acute stroke care treatment and management, in 2013, it accounted for about 6.5 million deaths and 25.7 million stroke survivors were burdened with multiple debilitating impairments worldwide [1]. However, the distribution of the global burden of stroke is uneven, with low-middle income countries (LMICs), especially those in Africa being disproportionately affected. In Africa, this burden is further accentuated by the increasing prevalence of hypertension [2-5]. This notwithstanding, the nature of acute stroke care is often poor due to the fact that the application of evidence-based acute stroke care interventions for optimal patient outcomes in such countries remain inadequate [6-9]. Evidence-based acute stroke care interventions in this context applies to all scientifically proven therapies, treatment procedures or service intervention for the provision of acute stroke care in clinical settings for optimal patient outcomes. In the context of Africa, the health systems are highly underfunded and as a result, there is low allocation to the national health budgets [10]. Compounded to this is the fact that the African continent is currently facing an epidemiological transition where rapid unplanned urbanization, aging population and increasing modifiable risk factors for noncommunicable diseases [11]. Yet prioritising the delivery of standardized care for acute stroke and other non-communicable diseases (NCDs) remain low in Africa and most resource poor regions [12, 13]. This makes it extremely difficult for most healthcare systems to provide standardised care.

Internationally, amongst the range of diverse acute stroke care interventions and services, four are recommended by most stroke experts as the most effective front-line interventions to significantly reduce stroke-related mortality and morbidity [14, 15]. These interventions comprise having a specialised stroke unit care [16, 17], thrombolytic therapy through tissue plasminogen activator (t-PA) for acute ischemic stroke care within 4.5 hours of a stroke [18-

21], aspirin therapy for ischemic acute ischemic stroke within 48hours of a stroke [22] and decompressive surgery within 48 hours of an acute stroke [23]. In recent times, endovascular therapy has also shown promise for improved neurological outcomes following a stroke [24]. The stroke unit care, for example, has been distinguished as a core component of modern stroke services given its proven benefits to stroke patients in general [17], and the cost-effectiveness of such care [25-27]. A stroke unit is a designated ward where a multidisciplinary team specialised in stroke treatment and management provides exclusive care for acute stroke patients [17]. The multidisciplinary team include medical, nursing and therapy/allied health staff, comprising specifically of physiotherapists, speech therapists, occupational therapists, pharmacist, dietitians, radiologists, clinical psychologists, and social workers [28].

More importantly, existing evidence uptake of such interventions is much lower in LMIC such as Africa [7, 9, 29], despite such countries bearing much of the global stroke burden. It has been suggested that the provision of care for stroke patients within such resource poor settings is often poor and fragmented [30-32] and less likely to follow evidence-based recommendations due to limited resources [33]. For example, a recent review on the global uptake of thrombolytic therapy revealed only 19% uptake in LMIC compared to 50% HIC [7]. Evidence from the UK estimated 82% patients receive care in a stroke unit [24] and another 86% in Sweden [25]. Such disparities in uptake apparently warrants global policy actions to ameliorate this situation given that LMICs bear a larger share of the global burden of stroke and yet have limited access to the best interventions for optimal patient care. Previous research has reported that barriers such as limited health policy priority, patient, health professionals' and other organizational context factors potentially underpin the currently low uptake of evidence-based interventions for acute stroke care in Africa [34].

Given indications of variable and poor nature of acute stroke services in Africa, evidently manifested in high case fatality rates of about 40% in Ghana [35, 36] and 70% in Mozambique [37], it is important to understand the exact nature of acute stroke care interventions in this particular region of the world. However, the extent to which evidence-based acute stroke management interventions are used within the African region specifically is not well understood and so there is insufficient knowledge on the forms of acute stroke care interventions and whether such interventions result in optimal patient outcomes. Although some reviews have been conducted on the use of these acute stroke care interventions in LMICs [7, 32], this work did not focus exclusively on Africa. This study aims to identify and compare four recommended acute stroke management interventions (stroke unit, thrombolytic therapy, aspirin and decompressive surgery) with alternative care on overall patient mortality and morbidity outcomes, functional independence and length of hospital stay across hospital settings in Africa. A synthesis of this evidence will address the current knowledge gap on application of evidence-based acute stroke management and potentially help formulate strategies to strengthen the clinical capacity of the current healthcare system to improve uptake of current interventions in Africa.

Methods

This review was guided by the standardised Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) approach [38]. The review protocol was registered (PROSPERO 2016:CRD42016051566).

Eligibility Criteria

Study Design

Studies for this review comprised randomised control trials (RCTs), quasi-randomised trials, non-randomised clinical studies, quasi-experimental studies and reporting on acute stroke care.

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To ensure inclusion of all relevant potential studies, prospective and retrospective cohort studies, case-control studies, before-and-after studies and analytical cross sectional studies were also considered. Included studies also reported patient outcomes after in-patient stroke treatment and management intervention. To qualify for inclusion, eligible studies reported patients' baseline characteristics and duration of follow-up. Editorials or opinion pieces related to the subject of the review were excluded.

Participants

This review considered studies on adult stroke patients 18 years and older, of either sex. Studies reporting patients diagnosed and treated for transient ischemic attack were excluded. Studies which included a mix of patients with stroke and other health conditions were also excluded.

Interventions

Studies evaluating the efficacy of acute stroke care interventions were included. The interventions of interest included the use of aspirin, thrombolytic therapy and hemicraniectomy or decompressive surgery. Studies which reported on acute stroke outcomes following multidisciplinary stroke team care in a stroke unit were also included. Additionally, secondary interventions of interest such as endovascular therapy were included. The comparators of interest included normal care, conventional care or no other treatment.

Outcome Measures

Study outcomes were categorised into two; primary and secondary. The primary outcomes of interest were interventions reporting on in-patient deaths (mortality outcomes), length of hospital stay, functional independence and morbidity outcomes such as asymptomatic intracranial haemorrhage and extracranial haemorrhage. Secondary outcomes included patient access to the following acute stroke care services: magnetic resonance imaging, computed tomographic scan, electrocardiogram (ECG) and Carotid Doppler services.

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Search Strategy and Selection Criteria

An electronic search of six databases comprising Medline, Embase, CINAHL, Academic Search Complete, Web of Science and Cochrane Library was conducted. All databases were searched individually to ensure all relevant studies were considered. Other sources such as Google Scholar, African Journals Online and African Index Medicus were also searched. In addition, reference lists and bibliographies from eligible studies were screened manually for further eligible studies. The year limit for searches was opened up to November 2016 and only studies published in English or French were considered. Finally, studies had to be conducted in an African country hospital setting. For search terms, an initial scoping of literature was undertaken to identify key words, subject specific terms or MeSH terms related to stroke and the acute stroke care interventions. An example of the search strategy in Medline database employed in the search process is provided (**Supplementary File 1**).

Study Selection and Data Extraction

Selection and extraction of potential studies was conducted through a four-step process. First, one author (LB) screened and retrieved all potential studies and consequently imported them into a reference manager (Endnote) which helped organise the entire data and supported in the removal of duplicates. In the second stage, the remaining studies were screened by two authors (LB and SS) for eligibility on the basis of title and abstract relevance. The third stage involved cross-checking of studies eligible for full text screening by a third author (AS) in order to minimise selection bias. The final stage involved full text screening to select studies meeting the inclusion criteria or considered potentially relevant by one author (LB) and this was double checked by another author (SS). Using a standardised pre-designed data extraction form, all eligible studies were extracted according to author (s), year of publication, country of study origin, study aim, population characteristics and sample size, level of evidence, intervention type, comparator, study duration, outcomes of interest and key findings.

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Assessment of Methodological Quality

To minimise bias and improve the strength of evidence, the quality of each included study was first assessed independently by one author (LB) applying the Joanna Briggs Institute quality appraisal tool for assessing risk of bias in observational cohort studies and case series [39]. This was verified by other authors (CC and SS). A joint discussion was conducted to achieve consensus where differences emerged during quality assessment. Assessment of study quality for risk of bias was conducted based on how participants were selected, sampling approach, representativeness of sample, study design, assessment of exposure, adequacy of case definition and selection of controls exposure for all study types. In classifying the evidence levels for each of the eligible studies, the Oxford Centre for Evidence-based Management framework was employed [40]. This is an established and widely applied framework in classifying the evidence levels of clinical experimental and non-experimental study designs based on the best available scientific evidence.

Data Synthesis

This review followed the narrative synthesis framework by Popay et al [41] in conducting the data synthesis in systematic reviews. To minimise heterogeneity effects resulting from the diverse reported study designs, extracted data were managed and reported separately according to the particular form of in-patient stroke care. The main outcomes of interest were also analysed and presented in text form according to the various forms of in-patient care interventions and services. Information such as the effect of acute stroke management interventions on key patient outcomes such as in-

patient mortality, morbidity and length of hospital stay as well as other variables of interests were assessed. Results were reported in simple statistical or descriptive format comparing patient outcomes across eligible studies. Differences and similarities across interventions were

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also discussed. In addition, key conclusions of each study were summarised and reported in the evidence table. However, the limited number of included studies, small sample sizes and the heterogeneity of the study outcomes measured made it impossible to conduct a meta-analysis. As a result, the general results were reported as a narrative summary.

Results

Overall, the search yielded 1896 studies (Medline = 498, CINAHL= 284, Embase =293, World of Science =15, Cochrane Library = 147, Academic Search Complete = 648 and 11 from other sources). Of these, 11 studies were from other sources. A total number of 625 duplicates were removed. Another 1234 studies were removed after title and abstract screening for relevance. Consequently, a full text article screening for eligibility was conducted for 37 studies. The full text assessment excluded another 33 as they did not meet the eligibility criteria. Finally, a total of four studies met the eligibility criteria for this review. The search results are presented in **Figure 1**.

Characteristics of Included Studies

A total number of 700 participants were included in this review. Studies were published between 2009 and 2016. Of the four eligible studies, there was no experimental studies, two were retrospective cohort studies [42, 43], a prospective cohort study [44] and a case series study [45]. Three of the studies reported on thrombolytic therapy using recombinant tissue plasminogen activator [43-45] and the remaining study focused on stroke unit care [42]. Three of the eligible studies were conducted in South Africa [42-44] and the other in Morocco [45]. The characteristics of the four eligible studies are summarised in **Table 1**.



Figure 1: PRISMA 2009 Flow Diagram

Quality and strength of evidence

On the basis of evidence classification, the three eligible cohort studies were classified as levels 3 whereas the case series study fell under level 4 per the Oxford Centre for Evidence-Based Management (OCEBM) levels of evidence for effectiveness [46]. Despite evidence of the efficacy of thrombolytic therapy using t-PA and stroke unit care, the quality of the eligible studies comprised the strength of the evidence. The lack of experimental studies, inadequate measures to account for confounding covariates and absence of randomisation showed a low level of evidence to unequivocally support the effectiveness of thrombolysis and multidisciplinary stroke unit care on clinical outcomes. For the cohort studies, the sampling procedure was only moderately conducted despite those studies employing a clearly defined selection criteria and had reliably measured and analysed patient outcomes.

Despite accounting for confounding factors in cohort studies, only one study [43] accounted for it in the analysis. Also, the retrospective nature of two of the cohort studies [42, 43], where outcomes were reportedly based on a chart review of medical records, could bias the results by potentially underestimating or overestimating the final outcomes. All included studies contained small and unrepresentative patient samples which limited their generalisability. Methodologically, the case series study, on the other hand, scored highly on the quality appraisal checklist. Nonetheless, it lacked important baseline information, limiting generalizability. On this basis, the overall quality of the cohort studies provide only limited support for efficacy of such interventions. Quality assessment of included studies is shown in **Table 2**.

	Appraisal questions for cohort studies	Bryer & Wasserman, 2012	Villiers et al, 2009	Klemperer et al, 2014
1	Were the groups similar and recruited from the same population?	Yes	Yes	Yes
2	Were the exposures measured similarly to assign people to both exposed and unexposed groups?	Yes	Yes	Yes
3	Was the exposure measured in a valid and reliable way?	Yes	Yes	Yes
4	Were confounding factors identified?	Yes	Yes	Yes
5	Were strategies to deal with confounding factors stated?	No	No	Yes
6	Were the groups/participants free of the outcome at the start of the study (or at the moment of exposure)?	Yes	Yes	Yes
7	Were the outcomes measured in a valid and reliable way?	Yes	Yes	Yes
8	Was the follow up time reported and sufficient to belong enough for outcomes to occur?	Yes	No	Yes
9	Was follow-up complete, and if not, were the reasons to loss to follow-up described and explored?	NA	NA	NA
10	Were strategies to address incomplete follow-up utilized?	NA	NA	NA
11	Was appropriate statistical analysis used?	Yes	Yes	Yes
	Critical Appraisal Questions for Case Series Study	Chtaou et al., 2016		
1	Were there clear criteria for inclusion in the case series?	Yes	-	-
2	Was the condition measured in a standard, reliable way for all participants included in the case series?	Yes	-	-
3	Were valid methods used for identification of the condition for all participants included in the case series?	Yes	-	-
4	Did the case series have consecutive inclusion of participants?	Yes	-	-
5	Did the case series have complete inclusion of participants?	Yes	-	-
6	Was there clear reporting of the demographics of the participants in the study?	Yes	-	-
7	Was there clear reporting of clinical information of the participants?	Yes	-	-
8	Were the outcomes or follow up results of cases clearly reported?	Yes	-	-
9	Was there clear reporting of the presenting site(s)/clinic(s) demographic information?	No	-	-
10	Was statistical analysis appropriate?	Yes	-	-
11	Were there clear criteria for inclusion in the case series?	Yes	-	-

Table 2: Risk and Quality Assessment of Eligible Studies

Lead Author Year & Country	Study Aim	Study Design	Intervention	Level of Evidence	Duration	Population sample	Outcome measures	Key Results
Villiers et al, 2009 South Africa	Examine the impact of multidisciplinary stroke care on in- hospital mortality, resource utilization, and access to inpatient rehabilitation facilities for stroke patients admitted to the stroke unit	Retrospective study	Stroke unit	Level 3	December 2001 - February 2002 March 2002 - May 2002	195 patients Mean age = 58.8 60% were female	length of hospital stay inpatient death transfer to a tertiary hospital number of patients who accessed CT brain	In-hospital mortality was 31 (33%) in general ward compared to 16 (16%) in the stroke unit (P=0.005) Mean length of hospital stay before stroke unit was 5.1 (6.5, 3.8–6.4) days compared with 6.8 (4.5, 5.9–7.6) days after stroke unit care (P=0.01) Access to CT brain scans increased from 13% (12) to 16% (16) Referrals to the tertiary academic hospital 7% (n=7) vs. 4% (n=4) did not change significantly
Wasserman and Bryer, 2012 South Africa	To evaluate early outcomes and safety of stroke thrombolysis in a South African setting	Prospective study	Thrombolytic therapy	Level 3	January 2000 - February 2011	42 patients	early neurological recovery functional independence at discharge rate of symptomatic intracranial haemorrhage (SICH) death	 Mean time to t-PA infusion was 160 mins (SD 50; range 60 to 270). 72.5% patients were thrombolysed within 180 mins Median NIHSS score fell to 7.5 (IQR 1 to 15) by the time of discharge 67% of patients achieved significant neurological improvement after thrombolysis 40.5% were functionally independent 2 (4.8%) patients suffered SICH 3 (7.1%) patients died at discharge

 Table 1. Characteristics of studies on interventions for acute stroke care

Klemperer et al, 2014	To evaluate the performance of SITS-SICH and	Retrospective Study	Thrombolytic therapy	Level 3	2000-2012	41 patients	bleeding complications	2 (4.9%) patients experienced SICH, (95% CI: 0–11.5%); SITS-SICH (5.1%) and SEDAN (6.5%) cohorts
South Africa	SEDAN scores in predicting the risk of SICH after thrombolysis						SICH risk	23 patients accessed CT brain scan
Naima Chtaou et al., 2016 Morocco	To report the case series of all patients who were treated with rt-PA in a stroke unit of HASSAN II University hospital between 2010 and 2013	Case series	Thrombolytic therapy	Level 4	2010-2013	52 patients Mean age = 63 years		 17 patients (32.7%) were treated within a 3 hours window of stroke onset and 35 (67.3%) within 3-4.5 hours 25 patients (48%) had significant early improvements within 24 hours, 21 (40.3%) had good outcomes at 3 months and 15 (29%) died Mean door-to-needle time was 75 min and mean onset-to treatment was 212mins 3 asymptomatic ICH and 4 symptomatic ICHs were reported 2 of the 4 symptomatic ICHs were fatal

Efficacy of the Acute Stroke Care Interventions

Stroke Unit

Two studies were identified which reported multidisciplinary team care in stroke unit [42]. This was a retrospective study to evaluate patient outcomes following multidisciplinary care in a South African stroke unit and a general medical ward among 195 patients. The study outcomes comprised inpatient deaths, patient access to CT brain scan, length of hospital stay and transfer to a tertiary hospital. Overall, the study showed less deaths (16%) in patients treated in the stroke unit compared to the general ward (33%); (p<0.005). The mean length of hospital stay prior to the stroke unit was 5.1 days in the general wards, compared to 6.8 days when the stroke unit care was introduced (p<0.01). Stroke patient referrals at discharge to inpatient rehabilitation also increased from 5% to 19% (p<0.04) after introducing the stroke unit. In contrast, only 3 patients (5%) were referred at discharge for further in-patient rehabilitation in the general wards before the advent of the stroke unit care. Additionally, there was disparity in access to brain scanning services between the two admitting wards. Patient access to CT brain scan was 12 (13%) in the general medical ward but this increased to 16 (16%) following the introduction of the stroke unit. The difference in access to brain CT scan between the two patient cohorts was not significant.

Thrombolytic Therapy

Three studies reported on thrombolytic therapy for acute stroke care; two in South Africa [43, 44] and another in Morocco [45]. The first study evaluated outcomes and safety of thrombolysis among 42 patients thrombolysed using t-PA in a tertiary academic hospital [44]. The outcome measures included in-patient deaths, early neurological recovery and rate of symptomatic intracranial haemorrhage (SICH). The results showed 17 (40.5%) of participants being were functionally independent at discharge. Risk of bleeding and other complications such as SICH

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is associated with thrombolysis use globally [18]. This study also found 2 (4.8%) patients experienced SICH whilst 3 (7.1%) patients died following thrombolysis.

The second South African study examined the risk outcomes associated with thrombolysis using t-PA among 41 patients [43]. The study outcomes included SICH, deaths, asymptomatic intracranial haemorrhage (AIH), and extracranial haemorrhage (EH). Two instruments were used to predict risk of SICH; SEDAN and Safe Implementation of Treatment in Stroke (SITS) scores. Overall, the study showed 2 (4.9%) patients experienced SICH, (95% CI: 0–11.5%) representing 5.1% for SITS-SICH and 6.5% for the SEDAN cohorts. One patient (2.4%) died as a result of SICH following thrombolysis. Evidence of AIH was found in 8 Eight (19.5%) patients reported evidence of AIH and another two 2 (4.9%) patients of EH. Of the 41 participants, 23 (56.0%) had access to Computed Tomography brain (CT) scan prior to the intervention.

The third study, which was a case series, examined patient outcomes following the use of thrombolytic therapy in a stroke unit [45]. Study outcomes measured in this study are deaths, early clinical improvement, clinical morbidities including SICH. The evidence showed that 25 (48%) patients had significant early clinical improvements within 24 hours, 21 (40.3%) at 3 months and 15 (29%) in-patient mortality cases. The early National and NIHSS score was more severe in the first patient cohort (NIHSS >15 in 58% of the patients) compared to the second patient cohort (NIHSS > 15 in 28% of the sub-patient group). The study also noted 3 (5.7%) asymptomatic intracerebral haemorrhage and 4 (7.7%) SICH complications. Two of the SICH cases were also fatal.

Discussion

This study set out to systematically identify the best available evidence on the application of interventions for acute stroke care across hospital settings in Africa. To our knowledge, this

review represents the first systematic synthesis of key interventions for acute stroke care and evaluation of patient clinical outcomes in hospital settings across Africa. Overall, despite global advancements in best practice interventions for acute stroke care, the evidence base in the African context remains limited. As demonstrated in this review, only four studies were eligible; one evaluating clinical outcomes following stroke unit care and the remaining three on outcomes following thrombolytic therapy. This limited number that met the inclusion criteria highlights the paucity of work on this topic to date. Nonetheless, this limited literature demonstrates improved patient clinical outcomes within the African context. The studies report similar results of improved patient outcomes compared to those studies conducted in other LMIC and HIC settings. Although the limited number of eligible studies, their nonexperimental nature, and methodological quality preclude more definite conclusions, the evidence reported in this review still provides valuable insight towards health policy formulation and future research to optimise clinical management of stroke patients.

Comparison with previous evidence

Studies that have examined evidence-based acute stroke care interventions in LMIC are scarce. An earlier review on the uptake of thrombolysis in developing countries also found very few studies [29]. A systematic review undertaken by Berkowitz et al, to estimate thrombolytic therapy uptake globally found the use of thrombolytic therapy was 19% in LMICs such as those in Africa [47]. In contrast, uptake was about 50% in HICs. Hence, this current review confirms the previously described paucity of evidence-based acute stroke care interventions in resource poor settings such as Africa [48-50].

The reviewed studies confirm previously identified improved patient outcomes in other settings following stroke unit care [17, 51, 52] and thrombolytic therapy [18, 53-55]. This efficacy seems consistent across various country contexts. For example, a reduction of in-patient

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mortality following stroke unit care in the South African study [42] corroborates with an Indian study which also found positive patient outcomes following admission in a stroke unit [51]. Further, a Canadian study also found favourable patient outcomes following stroke unit care [56]. This retrospective study compared two community hospitals, and found a significant reduction in in-patient deaths (17.1% to 8.3%). This study also found a significant reduction in length of hospital stay from 12 to 8 days. Comparable to the results of the Cochrane review on in-patient care in a stroke unit [17], the present review confirmed lower in-patient deaths in the stroke unit but no reduction in length of hospital stay in the stroke unit.

In this review, three studies reported improved patient outcomes following thrombolytic therapy. The study by de Bryer et al [44] demonstrated a relatively lower SICH and deaths following thrombolytic therapy, consistent with studies in India [57, 58] and Vietnam [53], as well as some HICs including Western Europe [59] and Australia [60, 61]. Similar positive findings have been reported previously in randomised control trials [18, 19]. In combination, such findings show that thrombolytic therapy can generate optimal patient outcomes in Africa. It is thus imperative for policy makers to increase efforts to upscale the use of thrombolytic therapy in hospital settings to reduce the current disproportionately high stroke burden in Africa. Previous work has identified some potential barriers to the use of thrombolysis in Africa and developing countries in general. According to some authors [34, 62], potential barriers such as patient late arrival for care in a hospital setting, lack of specialist stroke care professionals and inadequate medical facilities such as CT brain scanning services provide specific targets for policy makers.

Althought this review did not find studies on aspirin therapy, its low cost and ease of administration [62-64] are likely drivers for its widespread use for acute ischemic stroke care across hospital settings in Africa. The present review did not find any eligible study on the use of decompressive surgery in the region. However, studies in Nigeria which were excluded

because the cases were non-stroke patients did report such intervention [65, 66], suggesting that such interventions may be routine in Africa for acute stroke care but not yet reported in the literature .

Implications for practice, policy and future research

Stroke is a major public health problem in Africa and current evidence suggest its incidence will rise further. It is therefore important to ensure unimpeded access to standardised acute stroke care in hospital settings. The evidence from this review suggests a likely limited availability of 'best practice' interventions for acute stroke care across Africa. The current scarcity of evidence may be due to relatively increased attention on stroke prevention rather than treatment.

As noted previously, although multiple barriers such as limited stroke care specialists, patient delay in seeking care or limited access to brain scanning services may account for the low application of evidence-based acute stroke interventions such as thrombolysis, the most important barrier may be its cost [50]. This has been demonstrated by a study in Congo where eligible stroke patients could not afford the treatment [67]. Additionally, a feasibility study on thrombolysis provision has been conducted in Senegal [68], suggesting acute stroke patients can be treated with standard acute stroke care in Africa. However, factors such as limited health resources and cost need to be considered.

As there is an urgent global need to translate research evidence to community uptake and policy reform [69], the limited evidence evaluating the effectiveness of stroke unit care in this review requires policy attention. This relatively lower uptake in LMIC compared to HIC [49] may be a function the limited resources characteristic of most health systems in resource poor settings. One study in Africa which was excluded on the basis of lack of access to a full text reported improved clinical outcomes following multidisciplinary stroke team care in a Nigerian stroke

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unit [70]. The study reported consistent reductions in annual mortality since the introduction of the stroke unit, thus demonstrating that if more policy support is provided for intervention uptake, improved patient outcomes could be realised.

This review also revealed three studies which confirmed the safety and efficacy of thrombolytic therapy (t-PA). Despite persistent questions about its safety, thrombolytic therapy is recognised internationally as a highly effective pharmacological therapy for acute ischemic stroke cases. Yet, this review indicated that uptake was limited. Within the context of Africa where resources to support the health system are often inadequate, affecting access to t-PA which requires administration by specialised stroke physicians and nurses. Patient inability to pay for t-PA [62, 71] and late patient arrival are other major barriers to accessing t-PA [62, 72]. The availability of dedicated stroke units and brain CT scan services facilitate the administration of t-PA and thus are integral to ensuring optimal delivery of t-PA. The availability of decision-making tools, such as the SITS-SICH and SEDAN scores for assessing SICH [43] can support healthcare staff in evaluating the risk-benefit in relation to the selection of eligible patients for t-PA.

Overall, the paucity of studies identified in this review suggests a wide evidence-practice gap within the context of acute stroke treatment and management across the African region. Although a recent study illuminated the potential reasons for such under-utilization, it is important to review this within the broader context of the existing constraints to optimal healthcare delivery in Africa. The widespread development and provision of stroke unit care across Africa requires major health policy, with consequent budgetary requirements. Within this context, this review emphasises the need to review the applicability and contextappropriateness of current interventions for acute stroke care. This is necessary because the clinical trials which concluded on the efficacy of the current interventions were predominantly

from HICs and thus, their applicability to African settings remain unclear. This situation necessitates further research on potential adaptation of best practice for resource-poor settings.

Increased patient access to brain imaging services such as CT and MRI scans could optimise the benefits of aspirin towards the treatment of acute stroke and prevention of recurrent stroke. In Africa, access to brain scanning services is limited due to service availability and cost to patients [34]. Subsidies addressing these issues are a potential policy pathway to enhance access and availability. Centralisation of standard acute stroke care services may also be feasible in LMIC as a short term measure. Centralised stroke care services involve rerouting and transferring suspected stroke cases to a specialist referral centre, often a tertiary hospital and well-equipped to provide specialist care. This will replace the current practice of transporting and admitting stroke suspected cases to the nearest hospital. This is important given the under-funded nature of the existing healthcare systems to be able to resource most hospitals with adequate facilities to provide standard acute stroke care. Research in HIC suggests that this method can improve access to standard care for acute stroke patients resulting in reduction in mortality and length of hospital stay [73-76]. Low cost acute stroke interventions such as tenectoplase may be a potential alternative and could also be explored due to the high cost of thrombolysis. Although more evidence on the safety and efficacy of tenectoplase is needed, advocating for the use of such cost-effective and low-level evidence interventions could contribute to strategies to minimise the current rise in the global stroke burden in Africa and other LMIC regions.

The limited eligible studies and low methodological quality of the eligible studies in this review indicates a need for further research, particularly for prospective studies such as randomised control studies, to provide a clearer understanding of the effects of current interventions for acute stroke management on patient outcomes. The limited funds to support such research

studies in LMICs such as those in Africa could impede such efforts. In particular, there is a need for information on the factors influencing the low application of such acute stroke care interventions in resource poor settings such as Africa, particularly from the perspectives of stroke care practitioners, patients, health managers or from health policy makers.

Study Limitations and Strengths

The limited number of eligible studies in this review provide only a small evidential base. This may reflect the limited research on evidence-based acute stroke care interventions in Africa. It seems likely that informative research, yet unpublished, is underway currently, for example in Ghana [6], Congo [71], Morocco [45], Nigeria [77] and Egypt [78], indicating further emerging evidence of the availability of stroke unit care in hospital settings. Further, the quality of evidence from the included studies is low as the studies were non-experimental, non-randomised and did not control for confounding covariates. The low ranking of studies in the evidence classification also limited the strength of evidence. Another limitation worth noting is the small sample size in each of the eligible studies. This inherently compromises the statistical power of the studies to report accurate and precise differences and effects between acute stroke care interventions. Finally, it is possible the evidence reported in this review may have suffered from publication bias, arising from the publication of only significant results.

Despite the above limitations, to our knowledge, this represents the first systematic review on evidence-based acute stroke interventions and their effects on patient outcomes in the African region. Thus, the findings provide information with the potential to inform health policy makers in developing interventions in the future to optimise patient outcomes.

Conclusion

Despite the limited studies on current evidence-based acute stroke care interventions in Africa, this review highlights improved patient outcomes, hence the need for policy support to

routinize current best practice interventions for acute stroke care. However, because eligible studies were limited and had some methodological weakness, more definitive conclusions require further research which focuses on strong methodological procedures, primarily randomised control trials, to better understand the efficacy of contemporary acute stroke care interventions in the African region.

List of Abbreviations

LMIC	Low-Middle Income Countries
HIC	High Income Countries
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
CINAHL	Cumulative Index to Nursing and Allied Health Literature
SICH	Symptomatic IntraCerebral Haemorrhage
QASC	Quality in Acute Stroke Care
RCT	Randomised Control Trials
OCEBM	Oxford Centre for Evidence-Based Management (CEBM)
t-PA	Tissue Plasminogen Activator
СТ	Computed Tomography

Declarations

Ethics approval and consent to participate

Not applicable

Consent for publication

Not applicable

Availability of data and material

The authors declare that the data supporting this study findings are available within the article and the supplementary information files.

Competing interests

The authors declare no competing interests

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Author Contributions

LB and SS designed the study. LB searched the literature, led in the study selection, quality appraisal and analysis: CKYC, AS, SS contributed in the selection and appraisal of the eligible studies. LB wrote first draft of the manuscript. CKYC, AS, SS reviewed and critically revised the draft manuscript for important intellectual content. All authors have read and approved the final manuscript.

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Supplementary File 1: Medline Search Strategy

Search	Query
	(Stroke) OR (Acute Stroke) OR (Cerebrovascular Disease) OR (Cerebrovascular Accident) OR (CVA) OR
1	(Brain Attack) OR (Cerebral Infarction) OR (Lacunar) OR (Chronic Stroke) OR (Neurological Disorder)
	OR (Brain Tumour) OR (Brain Accident) OR (Brain Vascular Accident) OR (Cerebral Vascular Accident)
	OR (Cerebrovascular Trauma) OR (Cerebrovascular Injury) OR (Cerebral Infarction)
	(Stroke unit) OR (Organised Stroke Care) OR (Stroke Ward) OR (Organised In-patient care) OR (Organized
2	Stroke Care) OR (Organised Care) OR (Comprehensive stroke unit) OR (Stroke Service) OR (Renabilitation
	Stroke Unit) OR (Multidisciplinary Stroke Care) OR (Multidisciplinary Stroke Team) OR (Stroke Treatment
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6	Treatment) OP (Brain Management) OP (Acute Streke Treatment) OP (Streke Treatment) OP (St
	Management) OR (Acute Stroke Management)
	(Developing countr*) OR (Low income countr*) OP (Low middle income countr*) OP (Middle income
	(Developing countr') OR (Low income countr') OR (Low-initiate income countr') OR (Mitable income countr') OR (Africa) OR (Africa) OR (Africa) OR (Central Africa) OR
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	(Central African Republic) OR (West Africa) OR (Morocco) OR (Libya) OR (Cameroon) OR (Chad) OR
	(Algeria) OR (Congo) OR (Democratic Republic of Congo) OR (Congo, Demographic Republic) OR
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	OR (Iganda) OR (Angola) OR (Rotswana) OR (Lesotho) OR (Malawi) OR (Mozambique) OR (Namibia)
	OR (Swaziland) OR (Zambia) OR (Zimbabwe) OR (Benin) OR (Burkina Faso) OR (Cape Verde) OR (Cote
	D'ivoire) OR (Gambia) OR (Gambia, The) OR (Ghana) OR (Guinea) OR (Guinea-Bissau) OR (Liberia) OR
	(Mali) OR (Mauritania) OR (Niger) OR (Nigeria) OR (Senegal) OR (Sierra Leone) OR (Togo) OR (South
	Sudan) OR (Madagascar) OR (Comoros) OR (Mauritius) OR (Sao Tome and Principe) OR (Sevchelles) OR
	(South Africa)
8	2 OR 3 OR 4 OR 5 OR 6
9	1 AND 7 AND 8
	Full Text
. .	English and French Languages
Limiters	Academic Journals
	Humans

SECTION B

Health Professionals' Views on the Barriers and Enablers to Evidence-

Based Practice for Acute Stroke Care: A Systematic Review

Leonard Baatiema, Michael E. Otim, George Mnatzaganian, Ama de-graft Aikins, Judith Coombes, Shawn Somerset

Baatiema et al. *Implementation Science* (2017) 12:74 DOI 10.1186/s13012-017-0599-3

2.2 Overview and rationale

In order to put in context the potential reasons underpinning the limited application of evidence-based interventions for acute stroke care, the second systematic review which took a global scope, explored the barriers and enablers inhibiting stroke care professionals' ability to provide evidence-based acute stroke care interventions and therapies (aspirin, thrombolysis using t-PA, multidisciplinary care in a stroke unit and decompressive surgery). Overall, this review shed light on multiple barriers inhibiting the provision of evidence-based care for acute stroke patients. However, the studies predominantly revealed barriers militating against the uptake of thrombolysis. In addition, this review did not locate any relevant studies within the context of LMICs, Ghana in this context, to help clarify the main reasons for the inadequate and much lower uptake levels of such best practice interventions/services for acute stroke care. Evidence of these barriers were reported from only HICs thus, leaving a gap in our understanding of the factors accounting for the low uptake of these interventions in Ghana and most of LMICs. Section B of this chapter thus reports the findings of this review.

SYSTEMATIC REVIEW

Open Access



Health professionals' views on the barriers and enablers to evidence-based practice for acute stroke care: a systematic review

Leonard Baatiema^{1,2*}, Michael E. Otim³, George Mnatzaganian⁴, Ama de-Graft Aikins¹, Judith Coombes⁵ and Shawn Somerset²

Abstract

Background: Adoption of contemporary evidence-based guidelines for acute stroke management is often delayed due to a range of key enablers and barriers. Recent reviews on such barriers focus mainly on specific acute stroke therapies or generalised stroke care guidelines. This review examined the overall barriers and enablers, as perceived by health professionals which affect how evidence-based practice guidelines (stroke unit care, thrombolysis administration, aspirin usage and decompressive surgery) for acute stroke care are adopted in hospital settings.

Methodology: A systematic search of databases was conducted using MEDLINE, Cumulative Index to Nursing and Allied Health Literature (CINAHL), Embase, PsycINFO, Cochrane Library and AMED (Allied and Complementary Medicine Database from 1990 to 2016. The population of interest included health professionals working clinically or in roles responsible for acute stroke care. There were no restrictions to the study designs. A quality appraisal tool for qualitative studies by the Joanna Briggs Institute and another for quantitative studies by the Centre for Evidence-Based Management were used in the present study. A recent checklist to classify barriers and enablers to health professionals' adherence to evidence-based practice was also used.

Results: Ten studies met the inclusion criteria out of a total of 9832 search results. The main barriers or enablers identified included poor organisational or institutional level support, health professionals' limited skills or competence to use a particular therapy, low level of awareness, familiarity or confidence in the effectiveness of a particular evidence-based therapy, limited medical facilities to support evidence uptake, inadequate peer support among health professionals', complex nature of some stroke care therapies or guidelines and patient level barriers.

Conclusions: Despite considerable evidence supporting various specific therapies for stroke care, uptake of these therapies is compromised by barriers across organisational, patients, guideline interventions and health professionals' domains. As a result, we recommend that future interventions and health policy directions should be informed by these findings in order to optimise uptake of best practice acute stroke care. Further studies from low- to middle-income countries are needed to understand the barriers and enablers in such settings.

Trial registration: The review protocol was registered in the international prospective register of systematic reviews, PROSPERO 2015 (Registration Number: CRD42015023481)

Keywords: Acute stroke, Evidence-based practice, Therapies, Services, Barriers, Enablers

Full list of author information is available at the end of the article



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Background

Translation of research evidence into clinical practice is a major imperative for health professionals in policy, management and research, worldwide. It is almost half a century since Cochrane challenged conventional health care practices which consequently paved the way for the present day evidence-based practice movement in medicine and health care [1]. Nonetheless, routine clinical practice still lags behind contemporary research evidence [2-4], despite international calls for research evidence to guide healthcare delivery [5]. Globally, there is no single solution to closing this knowledge to practice gap [4, 6, 7]. In general, it has been estimated to take about 17 years for research evidence to be translated into clinical practice [8]. Delays in the adoption of evidence-based practice could be attributed to a multiplicity of barriers [9-12] underpinned by a plethora of theoretical and conceptual perspectives [2, 3, 13, 14], which have emerged to shed light on these barriers or enablers.

Stroke is caused by an interruption or blockage in blood supply or arterial bleeding into or around the brain [15, 16]. The early stages (first 48 h) of an acute stroke are a critical time-window for appropriate interventions to either stop or slow down brain tissue decay and minimise mortality and morbidity [17]. To provide acute stroke care in the early stages, current recommendations from Level-1 evidence for best practice include (1) stroke care in a specialist stroke unit [18, 19], (2) thrombolytic therapy with intravenous tissue plasminogen activator (t-PA) within 4.5 h of an acute ischemic stroke [20-22], (3) aspirin administration within 48 h of acute ischemic stroke onset [23-25] and (4) decompressive surgery if required within 48 h of stroke onset [26, 27]. The use of t-PA for example is the most effective pharmacological therapy for acute ischemic stroke despite the persistence of controversies surrounding its usage. First reported by the National Institute of Neurological Disorders and Stroke (NINDS) trials with a treatment window of 3 h [22], a later trial extended the treatment time to 4.5 h upon acute ischemic stroke [21]. Given such evidence consistently showed sound clinical outcomes over time, clinical guidelines have been developed and continually updated to support the application of these interventions for improved patient outcomes [28-34]. However, despite this scientific evidence and increased support for their usage, translation into clinical practice is slow, and this is greatest in low-middle income countries [35-37]. For example, despite the net benefits associated with thrombolytic therapy for acute ischemic stroke, global uptake in low-income countries is about 3% compared to 50% in high-income countries [35]. A recent survey of acute stroke services in eleven major referral hospitals in Ghana also revealed the lack of use of t-PA for acute ischemic stroke care and the availability of only one stroke unit [38].

The reasons for the slow uptake remains poorly understood. Some studies have however attempted to shed light on such barriers, and these comprised inadequate medical facilities for acute stroke care, health professionals' unwillingness for change, unawareness of evidence-based therapies, lack of health professionals' competence to apply evidence-based therapies, limited staff capacity and decision-makers' values and preferences could be attributed for the slow uptake [39–46]. Such barriers have resulted in the underutilisation of best practice interventions towards positive clinical outcomes. The recent Lancet series on Right Care [47], which seeks among others, to highlight the chronic underutilization of evidence-based interventions further underscores the centrality of this review.

To date, no study has attempted to systematically analyse published primary studies on the barriers and enablers perceived by health care professionals to influence the adoption of these four highly recommended acute stroke therapies or services. Prior studies on this topic were either limited in focus by only unilaterally exploring barriers related to the use of t-PA [41, 42, 44], neuroprotective therapy [45] or generalised acute stroke care guidelines [40]. A recent study by Craig et al. has also attempted to examine some of these barriers and enablers [48], though an important contribution, a different theoretical framework was used, and focused more on clinical behavioural components.

Our aim in this review was to identify health professionals' views on the barriers and enablers to their use of the above recommended evidence-based acute stroke care interventions. An understanding of these barriers and enablers is important towards closing the current knowledge to practice gap in stroke clinical practice. With the increasing stroke burden in low-middle income regions in recent times [49–51] and where uptake levels of such interventions are presently lowest, a clearer understanding of barriers and enablers, primarily from such regions may also be essential in developing context-specific strategies to optimise uptake of evidence-based acute stroke care recommendations in clinical practice to improve patient outcomes.

Methods

This review was conducted according to the Preferred Reporting Item for Systematic Reviews and Meta-Analysis (PRISMA) systematic review approach [52], as outlined in Additional file 1. The review protocol was registered in the international prospective register of systematic reviews, PROSPERO 2015 (Registration Number: CRD42015023481).

Eligibility criteria

Studies based on the views of stroke specialists, medical doctors, nurses and allied health professionals were considered. Other health professionals including health managers, health planners, health policy-makers or any health executives' about barriers or enablers to the uptake of evidence-based acute stroke care were included. For inclusion, interventions for evidence-based acute stroke care were restricted to barriers or enablers in relation to the provision of care in a stroke unit, thrombolytic therapy, the use of aspirin and decompressive surgery. Peer-reviewed articles of any study design were considered. Barriers and enablers based on database records were excluded. Included studies were based only on the views, opinions and experiences of the health professionals. Non-original research such as letters, commentaries, guidelines, magazines and editorials were excluded. Research studies with non-human components were also not considered.

Search strategy

A systematic search of the literature was conducted electronically using MEDLINE, CINAHL, Embase, PsycINFO, Cochrane Library and AMED. Reference lists and bibliographies from eligible studies published from 1990 to 2016 were also considered for inclusion. The review considered studies published within this time duration to correspond with the period when evidencebased medicine movement and scholarship enjoyed renewed interest and acknowledgement [53]. This was also done to ensure included studies reflect current evidence of health professionals' views on what acts as a barrier or an enabler to their uptake or adherence to evidence-based practice for acute stroke care. Due to lack of resources for language translation, all included studies were limited to studies published in English language. Search strings were designed to reflect related Medical Subject Heading (MeSH) terms, key terms and phrases from the selected databases related to the review aim. Details of the search terms used are presented in Additional file 2.

Study selection

Results were downloaded and imported into EndNote for screening to first remove duplicates by one author (LB). The next stage involved the screening of the remaining studies based on the relevance of study titles and abstracts to the review aim. When articles had insufficient information in the title and abstract to support this screening, a full-text reading was conducted. This was followed by the selection of all potentially eligible studies in full text. A second author (SS) reviewed the selected full-text articles to ensure they met the eligibility criteria. Results of the full text were also shared with the remaining authors to validate, and none of the authors raised questions about their eligibility. Articles which met the inclusion criteria following full-text screening by two authors (LB and SS) were selected for the final analysis.

Data extraction

A standardised data extraction tool (evidence table) was used to extract information relevant to the study aim by one author (LB). As shown in Table 1, the information extracted include the authors and year of publication, country of study, intervention, study aim, design, participants/sample, data collection methods and key findings on the barriers and enablers to uptake of acute stroke care interventions. This was systematically done to ensure extracted data characteristics from the eligible studies were consistent. The key findings and conclusions of the eligible studies which were reported as either barriers, enablers or barriers and enablers were identified by one author (LB). These findings were shared with the remaining reviewers to ensure consistency with the primary studies.

Data synthesis

Data analysis involved a thematic analysis of the results from the eligible studies. Based on the Tailored Implementation for Chronic Diseases project [54], a preexisting framework of seven domains developed by implementation science researchers to examine what informs change in clinical practice [55] was followed to categorise the themes of barriers and enablers. The checklist of seven domains comprised guideline factors, individual health professionals' factors, patient factors, professional interactions, incentives and resources, capacity for organisational change, and social, political and legal affairs. Additional file 3 provides further explanation of each domain. This process was done by one reviewer (LB) who is experienced in categorising themes using pre-existing frameworks. This was done with constant reference to the content of the pre-existing framework and identified barriers and enablers from the articles to ensure appropriate classification. Another reviewer (SS) validated the classification of the barriers and enablers (See Table 2), and one disagreement was recorded during this stage but was quickly resolved in consultation with another author (AdGA). One author (LB) consequently weighted each domain of barriers/enablers in a tabular form (See Table 3) according to the frequency of each barrier or enabler as reported in the articles.

Assessment of methodological quality

To capture the unique reporting differences within qualitative and quantitative studies, two separate quality

Lead author, year and country	Study aim	Stroke intervention	Study design	Participants/sample size	Data collection methods tools	Barriers or enablers
Meurer (2011) [60] USA	To describe barriers to thrombolytic use in acute stroke care	t-PA	Qualitative study	 - 65 emergency physicians - 62 nurses - 15 neurologists - 12 radiologists - 12 hospital administrators - 3 others (hospitalists and pharmacist) 	Focus groups/interviews topic guide	Patient factors: delayed presentation, family issues, age of patient, demand for t-pa, language, adverse to taking ambulance, early symptom recognition characteristics of the guideline, characteristics of the guidelines, outcome expectancy, presence of contradictory guidelines or "position statements on guidelines or "position statements on guidelines or "position statements of awareness of acute stroke guidelines, lack of guideline familiarity, interpretation confidence, lack of guidelines, lack of guideline agreement, lack of guideline agreement, inadeguate communication of the time sensitive nature of CT ordering and interpretation, inaccurate patient weight, staff recognition of stroke symptoms Resources and incentives: Resources and incentives: availability of scanner, finnited neurosurgety, lack of system process to alert radiologists of the emergency nature of stroke-related scans, lack of system process to alert radiologists of the emergency inter of stroke-related scans, lack of system process to alert radiologists of the emergency inter of stroke-related scans, lack of system process to alert radiologists of the emergency inter of stroke-related scans, lack of follow up/feedback, ED overcrowding, lack of system process to alert radiologists of the emergency inter of stroke-related scans, lack of follow up/feedback, ED overcrowding, lack of system process to alert radiologists of the emergency nature of stroke-related scans, lack of follow up/feedback, ED overcrowding, lack of follow up/feedback, ED overcrowding, lack of system process to alert radiologists of the emergency nature of stroke-related scans, lack of follow up/feedback, ED overcrowding, lack of system process to alert radiologists of the emergency nature of stroke-related scans, lack of follow up/feedback, ED overcrowding, lack of system process to alert radiologists of the emergency nature of stroke stroke
Hargis (2015) [65] USA	To identify barriers to the administration of intravenous tissue plasminogen activator (t-PA)	t-PA	Cross- sectional study	Stroke coordinators (36)	Survey questionnaire	Individual health professionals: physician reluctance to use t-PA and lack of urgency in emergency department Professional interactions: poor communication between care providers Organisation context/health system: lack of a dedicated and trained stroke nurse, role definition not clear Patient factors: patients' late arrival
Chan (2005) [63] USA	To assess the experience, knowledge and attitudes of emergency department directors on their use of t-PA	t-PA	Cross- sectional study	52 emergency physicians (directors)	Survey questionnaire	Guideline factors: ED directors' attitudes regarding its safety Individual health professionals:

support, lack of radiological support, willingness to use t-PA to treat acute ischemic stroke Resources and incentives: lack of CT access and lack of CT interpretation availability Organisation context/health system: lack of institutional attitudes, availability of ED protocols for use t-PA use, general lack of institutional support, limited radiological back up for CT interpretation and lack of protocols to support t-PA use	estionnaire Organisation context/health system: Stroke unit care not seen as priority by hospital, lack of management support and lack of staffing Professional Interactions: lack of allied health support, lack of nursing support and lack of physicial support Resources and incentives: lack of time, lack of money and lack of physical space Guideline factors: lack of evidence	estionnaire Organisation context/health system: lack of stroke protocols and pathways suppor lack of administrative support, emergency department delays, lack of support Resources and incentives: unsuitable hospital satting Inclividual health professionals. lack of knowledge and education on the use of t-PA, uncertainty with patient selection criteria, experience with t-PA inclusion and exclusions, personal stroke neurological experience, clinical diagnostic uncertainty Patient factors: pre-hospital delays Guideline factors: risk of intracerebral haemorrhage, uncertainty about benefits of t-PA	tured Organisation context/health system: and focus shortage of neurologists, lack of formalized guidelines or protocols, inconsistent use of pathways, lack of staff to constantly update pathways/guidelines, lack of formalised process to support consistent education, heavy workloads, lack of dedicated physician
	Survey que	Survey que	Semi-struc interviews group topic guid
	228 participants -99 allied health -72 nurses -57 doctors	11 physicians 13 nurses	84 clinicians (nurses, allied health staff, department or unit managers and physicians)
	Cross- sectional study	Cross- sectional study	Qualitative study
	Stroke unit	t-PA	Stroke unit and t-PA
	To determine stroke clinicians' preferences for models of inpatient stroke unit care and perceived barriers to establishing a comprehensive stroke unit model	To identify barriers which prevent rural health care providers from utilising t-PA in acute ischaemic stroke and proposes possible support mechanisms to increase its utilisation	To determine the local enablers and barriers to providing evidence-based stroke care
	O'Rourke (2013) [66] Australia	William (2013) [69] Australia	Purvis (2014) [62] Australia

or nurse for stroke care, limited funding for staff professional development, lack of dedicated allied health positions, frequent rotation of staff, lack of executive support and employment of part time staff Resources and incentives. Iimited number of stroke unit beds, lack of dedicated stroke unit, lack of resources, lack of time to provide education Professional interactions: lack of strong medical leadership-delays in clinical decisions in clinical decisions in clinical decisions in clinical decisions in clinical decisions in clinical decisions in clinical decisions administer t-PA, inability to administer t-PA and inconsistency	Organisation context/health system: performance monitoring, providing feedback on stroke care performance, checklist/decision aids (maintenance) Individual health professionals: knowledge on the use of t-PA treatment, skill and competency to use t-PA, modelling use of t-PA by senior staff	Organisation context/health system: lack of manpower, poor patient flow to the rehabilitation care centre and time to treatment delays (defiant referral behaviour of general practitioners) Resources and incentives : insufficient hospital logistics or beds Individual health professionals: negative attitude towards guideline use, lack of experience or competence, lack of knowledge Patient factors: patients are too late in hospital, hesitation by the patient or carer to use guideline Guideline factors: lack of confidence in the evidence, fear of comfidence in the evidence, fear of comfidence in the evidence, fear of comfidences in the vidence, fear of comfidences in the vidence, fear of comfidences in the suidence guideline implementation	Organisation context/health system:
	Survey questionnaire	Survey questionnaire	Survey duestionnaire
	429 participants Australasian College for Emergency Medicine Members	201 neurologists	453 doctors
	Cross- sectional study	Cross- sectional study	
	t-PA	Aspirin t-PA	t-PA
	To assess emergency physicians' perceptions of individual and system enablers to the use of tissue Plasminogen activator in acute stroke	To investigate barriers for guideline adherence to bring about suggestions for possible implementation strategies	To describe the use of t-PA in the hosnitals assess stroke chortors'
	Grady (2014) [64] Australia	Van Der Weijden (2004) [68] The Netherlands	Slot (2009) [67]

Table 1 Characteristic	cs of included studies (Continued)					
Scandinavian countries (Norway, Denmark and Sweden)	opinions on the use of t-PA, identify existing barriers against treatment and to ways to overcome the barriers		Cross- sectional study			lack of urgent triaging of stroke patients by ED due to high workload, hospitals lack of good protocols/routines for t-PA, and ambulance service staff inadequate triaging of acute stroke patients individual health professionals: ambulance staff lack of knowledge about t-PA, ED lack of knowledge about thrombolytic treatment and disapproval of the use of t-PA by physicians Patient factors: patients /lack of early recognition of symptoms, patients delay in contacting ambulance service and patients disinterest in t-PA due to side effects Guideline factors: risk of intracranial haemorrhage
Stecksen (2013) [61] Sweden	Identify facilitators of and barriers to the implementation of national guidelines on thrombolytic therapy for acute ischemic stroke	۲- ک	Qualitative study	9 physicians 7 nurses	Semi-structured interviews Interview guide	Organisation context/health system: stressful and overburdened working conditions, formal power structures, failure to react to guideline deviations, limited human resource capacity/few staff for stroke care, lack of continuity, duty schedule inhibiting training and lack of institutional support Resources and incentives: limited financial resources and insufficient time Professional interactions: poor professional identity, insufficient recognition by peers, inter-intra professional power structures, lack of support from more advanced hospitals and prestige and power relations individual health professionals old-fashioned views, lack of experience with thrombolytic therapy, limited time, patients' recruitment difficulties, lack of knowledge, lack of awareness of stroke as an emergency by ambulance services and other hospital staff and anxiety in using t-PA Patient factors: low expectations of therapeutic options, undue respect for the treatment (t-PA) and strict criteria for t-PA

Author and year	Stroke therapy or intervention	Guideline factors	Individual health professionals	Patient factors	Professional interactions	Incentives and resources	Capacity for organisational change	Social, political and legal factors
O'Rourke (2013) [66]	Stroke unit	х			х	Х	х	
Grady (2014) [64]	Thrombolysis		х		х		х	
William (2013) [69]	Thrombolysis	х	х	х			х	
Van Der (2004) [68]	Aspirin and thrombolysis	х	х	х		х	х	
Slot (2009) [67]	Thrombolysis	х	х	х		х	х	
Meurer (2011) [60]	Thrombolysis	х	х	х		х	х	
Purvis (2014) [62]	Stroke unit and thrombolysis	х	х	х	Х	х	х	
Stecksén (2013) [61]		х	х		х	х	х	
Hargis (2015) [65]	Thrombolysis	х	х	х	х	х	х	
Chan (2005) [63]	Thrombolysis	х	х			х	х	

Table 2 Domain of barriers or enablers to evidence uptake

X indicates a particular thematic barrier or enabler reported by the author (s)

reporting assessment tools were used. The checklist by the Joanna Briggs Institute for assessing qualitative studies was used for the qualitative studies [56], while the guidelines suggested by the Centre for Evidence-Based Management to appraise surveys was also used for the quantitative studies [57]. These checklists were used because they have comprehensively clear score sheets and instructions which enabled the authors to assess the relevance and rigour of all included studies. Given that there is still lack of consensus on the criteria for assessing the quality of qualitative studies in systematic reviews [58, 59]; included qualitative studies were not based on their quality scoring but on the basis of their overall contribution to the synthesis rigour. One reviewer (LB) appraised the quality of included studies. Another reviewer (SS) carried out a separate rating and slight variations were observed. However, these differences were quickly addressed by the two reviewers.

Results

Study selection

The electronic search yielded 9832 studies [MEDLINE = 2518, CINAHL = 458, AMED = 221, PscINFO = 1229, Embase = 873, Cochrane Library = 4507 and 26 additional studies retrieved from other sources]. After removing 1386 duplicates, 8446 studies remained. Screening based on title and abstract relevance excluded 8263 and 81articles, respectively. Studies excluded at this stage were either due to the fact that they were not primary studies, had irrelevant topics, that is, not focused on barriers and enablers to the four recommended evidencebased stroke care interventions. Other reasons for exclusion include duplicate studies, letters and editorials. A full-text screening of the remaining 102 potentially eligible studies led to further exclusions of 92 studies as they were deemed irrelevant to the study aim, focused on different population of interest, included review papers, guidelines and case reports. Overall, 10 studies met the inclusion criteria (See Fig. 1).

Study characteristics

Three qualitative [60-62] and seven quantitative studies [63-69] were included. Quantitative studies employed online and postal surveys while the qualitative studies used semi-structured interviews and focus group methods. Whereas analysis of the quantitative studies was conducted using predominantly descriptive statistics, thematic analysis guided the analyses of the qualitative studies. The total number of included participants was 1692, and these comprised nurses, general medical doctors, neurologists, emergency department physicians, allied health staff and health managers. Included studies were published between 2004 and 2015. Four studies were conducted in Australia [62, 64, 66, 69], three in the USA [60, 63, 65], two in Sweden [61, 67], and one each in Norway [67], Denmark [67] and the Netherlands [68]. Most of the barriers or enablers identified in the quantitative studies were also found in the qualitative studies. Studies predominantly examined the barriers or enablers to the use of thrombolysis [60, 61, 63-65, 67, 69]. One study focused exclusively on barriers related to the establishment of a stroke unit [66], another on the uptake of both aspirin and thrombolysis [68] and the remaining on stroke unit and thrombolysis [62]. Although most of the eligible studies focused on barriers related to the use of evidence-based care for acute stroke, all included studies reported on three or more related barriers or enablers (See Table 1 for additional information).



Quality assessment

The overall quality of the quantitative studies was moderate given that certain methodological limitations were found in the eligible studies. Only one study described in detail the sampling of study subjects and employed sampling techniques to minimise selection bias [69]. However, the rest of the cross sectional studies did not include substantive information on sampling techniques used to minimise selection bias. Three of the eligible studies reported high response rates of 91 [63], 92 [67] and 95.8% [66]. Conversely, low response rates of 13 [64] and 26% [69] were also noted. Details of quality of reporting evaluations are presented in Table 4.

On the other hand, none one of the eligible qualitative studies reported on theoretical or philosophical bases for methodological choice, limiting the ability to situate and assess methodological relevance. However, there was a common approach to the reporting of specific data collection and the analysis process. However, none of the studies reported on how the philosophical paradigm influenced data analysis and interpretation. All qualitative studies adequately described how interviews were conducted, although no assessment data trustworthiness through triangulation or member checking was reported. Finally, two of the qualitative studies [48, 62] addressed the issue of reflexivity, that is, potential reporting bias related to the researcher's professional background or areas of interest.

Synthesis of results

Summary of evidence: main barriers and enablers to evidence uptake

Overall, four studies reported on both barriers and enablers to uptake of evidence-based acute stroke therapies [61, 62, 66, 69] whilst five reported on only barriers to evidence uptake [60, 63, 65, 67, 67] and one study had an explicit focus on enablers to uptake of evidencebased care for acute stroke [63]. Despite some studies reporting on both barriers and enablers, studies which focused only on barriers often made reference to or inferred enablers as the opposite of the barriers, an approach that has been adopted in the present review. Thus, barriers and enablers were analysed and discussed collectively. As reported below, Table 3 shows the
Table 3	Barriers	and	enablers	to	evidence	-based	acute	stroke
care								

Domain of barriers and enablers	Frequency (%)
Guideline factors	16 (10.38%)
Individual health professionals	39 (25.32%)
Patient factors	15 (9.74%)
Professional interactions	10 (6.49%)
Incentives and resources	17 (11.03%)
Capacity for organisational change	57 (37.01%)
Social, political and legal factors	0 (0.0%)

Note: The weighted frequency was calculated based on the number of times a particular barrier or enabler was reported in the eligible studies

distribution and weighted frequency of each barrier which provides information on the potential significance of each barrier and enabler to the uptake of the four recommended acute stroke care interventions.

Capacity for organisational change

This category of barriers/enablers was the most highly cited by participants in all the eligible studies. According to the health professionals, the use of evidence-based care could be challenged by lack of institutional support [61]. They further highlighted limited health staff capacity especially lack of a stroke nurse or specialist [60, 62, 65] and inadequate funding opportunities for staff professional development [62, 64]. For example, participants reported that some hospitals were unable to provide or formalise acute stroke care guidelines to facilitate health staff use of evidence-based therapies [60, 69]. Additionally, instances were cited where there was limited or no executive support for professional development or upgrading to deliver current therapies for acute stroke according to best scientific evidence [62]. Of the varied barriers reported under this category, workload demands were also commonly cited as a key hindrance to the implementation of evidence-based acute stroke care [60, 62, 67]. In one study [69], 71% of participants indicated lack of protocols and pathways. The study by Van der Weijden et al. identified organisational level barriers as the most significant barriers to uptake of evidencebased practice [68].

Individual health professionals

Individual health professionals' factors were reported by participants as important barriers/enablers from the eligible studies. This domain of barriers was found in nine included studies [60–65, 67–69]. In the views of most participants, uptake of evidence-based interventions such as thrombolytic therapy is slow or not happening due to health professional's lack of awareness of a particular intervention [60, 61, 68, 69], lack of skills or self-efficacy to apply the intervention [60, 61, 68] or low motivation to implement an evidence-based therapy [60]. For example, in one study, 50% of participants indicated their lack of knowledge on the use of thrombolytic therapy hampered uptake in their routine clinical practice [60]. They also outlined barriers such as oldfashioned views about some specific acute stroke therapies [61]. Further, one study [63] reported that some neurologists disapprove of the use of thrombolytic therapy, which was agreed by (33%) of respondents.

Resources and incentives

This was another major domain of barriers or enablers to evidence uptake for acute stroke care. A total of eight of ten eligible studies identified resources and incentives related barriers/enablers as crucial to evidence uptake [60–63, 65–68]. Some of the common barriers/enablers comprised limited physical space to establish stroke units [66], lack of CT scans [63], lack of financial resources [61, 62, 66, 68], limited time [61, 66], limited stroke beds [62, 66] and limited staff capacity [61–63, 66, 68]. These factors were common in both qualitative and quantitative studies in this review.

Guidelines factors

The present review has shown the nature and characteristics of specific evidence-based therapies for acute stroke could influence their levels of uptake. Nine of ten eligible studies reported barriers related to the characteristics or the nature of evidence related to the stroke intervention or guidelines [60-63, 65-69]. Views related more to health professionals' misconceptions about the level of effectiveness of some acute stroke care therapies such as thrombolysis. For example, despite evidence that the benefits of thrombolysis outweigh potential associated side effects, participants expressed doubts in the effectiveness of this therapy because they were concerned about severe bleeding and other complications. In one study [69], 73% of respondents indicated risk of symptomatic intracerebral haemorrhage as a key barrier to administering thrombolysis. In another study [63], 33% of the participants expressed uncertainty about the evidence of using thrombolytic therapy for acute ischemic stroke and recommended the need for further studies for definitive evidence of its efficacy before they would use it for patient care. Disagreement on the recommended dosage for aspirin was also highlighted by participants in one study [68].

Patient factors

Within this domain of barriers and enablers, six studies highlighted factors such as late arrival to seek care, patients' or relatives' lack of awareness of early stroke symptoms or patients' decision for other acute care interventions outside the standardised recommendation

Table 4 Critical appraisal of eligible studies

	Appraisal questions for survey	O'Rourke (2013) [66]	William (2013) [69]	Van Der Weijden (2004) [67]	Grady (2014) [64]	Hargis (2015) [65]	Chan (2005) [63]	Slot (2009) [67]
1	Did the study address a clearly focused question/issue?	Y	Y	Y	Y	Y	Y	Y
2	Is the research method (study design) appropriate for answering the research question?	Y	Y	Υ	Y	Y	Y	Υ
3	Is the method of selection of the subjects (employees, teams, divisions, organisations) clearly described?	U	Y	Υ	Y	Y	Ν	Y
4	Could the way the sample was obtained introduce (selection) bias?	Ν	Ν	Ν	Ν	U	Ν	Ν
5	Was the sample of subjects representative with regard to the population to which the findings will be referred?	Ν	Ν	Ν	Y	Ν	Ν	Y
6	Was the sample size based on pre-study considerations of statistical power?	Ν	Y	Y	Ν	Ν	Ν	Ν
7	Was a satisfactory response rate achieved?	Υ	Ν	Ν	Ν	Υ	Y	Y
8	Are the measurements (questionnaires) likely to be valid and reliable?	Ν	Y	Ν	Y	Ν	Ν	Ν
9	Was the statistical significance assessed?	Ν	Ν	Ν	Y	Ν	Ν	Ν
10	Are confidence intervals given for the main results?	Ν	Ν	Υ	Ν	Ν	Ν	Ν
11	Could there be confounding factors that haven't been accounted for?	Ν	Ν	Ν	Ν	Ν	Ν	U
12	Can the results be applied to your organisation?	Ν	U	U	Ν	Ν	Ν	Y
	Yes (Y), Can't Tell (U) and NO (N)							
	Critical Appraisal Questions for Qualitative Studies	Meurer (2011) [60]	Purvis (2014) [62]	Stecksén (2013) [61]				
1	Is there a congruity between the stated philosophical perspective and the research methodology?	Ν	Ν	Ν				
2	Is there a congruity between the research methodology and the research question or objectives?	Y	Y	Y				
3	Is there a congruity between the research methodology and the methods used to collect the data?	Y	Y	Y				
4	Is there a congruity between the research methodology and the representation and analysis of data?	Y	Y	Y				
5	Is there a congruity between the research methodology and the interpretation of results?	Y	Y	Y				
6	Is there a statement locating the researcher culturally or theoretically?	Y	Y	Ν				
7	Is the influence of the researcher on the research and vice versa addressed?	U	Y	U				
8	Are participants, and their voices, adequately represented?	Y	Y	Ν				
9	Is the research ethical according to current criteria or, for recent studies, is there evidence of ethical approval by an appropriate body?	Y	Y	Y				
10	Do the conclusions drawn in the research report flow from the analysis, or interpretation, of the data?	Y	Y	Y				
	Yes (Y) No (N) Unclear (U) Not Applicable (NA)							

[60, 62, 66, 67–69]. The most frequently reported patient-related barrier was patients' late arrival in emergency departments to receive thrombolysis. For example, one study [69] reported that 91% of respondents indicated patients' late arrival for acute care as the major barrier. Another study ranked delayed patient

presentation for care as the major barrier to the use of thrombolytic therapy [65] due to the patients' failure to recognise stroke symptoms. Another key barrier was patients' preference for the non-use of thrombolysis as a therapeutic option due to perceived side-effects of this treatment option [67].

Professional interactions

The uptake of evidence-based care for acute stroke can also be influenced by the form and nature of interactions among health professionals, especially engagement with clinical leaders. Five studies showed evidence of this domain of barriers/enablers [61, 62, 64–66]. The present review found this as among the least described barriers/ enablers in the included studies. Barriers suggested by participants included: inadequate communication especially among clinical staff [65], lack of clinical leadership or support from senior clinicians [62]. As an example, Hargis et al. reported that 14% of respondents cited poor communication between emergency department staff, and the neurology team affected the use of thrombolytic therapy [65].

Discussion

This review aimed to explore the main barriers/enablers underlying adoption of evidence-based therapies for treatment and management of acute stroke. To date, prior studies have focused largely on barriers or enablers to generalised acute stroke guidelines or thrombolysis specifically. This review addressed a knowledge gap on the main barriers or enablers to the uptake of the four recommended evidence-based therapies/service for acute stroke, namely, stroke unit care, thrombolytic therapy, aspirin and decompressive surgery.

The specific innovations of this review are its primary focus on the four recommended evidence-based therapies for acute stroke care and the inclusion of both quantitative and qualitative study designs, both of which add depth to the analysis. Although this review was limited to ten eligible studies, there seems to be a saturation of potential determinants given the commonality and recurrence of barriers and enablers revealed between studies. There was also a significant overlap in the reported barriers or enablers, although these characterisations differed between health professionals. Findings from prior reviews on barriers to thrombolysis uptake [41, 44, 45, 70], other studies on the barriers and enablers to triaging, treatment and patients' transfer in emergency departments (ED) [48] and adherence to general stroke clinical guidelines [40], corroborated with majority of the barriers/enablers identified in this review.

On the most important barriers or enablers from the present review, organisational context or structural level factors were the most cited barriers or enablers to uptake of evidence-based care for acute stroke by health professionals. This finding substantiates the results of earlier works [9, 41, 70]. Given the importance attached to this category of barriers and as reflected in earlier works, a greater effort to address these barriers should be prioritise by health managers and planners for optimal uptake of evidence-based practice. Further, consistent with the

literature [9, 40, 41, 45, 71], the barriers related to the individual health professional and guideline level barriers, availability of adequate health resources and medical facilities were also predominant in this review.

The barriers/enablers associated with social, political and legal factors were not reported by any of the eligible studies, thus leaving a gap in our understanding of whether such thematic barriers or enablers play any important role in evidence-based care uptake. It is plausible that their influence on evidence-uptake is negligible and may not warrant immediate attention of health policymakers and health managers. The absence of evidence for this domain of barriers/enablers in this review was also evident in the checklist employed to contextualise the discussion in this review. In that review [55], which promulgated the checklist, this particular domain attracted the least eligible studies.

Importantly, the eligible studies were all conducted in high-income countries and so the findings may not be directly relevant to those in low-middle income countries. The inadequacy of medical facilities, limited health staff capacity and other health resource constraints characterised in low- and middle-income countries may emerge as the most important barrier since health systems in these contexts always have fewer resources overall compared to high-income countries.

This review has also underscored the need for increased attention on patient level barriers. Specifically, patients' late arrival in ED settings for care because of lack of recognition of early stroke symptoms was notable. To address the low awareness or lack of early recognition of stroke symptoms, we recommend the need for increased public health campaigns and research emphasising the urgent need to seek care at stroke symptom onset, as highlighted by the 'time is brain' research study [72] and the 'FAST' stroke awareness campaign messages in the UK [73, 74]. The UK FAST stroke awareness campaign strategy could be a unique exemplar for low- and middleincome countries where evidence [75-77] suggest low awareness of stroke symptoms is a major obstacle to care. With the exception of thrombolytic therapy, the barriers or enablers on the remaining three evidence-based recommendations were less explored. No studies explored decompression surgery, although an earlier review suggested patient level barriers as more essential [45]. Other researchers have cited limited access to computed tomographic (CT) brain scans in low-middle income as the most important factors to address to improve uptake of aspirin therapy [78].

Implications

The analysis from this review may inform the circumstances in which health professionals are able to provide evidence-based care for acute stroke patients. Despite the increased scholarship and policy recommendations for this, the reported barriers or enablers persist, consequently depriving patients of sound and effective therapies. Given that previous evidence suggest, overall, a significant number of patients receive clinical care without sound scientific evidence [2, 10, 79], these findings have the potential to contribute to present efforts aimed at ensuring stroke patients receive effective care.

Increasingly, reports of the rising incidence and mortality rates from stroke in low- and middle-income countries continue to attract the attention of global health authorities. Nonetheless, studies thus far have indicated a low uptake of evidence-based care for acute stroke in Africa and other low/middle income regions [35, 36]. However, no eligible studies were found in lowand middle-income countries to improve understanding about the factors accounting for this apparent gap. It is essential to explore the barriers or enablers in the context of Africa and other low- and middle-income regions to develop context-specific interventions to enhance uptake of evidence-based care for acute stroke.

Various health professionals play major primary roles as acute caregivers and consequently have unique challenges that deserve attention in future studies since this review was unable to separate determinants according to specific health professionals. Future research should endeavour to explore the barriers or enablers unique to stroke specialists, medical doctors, nurses and allied health staff. As emphasised earlier, identifying the views of stroke patients and carers on the barriers and enablers to stroke care should be part of future research efforts.

Strengths and limitations

An important strength of this review is its primary focus on the four recommended evidence-based care interventions. The inclusion of both quantitative and qualitative study designs further adds to the analytical breadth and depth of this review. Nonetheless, this review has some limitations. First, we acknowledge that since this study was limited to studies published in English language, there remains a possibility other relevant studies and insights from LMIC were missed. Also, the screening process for eligible studies was conducted by a single author, and this may have affected the accuracy, reliability and transparency of the process. Additionally, the search for relevant studies was limited to only peer-reviewed journals thus potentially relevant theses, conference presentations and book chapters were excluded. Although, the reasons for the lack of studies from low- and middle-income countries remains unclear, this could be explained by the prevailing situation of limited international literature on the uptake of evidence-based acute stroke care interventions from such settings.

The limited number of eligible studies made it impossible to draw definitive conclusions about the primary barriers or enablers to evidence uptake for acute stroke care. Also, although the present study attempted to rank the importance of the barriers and enablers based on their weighted frequencies, this is not optimal. This field is less developed with currently no time-tested approaches to qualitatively rate the importance of such drivers to change in healthcare. Approaches such as the GRADE-CERQual framework to measure the confidence of synthesised evidence [80] could be explored in similar reviews in future. As we used a pre-designed taxonomy of barriers and enablers to contextualise our findings, it is possible other relevant barriers and enablers considered unfit to the framework were inadvertently missed out.

Conclusions

The reported barriers or enablers mapped well with the previously proposed taxonomy of barriers or enablers. Our findings are consistent with previous studies [9, 40] where lack of adherence to or inadequate use of evidencebased care was attributed to organisational level factors, professionals' lack of awareness and familiarity to a particular evidence-based care, financial constraints, lack of confidence in a particular therapy, fear of adverse effects, personal beliefs, patient delays, lack of time to implement evidence-based treatment guidelines and preferences or values about the use of evidence-based care.

Despite considerable effective therapeutic options for acute stroke care, poor understanding of barriers or enablers and lack of a clear evidence-based health policy to ensure their uptake render such therapeutic services underutilised. In light of this, efforts by health managers and policy-makers to formulate context-specific policies and design interventions to enhance uptake of evidencebased care should be informed by these barriers and enablers. Following this review, we are also proposing research studies be conducted in low-middle income countries to enhance our understanding of the key barriers accounting for the currently low uptake levels of evidence-based acute stroke care interventions.

Additional files

Additional file 1: PRISMA 2009 Checklist. (DOCX 15 kb) Additional file 2: Search strategy for MEDLINE. (DOCX 17kb) Additional file 3: Checklist for Barriers and Enablers. (DOCX 12 kb)

Abbreviations

AMED: Allied and Complementary Medicine Database; CINAHL: Cumulative Index to Nursing and Allied Health Literature; CT: Computed tomographic; ED: Emergency department; FAST: Facial drooping, arm weakness, speech difficulties and time; GRADE-CERQual: Confidence in the Evidence from Reviews of Qualitative Research; ICU: Intensive care unit; MeSH: Medical Subject Heading; NINDS: National Institute of Neurological Disorders and Stroke; PRISMA: Preferred Reporting Item for Systematic Reviews and Meta-Analysis; t-PA: Intravenous tissue plasminogen activator

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Availability of data and materials

The authors declare that the data supporting the study findings are available within the article and Additional files.

Authors' contributions

LB is responsible for the protocol design, literature search of databases, study selection and data extraction processes. MO, SS, GM, AdGA and JC contributed to the selection and data extraction processes. LB and SS helped in quality appraisal process. LB AdGA and SS are responsible for the classification of the themes. LB wrote the first draft of the manuscript. MO, SS, GM, AdGA and JC reviewed the manuscript for content analysis and discussion. SS, MO, GM, AdGA and JC supervised and coordinated the entire review process. All authors read and approved the final manuscript.

Competing interests

The authors declare that they have no competing interests.

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CHAPTER THREE RESEARCH METHODOLOGY AND DESIGN

3.0 Introduction

This section presents an overview of the methodology employed for the thesis. It examines the epistemological and philosophical rationales underpinning the different study designs used in the thesis. The underlying rationales for the study settings, sampling approaches, participant recruitment, data collection and analysis are also described. The section also discusses the strengths and limitations of the selected methods used. Overall, this thesis employed three different, stand-alone, single but interlinked study designs, a design described by Creswell and colleagues as a nested or an embedded mixed methods design [190]. According to Wisdom et al [191], this is an advanced form of a mixed methods research design commonly employed in implementation, translation or dissemination health research projects, hence its application in this thesis. The studies comprise: a survey, a retrospective cohort and a qualitative interview study. As will be illustrated further below, these study designs draw knowledge from both quantitative and qualitative research philosophical paradigms.

3.1 Philosophical Paradigms in Research

3.1.1 Quantitative Approach

According to the quantitative research approach, which is based on the positivist paradigm, the main underlying philosophy for quantitative research is the generation of valid knowledge subject to rigorous testing, measurement and replication [192-194]. Postulates of this view believe in the existence of objective reality which can be generated, predicted or controlled through standardised procedures [193]. The proponents argue for objectivity in the entire research process to minimise bias. In this paradigm, knowledge gained from individual's subjective experiences, opinions, interpretation are less appreciated, often described as external

and not purely objective [193, 195]. However, in recent times, this paradigm has begun to appreciate the value of data from qualitative research inquiry in the testing or generation of hypotheses, designing large scale surveys or in researching a topic of which very little information is available [196]. Overall, the focus of the quantitative paradigm is situated within the context of the natural world [193], unlike the social world of the qualitative research approaches.

3.1.2 Qualitative Approach

On the other hand, the constructivist paradigm, also known as the interpretivist or naturalist paradigm, aligns with qualitative research approaches. Advocates of this paradigm refute the existence of total objective knowledge, the supposedly unproblematic nature of reality [193, 195, 197, 198]. Proponents of this approach believe in the existence of multiple realities and argue that the positivist research ideologies are idealistic, explaining that natural science is a social process controlled by human beings whose values, subjectivity and biases are not detachable from their everyday activities [197-200]. The qualitative research approach emphasises the generation of knowledge through negotiation, interpretation of human subjective views, and values of individuals [195, 201, 202]. Hence, this provides a contextually rich knowledge detached of hard, predictive and objective facts. In fact, the qualitative research approach has been increasingly recognised in contributing to the understanding of health and health outcomes [192, 203]. This is particularly the case in contemporary public health practice, a discipline within which the present thesis is contextualised.

3.1.3 A Pragmatic Paradigm

Regardless of which philosophical, epistemological, or methodological standpoints are employed in any form of research inquiry, a renewed focus in recent research approaches tend to support multiple methods and data sources [204-206]. Indeed, the use of diverse methodological approaches in the collection of data for empirical research has been increasingly recognised over the past decade due to the practicality and value-laden nature of such an approach [205, 207]. Drawing on the core tenets of quantitative and qualitative approaches, the pragmatic approach or pragmatism has now become popular [196]. This approach advocates for the use of multiple theories, approaches, methods and data most suitable to answer the research questions under investigation [196, 208]. Sale et al [209] argues that, despite the diverse epistemological, ontological and methodological standpoints and origins of research, in health research, the two traditional research approaches can be practically combined to complement each other to optimally and adequately address a particular phenomenon of inquiry using different methods to examine different but related issues

Overall, proponents of the pragmatic approach argue that the conduct of research and the strategy to employ should not be dogmatically hinged on quantitative or qualitative approaches but rather on the basis of the nature and scope of the research, and the data required to adequately answer the specific research question(s). This line of thinking resonates with the view of Flyvbjerg, that the conduct of research should be underpinned primarily by the research problem and not the methodology [210]. This thesis is thus contextualised within the epistemological and philosophical standpoints of both quantitative and qualitative research methods, known as pragmatism or the pragmatic approach. Therefore, using the, complementarity principle in the pragmatic approach, this thesis employed both quantitative and qualitative methods to investigate the uptake of evidence-based acute stroke care within the Ghanaian context.

To address the first and second research questions, two quantitative approaches were utilised to examine the range of acute stroke care services in the major referral hospitals across Ghana, and the extent to which such stroke services translate into optimal clinical outcomes. The qualitative aspect on the other hand, sought to explore the practical barriers associated with the

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provision of acute stroke care. The qualitative approach provided an in-depth understanding of the barriers to evidence-based acute stroke care, a phenomenon which cannot be studied adequately using only quantitative approaches. In sum, this study was conducted within a pragmatic philosophy to provide a more contextualised and complete understanding of the knowledge-translation problem. Closely consistent with the recommendation of research methodologists on the stages of the research design and processes [193], **Figure 1** presents the overall research approach showing how the research was conducted. In summary, it describes the main stages from planning and design of the study, review of literature, formulation of research questions/aims, the selection of study sites, the instrumentation process, data collection and analysis. The remaining stage entailed discussion/interpretation of the research findings and the writing up of the entire research project/thesis where conclusions and recommendations are finally made.



Figure 1: Flow chart showing the research process/stages for the thesis

3.2 Ethical Considerations

This research was conducted in accordance with the Helsinki declaration for medical research [211]. The following ethical and institutional review committees granted approval for the research: Australian Catholic University Human Research Ethics Committee (2015-154H), Institutional Review Board of the 37 Military Hospital (37MH-IRB IPN 035/2015) and the Ghana Health Service Ethical Review Committee on Research Involving Human Subjects (GHS-ERC:11/07/15). Ethical clearance was also obtained from the Committee on Human Research Publications and Ethics of the School of Medical Sciences of the Kwame Nkrumah University of Science and Technology and the Komfo Anokye Teaching Hospital (CHRPE/AP/141/16). All data from the research were reported in an aggregated form to guarantee confidentiality and anonymity of participants and hospitals.

Written consent was obtained from all participants prior to data collection. Two signed copies of the consent form was obtained, one for the participant, and the other for the researcher. In addition, all participants were provided with the research information sheet which outlined the main study purpose, associated benefits and risks, issues of confidentiality and anonymity in relation to their participation. The form also provided information about the researcher, supervisor and also contact information of the key ethics committee contact person they could reach when necessary. All ethical approval letters supporting the conduct of this study are found in appendix 3.

3.3 Scientific rigor in the study

Scientific rigor is an essential component in evaluating the scientific value of any research. Central to the evaluation of scientific rigor in both quantitative and qualitative studies are the components of reliability, validity, bias, comparability, reflexivity and transparency [193, 212-215]. In recognition of this, a number of strategies were adopted to enhance scientific rigor: standardized and scientific guidelines were followed in the design, data collection analysis, reporting and interpretation processes. These included the survey reporting guidelines by Bennett and associates [216], the RECORD Statement for reporting observational studies from routinely collected hospital data [217] and the guidelines by Tong et al for qualitative interviews [218]. **Table 1** below summarized the steps and measures undertaken to enhance the scientific rigor of the research:

Study	Strategies used to enhance scientific rigor
Survey	 Pre-test of research instrument Representative sample Comparability of findings with previous studies Results comprehensively reported Adequate reporting of background and context information Validation of preliminary results by study sites
Retrospective cohort study	 Pre-test research instrument Representative sample Comparability of findings with previous studies Results comprehensively reported Adequate reporting of background and context information
Qualitative in-depth interviews	 Pre-test of interview guide Ensure saturation of findings Clear descriptions of methods Comprehensive records for data collection analysis. e.g. field notes and audio recording of interviews Member validation/cross checking of results Results comprehensively recorded Adequate reporting of background and context information Compare findings with previous studies Role of researcher clearly explained (Reflexivity)

Table 1: Measures to enhance scientific rigor

3.4 Methods for quantitative data collection

This section outlines the methods employed in collecting quantitative data derived from the survey and the retrospective cohort studies. To this end, the ensuing sections describe the study designs, settings, target population, sampling and recruitment of research participants, data collection and the analytical approaches adopted. Further details of the methods are reported in chapter 4.

3.4.1 Study 1: Survey of acute stroke care services and therapies

The aim of the survey was to provide information on the kinds of acute stroke services or therapies available to support the treatment and management of acute stroke patients in Ghanaian hospital settings. Consequently, the data were evaluated to establish the extent to which available acute stroke services were consistent with best practice recommendations, using the World Stroke Organisation action guidelines [219], as a reference for providing evidence-based stroke care. This study presents the first baseline information on evidence-based acute stroke care services available from the public major referral hospitals in Ghana. The findings also support the identification of gaps in the current health system capacity of these hospitals to deliver evidence-based acute stroke care and makes recommendations thereof, for health policy action to improve stroke care.

Study Design

The study implemented a survey across all the study sites because of the advantage of collecting several variables of interest, in this case, different stroke care interventions and services without additional time and cost [192, 193, 220-222]. The choice of other methods, like qualitative interviews, could have been used but this would have limited the study ability to capture as many acute stroke services across the main referral hospitals in Ghana, and more importantly would have limited the study ability to report an objective, subjective-free data on availability

of acute stroke care services. Generalisation of study findings is one of the strengths of the survey method [221], and as such, using this method to gather research evidence from the main referral hospitals or where the highest level of acute stroke care is provided in each administrative region in Ghana gives a strong basis for the study findings to be generalised. The survey design further stood out as the more appropriate approach as it has previously been used successfully to gather similar data in Australia [103], the UK [223] and some European countries [106, 107]. In addition, in Ghana, the survey design is a popular approach used consistently to report the availability and accessibility of healthcare services [171, 172]. On the basis of this context, the survey design was concluded to be the most suitable approach to collate evidence on the range of acute stroke care services in Ghana.

Study Settings

The survey was conducted in eleven referral hospitals in Ghana (4 tertiary-teaching and 7 regional hospitals). Although there are more than 300 public and private hospitals, the selected hospitals are among the main referral public hospitals where the highest level of clinical care is provided in each of the ten administrative regions of the country [167]. In the Ghanaian setting, more medical admissions with conditions, such as a stroke, are greater in the public regional and teaching hospitals compared to private hospitals, district or sub-district hospitals. The clinical capacities of the selected public hospitals differ according to their categorisation as a teaching or a regional hospital. In contrast to the seven regional hospitals, the tertiary-teaching hospitals serve as larger referral centres and are well-resourced with diagnostic and therapeutic facilities. They are also semi-autonomous and serve as tertiary academic centres offering training in a range of highly specialised medical or clinical options. The remaining seven regional hospitals on the other hand have the capacities to deliver clinical care for acute stroke but with less clinical capacity compared to the tertiary-teaching hospitals. In Ghana, there also exists Municipal, District and Sub-District hospitals but these were excluded from

this study because they have limited clinical capacity to support acute stroke care compared to the regional and tertiary referral hospitals. As a result, these are less likely to provide evidencebased care for health conditions such as acute stroke. This formed the basis for the selection of the study sites, representing at least one major public referral hospital in each administrative region of the Ghana. A detailed description of the healthcare organisation in Ghana is outlined in chapter 1. Table 2 shows the study hospitals based on their status, bed capacity and stroke admissions for 2014.

Study Participants

The target respondents included senior hospital staff in charge of the provision and supervision of acute stroke care in the study hospitals. The choice for this category of health care staff stemmed from the fact that they play central roles in the provision of healthcare in hospitals including but not limited to supervising the delivery of acute stroke care, making strategic decisions in the hospitals' operations such as procurement of stroke services and organisation of clinical care. Participants included in the study had served in the post for at least one year. Resident doctors or doctors in training were not eligible. Table 2 below presents the distribution of the participants, their ranks and the settings.

Hospital status	2014 stroke admissions	Hospital bed capacity
Teaching Hospital 1	1500	653
Teaching Hospital 2	1000	650
Teaching Hospital 3	118	500
Teaching Hospital 4	125	400
Regional Hospital 1	409	194
Regional Hospital 2	313	358
Regional Hospital 3	-	250
Regional Hospital 4	520	235
Regional Hospital 5	71	400
Regional Hospital 6	39	226
Regional Hospital 7	49	200

Table 2: Characteristics of study hospitals

Sampling Procedure

This study adopted a non-probabilistic purposive sampling technique to recruit participants. This method of sampling targets participants based on their specialised and informed knowledge of the study topic [193, 197, 224]. Thus, this study sampled only participants who worked in the study hospitals purposively or primarily to provide direct acute stroke care to patients or acting as supervisor for the delivery of acute stroke care. This was essential as the present study focused exclusively on staff clinically qualified to provide acute stroke care directly to stroke patients in acute hospital settings. Overall, one respondent (i.e. 11 in total)

was selected from each study hospital deemed appropriate and knowledgeable based on their job titles and roles.

Respondents	Regional Hospital	Tertiary-Teaching Hospital	Overall Total
Years of professional experience			
1 -5	4	1	5
6-10	1	2	3
11-20	1	1	2
21+	1	-	1
Sex			
Male	5	2	7
Female	2	2	4
Rank/Post in the Hospital			
Neurologist Consultant	-	1	1
Neurologist	-	1	1
Physician Specialist	2	1	3
Clinical Care Coordinator	1	-	1
Senior Medical Officer	3	-	3
Medical Officer	2	1	3

Table 3: Characteristics of survey respondents and study hospitals

Recruitment

The recruitment process involved five stages. First, following ethics approval for the study, all study hospitals were formally contacted and invited to participate in the study. The invitation letter included a detailed study protocol which outlined the study purpose and the criteria for eligibility. In addition, copies of all ethics approval documents were included in order to showcase the credibility of the study.

Second, in order to further give credibility to this study, an introductory / supporting letter for the study was also sought from the Director General of the Ghana Health Service. The Director General oversee the delivery of healthcare in all public and non-teaching hospitals, and as well oversee the implementation of all national health policies and interventions. This letter was included in all the invitation letters sent out to the study hospitals.

Following responses from hospitals confirming their participation in the survey, and through personal visits and telephone calls to the appropriate Unit/Department heads, Human Resource Managers or Hospital Administrators of the hospitals, an eligible respondent from each hospital was selected. Subsequently, arrangements were made to meet the survey respondent, where they were briefed about the study, then discussed and agreed on a date, a place and time for the survey to be completed.

Survey Instrument

The survey tool (See Appendix 3) was adapted from a well-established survey instrument developed by the National Stroke Foundation of Australia to audit acute stroke services [225]. The content of the tool was also informed by other key documents [219, 226-228]. The survey instrument was a paper-written structured questionnaire designed with 80-question items requiring respondents to provide responses on the range of hospital-based services provided to stroke patients. Questions were mainly closed ended, with a minority being open-ended. The

questionnaire was written and administered in the English language. Questions in the instrument were categorised into nine sections covering the following domains: direct questions on respondents' demographic and hospital data, data on services and hospital arrangements to support early presentation of acute stroke patients. Information on diagnosis, assessment services and stroke clinical guidelines covered the next section. In the next section, data were collected on available clinical management plans/guidelines, neuro-imaging facilities (CT and MRI scans), acute stroke services and treatments as well as stroke rehabilitation services. Data were then gathered on stroke care workforce, acute stroke services and therapies. Finally, data were collected on the extent of health / hospital policy initiatives and interventions to support acute stroke care.

Data collection

An interviewer-administered approach was employed where the questionnaires were administered to respondents in their offices, clinic rooms and hospital wards. The interviewer-administered approach was considered for three important reasons: to guarantee the solicitation of complete and appropriate responses (49, 51-53), to enhance response and compliance rates, allow the opportunity for certain concepts or questions to be clarified and to guarantee complete appropriate responses were elicited [220, 222, 229]. This approach to data collection is the most prominent, widely used and accepted approach of collecting survey data in Ghanaian settings, e.g. [171, 230]. On average, each survey questionnaire took about 45-minutes to complete.

Quality Control

Given the diversity on many fronts between Australia and Ghana (country of study), the survey tool had to be pre-tested in Ghana prior to data collection in non-study public hospitals (with similar features to a regional hospital) to test for suitability and relevance to the test population. In addition, the pre-test was conducted to ensure questions were clear, understandable, and appropriate within the study context and served as an opportunity to assess response category adequacy [203, 220, 222]. Feedback from the pilot exercise was used to modify the survey prior to the actual data collection. In addition, the raw data from the survey were shared/sent back to each study hospital to validate whether the reports from the survey were consistent with their earlier responses about stroke services availability in their respective hospitals. This afforded hospitals the opportunity to address any potential errors prior to the final analysis.

Data Analysis

Descriptive statistical analysis were conducted using SPSS Version 22.0. Data from this analyses were graphically displayed in frequencies, percentages, and proportions using tables to show the types of stroke care services available in each study site. The data analysis also showed potential inequities and discrepancies in the availability of stroke services in the study sites. Finally, in order to evaluate the extent to which available services align with global best practice recommendations for acute stroke services, the World Stroke Society stroke service guideline was adopted.

3.4.2 Study 2: Retrospective cohort study on in-hospital mortality outcomes

This study aimed to evaluate in-hospital mortality outcomes among acute stroke patients admitted in Ghana. Whilst elucidating the extent to which available acute stroke care services in the study hospitals are effective, the study findings also potentially offer new insights with the potential to contribute valuable data towards decisions and development of interventions to minimise preventable deaths for future acute stroke patients and promote standardise care for acute stroke patients.

Study Design

This was a multi-site, hospital-based retrospective cohort study that aimed to evaluate any possible relationship between available acute stroke care services / process of care for acute stroke care and in-hospital mortality outcomes in six major referral hospitals in Ghana between November 2015 and April 2016. The six hospitals were part of the 11 discussed in the first study. Retrospective studies are commonly and preferably used in health research to investigate several variables of interest at a lesser cost and time compared to a prospective cohort study or a randomised control trial [231, 232]. Such studies, often based on data routinely collected in hospitals for administrative purposes, have been growing in health research over the past decades [217]. However, retrospective studies sometimes involve incomplete classification and documentation of patient records. A prospective study design may have provided a better quality and standard data to address the study aim. To control for these potential limitations, a strict eligibility criterion was applied in the data collection process to ensure the collection of objective, complete and accurate data. As reported in the data analysis section, other methodological considerations were made to minimise potential compromise of the data quality.

Study Setting

Due to time and resource constraints, the retrospective cohort study was conducted using the medical records units of three teaching hospitals and three non-teaching hospitals. The study sites (See table 4) comprised two hospitals each from the southern, middle and northern belts of Ghana, in order to take account of the geo-spatial and socio-economic contrasts among the administrative regions of the country. Additional information about the regional and tertiary teaching hospitals are outlined in chapter one.

Hospital	2014 stroke admissions	Hospital bed	capacity
TH1	1500	653	
TH2	1000	650	
TH3	118	500	
RH4	409	194	
RH5	520	235	
RH6	49	200	

Table 4: Characteristics of study hospitals

TH =Tertiary (Teaching) Hospital,

RH= Regional Hospital

Study Population

Stroke patients (aged \geq 18) admitted to the hospital for their first acute stroke between January and December 2014 were eligible to participate. The study reviewed medical records of stroke patients based on index admissions, that is, admissions for which acute stroke was treated. Patients were excluded if they had recurrent strokes, if they were diagnosed with transient ischemic attacks or any neurological deficits arising from a non-cerebrovascular cause or nonstroke diagnosis, or if clinical records were incomplete via limited clinical information to address the study aims. Table 5 shows the demographic and clinical characteristics of the patient cohort.

Participants	Regional Hospital	Tertiary-Teaching Hospital	Total
Sex			
Male	64 (44.1%)	81 (55.9%)	145 (48.3%)
Female	86 (55.5%)	69 (44.5%)	155 (51.7%)
Age			
15-30	8 (72.7%)	3 (27.3%)	11 (3.7%)
31-45	22 (47.8%)	24 (52.2%)	46 (15.3%)
46-60	48 (45.2%)	46 (54.8%)	84 (28.0%)
61 and above	82 (51.6%)	77 (48.4%)	159 (53.0%)
Stroke subtype			
Ischemic	27 (36.0%)	48 (64.0%)	75 (25%)
Haemorrhagic	17 (26.2%)	48 (73.8%)	65 (21.7%)
Undocumented	106 (66.3%)	54 (33.8%)	160 (53.3%)
Risk Factors			
Hypertension	87 (46.3%)	101 (53.7)	188 (69.9%)
Obesity	29 (61.7%)	18 (38.3%)	47(17.5%)
Diabetes	51 (45.9%)	60 (54.15)	111 (41.3%)
Smoking	16 (32.7%)	33 (67.3%)	49 (18.2%)
Alcohol intake	11 (40.7%)	16 (59.3%)	27 (10.0%)
Asthma	6 (27.3%)	16 (72.7%)	22 (8.2%)
Atrial Fibrillation	27 (45.8%)	32 (54.2%)	59 (21.9%)
Family history	15 (48.4%)	16 (51.6%)	31 (11.5%)
Access to brain (CT scan)	43 (35.5%)	77 (64.2%)	120 (40.0%)
Status at discharge			
Dead	40 (26.7%)	55 (36.7%)	95 (31.7%)
Alive	110 (73.3)	95 (63.3%)	205 (68.3)

Table 5: Patient demographic and clinical characteristics according to hospital status

Sampling and Sample size

Although multiple study outcomes were sought, the main study outcome was in-hospital mortality, based on which the overall retrospective cohort study sample was estimated.

Sample size calculation was based on an African study which found that 16% of those treated in a stroke ward died compared to 33% in medical wards [109]. Using a two-sided alpha of 0.05, power of 0.8, ratio of treatment of groups of 3:1, and proportions described above, the study needed a total of 284 patients with 71 being treated in specialised acute wards. Using the admission and discharge medical logbooks as the sampling frame, past-hospitalised stroke patients in the study hospitals from January to December 2014 were selected from each site using a sex-stratified systematic probabilistic random sampling technique. The sampling procedure involved a four-stage process: First, all stroke cases treated between January to December 2014 in the study sites were identified. Next, patients were stratified according to their sex in each of the study hospital. The third stage involved a random selection of every fifth individual enlisted in the admission and discharge logbooks as having an acute stroke and their identification numbers noted. In the final stage, based on the unique patient IDs in the hospital files, patients' medical folders were subsequently retrieved manually by health information personnel from each of the medical records unit of the study hospitals. Where retrieved patient medical records had limited information to address the study aim, or in situations where a patient folder was irretrievable, random sampling of patient medical records continued according to the above protocol until the required sample was reached. However, in order to account for possible methodological challenges which could arise (such as missing data), a sample of 50 stroke patient medical records was reviewed in each hospital, resulting in an overall total of 300 stroke patients' medical records, that is, 50 past stroke cases from each study hospital, within equal sex distribution.

Chart Review

A paper-based structured medical extraction form was used for the chart review. The patient medical records extraction form was trialled in each study hospital on a single acute stroke case and revisions made where necessary. The content of the form was adapted from relevant literature such as the National Stroke Foundation Clinical Audit tool [95]. The instrument collected data on the following: patient demographic data (age, gender, etc.), patient admission and discharge information, (admission and discharge dates, length of stay, destination at discharge). Data were also collected on the process of care indicators such as information on

whether the patient was admitted and treated in a stroke unit, general ward or an intensive care unit, treatment using t-PA or aspirin for an ischemic stroke, attended to by a therapist and having access to a brain scanning service. Finally, the instrument also made provision for data collection on medical diagnoses of stroke type and other relevant stroke patient health characteristics.

Following the sampling procedure, data on index admissions of stroke cases in the study hospitals were extracted from the hospital morbidity and mortality logbooks, admissions and discharge records logbooks and other available records (patient folders, electronic storage, etc.). The admission and discharge record books and logbooks are prospective registers of all consecutive patients with a wide range of health conditions admitted to hospitals for clinical care. Primarily, the information collected in these logbooks includes date and time of admission and discharge, patient demographic information (age, sex, occupation, date of birth, hometown, marital status, etc.) and some clinical information (diagnosed health condition, comorbidities/risk factors, discharged alive, deceased). The collection and storage of patients' medical records is often supervised by skilled health information officers in each hospital. All extracted data were de-identified and codes were applied to ensure data anonymity.

Patient Outcome Measures

Outcomes of relevance relate to all-cause in-hospital mortality from all first time stroke admissions in the study sites. Also of interest in this study was patient length of stay, measured as the date of admission to discharge or death. The overall outcome was to measure the efficacy levels of treatments and the process of care procedure. The process of care indicators included type of admitting wards, access to CT scan, aspirin, t-PA, and care provided by allied health staff (physiotherapist, dietitian, etc.)

Data Analysis

Descriptive and inferential statistical analyses were conducted using SPSS version 22.0. Descriptive statistics were conducted on patient demographics, patient health outcomes (death or alive) at discharge, stroke therapies and use of brain imaging services, patients' characteristics (stroke types, sex and gender distribution). On the other hand, inferential statistics involved the use of Pearson chi-square and Fisher exact tests to make comparisons in outcomes across the study sites and other variables of interests. The mean differences between the various groups were also evaluated using Student's t-test or one-way ANOVA. The nonparametric Mann-Whitney U-Wilcoxon test was used for variables that did not show a normal distribution. Normality of distribution was determined by standard diagnostic tests such as normal probability plot and Shapiro-Wilk test. Statistical significance was set at a *p*-value of <0.05 (two-sided). In addition, a multivariate regression analysis was conducted to investigate patient factors associated with all-cause in-hospital mortality outcomes while accounting for confounding variables such as age, gender, stroke risk factors (hypertension, obesity, diabetes, atrial fibrillation, asthma, family history and alcohol intake) or type of admitting ward (stroke unit, medical emergency and general medical wards). Similarly, the probability of dying was plotted and illustrated in Kaplan-Meier curves and differences in outcome variables were compared using the log-rank test.

3.5 Methods for qualitative data collection

This section describes the qualitative data collection and analysis process for the research. Further details of the qualitative study approach are reported in chapter 4.

3.5.1 Study Three: In-depth interviews of barriers to acute stroke care

This study aimed to provide context to the survey and retrospective cohort study data by exploring stroke care professionals' views on barriers to providing evidence-based care for acute stroke patients in the study hospitals. Thus, insights from this study illuminated our understanding of the practicalities associated with the implementation of current evidence-based interventions for acute stroke. In other words, the data broadened our understanding of why health professionals, especially from LMICs, often provide care unlikely to meet best practice guidelines. A better understanding of these barriers may be instrumental in designing well-targeted policy interventions to enhance uptake of evidence-based therapies for acute stroke care.

Study Design

A qualitative study design was employed to explore the barriers faced by stroke care professional in providing evidence-based care for better patient outcomes. In providing context to the previous two studies as reported in the preceding sections, the qualitative study provided an important source of data to understand the possible rationales behind limited utilization of evidence-based acute stroke care services/interventions as well as the variable/less optimal patient outcomes (relatively high in-patient mortality outcomes) in the admitting hospitals. Few efforts have been made to understand the implementation processes of evidence-based interventions and underlying factors for effective translation[137]. Hence, the use of qualitative research has increasingly been recognised in contemporary works as an important data source in understanding the evidence implementation process and the underlying factors behind

evidence uptake [233]. First, this is suggested as the most preferred data collection technique to understand views on barriers to healthcare delivery in hospital settings [234]. Second, in studying gaps between policy and practice, qualitative research has been highly recommended as the best technique to explore nuances associated with why policy recommendations do not often translate fruitfully in practice [134, 235]. Another key attribute of this method, influencing its choice, is its suitability in generating contextually rich data through the capture of 'taken for granted knowledge', questions of 'why' and 'how' from participants subjective lived experiences and construction of reality [236, 237]. In terms of methodological feasibility, a previous systematic review as part of this thesis (see chapter two) suggests that previous studies resorted to both quantitative (surveys) and qualitative studies in reporting the barriers to acute stroke care [125]. Nonetheless, the aforementioned comparative advantages of the qualitative in-depth interviews distinguishes and underscores the centrality of a qualitative study design as the more suitable option for gathering relevant data to contextualise an in-depth evaluation of the knowledge-practice gap in acute stroke care in Ghana.

Study Settings

The qualitative in-depth interviews were conducted in three tertiary (teaching) and three regional hospitals that were selected to account for the geographical, political, socio-economic diversity of the three regional belts in Ghana (northern, middle and southern). The selected hospitals are major referral points in Ghana, representing six of the ten administrative regions. Although all hospitals have the clinical capacity to provide a comprehensive service for acute stroke care, the tertiary-teaching hospitals are much better resourced with modern medical technology and diagnostic equipment. Table 6 shows the selected study hospitals, the annual stroke admissions for 2014 and the hospital-bed capacity at the time of the study.

Hospital	2014 stroke admissions	Hospital bed-capacity	
TH1	1500	653	
TH2	1000	650	
TH3	118	500	
RH4	409	194	
RH5	520	235	
RH6	49	200	

Table 6: Characteristics of study hospitals

TH =Tertiary (Teaching) Hospital,

RH= Regional Hospital

Study Participants

Participants were either key hospital staff primarily involved in the delivery or the supervision of acute care including stroke (See Table 7). To maximise the diversity of responses, participants recruited comprised males and females, had different expertise and core roles in the provision of acute stroke care in the hospital and with varying years of professional experiences. These various categories of health professionals are regarded as the core multidisciplinary team for stroke care [238], and thus their inclusion maximised the chance all relevant responses relating to the subject under study being elicited. However, health professionals not involved in acute stroke care were not eligible. Table 7 shows the distribution of participants across study sites.

Participants	Tertiary/teaching hospitals	Regional hospitals	Total
Nurses	11	9	20
Neurologist consultant	1	-	1
Neurologist	1	-	1
Emergency Physician specialist	1	-	1
Senior Medical Officer	1	1	2
Medical Officer	2	5	7
Clinical psychologist	1	1	2
Physiotherapist	2	3	5
Dietitian	0	1	1
Total	20	20	40

Table 7: Characteristics of respondent sample for qualitative data collection

Sampling Procedure

A purposive sampling technique was employed to select the study sites, comprising three tertiary-teaching and three regional hospitals. These hospitals were strategically selected because of their diversity in clinical capacities and geographical locations, to support analytical examination of views on these barriers in hospitals from the three main geographical areas in Ghana; the northern, middle and southern belts. Participants were enlisted using a purposive sampling technique. As a non-probability sampling technique, this method is a judgemental selection of respondents based on their specialised knowledge related to the study [192, 196, 197]. As a result, only participants with primary roles related to the delivery or supervision of acute stroke care were recruited.

In respect of the sample size for this study, the theoretical sampling technique was utilised where recruitment for more participants ended when newly recruited participants added no new insights to earlier views from participants [192, 198, 234]. Notwithstanding this, there is no current evident to suggest the existence of a unified position among qualitative researchers as to how many participants are sufficient for a complete qualitative study. Whilst some posit that fifteen interviews are adequate to reach saturation [239, 240], or that the number of participants should be based on the quality of the responses in obtaining the requisite information [241], others are of the view a single interview could even be sufficient, provided the study purpose is to provide a rich and contextualised account of a particular issue or the aim is to help establish the feasibility of an intervention [242, 243]. In addition, it is argued that if the study purpose is to support comparison or the identification of common grounds among different study groups or settings, a much larger sample is suggested [242, 244]. Given the current absence of a unified perspective about the required number pf participants in qualitative interviews, and in the light of uncertainty of sufficient sample, and guided by the data saturation principle as mentioned earlier, a sample of 40 participants was recruited and interviewed to provide in-depth coverage and diversity of responses. On average, six participants were interviewed in each hospital. Ideally, interviews should have been conducted per hospital until saturation was reached but this study was constrained by time and resources to do this and so an overall saturation was sought instead.

Recruitment of Participants

The recruitment process involved several stages. First, following formal correspondence with respective study hospitals to solicit their participation, and subsequent approval, a series of meetings was held with key gatekeepers¹ in the hospitals. The gatekeepers included nurses incharge, health services administrators, human resource managers, in-service training and research coordinators, and heads of department or units within the hospitals. The study

¹Gatekeepers in the study context refer to the guardians of hospitals, units, departments or the person who can grant arbitrary approval to the research study or access to study participants.

strategically prioritised such meetings to promote the study adequately and as an opportunity to identify suitable participants. This was because of their ease of access to potential study participants and given that research participants readily trust gatekeepers and are more willing to participate in a research process brokered by a gatekeeper [245]. Prospective participants (interviewees) were recommended during such meetings. Secondly, follow up visits and calls were made to the wards, consulting rooms and individual officers of the participants to discuss the study, where dates, times and venue for the interviews were fixed. Due to time and workload restrictions, three participants declined to participate in the study. The number of participants enrolled into the study was determined by data saturation as discussed in the preceding section.

Interview Guide

A semi-structured interview guide (see appendix 3) was prepared to systematically direct and facilitate the interview process. Questions were open-ended to minimise imposition of the researcher's viewpoints on research participants. The tool was developed and trialled in non-study hospitals before being used in the actual data collection process. To ensure content validity, the guide was designed following an extensive analysis of relevant literature related to stroke care professional views on barriers and enablers to acute stroke clinical care. Overall, the questions resonated with the recent systematic review on the seven thematic factors which enable or inhibit improved practice in healthcare settings [146].

The interview guide comprised of a series of exploratory interview questions focused on how participants provided clinical care for stroke patients, their professional practice, exploring their knowledge, attitudes and familiarity with current evidence-based therapies or clinical guidelines, considerations in adopting evidence-based therapies and services. The other set of questions asked participants about their perceptions or views on possible barriers to evidencebased stroke clinical care. The last set of questions sought to elicit participants' views on what they recommend as the best strategies/measures to improve the delivery of acute stroke care in their respective hospital settings.

Data Collection

To address the issue of reflexivity, my professional background, position as a PhD research student with no formal association with the Ghana Health Service, the Ministry of Health or their hospital authorities, was first revealed prior to all interviews. This action is recommended to ensure no inherent bias/or perceived conflict of interest influenced the interview process, or the potential to restrict the extent of interviewee openness and responses to questions during the interview process [212].

A face-to-face in-depth interview with the participants using an interview guide was conducted. Data collection occurred in the general and emergency wards, patient consulting rooms, physiotherapy departments, conference rooms within the hospitals and participants' office rooms during their work shift periods. The questioning approach was unstructured, whilst prompts and follow up questions were frequently used to gain greater insights into the responses and to clarify responses from the interviewees. Throughout the data collection process, the interview guide was revised where necessary based on the outcomes and the interview process as it progressed from one interviewee to the next, a strategy which supported the elicitation of new insights from the subsequent interviews.

Prior to all interviews, written consent were obtained from participants for their participation and the overall interview process was audio-recorded. With participants' consent, all interviews were audio-recorded and transcribed verbatim. At the same time, detailed field notes were taken during and after every interview to note participants' expressions, reactions of feelings during the interview process, as well as other observed events. The average duration per interview was about 45 minutes.

Trustworthiness and Quality Control

To increase data trustworthiness, the interview guide was pre-tested among selected clinicians from non-participatory study sites. The guide was subsequently revised to ensure all questions were context relevant and appropriate, adequate and well structured. To further enhance data confidence, iterative questioning and probes characterised the entire data collection process, as this potentially minimises or uncovers deliberate falsehoods from participants [246]. Lastly, cross-checking of transcripts from a sample of participants was done in order to seek corroboration and ensure records on transcripts matched the intended responses, a measure to further enhance the validity of the results from the interviews [193]. Hence, selected transcripts from interviews were shared with selected participants to cross-check and ensure the content apply represented their views as expressed during the interview process.

Data Management and Analysis

Despite the existence of multiple approaches to analysing qualitative research data, this study employed two known approaches for qualitative data management and analysis; thematic data analysis and grounded theory approaches. Due to the abundance of research on the drivers of evidence uptake in healthcare settings [145, 146, 148], a thematic analysis method employing pre-existing categories of themes relevant to the study was utilised over the grounded theory approach. Thematic data analysis involves identifying, analysing and reporting themes emerging from empirical data [247-249]. This method is flexible and has the advantage of capturing data content for comprehensive appraisal [249]. Themes were identified based on their recurrence and how they interconnected with the literature on barriers or enablers to uptake of evidence-based care for stroke. This framework is considered as the conventional analytical framework widely used in qualitative research [193, 250]. According Braun and Clarke [249], the role of thematic analysis in qualitative research remains central and thus cannot be narrowed to any theoretical or epistemological research paradigm. The grounded theory approach on the other hand, involves the identification of concepts, themes, latent patterns or categories which emerged from the data and not based on a preexisting category of themes [251, 252]. This approach took an inductive approach to ensure all essential emergent themes, concepts or patterns from the codes not included in the deductive pre-existing code list of barriers were adequately captured. In other words, this approach is not guided by a pre-conceived framework, and is rather more analytic and supports comparative inquiry of knowledge [253, 254]. The study found the need to utilise a second data analysis approach in order to ensure all relevant accounts of barriers to optimal patient care were identified and analysed within the appropriate context. To this, the framework analysis technique [255, 256] was followed. This data analysis guideline proposed a seven-staged process to qualitative data analysis:

First, all qualitative in-depth interviews from the field data collection were audio-recorded and transcribed verbatim. Secondly, data from the interview transcripts were familiarised through constant line-by-line reading and re-reading. As encouraged by qualitative researchers [255], re-listening of audio recordings and reading of field notes was further undertaken during this stage to enhance familiarity with the data. Third, coding and taking of notes to categorise emergent key concepts and patterns was then conducted. The NVivo version 10.0 [257] supported the coding process, which was predominantly deductive given the large body of evidence on barriers to evidence-uptake in healthcare settings. An initial codebook based on prior codes was developed and subsequently modified with the addition of new emergent themes after a line-by-line reading and re-reading of seven transcripts across different stroke care professionals. The remaining transcripts were coded and themes identified through repeated line-by-line reading of transcripts, and in some instances, listening to audio-recordings and reviewing field notes. An open-coding process was also conducted using an inductive approach to capture all essential elements that were potentially missed during the deductive
coding process. In the fourth step, an analytical framework was established based on the categorisation of the initial codes. This process was done iteratively to explore emerging themes in the subsequent interviews with new study participants. Fifth, new codes were indexed into the framework based on coding and categorisation from additional transcripts from the interview until all transcripts were coded and indexed into the analytical framework. The sixth step involved the charting process where all codes from the data were summarised into categories based on each transcript. As part of this step in data analysis, themes were supported by illustrative quotes from participants to highlight a particular theme of a barrier with the aim of supporting analytical generalisation, a unique feature in qualitative research [193].

The final step involved interpretation of the data through constant comparison for common or diverse codes/themes. This was done to support the identification of key thematic barriers or patterns relevant to the uptake of evidence-based therapies for acute stroke. For analytical purposes, using the constant comparison approach, common to grounded theory data analysis techniques [258-260], cross-sectional analysis of both emergent and prior themes was conducted between study sites and from different stroke care professional groups. This enabled points of convergence and divergence on barriers to evidence-based stroke care to be identified.

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CHAPTER FOUR

RESULTS

4.0 Introduction

The chapter presents the empirical results for the thesis. This is categorized into three sections, comprising findings from a survey, retrospective cohort study and a qualitative interview study. The first section (study one) reports results from a survey on hospital-based strokes for acute stroke care in Ghana. The second section (study two) evaluates in-hospital mortality from acute stroke patients who received care in three different admitting wards. The final section (study three) reports results from a qualitative study on the barriers to providing evidence-based acute stroke care.

Study One

Towards best practice in acute stroke care in Ghana: a survey of hospital services

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Baatiema et al. BMC Health Services Research (2017) 17:108 DOI 10.1186/s12913-017-2061-2

4.1.1 Overview and rationale

The first section reports findings from a survey which was conducted in 11 major public referral hospitals in Ghana to identify acute stroke care interventions and services for acute stroke care and evaluate the extent to which such services align with international best practice guidelines. This study was conducted based on the paucity of information on the range of acute stroke care services and interventions provided to acute stroke patients within the context of LMICs, especially Africa. The was established based on the findings of a systematic review reported in chapter two which highlighted the limited nature of information on acute stroke care interventions across the African region. Importantly, findings from this review showed none of the eligible studies were not reported from Ghana, leaving a gap in our understanding of the availability of evidence-based acute stroke care interventions in Ghana. It highlighted the need for future studies to comprehensively report on the kinds of acute stroke care interventions currently available in the hospital settings of Africa. This thus provided a rationale and scientific bases for the conduct of this study in Ghana.

Overall, the findings from this survey highlight limited and variable evidence-based acute stroke care services. It also points to inequitable availability to these services across of the study sites. Using the World Stroke Organization guidelines for stroke services in hospital settings, the availability of contemporary services and interventions for acute stroke care were lacking although the tertiary hospitals expectedly had better services compared to the regional non-tertiary hospitals. The findings also emphasized a deficit in health policy imperative for acute stroke care. On the basis of this, gaps in evidence-uptake were highlighted and key considerations for health managers and policy makers to improve patient made. The published article arising from this study is reported in the next section.

RESEARCH ARTICLE

Open Access



Towards best practice in acute stroke care in Ghana: a survey of hospital services

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Abstract

Background: Stroke and other non-communicable diseases are important emerging public health concerns in sub-Saharan Africa where stroke-related mortality and morbidity are higher compared to other parts of the world. Despite the availability of evidence-based acute stroke interventions globally, uptake in low-middle income countries (LMIC) such as Ghana is uncertain. This study aimed to identify and evaluate available acute stroke services in Ghana and the extent to which these services align with global best practice.

Methods: A multi-site, hospital-based survey was conducted in 11 major referral hospitals (regional and tertiary - teaching hospitals) in Ghana from November 2015 to April 2016. Respondents included neurologists, physician specialists and medical officers (general physicians). A pre-tested, structured questionnaire was used to gather data on available hospital-based acute stroke services in the study sites, using The World Stroke Organisation Global Stroke Services Guideline as a reference for global standards.

Results: Availability of evidence-based services for acute stroke care in the study hospitals were varied and limited. The results showed one tertiary-teaching hospital had a stroke unit. However, thrombolytic therapy (thrombolysis) using recombinant tissue plasminogen activator for acute ischemic stroke care was not available in any of the study hospitals. Aspirin therapy was administered in all the 11 study hospitals. Although eight study sites reported having a brain computed tomographic (CT) scan, only 7 (63.6%) were functional at the time of the study. Magnetic resonance imaging (MRI scan) services were also limited to only 4 (36.4%) hospitals (only functional in three). Acute stroke care by specialists, especially neurologists, was found in 36.4% (4) of the study hospitals whilst none of the study hospitals had an occupational or a speech pathologist to support in the provision of acute stroke care.

Conclusion: This study confirms previous reports of limited and variable provision of evidence based stroke services and the low priority for stroke care in resource poor settings. Health policy initiatives to enhance uptake of evidence-based acute stroke services is required to reduce stroke-related mortality and morbidity in countries such as Ghana.

Keywords: Stroke, Hospital services, Organised care, Evidence-based care, Health policy, Ghana

Background

Stroke remains the second leading cause of deaths globally, recording a 26% increase in stroke deaths between 1990 and 2010 [1]. According to the World Stroke Society campaign highlights, one in six people in the world will suffer a stroke in their life time [2].

In Africa and other LMIC, stroke and other noncommunicable diseases have become a great public health concern as current evidence suggests such settings are disproportionately affected by the overall global burden of stroke [3–5]. For example, of the estimated 5.9 million deaths linked to stroke worldwide in 2010, 71% were from LMIC settings [1]. Researchers further suggested that whereas high-income countries (HIC) show significant reductions in stroke incidence of about 42% over the last 40 years, a 100% increase in stroke incidence occurred in LMIC over the same period [6].



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In Ghana, several studies have also confirmed an increasing stroke burden, with one month in-hospital case fatality as high as 41-43% [7-10]. For example, one of such studies examined a total of 12,233 stroke admissions over a 30 years period (1983-2013) and found that 28 day mortality during the study period was 41.1% [8]. In addition, the US Centres for Disease Control and Prevention (CDC) has reported that stroke is the fourth cause of mortality in Ghana [11]. These relatively high rates of in-hospital mortality raise important questions about the nature of acute stroke services in Ghana. Based on the current epidemiological transition attributed to aging populations, urbanization and modifiable stroke risk factors [12, 13] the future burden of stroke is substantial in LMIC [14], and inevitably, there will be an increased demand for acute stroke care interventions. The World Health Organisation (WHO) has previously asserted that the current stroke mortality burden in LMIC such as Ghana can be attenuated by the provision of quality and standardised stroke care [15], highlighting the need to ensure increased uptake to evidence-based stroke care interventions in such settings.

Despite the concept of evidence-based medicine is highly contested and has been diversely conceptualised [16, 17], the definition by Sackett et al. is widely acclaimed and accepted among medical researchers and practitioners [18]. The authors defined evidence-based medicine as 'the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients as well as integrating individual clinical expertise with the best available external clinical evidence from systematic research'. Thus, evidence-based acute stroke care interventions in this context refer to those interventions which are guided by sound scientific evidence, are well consistent with the clinical judgement and expertise of the individual clinician and meet the needs of patients for improved clinical outcomes.

Internationally, there is consistent body of evidence that stroke patients treated a) in a stroke unit by a multidisciplinary care team [19], b) using thrombolytic therapy through tissue plasminogen activator (t-PA) for acute ischemic stroke care patients within 4.5 h of stroke onset [20, 21], c) administering of aspirin for ischemic acute ischemic stroke patients within 48 h of a stroke [22], and d) decompressive surgery within 48 h of an acute stroke [23, 24] have reduced stroke-related mortality and morbidity. To support health systems worldwide especially of poor resource settings with high stroke burden to be able to consistently provide standard care for improved patient outcomes, a stroke services guideline by the World Stroke Organisation was developed [25].

Despite clear demonstration of the effectiveness of these evidence-based interventions for acute stroke care, there is widespread variation and limited uptake globally and this is substantially lower in LMIC such as Ghana [26–28]. The World Stroke Society has consequently prioritised access to evidence-based stroke care as a key theme in their 2016 global campaign, emphasizing the importance of this study. The slow uptake of evidence-based stroke care interventions is underpinned by multi-factorial barriers at the health system, patient, health care providers and nature of acute stroke interventions levels [29–31].

To date, research on the availability of evidence-based acute stroke care interventions in hospital settings globally has been limited to high income countries. The UK, Australia, Canada and some European countries are exemplars [32–35]. Conversely, there is little information on evidence-based acute stroke services in Africa and other resource-poor settings. From the few studies available, the use of evidence-based acute stroke care services in LMIC settings is often asserted to be limited, poor and less likely to follow best practice guidelines [26-28, 36, 37]. An immediate question of public health interest will be to what extent are evidence-based acute stroke care interventions provided to acute stroke patients in the hospitals of LMIC such as Ghana? Addressing this question has the potential to provide baseline information on available evidencebased acute stroke care interventions and as well identify gaps in current stroke services which could support the development of future interventions seeking to standardise and improve acute stroke care services for optimal patient outcomes. This study therefore aims to identify available acute stroke services in Ghana and to evaluate the extent to which these services align with global best practice.

Methods

Study design and settings

This is descriptive study involving a survey conducted in major referral hospitals in all the ten administrative regions of Ghana to collect data on available acute stroke services from key acute stroke care providers between November 2015 and April 2016.

Ghana has a multi-health care system with the involvement of both public and private health care providers where healthcare delivery is provided by the formal medical healthcare system, faith-based health care system and the services from the ethno-medical system [38]. Of these, there are tertiary-teaching hospitals, regional hospitals, psychiatric hospitals, district hospitals and subdistrict health centres in the public sector [39]. However, the district hospitals and sub-district health centres often have limited clinical capacity for stroke care and so were excluded in this study. This study therefore purposively sampled only major public referral hospitals representing four of the five teaching hospitals as well as seven of the nine regional hospitals in Ghana. Except for one region (Greater Accra) where it was convenient to collect data from two major referral hospitals (one regional and one tertiary hospital), data was collected from either tertiary teaching or regional hospital which acted as the primary referral hospital in that particular administrative region. In spite of differences in the clinical capacities of the study hospitals on the basis of their status as a tertiary-teaching or regional hospital, these hospitals were chosen because they act as major referral hospitals for other hospitals and health centres in each of the ten administrative regions. Unlike the seven regional hospitals, the tertiary teaching hospitals serve as larger referral centres and are betterresourced with diagnostic and therapeutic facilities. They also serve as tertiary academic centres offering training in a range of highly specialised clinical disciplines. As presented in Table 1, the overall hospital bed capacity for admissions in the study sites ranged from 150 to 653 with annual stroke admissions for 2014 within the range of 49 to 1500 stroke cases per hospital.

Study participants

Respondents comprised neurologists, medical officers (general physicians) and physician specialists. These key informants were targeted because: they have relevant knowledge or expertise on acute stroke care in the study hospital; they play central roles as either acute stroke care providers or supervisors of the delivery of acute stroke care in the hospital. Their inclusion was also informed by the fact most play a role in making strategic decisions in the organisation of acute stroke care. All respondents were full time regular employees of the study sites. Part-time employees and resident physicians were not eligible. Administrative or other staff whose roles are

Table	1	Characteristics	of	study	hospitals	and	respondents
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Hospital	2014 stroke admissions	Hospital bed capacity	Survey respondents
TH1	1500	653	Consultant Neurologist
TH2	1000	650	Neurologist
TH3	118	500	Physician Specialist
TH4	125	400	Medical Officer
RH1	409	194	Medical Officer
RH2	313	358	Medical Officer
RH3	-	250	Physician Specialist
RH4	520	235	Physician Specialist
RH5	71	400	Senior Medical Officer
RH6	39	226	Senior Medical Officer
RH7	49	200	Senior Medical Officer
Total			11

TH Tertiary (Teaching) Hospital, RH Regional Hospital

not directly involved in the provision of acute stroke care to patients were also excluded.

Sampling and recruitment

We employed a non-probabilistic purposive sampling technique to recruit respondents with one respondent per hospital. All study hospitals were formally contacted and their participation solicited using an official letter of invitation with information about the study, researchers and all ethical approval letters. The invitation letter also included a detailed study protocol and a study statement outlining the study purpose, potential study benefits, and an estimated time for survey completion. Prior to recruitment and actual data collection, discussions were held with the health administrators, clinical coordinators, regional human resource managers, medical directors and heads of department to select appropriate respondents. Consequently, one eligible respondent per study site was selected and contacted directly by the first author to organise the survey administration.

Data collection

An interviewer-administered survey approach was conducted in respondents' offices, clinic rooms and wards of each hospital. This approach was chosen to enhance response and compliance rates, provide opportunity for concepts and questions to be clarified and to ensure appropriate responses were elicited [40, 41].

The survey instrument (Additional file 1) was adapted from a previous national survey used in Australia [42]. A review of other relevant studies on acute stroke care quality indicators [25, 43-45] also informed the content of this instrument. The instrument was a paper-based, structured questionnaire containing 80-question items which required respondents to provide responses on the range of hospital-based services provided to acute stroke patients. The questionnaire was written and administered in English. Questions were mostly closed ended in nature and categorised into eight sections. These included information on respondents' professional background and qualification, characteristics of study sites, institutional services and arrangements to support early presentation of acute stroke patients, and data on diagnosis, assessment services and stroke clinical guidelines. The remaining sections collected information on available acute stroke services and treatments, the stroke care workforce, key institutional policies, practices and interventions to support acute stroke care and on key challenges to acute stroke care.

Quality control

The survey tool was pre-tested in six non-study sites among six acute stroke care physicians, representing two each from the southern, middle and northern belt of Ghana to account for the varied geo-political and socioeconomic development differences. This process also tested the instrument's suitability and relevance to the study settings, assess adequacy of response categories and whether all questions were appropriate within the study context [40, 41, 46]. The instrument was accordingly revised. Additionally, preliminary survey results were sent back to individual respondents for validation to ensure the data reflected their earlier responses.

Data analysis

Analyses were conducted using the Statistical Package for the Social Sciences (SPSS) Version 22.0. Findings from the analysis were reported in the forms of numbers and percentages displayed in tables with scores underlying the availability of acute stroke care service and according to the study sites. Analysis also highlighted variances in available acute stroke services across the study hospitals. The World Stroke Society stroke service guideline [25] was used as a reference to evaluate the extent to which available services align with global best practice recommendations.

Results

Respondents included four female and seven male acute stroke care providers, comprising Consultant Neurologist (1), Neurologist (1), Physician Specialist (3), Senior Medical Officer (3) and Medical Officer (3). Participants' clinical practice experience ranged from three to twenty years. Table 1 presents the characteristics of the study hospitals and respondents. The next section presents the results from the survey as displayed in Table 2.

Acute stroke presentation in hospitals

All participating hospitals have designated accident and emergency departments where acute stroke patients are first triaged. Only 9.1% of the hospitals reported the existence of locally developed protocols to support rapid triage of stroke patients. Both local ambulance services and private cars/taxis are used to transport acute stroke patients to hospital, with respondents indicating the predominant means of transport being commercial vehicles (taxi/cab). Local ambulance services were mostly used when patients were referred from another hospitals.

Acute stroke diagnosis and assessment services

Available diagnostic and assessment services were diverse. Although 72.7% (8) of the study hospitals indicated the availability of a CT scan, only 63.6% (7) of these major referral hospitals had functional CT scan machines at the time of the survey. Access to brain CT scanning was only available 24 h/7 days in only 18.2% (2) of the study sites, whilst the rest only had access to these services during weekdays from 9 am–5 pm.

Availability of MRI scan services and other advanced neurovascular diagnostic services such as electroencephalogram and interventional radiology were very limited (See Table 2). The survey showed only 36.4% (4) of the hospitals indicated the availability of MRI scanning services although only 27% (3) hospitals had functional MRI services. These services were only available only on weekdays from 9 am-5 pm. Carotid Doppler services were available in 3 hospitals with similar limited access during weekdays. None of the hospitals had specific stroke clinical guidelines. Instead, a general guideline for all health conditions known as the standard treatment guideline from which some guidelines on acute stroke care are embedded was available. Observations were made by the first author to ascertain the availability of CT and MRI brain scanning services in those study hospitals.

Acute stroke care interventions and services

The survey revealed only 9.1% (1) of the study sites was reported to have a stroke unit. All hospitals had general medical wards for admissions and continuous in-patient care post-accident and emergency wards. Although elements of a multidisciplinary team for acute stroke care were evident, no functional and standardised one was reported in any of the hospitals. Furthermore, no provision of thrombolysis using tissue plasminogen activator for acute ischemic stroke care was reported in any of the study sites although 6 of respondents acknowledged awareness of this therapy. This absence was attributed to limited skilled personnel, cost and lack of national and organisational (hospital) level support to provide this therapy. In contrast, the use of aspirin for acute ischemic stroke was reported in all the hospitals. Surgical procedures for acute stroke care such as revascularization, decompressive craniotomy, arteriovenous malformation treatment, surgery for aneurysm treatment were not conducted in any of the study hospitals.

Stroke care workforce

Specialist health workforce for acute stroke care was limited from the study. For example, the results showed only 36.4% (4) of the hospitals reported having a neurologist as part of the acute stroke care team whereas 27.3% (3) of the hospitals also indicated the availability of a neurosurgeon to their acute stroke care workforce. Other medical specialities (physician specialists) were reported in 72.7% (8) of the study sites. The availability of a speech therapists, occupational therapists and stroke nurses or stroke care coordinators was not reported in any of the study hospital. On the other hand, the availability of other acute stroke care staff in the study hospitals was within appreciable levels. All hospitals reported having medical doctors, nurses, physiotherapists and

Table 2 Stroke services and availability in study hospitals

Thematic areas	Stroke services evaluated	Hospital response to available stroke services			
		Tertiary-Teaching Hospitals (<i>n</i> = 4)	Regional Hospital (n = 7)	Overall Total (n = 11) %	
Acute Presentation of stroke	Accident and Emergency Department	4	7	11 (100.0%)	
	Local emergency department protocols for rapid triage	1	0	1 (9.1%)	
	Common means of stroke patient transport to hospital				
	- Local ambulance services	0	0	0 (0.0%)	
	 Taxi/Private transport arrangement 	4	7	11 (100.0%)	
Diagnosis and Assessment Services	Functional CT Scan Service	3	4	7 (63.6%)	
	CT scanner (24/7)	2	0	2 (18.2%)	
	CT scanner (weekdays 9 am–5 am)	2	4	6 (54.5%)	
	Functional MRI Scan Service	3	1	4 (36.4%)	
	MRI (24/7)	0	0	0 (0.0%)	
	MRI (weekdays 9 am–5 am)	3	1	4 (36.4%)	
	Electrocardiogram (ECG)	4	5	9 (81.8%)	
	Electroencephalogram	2	0	2 (18.2%)	
	Neurovascular ultrasound diagnostic services e.g. Carotid Doppler Services	2	1	3 (27.3%)	
	Magnetic Resonance Angiography	3	0	3 (27.3%)	
	Computed Tomographic Angiography	4	4	8 (72.7%)	
	National Institute of Health Stroke Scale (NIHSS)	2	2	4 (100.0%)	
Acute Stroke services, treatments and	Dedicated stroke unit (ward)	1	0	1 (9.1%)	
rehabilitation services	Institutional CLS can Service34CT scanner (24/7)20CT scanner (weekdays 9 am–5 am)24Functional MRI Scan Service31MRI (24/7)00MRI (weekdays 9 am–5 am)31Electrocardiogram (ECG)45Electroencephalogram20Neurovascular ultrasound diagnostic21services e.g. Carotid Doppler Services30Computed Tomographic Angiography30Computed Tomographic Angiography22andDedicated stroke unit (ward)10General (Medical) Ward47Multidisciplinary stroke care team00Thrombolytic therapy (t-PA)00Aspirin (antiplatelet)47Early discharge care plans47Revascularization (Carotid Endarterectomy)00On site rehabilitation services47Clinical psychologist44Trained Stroke Nurses10Physician Specialist44Neurosurgeon30	7	11 (100.0%)		
	Multidisciplinary stroke care team	0	0	0 (0.0%)	
	Thrombolytic therapy (t-PA)	0	0	0 (100.0%)	
	Aspirin (antiplatelet)	4	7	11 (100.0%)	
	Early discharge care plans	4	7	11 (100.0%)	
	Revascularization (Carotid Endarterectomy)	0	0	0 (0.0%)	
	Decompressive surgery (craniotomy)	0	0	0 (0.0%)	
	Arteriovenous Malformation Treatment	0	0	0 (0.0%)	
	Surgery for Aneurysm	0	0	0 (0.0%)	
	On site rehabilitation services	4	7	11 (100.0%)	
Stroke care workforce	Clinical psychologist	4	4	8 (72.7%)	
	Trained Stroke Nurses	1	0	1 (9.1%)	
	Physician Specialist	4	4	8 (72.7%)	
	Neurosurgeon	3	0	3 (27.3%)	
	Medical Officer	4	7	11 (100.0%)	
	Nurse	4	7	11 (100.0%)	
	Neurologist	3	1	4 (36.4%)	
	Emergency department staff	4	7	11 (100.0%)	
	Stroke care coordinator	0	0	0 (0.0%)	
	Occupational therapist	0	0	0 (0.0%)	
	Physiotherapist	4	7	11 (100.0%)	
	Speech pathologist	0	0	0 (0.0%)	

	Social worker	4	7	11 (100.0%)
	Dietician	4	7	11 (100.0%)
Health policy support for stroke care	Staff professional development and quality improvement for stroke care	0	0	0 (0.0%)
	National level support/ policies for stroke care			
	– High	0	0	0 (0.0%)
	– Average	0	0	0 (0.0%)
	- Low	0	0	0 (0.0%)
	– No support	4	7	11 (100.0%)
	Hospital level support/policies for stroke care			
	– High	0	0	0 (0.0%)
	– Average	0	2	2 (18.2%)
	- Low	2	1	3 (27.3%)
	– No support	2	4	6 (54.5%)
	Stroke register/Database	2	0	2 (18.2%)
	Community/hospital stroke awareness program	0	0	0 (0.0%)
	Access to community stroke rehabilitative programs	0	0	0 (0.0%)

Table 2 Stroke services and availability in study hospitals (Continued)

Note: The listed numbers within the body of the tables indicate a "yes" answer

emergency department staff. In addition, clinical psychologists and social workers were also found in seven of the eleven hospitals.

Health policy support for stroke care

Respondents indicated no direct health policy support from the state or national level for stroke care, or a national stroke policy framework, or national stroke clinical guideline existed. The common form of state support was a broad-based support for improvement of care across all hospital units and health conditions. Respondents reported that a national policy on non-communicable diseases existed but was yet to be operationalised as a full national policy framework due to lack of political will. On available opportunities for staff professional development and stroke care quality improvement programs, respondents reported that although all hospitals had policies to support staff develop professionally, these were not being implemented due to lack of funds. Only two hospitals had a stroke-specific database although all hospitals had a common database for all health conditions. No national level or hospital level community stroke awareness programs were reported.

Discussion

To our knowledge, this is the first study to present information on the availability of best practice hospital level facilities for acute stroke services in Ghana. Importantly, the results from this study has clarified current uncertainties and speculation about the extent of evidencebased practice uptake for stroke care in a LMIC. Overall, the results suggest a limited adoption of evidence-based acute stroke care interventions, with the provision of a stroke unit care in only a single study hospital and no reported application of thrombolytic therapy as well as limited access to surgical procedures for acute stroke treatment. However, the use of aspirin for acute ischemic stroke was common to all study sites. Brain scanning services especially CT scans were often available but underutilised due to high cost of access. On the other hand, access to MRI and other advanced diagnostic services were more limited in the regional hospitals. Overall, national and hospital level health policy initiatives to support acute stroke care specifically were limited. This study also demonstrated that despite overall shortages in the specialist health workforce for acute stroke (especially neurologists), shortage of specialists were more predominant in the regional hospitals than the teaching hospitals.

Globally, emergency transport systems via ambulance and other emergency medical transport services are reported to support early and safe arrival for immediate provision of appropriate care to facilitate optimal patient health outcomes [47, 48]. However, the use of taxis or private cars was the commonest means of transport to hospitals by stroke patients in the present study, a situation which may lead to considerable delays in patient arrival for care. This has the potential to compromise prompt and safe responses for acute stroke patients in the major referral hospitals. Although this study reported the presence of a stroke unit in only one study hospital, this finding further corroborates previous reports indicating the limited provision of stroke unit care in LMIC [26, 27]. The stroke unit that was reported in this study is a six-bed capacity unit, found within a larger medical ward. Given the finding of only a single stroke unit of the eleven major referral hospitals in this study, it means the general medical wards represented the predominant acute stroke care wards despite evidence of less optimal patient outcomes compared to a stroke unit [19].

Additionally, evidence of no provision of thrombolytic therapy from the study finding supports earlier studies asserting the limited uptake of this treatment option in LMIC [28, 49, 50]. This requires policy attention to support the provision of thrombolytic therapy in these major referral hospitals in view of the substantial effects of this therapy on stroke survival. The widespread use of aspirin therapy by all study hospitals for acute stroke care may reflect this intervention as an inexpensive choice and easy to administer in clinical settings [51, 52]. The uptake of aspirin could further be maximised with enhanced access to brain scanning devices to ensure eligible patients are treated with aspirin.

Although seven of eleven study sites provided brain CT scan services, access was limited only to weekdays (9 am-5 pm). This has important implications for early access to appropriate care given that improved patient outcomes are often time-dependent [53]. This highlights the need for improved access to brain imaging services in hospitals, especially regional, because most stroke patients are likely to be treated in non-teaching hospitals before they are referred to tertiary teaching hospitals. The importance of this is heightened by the fact that patient referral to such tertiary hospitals is however largely dependent on the financial capacity of the patient. Although there is still lack of clarity on the direct influence of access to brain CT scanning services on mortality and morbidity, without early access to brain scan services, there is high potential for inappropriate provision of care to patients (e.g. inadvertent administration of aspirin therapy to a haemorrhagic stroke patient).

The considerable deficit in the human resource capacity to treat acute stroke patients in all study sites, especially in regional hospitals, is also noteworthy. Acute stroke care by a neurologist was limited to four of eleven study hospitals whilst care provided by occupational and speech therapists were not reported in any of the hospitals. This gap will likely inhibit effective patient evaluation for impairment and disability. For example, given that the incidence of dysphasia following an acute stroke is around 37-78% [54], the absence of speech therapist to conduct effective assessment and support likely compromises the quality of life of stroke patients with dysphasia. These results reaffirm the limited availability of acute stroke care workforce asserted in previous studies [55–57]. In a key report [57] outlining the principal challenges compromising global efforts to control the increasing burden of non-communicable diseases such as stroke, the issue of inadequate skilled health work force was highlighted. This indicates an important gap in the capacity of the health care systems to provide acute stroke care, although regional hospitals require more policy attention, particularly via rehabilitative specialists, neurologists, neurosurgeons and other stroke specialists to support optimal recovery in view of reduced in-patient stroke mortality and dependency at discharge following treatment by neurologists [58]. As demonstrated in Nigeria [59], in sub-Saharan Africa, a study on task shifting of specialist stroke work force roles to non-specialists demonstrated improved knowledge on acute stroke care and so this could be explored by the Ghanaian health policy makers and managers as a short term measure to address the current stroke workforce deficit.

The absence of national level support for acute stroke care, limited funding from hospital management, no community/hospital stroke awareness program, and state supported community stroke rehabilitative programs reported in this study raises important health policy questions about the state's readiness and commitment to reducing the increasing stroke burden. Long-term and communitylevel care after in-patient care remains largely a family responsibility in the absence of a community level rehabilitative care. This augments earlier reports of limited health policy commitment to address the current disease burden posed by stroke and other non-communicable diseases in Ghana [39, 60-63]. It also concurs with reports of low prioritization of stroke care in the health policy agendas of most LMIC [64-67]. Contextualising this within the global health policy support for stroke, the deficit in health policy support in this study underscores previous reports of inadequate global health funding for stroke and other non-communicable diseases [3, 68]. For example, the Institute for Health Metrics and Evaluation recently reported that only 1.3% of overall donor support for health was allocated to NCDs in 2015 [68]. As demonstrated in some other LMIC [69, 70], the capacity of Ghanaian health systems could be improved to address the growing stroke burden by increasing funding and infrastructural support, training for more stroke specialists, formulating evidence-informed policies, plans, treatment guidelines and strategies to support effective acute stroke diagnosis and treatment.

Table 3 World Stroke Organization checklist for health service capacity for acute stroke care

Component of acute stroke service	Service availability		
	Tertiary-Teaching Hospitals (<i>n</i> = 4)	Regional Hospital (n = 7)	Overall Total (<i>n</i> = 11) %
Advanced stroke services			
Access to advanced diagnostic services			
– Magnetic Resonance Angiography	3	0	3 (27.3%)
 Computed Tomographic Angiography 	4	4	8 (72.7%)
– Electroencephalogram	0	0	0 (0.0%)
– Electrocardiogram (ECG)	4	5	9 (81.8%)
– Neurovascular ultrasound diagnostic services, e.g. Carotid Doppler Services	3	0	3 (27.3%)
– Magnetic Resonance Imaging	4	1	5 (45.5%)
- Computed Tomographic Scan	4	4	8 (72.7%)
Access to physicians with stroke expertise (and physician specialists)			
– Neurologists	3	1	4 (36.4%)
– Neurosurgeon	3	0	3 (27.3%)
– Physician Specialist	4	4	8 (72.7%)
Access to advanced acute stroke care interventions			
– Stroke unit care	1	0	1 (9.1%)
– Tissue plasminogen activator (t-PA)	0	0	0 (0.0%)
– Decompressive surgery	0	0	0 (0.0%)
 Arteriovenous Malformation Treatment 	0	0	0 (0.0%)
Surgery for Aneurysm	0	0	0 (0.0%)
Revascularization (Carotid Endarterectomy)	0	0	0 (0.0%)
Access to specialist rehabilitation therapists			
– Physiotherapists	4	7	11 (100.0%)
– Occupational Therapists	0	0	0 (0.0%)
– Speech Therapists	0	0	0 (0.0%)
Access to community programs for recovery after stroke	0	0	0 (0.0%)
Essential stroke services			
Access to basic diagnostic services			
– Laboratory	4	7	11 (100.0%)
– ECG	4	5	9 (81.8%)
– Computed Tomographic Scan (CT scan)	4	4	8 (72.7%)
– Neurovascular ultrasound diagnostic services	3	0	3 (27.3%)
– National Institutes of Health Stroke Scale (NIH)	2	2	2 (18.2%)
Access to nurses	4	7	11 (100.0%)
Access to physicians, not necessarily stroke specialists	4	7	11 (100.0%)
Access to acute thrombolysis with t-PA	0	0	0 (0.0%)
Access to stroke unit care	1	0	1 (9.1%)
Antiplatelet (Aspirin) therapy	4	7	11 (100.0%)
Access to rehabilitation services	4	7	11 (100.0%)
Minimal healthcare services			
Variable access to healthcare workers (nurses or lay workers)	4	7	11 (100.0%)
Very limited access to physicians	0	2	2 (18.2%)
No access to diagnostic services or hospital care	0	0	0 (0.0%)
Care provided in local communities	0	0	0 (0.0%)

Note: The listed numbers within the body of the tables indicate a "yes" answer

The historical development gap between northern Ghana and the rest was also evident in the inequitable distribution of stroke services across the study sites. Overall, the tertiary hospitals were much more equipped with modern stroke services to support standard care compared to the regional hospitals. However, the major referral hospitals in the northern part of Ghana recorded limited evidence-based acute stroke services. For example, apart from the single tertiary hospital in northern Ghana, the other two northern regional hospitals do not have CT, MRI brain scanning services or a neurologist. This finding reinforces earlier reports of limited access to health care facilities in the northern parts of Ghana and has often resulted in poor health outcomes compared to the other parts of Ghana [39, 71, 72]. To address this, an affirmative action in the form of health policy reforms to address this situation will be in the right direction.

Based on the global stroke services guideline for stroke care proposed by the World Stroke Society [25] as reported in Table 3, this study suggests an overall limitation in the capacity of the health care system in both teaching and regional hospitals to provide advanced evidencebased acute stroke services. The present study results shows the major tertiary - teaching hospitals have more capacity to provide most of the essential elements of the evidence-based acute stroke care recommendation compared to the regional hospitals despite the fact that regional hospitals first receive most of the acute stroke cases before likely referring to a teaching hospital. In general, the current results underline the overarching scope and need to improve evidence-based practice for acute stroke care in resource poor countries such as Ghana.

Strengths and limitations

This study is the first to inform on availability of evidence-based acute stroke care interventions in Ghana. An added strength relates to its focus on regional and tertiary-teaching hospitals being the major referral hospitals in each administrative region in Ghana, gives the study a national character with potential generalizable results and relevance to other low-middle income settings. However, this was a descriptive study which limited our ability to evaluate the effects of these services on patient clinical outcomes. This study was also limited in scope by restriction to eleven public regional and teaching hospitals and excluding private and non-regional hospitals. Future studies should focus on both public and private hospitals to achieve better representation.

Conclusion

A growing body of evidence on effective acute stroke care interventions exist. However, results from this study highlight limited access to these services especially in the regional non-tertiary teaching hospitals. Significant effort is required to ensure acute stroke patients access the best care not only in tertiary but also regional hospitals given that not all acute stroke patients can afford care in teaching hospitals.

Based on this study, it is clear Ghana is yet to adequately translate in health policy wise its global commitments to reducing the global burden of stroke. An overall improvement in national policy for stroke care is needed. This should be well targeted and equity-based given the significant disparities found across these major referral hospitals in our study. With current projections of a global rise in stroke incidence and the increasing aging population, demand for acute stroke care will inevitably witness further increase and so there is considerable scope to improve acute stroke care in low middle income countries such as Ghana in order to minimise premature stroke-related mortality and disability.

Additional file

Additional file 1: Survey Instrument: Acute Stroke Care Services in Ghanaian Hospitals (DOCX 40 kb)

Abbreviations

CDC: Centres for Disease Control and Prevention; CT: Computed Tomographic; HIC: High-Income Countries; LMIC: Low-Middle Income Countries; MRI: Magnetic Resonance Imaging; NCDs: Non-Communicable Diseases; SPSS: Statistical Package for the Social Sciences; t-PA: Tissue Plasminogen Activator; WHO: World Health Organisation

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Availability of data and materials

The data which was collected and analysed for this present study are not publicly available per the conditions binding the approval of this study by the various research ethics committees which granted approval for the conduct of this study. However, data may be available from the corresponding author on reasonable request.

Authors' contributions

Study concept and design; LB, MO, GM, AA and SS. Data collection and analysis; LB. Data interpretation: LB, MO, GM, AA, JC and SS. Writing of first manuscript; LB. Manuscript review LB, MO, GM, AA, JC and SS. All authors read and approved final work.

Competing interests

The authors declare that they have no competing interests.

Consent for publication

Not applicable.

Ethics approval and consent to participate

Ethical clearance for this study was granted in accordance with the Helsinki declaration for medical research [73] from the following institutional review committees: University Human Research Ethics Committee (2015–154H), the Ghana Health Service Ethical Review Committee on Research Involving Human Subjects (GHS-ERC:11/07/15), the Committee on Human Research Publications and Ethics of the School of Medical Sciences of the Kwame Nkrumah University of Science and Technology and the Komfo Anokye Teaching Hospital (CHRPE/AP/141/16). We also received ethical clearance from the Institutional Review Board of the 37 Military Hospital (37MH-IRB IPN 035/2015). Written informed consent was sought from participants prior to the data collection. Data were reported in an aggregated form to enhance confidentiality and anonymity of the respondents and participating hospitals.

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Study Two

In-hospital mortality following acute stroke in Ghana: comparing three admitting wards

Leonard Baatiema, Michael Otim, Shawn Somerset, Ama de-Graft Aikins, Judith Coombes, George Mnatzaganian

4.2.1 Overview and rationale

This section presents results of a retrospective cohort study to evaluate acute stroke patients' in-patient mortality outcomes data to highlight the efficacy levels of existing acute stroke care interventions. Two key rationales informed the conduct of this study. First, there is general dearth of information on acute stroke treatment and patient outcome data in Ghana and most parts of Africa. Second, the quality of data from the few existing studies which have attempted to shed light on this problem are problematic. Most of such studies lack methodological rigour, used small sample sizes and with limited provisions to control the effect of confounding factors in the eligible studies which limited firm conclusions about the efficacy of the acute stroke care interventions. These assertions have been underscored by findings of the first systematic review in chapter two which highlights the paucity of information and limited nature of quality data on the eligible studies in the review. The above reasons emphasized the need for further research to bridge the knowledge gap and for robustly designed studies to report on the patient outcomes following acute stroke care in LMICs such as Ghana. As a result, a retrospective cohort study was conducted and the findings reported herein.

Overall, the findings provide further evidence of high in-hospital mortality and varied levels of care for acute stroke patients in most LMICs. Importantly, aspirin intake was found as the most predominant acute stroke care therapy and this resulted in improved in-patient mortality outcomes. Hypertension was also highlighted as the most significant risk factor and predictor of in-patient mortality outcomes. In light of the limited and variable delivery of contemporary acute stroke care interventions, and a high case fatality rate in this study cohort, the need for increased policy attention to improve acute stroke care is imperative. The findings of this study are organised and reported in a typical research paper format, yet to be submitted for publication. The manuscript reporting the findings of this study is reported in the next section.

Abstract

Rational aims and objectives

In-hospital mortality following acute stroke varies across acute care settings globally. However, treatment outcomes after stroke in Ghana and most parts of the developing world remains limited. This study aims to compare in-hospital mortality following first acute stroke treatment in patients admitted to stroke, medical emergency or general medical wards in Ghana.

Methods

In a retrospective cohort study, consecutive patients with acute stroke, admitted to six major referral hospitals, were selected randomly using a probabilistic stratified sampling method aiming to have a sample of 50 patients from each hospital. Data relating to patient characteristics, medical condition, and mortality were extracted by medical chart review. Patients were followed from admission through to discharge from the hospital or death. A multivariable logistic regression was constructed to compare mortality according to ward of care after accounting for length of stay, demographic and medical risk factors.

Results

Patients (N=300) were recruited from three acute care admitting wards in six hospitals. Patients had diverse demographic and clinical characteristics. No significant age differences were observed between wards (p = 0.5). Compared to other wards, the stroke ward admitted stroke patients with more co-morbidities. Further, significantly more patients with haemorrhagic stroke were admitted to the stroke ward (48% compared to 22.4% in the medical emergency, and 14.9% in the medical wards, p < 0.001. Overall, in-hospital mortality rate was 31.7% at 30 days for all admissions. Multivariate logistic regression analysis showed less in-hospital mortality among patients given aspirin, adjusted-OR 0.484, 95% CI 0.27 – 0.86, p = 0.013, but significantly more among those with hypertension, adjusted-OR 1.86, 95% CI 1.06-3.27, p=0.032. No significant differences in in-hospital mortality were observed between the wards. **Conclusions**

These findings provide further evidence of elevated in-hospital mortality and varied levels of care from stroke in a developing country setting. Policy support to improve access to evidence-based care may facilitate optimal in-patient outcomes.

Keywords: Stroke, Acute care, mortality, outcome evaluation, process of care, in-hospital

Background

Despite considerable therapeutic advances for acute stroke care in recent times, in-hospital mortality from stroke is still a major concern worldwide. The latest global burden of stroke study reported that about 5.9 million stroke-related deaths were recorded in 2010 of which 71% occurred in low-middle income countries (LMICs) [1], highlighting inequity in global stroke burden.

In Ghana, although national stroke data are scant, current evidence suggests a rise in incidence and associated mortality [7, 9, 10, 74, 75]. Based on the country data from the global burden of stroke study, there has been over 100% increase in absolute stroke related deaths (2,484 in 1990 to 5,771 in 2010) [1]. Further evidence suggests that in-hospital mortality following acute stroke in Ghana ranges from 41% to 43% [10, 76, 77]. In contrast, in-hospital stroke case fatality rates in developed countries are as low as 8% in France [6]. It is argued that the poor in-patient outcomes in LMICs such as Ghana are attributable to poor prognosis of acute stroke, limited medical facilities such as brain scanning services, a limited specialist workforce for acute stroke care and limited access to effective acute stroke care interventions such as stroke unit care and thrombolytic therapy [26, 36, 55, 56, 78]. Results from a study in South Africa demonstrating poor in-patient outcomes in general wards exemplifies this point [79]. Based on this, some stroke scholars suggest the quality of acute stroke care in these countries is below global standards [26-28, 37, 80]. Yet, data on clinical outcomes following treatment of acute stroke patients remains limited in most parts of the developing world.

To our knowledge, research in Ghana on in-hospital mortality following acute stroke is limited to two teaching hospitals [7, 10, 77, 81] despite acute stroke care responsibilities extending to regional hospitals also. Despite evidence that the quality of such care can be affected by patient and treating wards characteristics [82, 83], it is however not clearly known how patient characteristics and treatment outcomes such as in-hospital mortality differ across different admitting wards in Ghana. Therefore, this study compared in-hospital mortality following first acute stroke in patients among three stroke admitting wards: stroke, medical emergency and general medical wards with the objective of providing useful and comprehensive insights for future planning efforts to improve stroke care in Ghana, with potential applicability in other developing countries.

Methods

Ethics Approval

This study received ethical approval from the University Human Research Ethics Committee (2015-154H), the Ghana Health Service Ethical Review Committee on Research Involving Human Subjects (GHS-ERC: 11/07/15), the Committee on Human Research Publications and Ethics of the School of Medical Sciences of the Kwame Nkrumah University of Science and Technology and the Komfo Anokye Teaching Hospital (CHRPE/AP/141/16). Ethical approval was also received from the Institutional Review Board of the 37 Military Hospital (37MH-IRB IPN 035/2015). The need for informed consent from patients was waived by the ethical committees due to de-identified data being used.

Study Design and Setting

Data from this study forms part of an original research conducted in Ghana to examine the provision of hospital services for the treatment and management of acute stroke patients. The study followed a multi-site hospital-based retrospective cohort design conducted in three major referral tertiary (teaching) and three regional (non-teaching) hospitals situated in the southern, middle, and northern regions of Ghana. Hospitals were purposively selected to take into account the geographic and socio-economic contrasts among the administrative regions of Ghana. Unlike regional hospitals, tertiary hospitals serve as larger referral centres for the whole

country and are well-resourced with diagnostic and therapeutic facilities. These tertiary hospitals are also semi-autonomous and serve as academic centres offering training in a range of highly specialised medical or clinical options. Regional hospitals also have the capacity to deal with acute stroke care and complications, although complicated cases are usually referred to tertiary hospitals. All study hospitals had accident and emergency department wards where acute stroke patients are first assessed and stabilised before being transferred to the three separate admitting wards, namely: stroke, medical emergency or general medical ward. The stroke ward is a designated admitting ward for stroke patients only, whereas the medical emergency ward provides intensive care to all acute cases including stroke. Patients were recruited from the general medical ward who had been admitted after assessment and stabilisation in an accident and emergency ward. Data were collected from the three wards in six hospitals, thus constituting the unit of analysis in this study.

Population and Sampling

Sample size calculation was based on an African study which found that 16% of those treated in a stroke ward died compared to 33% in medical wards [79]. Using a two-sided alpha of 0.05, power of 0.8, ratio of treatment of groups of 3:1, and proportions described above, the study needed a total of 284 patients with 71 being treated in specialised acute wards. Based on this study, a sample size of 300 patients was determined for this study.

Inclusion and exclusion criteria: All adult patients (aged ≥ 18) admitted to hospital for their first acute stroke in 2014 were eligible to be included in this study. Selection was based on a recorded diagnosis of acute stroke in the patient's medical chart. Patients were excluded if they had recurrent strokes, or if they were diagnosed with transient ischemic attacks or any neurological deficits arising from a non-cerebrovascular cause or non-stroke diagnosis, or if clinical records were incomplete via limited clinical information to address the study aim. Sampling method: Using the admissions and discharge logbooks as the sampling frame, a systematic sex-stratified random sampling technique was used to select the study population treated for acute stroke between January and December 2014 in each of the participating hospitals. In this procedure, every fifth individual enlisted in the admission and discharge logbooks as having an acute stroke was selected and their identification numbers noted. Based on this, 50 past stroke cases in each hospital, comprising approximately 25-females and 25-males were included. Identification numbers were used by health information personnel to manually retrieve patient folders from the medical records unit of each hospital. Where retrieved patient medical records had limited information to address the study aim, random sampling of patient medical records continued by the researcher according to the above protocol until the required sample was met.

Data Collection

Using a paper-based structured data collection form, I extracted all medical and sociodemographic information relevant to the study from the patient medical records, discharge summary notes and case notes. Data collected included clinical demographic information (age, sex and employment status/type), patient admission and discharge information, and the process of care indicators where available. Data were primarily limited to whether the patient was admitted and treated in a stroke ward, general ward or a medical emergency ward. Data were also limited to treatment with thrombolytic therapy, aspirin or access to a brain scan. Other information such as co-morbidities, medical diagnoses of stroke subtype, stroke risk factors (hypertension, atrial fibrillation, asthma, smoking, diabetes and obesity) were recorded.

The admission and discharge record books are prospective registers of all consecutive patients with a wide range of health conditions admitted to hospitals for clinical care. Health information officers (patient records personnel) assisted in the retrieval of patient folders at each of the study sites. All extracted data were de-identified and coded to ensure data anonymity.

Statistical Analysis

Pearson chi-square tests were used to compare categorical variables and the Kruskal Wallis test was used to compare mean differences between various groups. Survival was calculated from the day of hospital admission until discharge. Kaplan Meier survival curves were constructed to compare survival between male and female patients. The log rank test was used to evaluate differences in survival curves. Multivariate logistic regression was conducted to identify independent predictors of in-hospital mortality following acute stroke while accounting for collected demographic, medical, and other risk factors and length of stay in hospital. Covariates with a p value of < 0.4 from the bivariate logistic regressions that assessed the association of each variable and death were included in the multivariate model. Goodness of fit of the multivariable model was assessed by Hosmer-Lemeshow test. Statistical significance was set at a p value of <0.05 (two-sided). All analyses were conducted using SPSS version 22.0.

Results

Demographic and Clinical Characteristics

A total of 300 acute stroke patients from three regional hospitals and three tertiary teaching hospitals. Table 1 shows the characteristics of patients according to admission into three separate hospital wards. A total of 99 patients (33.0%) were recruited from acute care wards (50 from a stroke ward and 49 from a medical emergency ward) and the remaining 201 (67.0%) came from four general medical wards. Confirmation of a stroke subtype through a brain CT scan was available in 40% (120) of the sample population. No age differences were observed between patients admitted to the different wards. The mean age (standard deviation) were 59.2 (15.9), 59.3 (15.9) and 61.4 (16.4) years for stroke ward, medical emergency ward and general

medical wards (p = 0.5), respectively. Compared to other wards, those admitted in the stroke ward were more often males and more likely to have co-morbidities such as hypertension and atrial fibrillation. Significantly more patients with haemorrhagic stroke were admitted to the stroke ward (48% compared to 22.4% in the medical emergency ward, and 14.9% in the medical ward, p < 0.001). Furthermore, compared to the other two wards, the stroke ward admitted more male stroke patients, with a history of smoking (30%) and alcohol consumption (22%). The median length of hospital stay was 6.0 days (range 0-163 days). No statistically significant differences in the length of stay between males and females were observed (p =0.17). The mean length of stay was 7.0 and 10.2 days for males and females, respectively. Table 1: Demographic and Clinical characteristics of acute stroke patients by admitting hospital wards

	1	T		1
Characteristics	Stroke unit	Medical Emergency Ward	General Medical Ward	P value [!]
	N=50 (16.7%)	N 40 (16 20()	N 201 (67 00()	
		N=49 (16.3%)	N=201 (67.0%)	
Age, mean (SD), range years	59.2 (15.9), 30-87	59.3 (15.9), 25-86	61.4 (16.4), 18-92	0.5
Sex, %				
Females	44.0	67.3	49.8	0.043
Males	56.0	36.7	50.2	
Type of stroke, %				
Ischemic	38.0	30.6	20.4	
Haemorrhagic	48.0	22.4	14.9	<0.001
Not documented	14.0	46.9	64.7	
Hypertension, %	58.0	26.5	34.3	0.002
Diabetes, %	40.0	24.5	30.3	0.234
Atrial Fibrillation, %	44.0	22.4	22.9	0.008
Asthma, %	4.0	0.0	10.9	0.021
Obesity, %	20	22.9	19.4	0.861
Smoking, %	30.0	6.1	18.4	0.009
Alcohol consumption, %	22.0	4.1	10.9	0.018

! Between-group comparisons were analysed using the non-parametric Kruskal-Wallis test, whereas proportions were compared using Chi-square tests. Statistical significance was determined at p value = < 0.05.

Process of Care

Patients admitted to a stroke ward were more likely to receive a brain scan (70%) compared to 53.1% and 29.4% in medical emergency and general medical wards, respectively (p = 0.001). Provision of in-patient care using thrombolytic therapy (t-PA) was not found in any study site. No statistically significant differences were observed among the three different hospital wards relating to aspirin administration, or provision of care by physiotherapists, dieticians, or clinical psychologists (See Table 2).

waru						
Process of medical	Stroke unit	Medical Emergency	General Medical	p value		
care	N=50 (16.7%)	Ward	Ward			
		N=49 (16.3%)	N=201 (67.0%)			
D	70.0	52.1	20.4	.0.001		
Brain scan, %	/0.0	53.1	29.4	<0.001		
Aspirin intake, %	38.8	51.0	55.5	0.109		
Physiotherapist,%	58	55.7	62.3	0.590		
Dietician, %	26	26.1	24.6	0.966		

Table 2: Process of medical care indicators for patients with acute stroke by admitting hospital ward

In-hospital mortality

The overall in-hospital mortality rate was 31.7% (95) for all admissions within the sample population with risk of dying over time marginally higher among males as shown in the Kaplan Meier graph (Figure 1), although this difference did not reach statistical significance (log rank test p = 0.06). The total case fatality rate for males within 48 hours was 15.2% compared to 9.0% for females (p = 0.102), and one-week rates were 24.8% for males and 19.4 for females (p = 0.25). See Table 3.



Figure 1. Kaplan-Meier Survival Estimates for acute stroke patients according to sex

Study variables	48-hours	1-week	2-weeks	30-days	In-hospital Mortality
Sex, %					
Male	15.2	24.8	30.3	33.1	34.5
Females	9.0	19.4	25.2	28.4	29.0
P-value	0.10	0.25	0.32	0.38	0.31
Overall %	12.0	22.0	27.7	30.7	31.7

Table. 3: Proportions of In-hospital mortality at 48hours, 1week, 2weeks and 30days by gender

Bivariate logistic regressions (Table 4), showed that survival of patients in a stroke ward was not different to that in a medical emergency ward; Odd Ratio (OR) = 1.3, 95% Confidence Interval (CI) 0.7-2.5, p = 0.4. Hemorrhagic stroke was associated with increased mortality, OR= 2.5, 95% CI 1.23–5.16, p = 0.011, and patient history of hypertension also increased mortality odds, OR=1.9, 95% CI 1.15–3.12, p = 0.012. Conversely, aspirin usage was associated with less in-hospital mortality; OR of 0.41, 95% CI 0.25 – 0.68, p = 0.001. Staying fewer days in hospital was associated with less mortality; OR 0.96, 95% CI 0.92 – 0.99, p =0.025.

	Odds ratio, 95% CI	p value
Admitting ward		
Stroke unit	1.32 (0.7 – 2.5)	0.4
Medical emergency ward	1.25 (0.64 - 2.42)	0.5
Medical ward (reference)	1.00	
Age categories, years		
18-50	1.00	
51-61	0.92 (0.45 - 1.88)	0.8
62-75	1.32 (0.68 – 2.57)	0.4
76 +	1.44 (0.74 – 2.84)	0.3
Female sex	0.78 (0.48 - 1.27)	0.3
Type of stroke		
Ischemic (reference)	1.00	
Haemorrhagic	2.53 (1.23 - 5.16)	0.011
Not documented	1.19 (0.64 – 2.22)	0.6
Hypertension	1.90 (1.15 – 3.12)	0.012
Diabetes	1.06 (0.64 - 1.75)	0.8
Atrial Fibrillation	1.03 (0.56 - 1.90)	0.9
Asthma	0.80 (0.30 - 2.10)	0.6
Obesity	1.27 (0.66 – 2.44)	0.5
Smoking	1.18 (0.62 – 2.25)	0.6
Alcohol consumption	1.30 (0.57 – 2.96)	0.5
Brain scan	1.14 (0.69 – 1.86)	0.6
Aspirin intake	0.41 (0.25 - 0.68)	0.001
Physiotherapist	0.71 (0.44 – 1.17)	0.2
Dietician	0.91 (0.51 – 1.61)	0.7
Length of stay (continuous)	0.96 (0.92 – 0.99)	0.025

In multivariable logistic regression adjusted for all variables listed in Table 5, aspirin intake was significantly associated with less mortality. Those who took aspirin immediately after they were admitted were 52% less likely to die compared to no aspirin treatment; adjusted OR 0.48, 95% CI 0.27 - 0.86, (p = 0.013). Hypertensive patients were 86% more likely to die than those without hypertension, adjusted-OR 1.86, 95% CI 1.06 - 3.27, p = 0.032. No statistically significant differences in in-hospital stroke mortality were observed between the wards.

Table 5 : Odds ratios for in-hospital mortality following acute stroke: multivariable logistic analysis					
	Odds ratio, 95% CI	p value			
Admitting ward					
Stroke unit	0.95 (0.44 - 2.05)	0.9			
Medical emergency ward	1.35 (0.65 – 2.80)	0.4			
Medical ward (reference)	1.00				
Age categories, years					
18-50	1.00				
51-61	0.90 (0.42 - 1.95)	0.8			
62-75	1.66 (0.80 – 3.43)	0.2			
76 +	1.62 (0.78 - 3.36)	0.2			
Female sex	0.79 (0.44 - 1.39)	0.4			
Type of stroke					
Ischemic (reference)	1.00				
Haemorrhagic	1.74 (0.75 – 4.02)	0.2			
Not documented	1.05 (0.53 – 2.11)	0.9			
Hypertension	1.86 (1.06 – 3.27)	0.032			
Atrial Fibrillation	1.12 (0.57 – 2.21)	0.7			
Asthma	0.66 (0.22 – 1.93)	0.4			
Smoking	1.19 (0.57 – 2.53)	0.6			
Alcohol consumption	1.37 (0.54 – 3.48)	0.5			
Aspirin intake	0.48 (0.27 – 0.86)	0.013			
Physiotherapy	0.75 (0.43 – 1.29)	0.3			
Length of stay, days (continuous)	0.96 (0.92 - 0.99)	0.026			
Discussion

This study sought to evaluate risk adjusted in-hospital mortality outcomes of acute stroke patients in three admitting wards after initial assessment and stabilization in the accident and emergency departments of the study sites. Patients admitted in a stroke unit were more likely to receive a brain scan compared to the medical and general medical wards. Our study found no significant association between in-hospital mortality and the three admitting wards even after adjusting for various risk factors. Given an overall 31.7% in-hospital mortality rate at 30 days, the study findings support previous suggestions that the provision of best practice acute stroke care in LMICs is limited [26-28, 37]. Aspirin therapy for acute stroke patients proved to be a principal protective intervention among acute stroke patients in this study population.

Overall, these findings provide new insights into in-hospital mortality outcomes after acute care in different admitting wards in a developing country context where data on in-hospital stroke mortality are limited. Whilst this finding corroborates a recent South African study [84], the finding that age did not predict in-hospital mortality differs from prior studies in Ghana [9, 77], which showed age as a strong predictor of stroke in-hospital mortality. The present study findings are also inconsistent with extensive body of evidence in other countries where age has been reported as a predictor of in-hospital mortality following acute stroke [84-87]. This inconsistency may relate to the limited study sample. Although no current evidence exists to support this, such a finding could also have been attributed to less number of older stroke patients being admitted because of limited geographical and financial access to care. However, the mean age reported in this study did not differ from previous studies in Ghana [10, 76] and in other African countries [79, 88-91].

Hypertension as a risk factor for in-hospital mortality had a significant association with inhospital mortality in both the univariate and multivariate logistical analyses. Similar to these results, previous studies in Ghana also reported a statistically significant relationship between hypertension and in-hospital mortality [8, 81]. Previous works have also emphasized the significant role of hypertension as a risk factor to stroke associated mortality [6, 85, 92, 93]. Given that in-hospital stroke mortality was independently associated with patient history of hypertension, this emphasized the need for pragmatic measures to control hypertension and the other risk factors as primary drivers of stroke mortality in Ghana.

Access to CT or magnetic resonance imaging (MRI) scanning to distinguish stroke subtype is highly recommended as best practice in acute stroke treatment [94, 95]. However, this is often lacking in LMICs [36, 55, 96]. In the present study, patients admitted to a stroke ward had better access to CT scans compared to other admitting wards. In Ghana, previous research reported access to CT scans was limited due to patients' financial constraints since the National Health Insurance does not cover these costs [97]. Comparable to our finding of increased access to CT scans in stroke ward admissions, a study in South Africa on multidisciplinary acute stroke care revealed that patients admitted to a stroke ward had increased accessed to CT scanning services compared to general ward [79]. Given that most patients in the present cohort did not receive a CT scan, a health policy to enhance access to brain scanning could potentially improve clinical outcomes.

Consistent with previous evidence, the odds of death for hemorrhagic stroke patients were higher than ischemic stroke patients in univariate analysis. Although this association was not statistically significant in the adjusted model, this condition has clinical importance and further highlights the increased risk of deaths associated with hemorrhagic stroke patients worldwide. Prior studies in Ghana and other African countries have reported similarity of higher mortality risk in patients with hemorrhagic stroke [9, 77, 98]. This is comparable to in-hospital stroke mortality risk in other LMICs compared to HICs [6, 85]. However, this contrasts with the latest report on the global burden of stroke where ischemic stroke mortality is much higher [99].

Unexpectedly, no statistically significant differences in in-hospital mortality across the three admitting wards were reported. Even though there is preponderance of evidence about the effect of patient care in a stroke unit on reduced in-patient mortality [12, 70, 71], with favourable outcomes up to 10 years post stroke [72, 73], evidence from this study reports no significant relationship with in-patient mortality. Such a finding is not uncommon as past studies have reported similar results [74, 75]. This finding could arise from a multiplicity of factors. Firstly, the nature of acute stroke care provided in these admitting wards could influence mortality outcomes. Also, more severe patients from smaller non-tertiary hospitals are mostly referred to and admitted in wards of major tertiary hospitals thus exposing them to potentially admit more severe stroke patients with multiple comorbidities. Thirdly, the most likely residual confounding factor for in-hospital stroke mortality in this study was severity of stroke which could not be assessed in the present study due to limited documentation on severity scores in almost all study sites. This may be a source of bias in the present study as severity levels have been reported previously as a strong predictor of in-hospital mortality variation [82].

Although the efficacy of acute stroke interventions such as stroke ward care, thrombolytic therapy and aspirin administration has been widely studied, there is limited information about the levels of usage and efficacy in LMICs such as Ghana. Evidence from this study indicates limited access to stroke ward care and lack of evidence of thrombolytic therapy for acute ischemic stroke patients, which is consistent with previous studies asserting the limited nature of evidence-based acute stroke care in LMICs [27, 28, 49]. The capital-intensive nature of stroke unit care and the limited availability of specialized health staff to administer thrombolytic therapy are the likely reasons for these findings. However, the use of aspirin

therapy was revealed as the strongest protector of life for stroke patients after adjusting for possible confounding predictors of in-hospital mortality. As demonstrated in the multivariable logistic regression model, those taking aspirin were 60% less likely to die than those who did not take aspirin (Adjusted-OR = 0.40, 95% CI 0.2-0.7, p=0.002). As posited previously by researchers [51, 52, 100], the present finding on aspirin could be attributable to the costeffective nature of this therapy as well as the ease of its usage in clinical settings by care providers. This revelation accentuates the need for continuity of aspirin therapy for acute ischemic stroke patients in LMICs where access to stroke unit care and thrombolytic therapy are still limited. Notwithstanding this, due to limited access to brain scanning in the study hospitals and as reported in other studies in Africa [79, 101-104], it is plausible that aspirin therapy is still highly underused despite its proven efficacy. In order to improve patient clinical outcomes using aspirin, it is important for decision makers and health managers to formulate interventions to increase access to CT scanning and to optimize the use of aspirin among a greater proportion of eligible patients.

Limitations and Strengths

The present study did not account for stroke severity in adjusting mortality outcomes for the different case mix, thus presenting a potential confounding factor for in-hospital mortality. Only all-cause stroke-associated mortality was examined because information on the cause of in-hospital acute stroke mortality (confirmed through autopsy report) was limited. Nonetheless, this study is important in many respects. First, whilst providing further evidence on in-hospital mortality in Ghana and other LMICs where data are limited, the present findings provide new insights into in-hospital stroke mortality in different acute care wards in both teaching and non-teaching hospitals.

Conclusion

In this study, risk-adjusted in-hospital mortality outcomes in different admitting acute care hospitals were evaluated. Whilst adding to previous studies in Ghana on in-hospital stroke mortality, the present study findings were extended to include in-hospital mortality outcomes from non-tertiary teaching hospitals. No differences in in-hospital stroke mortality across the three wards were found. Aspirin therapy was demonstrated as a significant protector against in-hospital stroke mortality. Notwithstanding this, the overall high in-hospital stroke mortality rate of 31.7% at 30 days further highlights the need to improve acute stroke care such as improved health infrastructure and more specialist care in these and other hospitals by health policy makers and relevant stakeholders. Even though stroke risk factors such as hypertension, atrial fibrillation, asthma, alcohol intake and smoking were not reported as independent predictors of in-hospital stroke mortality, their emergence as contributory factors to in-hospital stroke mortality raise further concern on the need for more pragmatic statewide policies to control their occurrence. Controlled prospective studies and larger sample population data taking into account stroke severity scores are needed in future studies to provide definitive evidence on in-hospital mortality in these admitting hospital wards. This is an essential step towards efforts to improve acute stroke care and to further reduce the current disproportionate burden of stroke in LMICs such as Ghana.

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Study Three

Barriers to evidence-based acute stroke care in Ghana: a qualitative study on the perspectives of stroke care professionals

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4.3.1 Overview and rationale

Global uptake of contemporary acute stroke care interventions is hampered by multiple barriers. Importantly, the uptake of current best practice interventions in LMIC remain low and there is limited contextualized information explaining reasons for the current situation in such settings. On the basis of this, the second systematic review reported in chapter two (Section B) presents information about the barriers to delivery of key contemporary acute stroke care interventions. The findings from this review highlighted multidimensional barriers. Also, barriers were focused more on the uptake of thrombolysis. Importantly, the findings from this review emanate from studies conducted in only HICs, hence little is still known about the barriers underpinning the low uptake rates of current acute stroke care interventions in LMICs. The research paper reported in this section was designed and conducted against the backdrop of this knowledge gap. This was a qualitative study aimed to advance understandings of the factors perceived by acute stroke care professionals as barriers to delivery of acute stroke care in Ghana.

Largely, this study reported multiple barriers at the patient, health professionals, health system/organizational context and the broader national level barriers. Whilst corroborating with some existing barriers in the literature from HICs, some unique and context specific barriers were observed. Factors such as discharge against medical advice and the role of socio-cultural and religious beliefs/practices remain as substantial barriers to optimal patient care. All in all, the findings also indicate the need for future plans and interventions to consider the nature and uniqueness of these barriers in order to develop well-tailored interventions for improved patient outcomes. The next section reports findings from this qualitative study.

BMJ Open Barriers to evidence-based acute stroke care in Ghana: a qualitative study on the perspectives of stroke care professionals

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ABSTRACT

Objective Despite major advances in research on acute stroke care interventions, relatively few stroke patients benefit from evidence-based care due to multiple barriers. Yet current evidence of such barriers is predominantly from high-income countries. This study seeks to understand stroke care professionals' views on the barriers which hinder the provision of optimal acute stroke care in Ghanaian hospital settings.

Design A qualitative approach using semistructured interviews. Both thematic and grounded theory approaches were used to analyse and interpret the data through a synthesis of preidentified and emergent themes. Setting A multisite study, conducted in six major referral acute hospital settings (three teaching and three nonteaching regional hospitals) in Ghana.

Participants A total of 40 participants comprising neurologists, emergency physician specialists, nonspecialist medical doctors, nurses, physiotherapists, clinical psychologists and a dietitian.

Results Four key barriers and 12 subthemes of barriers were identified. These include barriers at the patient (financial constraints, delays, sociocultural or religious practices, discharge against medical advice, denial of stroke), health system (inadequate medical facilities, lack of stroke care protocol, limited staff numbers, inadequate staff development opportunities), health professionals (poor collaboration, limited knowledge of stroke care interventions) and broader national health policy (lack of political will) levels. Perceived barriers varied across health professional disciplines and hospitals.

Conclusion Barriers from low/middle-income countries differ substantially from those in high-income countries. For evidence-based acute stroke care in low/middleincome countries such as Ghana, health policy-makers and hospital managers need to consider the contrasts and uniqueness in these barriers in designing quality improvement interventions to optimise patient outcomes.

BACKGROUND

Recent significant technological advancement in medical practice has increased demands, expectations and pressures on healthcare staff to provide quality and evidence-based care. This is exacerbated by the wide knowledge-clinical practice gap across the world, particularly in low/

Strengths and limitations of this study

- This study represents the first in Ghana to explore, in-depth, the barriers perceived by stroke care professionals to optimum provision of acute care in hospital settings.
- The work focused exclusively on the perspectives ► of acute stroke care professionals from diverse professional disciplines, expertise, gender. tertiary and non-tertiary hospitals across different geographical settings.
- This study did not focus on barriers to a specific stroke care intervention, as reported extensively in previous works, but rather on barriers across the continuum of stroke care.
- The study reported results from a limited set of participants whose views may not be reflective of the wider health staff responsible for acute stroke care in Ghana.
- Given the qualitative nature of the study, data interpretation could be subjective and thus, caution should be applied in interpretation.

middle-income countries² where research translation has become an urgent healthcare agenda.³ Empirical evidence in the USA and Europe, for example, demonstrates how only about 30% to 50% of patients receive evidence-based interventions in clinical settings.^{4 5} It is further suggested that translation of an evidenced-based health intervention into routine clinical practice can take up to 17 years.⁶ The need to identify barriers that underpin the slow uptake of evidence-based care in clinical settings is essential in understanding the extent to which health professionals provide such care to patients.^{5 7} As a result, theoretical and conceptual attempts have been made to shed light on the factors which affect the current knowledge-practice gap in healthcare settings.589

Due to the increasing global stroke-remorbidity,¹⁰ lated mortality and decades have witnessed a the past

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proliferation of evidence-based acute stroke care interventions.^{11–16}Throughout this paper, the term evidence-based acute stroke care interventions also referred to as optimal acute stroke care comprised all acute stroke care interventions based on scientific evidence, clinical judgement and expertise of a clinician and the needs of patients.¹⁷ Other key stroke experts have also recommended essential components of an evidence-based acute stroke care for improved patient outcomes.¹⁸ ¹⁹ Notwithstanding such advances, uptake of such recommendations in clinical settings remains slow,^{20 21} suggesting that only a small proportion of stroke patients receive optimal care. Although the low uptake of these interventions is a global health challenge, evidence suggests the pace of uptake in high-income countries exceed that of low/middle-income countries.²⁰⁻²² Numerous barriers have been identified to explain the low uptake of such evidence-based stroke care interventions into routine clinical practice. Some of these barriers include inadequate medical facilities, inadequate knowledge and skill levels of stroke care providers, low awareness of current acute stroke care interventions and the perceived efficacy levels of acute stroke care interventions.^{23–25} There are also barriers at the patient level which include delays in seeking emergency care due to lack of awareness of early stroke symptoms or financial constraints.^{26 27}

Although research has increased our knowledge about the range of barriers to the uptake of evidence-based stroke care in clinical settings, a more balanced and holistic understanding of such research is needed. Existing research to date only presents a one-sided view, and bias towards high-income countries (eg, Australia and USA) and moreover, is focused primarily on barriers inhibiting uptake of thrombolytic therapy.^{23 25 27 28} However, only few studies have looked at barriers to other components of acute stroke care interventions.²⁴ ²⁹ ³⁰ A study by Langhorne and colleagues also provides insightful information on the uptake of stroke unit care components in resource-poor settings.²⁰ It is unclear if these barriers apply to low/ middle-income countries such as Ghana, where the geopolitical, socioeconomic and health system contexts vary. An investigation of such barriers is important in low/middle-income countries because the global stroke burden is much higher there,^{10 31} and yet evidence suggests uptake of evidence-based acute stroke care interventions is relatively lower.^{20 21}

This study therefore aimed to identify the views of stroke care professionals on barriers inhibiting the provision of optimal acute stroke care in Ghanaian hospitals, since such information is non-existent. Acute stroke care in this context applies to the provision of care in the initial days and weeks after a stroke. Greater insights about these barriers and how they differ according to hospital settings and across stroke care professional disciplines are important for developing interventions towards enhancing optimal patient outcomes in Ghana. The findings may also have broader relevance to other resource-poor settings.

METHODS Study design

This study is part of a larger multisite study to evaluate the provision of evidence-based acute stroke care in acute care in major referral hospitals in Ghana. A qualitative study design using semistructured interviews was employed to gain a rich and in-depth understanding of the barriers faced by stroke care professionals. The importance of qualitative data to successful translation of best scientific evidence into clinical practice has also been recommended.³² The study design, data collection, analysis and reporting were conducted in accordance with the consolidated criteria for reporting qualitative research³³ as shown in online supplementary file 1.

Settings

The study was conducted in a convenient sample of three referral tertiary (teaching) and three regional (non-teaching) hospitals from the southern, middle and northern belts of Ghana, between November 2015 and April 2016. This represents three of the five tertiary-teaching hospitals and three of the nine regional hospitals in Ghana. The study hospitals are major referral hospitals for other hospitals and health centres located in 6 of the 10 administrative regions of Ghana and were chosen to account for the geographical and socioeconomic contrasts among the 10 administrative regions of the country. The hospital bed capacity for these hospitals is as low as 150 for the regional hospitals, whereas the teaching hospitals bed capacity is approximately 653. The tertiary hospitals are larger referral centres and are well resourced with diagnostic and therapeutic facilities, while the regional hospitals act as major referral points to other hospitals and health centres within their catchment areas. Overall, the annual stroke admissions for 2014 ranged from 49 for the regional and 1500 stroke cases for the teaching hospitals. See online supplementary file 2 for additional information on the study hospitals.

Research team

Participants have no prior relationship with the researchers but because of the previous works of two of the researchers (LB and Ad-GA) in some of the study regions, it is possible participants have met or are aware of their works. LB is a health services researcher with interest in health services and policy research, research on implementation science and quality improvement interventions for stroke care health professionals. He is skilled in both qualitative and quantitative research works. Ad-GA conducts social and health psychology research using largely qualitative methods. AS is a health services researcher employing a mixed methods approach. The remaining researchers (GM, CKYC and SS) on the other hand, also have relevant skills, knowledge and interest in qualitative studies and the topic under study. . Overall, the research team comprised two women and four men.

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Table 1 Distribution of interview participants and study hospitals				
Participants	Tertiary/teaching hospitals	Regional hospitals	Total	
Nurses	11	9	20	
Medical doctors/physicians	6	6	12	
Clinical psychologist	1	1	2	
Physiotherapist	2	3	5	
Dietitian	0	1	1	
Total	20	20	40	

Participants

Participants comprised key hospital staff, primarily involved in directing or providing acute care for stroke patients. To achieve maximum variation in the continuum of care that would reflect a real life setting, the study recruited nurses, specialist medical doctors (neurologists, emergency physician specialist), non-specialist medical doctors, clinical psychologists, physiotherapists and a dietitian, representing diverse expertise and experience relevant to acute stroke care. Table 1 shows participants' distribution across study sites.

Sampling and recruitment

Purposive sampling was used to recruit all study participants. Participant recruitment was facilitated by two of the researchers (LB, Ad-GA). . To commence recruitment and promote the study to eligible participants, meetings were held with hospital administrators, in-service training and research coordinators, department heads and nurses incharge in the study hospitals. Potential participants were then recommended from these meetings and engagements. Initial contact with prospective participants was made face-to-face or by telephone calls by the first author to identify the date, time and venue for the interviews. Potential participants were identified. Due to time and workload restrictions, three participants declined to participate in the study. The number of participants enrolled into the study was determined by data saturation.

Data collection

All interviews were conducted face-to-face in English by LB. Data collection was conducted in various venues including: general and emergency wards, consulting rooms, conference rooms, participants' office rooms and physiotherapy departments. The interviews were facilitated by an interview guide (see online supplementary file 3) developed by the researchers and informed by an extensive literature review on the topic. The interview guide was pilot-tested with three nurses and three medical doctors at non-study sites and adapted to reflect the professional role of the interviewees. With the permission of interviewees, each interview was recorded using a digital voice recorder. Detailed field notes were also taken. The study repeatedly used prompts to facilitate the elicitation of more and clearer information or clarification of certain concepts used by participants. The interviews lasted 45 min on average and all recorded interviews were transcribed verbatim by professional transcribers for the final data analysis. About a third of the transcripts were shared with selected participants to crosscheck and ensure the information reflected the interview process and 13 transcripts were returned.

Data analysis

Thematic data analysis,^{34 35} combined with some elements of a grounded theory approach,36 were used to analyse the data. Pre-existing thematic categories based on relevant literature were used in the data analysis. The grounded theory took an inductive approach to ensure all essential emergent themes from the codes not included in the deductive pre-existing coded list of barriers were captured. An initial codebook based on prior codes was developed and subsequently modified with the addition of new emergent themes after a line-byline reading and rereading of transcripts by one author (LB). A second author (Ad-GA), crosschecked the final coded results with a sample of the transcripts. Using the constant comparison approach,^{36 37} a comparative analysis of both emergent and prior themes was conducted between study sites and participants to understand areas of convergence and divergence. NVivo software package V.10.0 (38)³⁸ was employed to organise, code and identify all data.

Trustworthiness and transferability in the study results were facilitated by the consistent use of the interview guide during the interview process, audio recording of all interviews, professional transcription of the interviews and the use of the NVivo software to manage the entire data analysis process. As a measure to further enhance data trustworthiness,³⁹ some transcripts were shared with selected participants for crosschecking, known as member validation.

FINDINGS

A total of 40 participants took part in the study, approximately 6 participants per study site. Participants included both men and women of varied professional disciplines, ranks and years of practice in the study sites (see table 1). Downloaded from http://bmjopen.bmj.com/ on September 14, 2017 - Published by group.bmj.com

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Table 2 Themes and definitions	
Coding categories	Definition of barriers
Patient level	Includes factors, such as late arrival or low awareness of stroke symptoms, denial of stroke, financial capacity, sociocultural practices or beliefs inhibiting access or adherence to optimal acute stroke care.
Hospital or health system level	Relates to a lack of inadequate medical facilities or equipment, staff numbers, protocols, management support, supporting policies, organisational context or norms which support implementation of standard care and availability of staff professional development opportunities to support the provision of standard care.
Stroke care professionals	Describes acute stroke care providers' level of team support, communication or collaborations which affect the provision of care. Also includes competence, skill, knowledge, awareness, familiarity or agreement to specific treatments, their values, motivations or attitudes towards particular treatments or intervention.
National/state health policy context	Relates to the level of political will for acute stroke care in the form of national stroke policies, limited allocation of resources for acute stroke care, reimbursement of funds to hospitals, national health policies to support stroke patients' access to optimal care and the lack of any regulatory frameworks or policies to support stroke care.

Barriers to acute stroke care

Four key themes of barriers to the provision of optimal acute stroke care emerged from the data; patient, hospital or health system, healthcare providers and national health policy factors. Table 2 describes each of these barriers. Embedded in these themes were 12 subthemes which provided specific and contextualised meaning to the main themes.

Patient factors

Under this category of barriers, five subthemes were identified: financial constraints, delays, sociocultural or religious beliefs and practices, discharge against medical advice and denial of stroke.

Financial constraints

In all the study sites and across participants from the various professional disciplines, barriers such as lack of funds to transport patients to the hospital, inability to pay for medical expenses (eg, CT brain scanning services, laboratory tests and other healthcare associated expenses) were consistently raised. Patients' or their caregivers' decision to first seek medical care, organise means of transport to the hospital or pay for medical expenses were often constrained by their level of financial capacity. As a result, access to care was often delayed or deprived. An excerpt from a participant emphasised this:

'poverty and ability to pay for medical cost is the issue over here,...let's say a doctor will request a patient to do a CT scan, do some lab tests ..., but the patient just simply cannot afford it, or it takes too long for them to gather the money, so for two, three and sometimes five weeks you are treating a patient without a CT scan investigation' (Medical doctor, ID 9)

Delays

Patients' late arrival to the hospital was commonly cited as another barrier to acute stroke care. Participants suggested the reasons for such delays arose from their lack of awareness of early stroke symptoms and decision to first seek herbal or faith-based, rather than medical care. Delays were also attributed to financial capacity of the family to seek medical care, especially in instances where the family breadwinner was the stroke victim. Hence, patients with good financial circumstances were more likely to seek early acute medical care compared with those with poor finances:

"...they don't bring the patients early and when they come, they will tell you the condition just started, that they just noticed the symptoms and rushed the patient to the hospital. But you realize that this patient had the stroke for long, not very acute as they described, either they have sought treatments elsewhere or other interventions before arriving here' (Nurse, ID 4)

On the low awareness of early stroke symptoms, one participant noted:

'They don't have knowledge of early stroke symptoms, they are ignorant about stroke symptoms..., Because they don't know what the condition is, patients or families will rather prefer to self-medicate with painkiller or remain at home upon symptoms onset with the hope that the symptoms will disappear' (Medical doctor, ID2)

Sociocultural and religious beliefs

Patients' sociocultural or religious beliefs and practices emerged as another predominant barrier. Cultural beliefs and practices (eg, view stroke having a spiritual cause, retribution from their gods and not a condition which can be managed medically) were often very important and likely to influence patient health-seeking behaviour. A common practice from such beliefs was patients' desperate attempts to defer medical care for herbal or traditional medical care or make attempts to combine both while hospitalised. Some nurses noted such practices or beliefs have often compelled families of patients to abandon medical care in the hospital for alternative care provided by traditional or faith healers. For example, all physiotherapists interviewed believed sociocultural beliefs and practices have limited patient attendance of outpatient care after discharge as most resorted to local herbal treatment options or to prayer camps. A participant had this to say about the religious beliefs on treatment compliance:

"...they become very spiritual once they are diagnosed with a stroke; most now want to focus on their spiritual life instead. You realize that consistently our stroke patients want to talk about God, talking about how lucky they have been, how God has saved them from death' (Clinical psychologist, ID 1)

Discharge against medical advice

'Discharge against medical advice' was consistently discussed by participants and emerged as a key barrier to optimal acute stroke care. This practice was generally perpetuated by two factors; financial capacity to meet medical expenses and families' desire to resort to other forms of care such as traditional herbal medicine, consultation of spiritualists or faith healers. Participants attributed the increased patient and family interest to such alternative forms of care to the vibrant advertisements across the media by traditional herbal medicine practitioners and faith healers. Indeed, promises were made by such individuals to cure stroke and other chronic conditions within a week or two after commencing treatment:

'I recently heard one advertisement which said acute stroke patients should just come here and will be made to walk within a week. So it has gotten to the point where patients easily get misled by these adverts, they find these traditional or faith healers attractive and accessible' (Medical doctor, ID 11)

According to nurses, such incidences were also linked to the sociocultural beliefs and practices of the people where health conditions such as stroke, were associated with supernatural or spiritual causes. After being informed about their stroke condition, some stroke patients often insisted on being discharged. Moreover, refusal to heed patients' or families' requests for early discharge often resulted in non-compliance to treatment, sudden disappearance of patients or desertion of patients by family members:

'with the relatives, as soon as they find out that it is a stroke, they start finding ways of transferring the patient to seek herbal medication or to a prayer camp ..., so they request for discharge against medical advice and take the patient away' (Nurse, ID 15)

Denial

It was also reported that some family members or patients sometimes rejected the diagnosis and dissociated their condition from stroke after being informed about the condition. Participants even acknowledged instances where some family members challenged their professional competence because they felt an incorrect diagnosis was made. The denial of stroke stemmed from the diverse misunderstandings of the illness, with some patients/family members viewing it as an attack or retribution from their gods or spirits for a wrongdoing. In such situations, the provision of care was difficult, as some family members were less compliant during treatment:

'I remember one care giver following up to me to inquire whether we were sure the condition of their relative was a stroke, as she believed a wrong diagnosis was documented. Because to her, their relative does not deserve to have a stroke' (Nurse, ID 11)

Hospital or health system factors

The subthemes of these system factors were shortage of medical facilities/equipment, lack of a stroke specific protocol, inadequate staff numbers and limited staff professional development opportunities.

Shortage of medical facilities

The limited availability of essential medical equipment to facilitate effective provision of acute stroke care was a common feature in study hospitals within the northern belt. There was a shortage of medical facilities such as blood pressure (BP) monitoring apparatus, cardio monitors, suction machines, adjustable hospital beds and inadequate space to facilitate patient care. For example, participants in the only stroke unit in this study believed that the inadequate bed capacity (six-bed capacity) limited admission of many patients to receive optimal care. One participant commented:

'Unfortunately, you find stroke patients, they come in, no bed, they are sitting on chairs, sitting on the wheel chair or on the bare floors, these are the conditions under which we are expected to provide standard care..."(Medical doctor, ID 2) This experience and another comment below exemplified this barrier:

'We have just one oxygen for all the patients in this ward so the nurses are sometimes compelled to use their discretion to wean patients off oxygen to enable another patient benefit if his/her condition is more severe' (Medical doctor, ID 7)

Additionally, the lack of a stroke unit was a common concern expressed by medical doctors from hospitals in the middle and southern belts, a situation they believed was caused by limited funds allocated by hospitals and a low priority for acute stroke care. A lack of medical equipment and consumables could delay or deprive patients of standard care. Participants also talked about instances where some medical doctors acquired personal BP monitoring devices to support patient care because of shortages. Another issue was the absence or frequent malfunction or breakdown of diagnostic services such as CT scanning services, a situation which often delayed care delivery or led to referral of patients to other hospitals. According to some medical doctors, this situation sometimes compelled them to proceed with care delivery without a CT scan investigation to inform treatment options:

'I can say the biggest problem we face is our diagnostic equipment. See the whole of this so called big hospital, we have only one CT scan machine. The machine has been out of service for over 6 to 8 weeks and was only put to use again two weeks ago ...," (Medical doctor, ID 11)

Lack of a specific protocol for acute stroke care

Most nurses believed the absence of a specific protocol or clinical guideline for acute stroke care was a key barrier:

'....sometimes the cases come and you've forgotten some important procedures because I left the classroom a very long time ago' (Nurse, ID 13)

One nurse recounted her experience of providing an acute stroke care with much uncertainty because there was no medical doctor or a senior colleague to guide her. This nurse stressed the importance of a clinical protocol, which she argued could facilitate the provision of standardised care even in the absence of a specialist or a medical doctor:

'Most of the stroke cases I have witnessed were rushed in here during late hours, sometimes after mid-night and most times, its only nurses present to attend to the case. So the patient has to wait until a doctor arrives, sometimes the next morning and that is why I think the protocol will at least guide us to safely initiate initial treatment' (Nurse, ID 18)

Limited staff especially stroke specialists (eg, neurologists, neurosurgeons and trained stroke nurses) were also a key barrier across the study sites. This issue was more dominant in the non-tertiary regional hospitals and participants in the northern belt of Ghana. Participants, especially nurses, believed the current staff numbers were inadequate to provide optimal acute stroke care (eg, regular checking of BP levels, sugar levels, regular turning of patients to prevent pressure sores and management of urinal incontinence to minimise risk of urinary tract infections).They expressed frustration about the high workload, which often compromised effective patient care:

'you could have patients running over 40,..., some are in the wheel chair, some are on the chairs you see over there, some are on the beds, sometimes some are on the stretchers" (Nurse, ID 5)

Limited staff professional development opportunities

With the exception of medical doctors, nurses and allied health staff expressed great interest in opportunities for staff professional development, mainly in hands-on training workshops related to stroke clinical care. Although there were policies to support staff develop their current knowledge and skills, such opportunities were very rare. Nurses, for example, emphasised the importance of continuous education and professional development as current clinical practice was underpinned by what they were taught in schools many years ago. Overall, there was strong opinion on this matter and a lack of continuous training opportunities inherently affected the quality of care provided to acute stroke patients:

'we don't have regular workshops..., even if there will ever be such an opportunity, you will only consider attending provided you can afford the cost as this hospital won't support us attend such a workshop' (Nurse, ID 4)

Healthcare providers' factors

Two main subthemes of barriers were identified at the healthcare staff level; limited knowledge in acute stroke care and inadequate team collaboration and coordination.

Inadequate knowledge

Lack of knowledge on how to provide appropriate treatment was often discussed, particularly by nurses. Unlike the medical doctors, the nurses were unware of thrombolytic therapy. This particular type of therapy was not part of what the medical doctors recommended for acute ischaemic stroke care:

'What did you say again? thromboly... what? Not here, I am hearing thrombolysis for the first time. It is not part of our treatment plan for stroke patients in this hospital. How come you say it is one of the 6

key therapies for acute ischemic stroke and I am not aware of it?' (Nurse, ID 9)

Most nurses also identified insufficient knowledge of certain acute stroke care procedures as a barrier, especially in triaging unconscious stroke patients. They expressed uncertainty about their ability to often proceed with care delivery in the absence of a medical doctor. Although nurses talked about consulting senior colleagues, some level of uncertainty was still noted in proceeding to provide care in the absence of a medical doctor. Despite their clinical training, nurses cited difficulties arising from efforts to respond to unconscious stroke patients and conduct assessment to support an accurate stroke prognosis:

'Sometimes a stroke case arrives unconscious and you start shivering especially when it is in the night and there is no doctor around to respond immediately. I feel very nervous when I realise I am the only senior nurse in the ward to attend to this patient' (Nurse, ID 12)

Team collaboration and communication

According to most nurses and all allied health staff, collaborative work in a multidisciplinary stroke team was inadequate, and an obstacle to effective patient care. Physician driven stroke care without adequate involvement of other staff, was frequently discussed:

'I don't even think we have a working team here, it is more of a doctor giving instructions...,giving instructions to nurses, though nurses are there with the patients 24 hours, the medical doctors just come to see their patients and then disappear. Is that what you call teamwork?' (Nurse, ID 14)

Allied health staff expressed a sense of marginalisation and disconnectedness, especially in the early stages of care. A dietitian for example cited instances where medical teams (doctors and nurses) often discharge patients without his view on dietary plans at discharge. Three physiotherapists expressed similar concerns of limited involvement which in their view inhibited their ability to develop initial rapport with patients or the opportunity to educate patients about the importance of self-care practices, following discharge:

'There was an occasion my rounds coincided with the medical team's rounds; I quickly joined them. I made a suggestion on a particular patient we were attending to but this was brushed off and the medical doctor behaved as if I was trying to direct him what to do or take over his job' (Physiotherapist, ID 3)

National policy context factors

Participants identified one key barrier under this theme; lack of political will for acute stroke care.

Lack of political imperative

The lack of national level support and political imperative for acute stroke care was consistently cited as a broad level barrier, particularly by medical doctors. They expressed strong views on this issue, attributing it to the increasing out-of-pocket medical expenses for patients. Despite the existence of the national health insurance policy which was supposed to replace the practice of 'cash and carry', a lack of political imperative for the scheme has gradually introduced the policy of upfront payments by patients prior to acute care in most hospitals in Ghana presently. They believed this has negatively affected patients' access to care (not only stroke patients) because of their inability to pay for medical expenses. The limited coverage of the national health insurance scheme on chronic care, such as stroke, was also stated as a key barrier. Patients experienced difficulties paying for stroke-related medical costs (eg, CT brain scans and other laboratory tests) that were not covered by the national health insurance scheme. Overall, there was a sense of powerlessness about national level neglect for acute stroke care. Consequently, this resulted in staff dissatisfaction and a lack of motivation to provide effective care:

'The problems we face in our current health sector has very little to do with health professionals' reluctance to provide standard care. It is the health system!..., we are under a system where every medication is expensive for the ordinary Ghanaian to afford and yet, we make the patients to believe the national health insurance policy covers everything. Now almost every medication has to be paid for by the patient and if they can't afford what we recommend as best treatment option for their condition, we provide the alternatives which may not be very effective' (Medical doctor, ID 11).

DISCUSSION

Summary of main findings

This study provides in-depth insights of the barriers to the delivery of optimal acute stroke care in Ghana, a largely neglected low/middle-income country in Africa. The findings suggest that although the barriers identified share some commonality with those reported in previous studies in high-income countries, some barriers are unique to optimal stroke care in low/middle-income settings such as Ghana. Some of the predominant barriers to acute stroke care in high-income countries often comprised patient delay in seeking early care, inadequate medical facilities to support optimal patient care, healthcare providers' attitudes towards some acute stroke care interventions, poor communication and lack of cooperation among healthcare providers.^{23–25} On the contrary, although there is an overlap of these barriers in both high-income and low/middle-income countries, the issue of discharge against medical advice and the role of sociocultural and religious beliefs or practices of stroke patients and their families characterise the present study. While illuminating the reasons influencing the provision of optimal acute stroke care in a typical resource-poor setting, the findings further unravel barriers peculiar to different stroke care professionals and hospital settings where much policy attention is required for effective and timely translation of evidence-based stroke care intervention into routine clinical practice.

Comparison with previous literature

As found in this study, stroke care in high-income countries with modern resources has consistently reported barriers corresponding to patient, health system/hospital, health staff and the national level factors.^{23,25,40} Highlighting patient level barriers as the most predominant of all barriers identified in our study, a previous study corroborated this by reporting 91% of participants viewed prehospital delay at the patient level as the most dominant barrier to providing thrombolytic therapy.²⁷ An earlier study in Ghana⁴¹ found that only 40% (277/693) could correctly identify stroke symptoms, reinforcing the importance of our finding that participants identified patient delays to seek care due to low awareness of stroke symptoms.

Although our findings on the importance of patient level barriers to optimal stroke care are in line with previous research,^{23 27 30 42}the explanation and the circumstances in which some patient level factors acted as barriers to optimal acute stroke care were somewhat different . For example, sociocultural or religious beliefs and practices were perceived to underpin health-seeking behaviours of stroke patients and their families in Ghana. Although this is inconsistent with the literature on barriers to acute stroke care in high-income countries, our findings corroborate with research on other chronic diseases and health-seeking behaviour in Ghana.^{43 44}This underscores the influence of such beliefs and practices to health-seeking behaviours of patients and families in Ghana. Evidence within the African contexts suggests patient access to traditional and faith healers as complimentary avenues of care is due to the easy access, lower cost and cultural legitimacy of such alternatives. 45 46

In addition, patient discharge against medical advice was also a key barrier affecting optimal clinical care. This finding is also largely inconsistent with published barriers to acute stroke care from high-income countries. Despite the limited popularity of such barriers in previous studies, this has been well articulated in other health contexts and conditions with conclusive arguments of the practice being a drawback and an obstacle to provision of adequate and quality healthcare.^{47–50} Clearly, this issue requires further investigation in Ghana, and possibly other low/middle-income countries. L

Other important barriers from this study were related to the health system, such as limited stroke care specialists, increased workload for staff, inadequate medical facilities, lack of protocols and unavailability or limited access to CT brain scans. The importance of this set of barriers has been reported previously,^{23 29 51} highlighting the extent to which they affect provision of optimal patient care. For example, one study found that 71% of participants identified lack of protocols, care paths and opportunities for staff professional education as important barriers to the provision of optimal acute stroke care.²⁷ Comparable to our study, a Swedish study identified low staffing levels as a major barrier to optimal stroke care.²⁵ Despite these studies being conducted in high-income countries, their corroboration with the present study reinforces the importance of hospital/health system level barriers to the uptake of evidence-based practice.

The issue of limited collaboration or involvement of allied health staff and other providers in the provision of care is also worthy of attention. Multidisciplinary and coordinated care remains a central component in contemporary evidence-based practice for acute stroke care.^{18 52} As a result, inadequate involvement of these staff is a significant issue since participants noted that their limited involvement is detrimental to optimal patient care. Evidence from existing scholarship on such barriers has been previously reported,^{53–55} thus stressing the need to consider interventions to improve collaboration among stroke care professionals in acute stroke care.

Nurses' knowledge of acute stroke care interventions such as thrombolytic therapy was also identified as a barrier, consistent with previous studies.^{23 27 40} This issue has also been identified in an Australian study where 50% of nurses reported having limited knowledge of thrombolytic therapy.²⁷ Such findings highlight the importance of this issue to optimal stroke care in both low/middle-income and high-income countries.

Finally, another barrier identified in the present study relates to the low level of political will for optimal acute stroke care. This barrier is evident in the absence of a national stroke clinical guideline, a national framework for quality improvement interventions for stroke and limited coverage of the national health insurance scheme to cover patients' medical expenses. While this finding corroborates with previous studies asserting the limited prioritisation of acute stroke care by health policy-makers in resource-poor settings,^{56–59} this could also likely be symptomatic of the current limited global health funding for stroke and other non-communicable diseases compared with communicable diseases.⁶⁰

Implications for future research, policy and clinical practice

The present findings have several important implications for the provision of evidence-based acute stroke care in Ghana. First, patient financial constraints appear to be a key barrier to optimal care and needs urgent attention. It is apparent that patients and family members struggle with the financial costs of stroke treatment and strategies are needed to overcome this burden. The current Ghana National Health Insurance Policy offers limited financial risk protection for stroke care. This epitomises the fragile nature of healthcare systems in low/middle-income countries, which require significant structural and policy reforms to minimise the current high cost of treatment for chronic diseases such as stroke. If left unaddressed, the consequent increased incidence of late arrival or refusal to seek care, limited treatment options and patient discontinuation of treatment will negatively affect optimal patient outcome.

Second, the evidence of sociocultural or religious beliefs and practices as a barrier to optimal care also deserves attention, particularly since this has received little attention in the current literature . More research in other settings may be useful to unravel the extent to which such practices influence provision of optimal care. In addition, national and local public awareness campaigns to increase the health literacy levels of the populace regarding stroke risk factors, early stroke symptoms and the need to seek early medical care are critical. This level of public awareness and education campaigns have been implemented in high-income countries such as UK,^{61 62} Australia,^{63 64} Canada⁶⁵ and Germany.⁶⁶ Hence, Ghana and other low/ middle-income countries can clearly draw lessons from such public awareness campaigns on early recognition of stroke symptoms to minimise patient delays to seek care. Such interventions however would need to be adapted to suit the particular country and health context. They should be mainstreamed in the healthcare systems of such countries through collaboration with the public and private sectors to optimise the impact.

Importantly, the finding of patient discharge against medical advice has revived debates about the place of patients within the current evidence-based medicine paradigm where patients' needs and preferences are essential.⁶⁷ While more research on the implications of this issue is required, institutional measures exploring safe and appropriate times and conditions under which such requests could be granted should be identified. More importantly, strategies need to be adopted to ensure that requests by patients and families to be discharged against medical advice be counterbalanced with tailored communication and public campaigns to improve awareness of the risks and benefits. The roles of clinical psychologists and nurses can be pivotal in such communication. This has the potential to minimise the incidence of patient discharge against medical advice.

The limited collaboration and poor communication among stroke care professionals also warrants attention. Highlighted as an imperative in providing optimal acute stroke care by previous research,^{12 54 55} the finding in this study further emphasises the need to explore effective ways to build collaborative working environments. Structural policy reforms are needed to ensure equal respect for individual professional experiences, identity, autonomy and responsibilities. This may be in the form of healthcare professional trainings, educational meetings and conferences, workshops to explore ways of improving clinical outcomes. As indicated earlier, staff professional development plays a critical role to stroke care quality improvement⁶⁸ and overall health outcomes,⁶⁹ and as such, efforts to provide staff educational and professional development opportunities in stroke care could be useful in the Ghanaian setting.

Given that health system and hospital level factors were observed as important to stroke care, strengthening health systems through the provision of adequate and effective acute stroke care services is essential. For example, to address the issue of limited staff numbers, an immediate short-term measure would be to consider task shifting approaches, as has been trialled in Nigeria. This Nigerian study⁷⁰ showed improved knowledge of non-neurologists in acute stroke care, thus potentially translating into improved patient outcomes.

Another health system barrier which has critical implications is the reported arrangement of upfront payment by patients prior to delivery of healthcare services . This suggests that people with symptoms of stroke and other emergency conditions such as heart attack and asthma may be provided optimal care on condition the patient is able to pay for such services. A health policy effort to expand the current package of the Ghanaian health insurance policy to cover the cost of CT brain scanning services will be in the right direction. In line with this, regular reimbursement of claims by the appropriate state institutions may address the issue of upfront payment prior to care.

Finally, to increase implementation of evidence-based acute stroke care, there is the need for increased policy commitment for optimal acute stroke care through increased allocation of resources to hospitals in the form of infrastructural support, a comprehensive coverage of the current national health insurance policy to include CT brain scan services and medical expenses for chronic care, staff professional development opportunities, and development of a stroke-specific clinical guideline are urgently needed.

LIMITATIONS AND STRENGTHS

As a limitation, this study reported results from a limited set of participants whose views may not be reflective of the wider health staff responsible for acute stroke care in Ghana. Nonetheless, this was conducted in six major referral hospitals in 6 of the 10 administrative regions of Ghana and so the findings may be applicable to other stroke care professionals. Future studies should target a larger and more representative study sample to also include health planners and administrators in district and municipal hospitals. Further, given the qualitative nature of the study, the use of a semistructured interview guide and data interpretation could be subjective and thus, caution should be applied in interpretation. Nevertheless, using a robust reporting guideline, participant crosschecking and validation of interview transcripts, and the consistent use of the interview guide during the interview process minimised any possibility of bias but rather enhanced the study validity and reliability. Another key

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limitation is the lack of observational or documentary evidence which could have accounted for any potential important information which may not have been shared by the participants during the interview process.

Notwithstanding these limitations, this study also has several strengths. First, to our knowledge, this study represents the first in Ghana to explore, in-depth, the barriers perceived by stroke care professionals to optimum provision of acute care in hospital settings. Another key strength is its exclusive focus on the perspectives of acute stroke care professionals from diverse professional disciplines, expertise, gender and tertiary and non-tertiary hospitals across different geographical settings. Using qualitative design, the findings provide contextually rich information of such barriers which would have been more difficult to unravel quantitatively. The study findings provide some new insights of other factors which have been less recognised in previous literature on the barriers to evidence-based acute stroke care. Added to this, this study did not focus on barriers to a specific stroke care intervention, as reported extensively in previous works, but rather on barriers across the continuum of stroke care.

CONCLUSION

Overall, the views on barriers to optimal stroke care varied significantly based on specific professional discipline and study sites. Although most of the barriers were largely consistent with previous studies in high-income countries, the study unravelled some unique barriers which extend the body of literature on barriers to acute stroke care. Importantly, barriers in low/middle-income countries showed important differences to those from high-income countries. Greater political will for acute stroke care in terms of increased coverage of the national health insurance scheme, increased resource allocation, recruitment and training of an expanded stroke health workforce could improve uptake of evidence-based acute stroke care interventions. The information provided in this paper is potentially important to health managers, policy-makers, patients, grant managers or holders and other health stakeholders as it presents various reasons why delivery of acute stroke care in clinical setting may be far from optimum. To this end, to translate current evidence-based acute stroke interventions for optimal patient outcomes in Ghana and potentially in other resource-poor settings, a clear-cut understanding of these barriers to inform policy formulation, quality improvement and staff professional development, is critical.

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Barriers to evidence-based acute stroke care in Ghana: a qualitative study on the perspectives of stroke care professionals

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CHAPTER FIVE

DISCUSSION AND CONCLUSION

5.0 Introduction

The preceding chapter presented results of three separate but interconnected studies on the translation of key contemporary interventions for acute stroke care, patient outcomes data from acute stroke care and the barriers potentially accounting for the uptake of such interventions. However, what do the findings from the three different studies mean to contemporary efforts to translate current interventions for acute stroke care into better patient outcomes? This last chapter presents an overall synthesis of the thesis findings as a single integrated body of scientific exploration, illuminating on a wide range of implications for policy, clinical and public health practice and future research. The first section of this chapter presents the overall findings of the thesis. Second, an outline of the key findings in relation to pre-existing studies is discussed. Following, an in-depth and critical exploration and analysis of the findings is presented and any potential implications for clinical/public health practice and health policy herein discussed. Fourth, the chapter reports the study limitations, the key contributions of the thesis to scientific knowledge and the potential areas for future research. The last section outlines the thesis conclusion.

5.1 Summary of main findings

This thesis sought to examine the extent to which proven interventions for acute stroke care are implemented in standard practice in Ghana, a LMIC. To address this issue, three study aims were pursued. The first sought to understand what hospital-based services/therapies are available to support acute stroke care in Ghana and the extent to which such therapies/services are consistent with international best practice recommendations. The second evaluated inhospital mortality outcomes among acute stroke patients admitted in Ghanaian hospitals settings. The third aim explored the perspectives of stroke care professionals on the practical barriers militating against the delivery of evidence-based care for best patient outcomes. The overall discussion of the main study findings will be presented in relation to interventions for acute stroke care, the clinical effectiveness of the services/therapies and the factors which underpin the translation of such interventions into standard practice. The next section thus summarises the key findings from the thesis as follows:

First, despite the large and growing body of evidence on evidence-based acute stroke care, a systematic review in chapter two (accepted manuscript with minor revisions under review) indicated there remains limited evidence on the extent to which resource poor settings are implementing best practice interventions for acute stroke. Notwithstanding the limited eligible studies in this review, the evidence further points to some positive patient outcomes following the implementation of current evidence-based acute stroke care interventions in such countries, especially in the African region. This implies that there is a potential for optimal patient outcomes if such interventions are widely scaled up in LMICs especially those within the African region.

Second, whereas uptake levels of evidence-based interventions are inadequate at the global level, it is much lower in LMICs. In an effort to unravel the possible factors underpinning the situation of inadequate uptake, as part of this thesis, a systematic review was conducted to understand the current state of evidence and areas for future research. This review shed light on multiple barriers at the patient, individual healthcare professional, professional interaction, organizational context, acute stroke care interventions/guidelines, resources and incentives and organizational capacity levels which potentially influence the uptake of contemporary interventions for acute stroke care. However, this review did not locate any relevant study

within the context of LMICs, Ghana in this context, to help clarify the main reasons for the inadequate and much lower uptake levels of such best practice interventions/services for acute stroke care. The evidence was also predominantly focused on thrombolysis implicating partial and incomplete understanding of the barriers to the other interventions.

Third, a finding which remains central to the thesis was the largely limited uptake of evidencebased acute stroke care interventions in Ghana. For example, the evidence points to limited emergency medical transportation services such as ambulances in the hospitals surveyed. Access to brain scanning services such as CT and MRI services were limited with patient access to such services constrained by limited opening hours or financial capacity. Of the eleven study hospitals surveyed, only one had a stroke unit with no evidence of thrombolytic therapy use. Whilst teaching hospitals seemed better equipped with advanced and modern medical facilities to support the delivery of standard stroke care, regional hospitals, especially those in the northern part of the country, had relatively limited evidence-based acute stroke care services. In addition, the study confirms there is limited health policy support for acute stroke care and limited opportunities to support the professional development of acute stroke care providers. Further, the findings indicate that only the teaching-tertiary hospitals were in a position to provide the essential acute stroke care services. Disparities in acute stroke care service availability were also found across the study hospitals. In contrast to the referral hospitals in the southern and middle belts of Ghana, the regional referral hospitals in the northern belt, except one tertiary hospital, lacked stroke care specialists such as neurologists, neurosurgeons as well have inadequate medical doctors and nurses. This also included lack of brain scanning services and thus patients were often referred to the tertiary hospitals to enable access to Computed Tomography (CT) and Magnetic Resonance Imaging (MRI) brain scanning services. Using the World Stroke Society Guidelines as a focal point, this thesis argues that there is an overall deficit in the capacity of the Ghana healthcare system to deliver advanced and evidence-based acute stroke care.

Fourth, this thesis has demonstrated that, despite the existence of considerable and diverse evidence-based acute stroke care interventions, delivery of acute stroke care remains variable from one healthcare setting to another. As a result, patient outcomes, primarily in-hospital mortality, were also higher compared to international standards and varied across the study hospitals. Of the six sampled hospitals, only a single stroke unit was identified. Significantly, aspirin uptake was widespread across the study hospitals. Based on a multivariate logistic regression analysis where residual confounding factors were controlled, patients provided with aspirin recorded less in-hospital mortality. There was also insignificant variance in in-hospital mortality across the admitting wards. In addition, hypertension and haemorrhagic stroke sub-type were identified as the predominant risk factors for in-hospital mortality.

Finally, this thesis highlights multiple barriers at the patient, stroke care professional, healthcare system/organisation and the national context level as probable determinants for low uptake levels of such interventions and the high stroke related in-hospital mortality. Importantly, the barriers were context-specific and varied according to professional disciplines. In other words, barriers identified in Ghana and possible other LMICs may not be comparable to those from high income countries (HICs). These findings provide an alternative and unique perspective on the barriers to acute stroke care such as the influence of patients' socio-cultural/religious beliefs and practices since such findings have not been sufficiently emphasised in the international literature.

5.2 Comparison with pre-existing studies

The findings from this thesis will be discussed in relation to previously published studies on evidence-based acute stroke care services, in-patient mortality outcomes among acute stroke

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patients following acute stroke care and the potential barriers responsible for evidence-based care for acute stroke.

5.2.1 Evidence-based services and interventions for acute stroke care

As part of efforts to enhance optimal patient care for suspected stroke cases, scientific statements and evidence from research have recommended the need for stroke patients to be transported immediately to a care centre by emergency medical transport services such as an ambulance [1-3]. Indeed, research evidence suggests the use of ambulance and other emergency medical transport services potentially facilitate early and safe patient arrival for prompt assessment, diagnosis and delivery of appropriate care, hence the potential for better health outcomes [2, 4]. Despite this best practice recommendation, emergency medical transport services are still underutilised globally. Access to emergency medical transport services however appears to be higher in HIC than LMICs, as the case appears to be in Ghana based on findings from this thesis. A study in Australia [5] and Canada [6] reported about 80% and 70% of stroke patients, respectively, arrived in the hospital setting for care using emergency medical transport services. Evidence from the USA also reported that a third of stroke patients arrived for care with an emergency medical transport service [7]. In comparison, findings from this thesis reported limited or no access to these emergency medical transport services. The findings indicate patients' overreliance on private non-emergency medical transport services such as a taxis to seek care following a stroke [8]. Given that most of the current pharmacological therapies for acute ischemic stroke such as thrombolytic therapy are time-limited and more effective when administered immediately after stroke onset, late arrival to seek care due to limited access to emergency medical transport services will inherently deprive patients of optimal treatment. In other words, the potential for optimum benefits from thrombolysis is contingent on the availability of support services to fast-tract patients to hospitals for treatment following symptoms onset. This key point has previously been emphasised in the popular 'Time is Brain' publication [9]. Due to the importance of transporting patients rapidly for early care using emergency medical transport services, there is evidence to suggest some HICs even provide air transport services for patients [6, 10] or incorporate brain scanning services in ambulance services [11], thus highlighting the urgency of this point. However, evidence of such innovations remains unknown in LMICs.

Stroke unit care has been distinguished as a core component of modern stroke services given its proven benefits to stroke patients in general [12], and the cost-effectiveness of such care [13-15]. According to level one evidence, acute stroke care in a stroke unit reduces in-patient mortality by about 20% [16]. As a result, current clinical guidelines for stroke care include stroke unit care protocols [17-21]. However, there is limited and inequitable uptake of such evidence-based intervention globally. Evidence from this research points to a limited availability of stroke unit care. In fact, only one stroke unit facility was available in the sites surveyed. This concurs with widely documented evidence about the limited availability of stroke unit care in LMICs such as Ghana [22, 23]. In view of this, the general medical wards may be the predominant admitting wards in most hospitals where stroke patients are admitted despite evidence of suboptimal patient outcomes in general medical wards relative to stroke unit care [12]. Conversely, although uptake is far from ideal in HICs, it is relatively higher compared to LMICs such as Ghana. Evidence from the UK showed about 82% patients receive care in a stroke unit [24], in addition to 86% in Sweden [25]. This disparity in uptake also raises equity-based questions given that LMICs bear a larger share of the global burden of stroke and yet have limited access to the best interventions for optimal patient care. This finding thus underscores a clear need for the establishment of more stroke units to facilitate optimal patient care in Ghana.

Similar to stroke unit care, thrombolysis using t-PA is another important treatment option for optimal acute stroke care. To date, it is the single most effective pharmacological therapy for acute ischemic stroke. However, its translation into standard practice in clinical settings has been very slow so far [26]. Findings from this study showed non-utilisation of thrombolytic therapy. This finding is consistent with earlier research which points to its limited uptake in LMICs [26, 27]. However, uptake levels are relatively better in HICs. As demonstrated in the first systematic review in chapter two, some LMICs in Africa have however documented evidence of utilising thrombolysis with evidence of improved patient outcomes [28, 29], thus suggesting its feasibility in these countries. This finding also raises an important question about the possible factors for the non-utilisation of thrombolysis. The qualitative study [30] and systematic review [31] of this thesis highlighted potential factors for the non-utilization of this therapy reinforces previous evidence indicating lower uptake in resource poor settings [26, 32].

Based on the findings from this thesis, aspirin uptake was noted to be higher compared to stroke unit care and thrombolytic therapy. This was a common treatment option for acute ischemic stroke patients in the study sites. This finding lends support to previous indications of this therapeutic option as inexpensive and easy to administer, and thus a better choice for resource poor countries such as Ghana [33, 34]. However, there is a question of whether this option could be associated with better clinical outcomes compared to other interventions within resource poor settings. The evidence to date on this issue is limited. However, evidence in this thesis showed aspirin therapy reduced in-patient mortality following a stroke, that is, it is widely applied and a better protector of life compared to stroke unit care, and thus the need to ensure more eligible patients have uninhibited access to this therapy. As part of current best practice guidelines for acute stroke care, decisions on stroke diagnosis and treatment should be supported by results from CT and MRI since different treatments apply to the two stroke subtypes [18, 19, 21, 35]. However, access to such brain and neuroimaging services are often limited especially in LMICs. This is a critical barrier to the delivery of some evidence-based acute stroke care [36, 37]. Consistent with these suggestions, evidence from this thesis also points to limited access to such brain scanning services. Even in hospitals where such services were available, access was mediated by patients' ability to afford such services [30], and the time services are available to the general patient population, as 24/7 access was very limited. As shown in this thesis, seven of the 11 major referral hospitals provided CT brain scan services, though patient access was limited only to weekdays (9am-5pm). This has farreaching ramifications for prompt diagnosis and treatment per the best practice guidelines for acute stroke care. Limited access to CT/MRI brain scanning services will likely pave the way for clinical decisions on treatment options to be based solely on the judgement and clinical experience of the physician without recourse to CT scan confirmation of the stroke subtype. Though clinical judgement and expertise are still relevant, standard practice now requires stroke treatment decisions to be guided by CT scan evidence. This is done to minimise the consequences of errors in clinical decisions (e.g. a haemorrhagic stroke patient could be considered for thrombolytic or aspirin therapy). Current best practice for thrombolytic and aspirin therapies recommend CT/MRI scan to confirm there is no contraindication before aspirin or thrombolysis can be initiated [18, 19, 21, 35]. This indicates that, even in settings where best practice interventions such as thrombolysis and aspirin are available for patient care, limited access or unavailability of brain scanning services potentially limits efforts to provide such evidence-based acute stroke care interventions.

Inadequate human resource capacity for the treatment of NCDs such as a stroke has been highlighted as a potential challenge to addressing the current health threat posed by such NCDs [38-40]. However, the point must be stressed that the issue of limited human resource capacity gap is a global one, although the situation in LMICs is worse. Studies in Australia [41-43] and other countries in HIC regions [44, 45], allude to this fact. In line with this, the findings from Ghana point to a significant gap in the human resource capacity of the healthcare system to deliver optimal care. The survey in this thesis on hospital-based acute stroke care services and interventions revealed the limited availability of neurologists, neurosurgeons and allied health staff such as speech/occupational therapists. A study in the USA also reported the limited availability of neurologists and neurosurgeons [46, 47], although direct comparability with resource poor countries is complex. This finding emphasised the need for increased support to improve the current deficit in human resource capacity for acute stroke care. This is important because stroke care led by a neurologist/specialist stroke physician leads to better patient outcomes compared to care led by non-stroke specialists [48]. As has been shown in many conceptual frameworks [49-51], and other evidence for translating evidence based interventions for stroke care [52], a competent human resource capacity component is a requisite for translating evidence into practice.

The development of best practice interventions without corresponding health policy responses and interventions to ensure rapid uptake of such interventions creates the situation where proven interventions are likely to be underutilised. Based on previous evidence of limited health priority towards the control and treatment of NCDs such as a stroke [53], a fundamental reason for the slow evidence uptake in most LMICs is a lack of national policy commitment. Though some efforts have been made in these countries since the UN political declaration in 2011 to increase support for the fight against NCDs, evidence to date highlights inadequate political commitment in the form of national policies and interventions specifically on NCDs such as stroke [53]. Even in situations where policies are formulated, there is no corresponding funding support or specific action plans towards the implementation of the policies. For example, findings in this thesis showed that, in the three referral centres in the northern belt of Ghana, only one had brain scanning services and stroke specialists such as neurologists and neurosurgeons were also limited. As reported in prior studies [54-57], most LMICs commit fewer health resources to support the treatment of NCDs, stroke in this case. So, it was not unexpected to find low health policy attention to stroke care in Ghana. This may be in part due to a global phenomenon because stroke and other NCDs do not receive adequate financial support from the overall global health funding [58-61]. This does not however preclude action in resource poor settings since some LMICs have prioritized and increased national commitment to management of NCDs such as stroke [62, 63].

5.2.2 Efficacy of acute stroke care therapies and services

Although there were no significant variations in in-hospital mortality between the three different admitting wards, the overall 30-day case fatality rate was 31.7%. Such a finding suggests low survival rates, that is, high mortality from stroke in LMICs, a situation that may be a result of limited evidence-based acute stroke care. Though the 31.7% in-hospital mortality at 30-days was relatively high compared to HICs where this can be as low as 7% [64], this seems to be the common phenomenon in most LMICs especially those in Africa where 30-day mortality rates can even be above 40% [65-67]. Given an overall 31.7% in-hospital mortality rate at 30-day, the study findings support previous suggestions that the provision of best practice care for acute stroke in LMICs is limited and potentially contributes to high patient mortality outcomes [22, 23, 26, 68].

In addition, the thesis findings indicate the process of care indicators such as patient access to brain scanning services (CT/MRI scan) varied. Compared to the other hospitals, patients admitted to the stroke unit had better access to CT scans (p = 0.001). This appears consistent

with prior research also indicating higher patient access to CT brain scan among stroke unit patients compared to those admitted to the general wards [69].

Largely, the findings confirm previous evidence of limited and variable nature of acute stroke care in LMICs [23, 26, 32]. For example, there was no evidence on the utilization of thrombolysis. Also, even though there is a preponderance of evidence about the effect of patient care in a stroke unit on reduced in-patient mortality [12, 70, 71], with favourable outcomes up to 10 years post stroke [72, 73], evidence from this study reports no significant relationship with in-patient mortality. Such a finding is not uncommon as past studies have reported similar results [74, 75]. These findings can be attributed to multiple factors. First, more severe patients from smaller non-tertiary hospitals are mostly referred to wards of major tertiary hospitals, thus exposing them to more severe stroke patients with multiple comorbidities. The findings indicate that the stroke unit admitted more patients with a history of hypertension and other comorbidities. Data on a critical stroke mortality predictor (the extent of severity at admission) were not available and could be a potential source of bias as previously documented to be a principal predictor of variations in-hospital mortality [76, 77]. Having said this, it is important to indicate that, such a finding is not uncommon as past studies have reported similar results [74, 75].

Aspirin therapy can reduce stroke-related morbidities and recurrent strokes. Significantly, the use of aspirin proved to be a reliable therapy for acute stroke care. Multivariate logistic regression analysis showed less in-hospital mortality among patients given aspirin, (p = 0.013). The findings showed those taking aspirin were 60% less likely to die than those who did not take aspirin. This finding is commensurate with findings from previous studies [78, 79] and confirms the effectiveness of this therapy, particularly where thrombolytic therapy remains inaccessible. In order to improve patient clinical outcomes using aspirin, it is imperative for

policy makers and health managers to ensure increased and uninhibited access to brain scanning services as this has been highlighted to be a key impediment to patients receiving optimal benefits from aspirin therapy [80].

In keeping with previous evidence within Africa [67, 81], and elsewhere [82, 83], findings from the retrospective study also reported higher in-hospital mortality among stroke patients documented with hemorrhagic stroke sub-type. This is also consistent with global evidence which appears to suggest in-hospital mortality among hemorrhagic stroke patients are much higher compared to ischemic [64, 84, 85]. Thus, it was not surprising to see evidence from this thesis mirroring the global trend.

5.2.3 Barriers to evidence-based acute stroke care

Closing the evidence-practice gap in acute stroke care is a long-standing challenge with no single validated approach. A central aspect of addressing this gap is the need to identify the multiple barriers which influence the evidence-practice translation process [86]. Current understandings of such barriers are limited to studies from HICs (see evidence from a systematic review in chapter two). To address this knowledge gap, a qualitative study was conducted to explore these barriers [30]. Multiple barriers at patient, stroke care provider, healthcare system and the broader national health policy context levels emerged from this research. Overall, the majority of the barriers identified in this study have been reported previously [45, 87, 88].

A key barrier in the present study was the influence of patient level contexts to the current uptake of proven acute stroke care interventions. This study showed in most cases, patients are either unable to afford the medications, pay for laboratory and brain scanning services, or delay in seeking care due to limited awareness of early symptoms. Similar barriers have also been reported in previous studies. In the study by William et al [89], patient level barriers such as delay in seeking care were identified as the most dominant barrier to providing thrombolytic therapy. In fact, 91% of the participants identified this as a critical barrier. In light of this, any intentions to improve uptake must be comprehensive and cover a broad range of such patient level barriers. An important dimension of the patient level barriers in this study which seems to be at odds with existing literature, is the nature and circumstances within which such barriers occur. Notably, it was revealed that socio-cultural or religious beliefs/practices as well as patient discharge against medical advice appeared to contribute to a patient's decision to seek or adhere to care. Previous studies in Ghana have highlighted the role of such factors in patient healthcare seeking behaviours and treatment of other chronic conditions [90, 91]. Studies in other African countries such as Tanzania and South Africa have also affirmed the influence of religious and socio-cultural beliefs in the health seeking behaviours of people with chronic conditions such as stroke [92, 93]. However, the findings are less popular in the mainstream literature on barriers to evidence-based stroke care. These observations confirm the important role of context and the need for a broader understanding of the barriers from all countries to develop better and well-targeted interventions to facilitate rapid translation and use of contemporary acute stroke care interventions in clinical settings.

The findings in this thesis also highlight barriers at the healthcare system level particularly in relation to infrastructural and logistical provisions. In order to ensure successful and rapid translation of contemporary acute stroke care interventions for best clinical outcomes, it is imperative to address infrastructural and logistical deficits (e.g. adequate healthcare spaces, stroke care specialists, availability of BP and cardio morning devices, pulse oximeters, suction machines, brain scanning services and acute stroke units, etc.) highlighted both in the survey and qualitative interviews. These barriers are consistent with what has been reported previously [43, 87, 94]. It is also important to emphasise that the predominance of such barriers is not as pronounced in HICs compared to LMICs as the evidence suggests in this thesis. Nonetheless,

the comparability of such barriers reinforces the critical roles of such barriers to closing the translation gaps in all countries where there are limited infrastructural and financial investments in healthcare systems.

The present thesis also highlights stroke care providers' role in the overall delivery of optimal care for best clinical outcomes. Barriers at the provider level were diverse though some were common across all stroke care professionals. For example, consistent with other evidence [45, 87, 89], the present thesis noted limited health provider knowledge in acute stroke care and in some cases apparent lack of knowledge on certain interventions such as thrombolysis. A key barrier underscored in previous literature pertains to stroke care professionals' preferences for a particular therapy or disapproval of the use of proven and well-established interventions [88, 95]. Interestingly, there was a lack of similar evidence in the present thesis, suggesting this is plausibly a barrier common in only HICs. Limited collaborative or team work was also perceived by stroke care professionals as a barrier to acute stroke care. This issue has been recognised internationally and gained much policy and scholarly attention over the past decade as a challenge to effective and quality delivery of health care [96-99]. This is also consistent with previously identified barriers to acute stroke care [41, 100-103]. The consistency in the finding of limited inter-professional relationship among acute stroke care providers with the existing international literature suggests this is a global challenge which requires greater universal and local attention to optimise acute stroke care.

Barriers were also reported in the broader national and political contexts. Findings associated with this category of barriers related to the lack of specific health policy interventions to prioritize and promote acute stroke care as well as inadequate coverage of the national health insurance scheme to cover stroke care expenses such as brain scanning services. Owing to the lack of political imperative for acute stroke care in the hospitals surveyed [8], and as observed

in the qualitative study of this thesis [30], there is likely an increased out-of-pocket expenditure for patients. This situation will potentially exacerbate the situation of those already under financial stress, pushing them to find alternative means of care such as traditional or faith healers, often less optimal. Such findings of limited investment and priority for health care have also been observed previously [54, 55, 57, 104]. For any intervention to be effective towards closing the evidence-practice gaps, it is therefore essential to ensure insights from these barriers are incorporated into the design of future interventions.

5.3 Implications for policy and practice

The growing stroke burden and its threat to public health in LMICs are placing an enormous burden on the health systems of these countries. In view of this, it is important to appraise the overall implications of the thesis findings, in terms of policy, practice and the future research agenda. The ultimate goal of these reflections will be to explore how these findings could advance alternate perspectives and insights to close the current gap between evidence and practice in acute stroke care. Whilst reporting evidence on acute stroke care, scope of variability, efficacy of current interventions and the practical barriers to evidence uptake from a context which has received limited attention in evidence-based practice acute stroke care, the contextual insights from this study have implications which health policy makers and managers in Ghana and probably other LMICs could draw from to improve uptake of evidence based interventions for better patient outcomes.

First, despite evidence that patients use of ambulance transportation services enhances early arrival [7, 105], it was highlighted in the survey that most patients resort to private non-emergency medical transport systems following a stroke. This implies that patients are unable to access timely and appropriate care and thus are likely to suffer irreparable damage with compromised survival rates due to the potential delays associated with the non-utilization of
emergency medical transport services at stroke onset. Every minute of delay without immediate transport to a hospital for care results in a 2.5% reduction in treatment time [106]. For example, thrombolysis therapy has a treatment window of 4.5 hours [107]. Given that studies have consistently identified patient delays as one of the fundamental reasons for low thrombolysis therapy globally [31], the currently limited access to emergency medical transport services as demonstrated in this study will undoubtedly limit access to thrombolysis once it is available as a treatment option. The 'time is brain' study was emphatic about the need to minimise delays in seeking care following symptom onset [9]. However to date, patient delays remain one of the critical barriers to the low uptake levels of thrombolytic therapy [7, 108, 109]. For these reasons, there is a clear policy need to address limited access to emergency medical transportation services in Ghana and other LMICs. The need also to educate the public on early recognition of stroke signs and the subsequent need for urgent transport is imperative. Allocating adequate resources to support the work of stroke care professionals in educating the public on early stroke symptoms and the necessity to first seek early medical attention using emergency medical transport services has the potential to reduce pre-hospital delays in seeking care.

Another key finding was the limited, variable and inequitable distribution of hospital-based services and interventions to support evidence-based stroke care. For example, thrombolytic therapy was non-existent, only a single stroke unit was found in the study sample and access to brain scanning services was also limited. It is therefore imperative for greater policy attention to increase patient care in a stroke unit, increase the availability of thrombolysis as a treatment option and provide 24-hour access to brain scan in all major referral hospitals, particularly in regional hospitals where some were found to lack brain scanning services. Without the introduction of such relevant policy reforms to scale up the availability and access to these

services, the current evidence-practice gap will remain and patients will continue to be deprived of optimal care.

Evidence from this thesis and that from previous literature clearly suggest the limited and variable nature of acute stroke care in LMICs, Ghana for the purpose of this thesis. Current interventions for acute stroke care are yet to be widely available in Ghana for optimal patient outcomes. The high case fatality rate of 31.7% compared to international standards may reflect the limited and variable nature of acute stroke care or the active influence of the aforementioned barriers to evidence uptake. Hence, it is necessary for policy makers and other healthcare stakeholders to ensure these factors are reflected in any local or national intervention to promote evidence-based care and thus close the knowledge-practice gap.

Thrombolysis and Aspirin are highly recommended pharmacological therapies for optimal acute ischemic stroke care. However, this thesis revealed the former was non-existent whilst the latter was widely used. In relation to thrombolysis, as noted previously, there is a limited policy priority for treatment of stroke and other chronic NCDs in most parts of the developing world [57, 104], and this plausibly explained the unavailability of thrombolytic therapy despite the unequivocal evidence of its relative net benefits to patient outcomes. There is an imperative for health policy to support the application of this therapy for patient benefits in Ghana. It is clear from the research findings that aspirin appears to be the mainstay for patient survival in Ghana. Previous studies have noted that the net benefit of aspirin is potentially limited in LMICs because of the limited CT scan services in order to ensure appropriate patients be given this therapy [110]. It is therefore important to ensure barriers impeding patient access to brain scanning services which makes it financially difficult for a majority of patients to access. To

this, it would be useful to ensure the existing national health insurance policy covers brain scanning expenses.

As highlighted earlier in this thesis, translating current best practice interventions for acute stroke care will require concerted efforts to identity and address existing multiple barriers. The findings from this thesis show these barriers are complex, context and discipline specific. Developing interventions based on insights of such complexity and variability by health policy makers and managers remains critical. Across the major barriers reported at the patient level, it is clear creating awareness on early signs of a stroke and to first seek care in a hospital setting is imperative. The existing empirical literature documents a significant number of stroke awareness campaign interventions, mainly from HICs including the UK [111, 112], Australia [113, 114], Sweden [115], Canada [116] and Germany [117], from which Ghana and other LMICs can draw some lessons. As shown in the survey results, community-based interventions to raise stroke awareness are non-existent and thus highlighting an overarching need to make this a policy priority. These campaigns could also act as avenues to dispel erroneous public perceptions about stroke as a non-medical condition. Offering the public such reliable information could prevent the patronage and access to non-medical care (e.g. herbal or spiritual care), hence, enhancing the potential to improve the uptake of evidence-based interventions for acute stroke care. It is also important to design interventions to educate patients and their families on the the need to seek medical attention and demystify the erroneous beliefs they hold about stroke as a non-medical condition which cannot be treated medically. Here, individual local hospitals, as well as national level interventions, could be explored and implemented. Similarly, the issue of patient needs, interests and preferences is a fundamental aspect of the evidence-based paradigm. The prominence of patient discharge against medical advice as a principal barrier to evidence-based acute stroke care revives the debate around the role of patients in the evidence-based practice discourse. The general medical literature suggests

patient discharge against medical advice potentially put the patient at risk of adverse outcomes especially mortality [118, 119]. However, at present, there are limited empirical studies addressing this particular issue within the context of acute stroke care and thus it is essential for further investigation to shed light on the extent to which such practices compromise efforts aiming at translating current interventions for evidence-based stroke care.

Parallel to the preceding issue, the critical role of socio-cultural or religious beliefs and practices require close scholarly scrutiny and greater health policy attention. This particular issue has not been sufficiently recognized in the international academic literature and as a result, the existence of specific interventions to mitigate these patient level barriers are unknown. It will be worthwhile for future research efforts to elicit further understandings of the scope of this practice and its possibility of undermining optimal patient care. As noted in this thesis, this phenomenon often results in the incidence of patient discharge against medical advice, non-adherence to medical care and an unhealthy relationship between acute stroke care professionals (healthcare providers) and patients or their families. Given the centrality of this issue, it is important multiple interventions be taken at the healthcare providers' level, the hospital/organizational level and the broader policy level. This could be in the form of increased public campaigns about acute stroke, the potential adverse effects of seeking nonmedical care for acute stroke and awareness creation about the debilitating effects of delays in seeking medical care such as the risk of mortality and the high cost of care. More community level engagement is required on these specific issues especially in the design of campaign interventions and the need to access medical care for acute stroke care. However, campaign messages should be culturally and contextually appropriate to ensure an emphasis on the need to seek medical care and at the same time challenging the prevailing socio-cultural or religious beliefs and practices impeding access and adherence to hospital-based acute stroke care. Health care providers could play a key role in reinforcing such information to patients in the

early stages of admissions. Sufficient time needs to be spent educating patients and families about the causes and risk factors for stroke and the implications of seeking other forms of care outside the orthodox framework of care in hospital settings. Increased patient education in these lines could minimize the influence such beliefs, norms and practices have on the optimal delivery of acute stroke care.

As highlighted in the qualitative study of this thesis [30], the interference of socio-cultural and religious beliefs and practices to optimal patient care requires close policy scrutiny as part of efforts to improve uptake of contemporary interventions for acute stroke care. Evidence suggests that the patients' increasing utilization of services provided by traditional and faith healers is potentially due to the fact that such services are relatively easy to access and considered inexpensive and culturally appropriate compared to the orthodox medical care [120]. This situation has led to the current predominant practice of 'healer shopping' in Africa where patients explore multiple options of care including the biomedical services, ethnomedical services, faith healers or spiritualists [90], depending on their beliefs about the cause of the disease, perception about the effectiveness of the care option, its appropriateness or affordability [92, 120, 121].

To mitigate this, it is important to take certain appropriate policy measures and actions relevant to clinical practice for acute stroke care. These may be in the following: First, there is the need to ensure the existence of a culturally and contextually responsive health system for acute stroke care, that is, a system which ensures care plans are prepared and implemented without total disregard to the cultural and religious beliefs, values and practices of patients. As previously demonstrated, the provision of culturally responsive healthcare potentially improves patient access to healthcare [122]. In light of this, it is important for stroke care professionals to be educated about the diverse cultural and religious beliefs and practices of patients and how

these are often reflected in their attitudes, adherence to treatment and largely how these often conflict with biomedical healthcare options. An informed understanding of these practices, beliefs and patient health seeking modalities on the part of stroke care professionals will ensure contextually appropriate and patient centered care. This is supported by the previous acknowledgement that healthcare systems are not independent of the culture, ideologies, social values and norms of the populace which the healthcare system seeks to serve [123]. Second, there is an increasing global recognition of the role of faith and traditional healing and their subsequent integration with the modern healthcare delivery system in most parts of the developing world [124-126]. The WHO estimates about 80% of people in Africa access such services, and that plausibly explains the finding in this thesis where stroke patients patronize such services or combine with the modern healthcare delivery. In view of this, a robustly functional regulatory body or institution is required at the national level to regulate such partnership or activities and practices of traditional or faith healers. Such regulatory bodies could focus on promoting a positive partnership between orthodox healthcare providers and the various faith or traditional healers. This could create an opportunity for faith and traditional healers to be educated on the etiology of certain illness such as a stroke and the need for them to encourage community members to seek immediate care at symptoms onset or make referrals to hospitals for treatment. Aspects such as the psychospiritual needs of the patients could then be tackled by them. Third, a well comprehensive social health insurance policy which subsidizes and covers a considerable percentage of the costs incurred by patients could improve access to current interventions for acute stroke care in hospital settings. As demonstrated in the qualitative study [30], patients sometimes request for discharge against medical practice due to the rising medical expenses during in-patient care in order to continue unorthodox treatment from traditional and faith healers, perceived to be relatively cheap

In general, a collaboration between health care staff remains a major organisational challenge in health care organisations [127], despite evidence of its prospects to advance optimal care [128]. As stroke patients often receive care from an array of clinicians, the extent to which these multidisciplinary teams collaborate is critical. In fact, this has been advocated as an indispensable element for a successful translation of evidence-based acute stroke care [52]. There are convergent views about the fact that inadequate coordination and collaboration by healthcare providers has the potential to threaten effective multidisciplinary stroke care, a core component of evidence-based stroke care [12, 99, 100]. Thus, the need to create a supportive and collaborative working environment to promote evidence uptake remains fundamental. A way forward in this regard is the introduction of health policy reforms relevant specifically to human resource development within the current health system in Ghana to ensure equal recognition of individual professional expertise. Creating platforms and training workshops among stroke care multidisciplinary staff could also promote effective working contexts.

Insights from this thesis also highlight the fundamental need for health systems reform and reorientation to increase attention and support for acute stroke care. Based on findings from this thesis, health policy attention for stroke care in Ghana is lacking and so the need for increased health policy attention is recommended. This may be approached in various ways. First, in terms of the limited human resource capacity for stroke care (such as neurologists, neurosurgeons, speech pathologist and occupational therapists) and inadequate opportunities for staff professional development, the current national policy and plan on the human resource development in Ghana [129] could be harnessed to make adequate resource allocations to support the recruitment and training of stroke care specialists. In the same light, prospects for professional growth in stroke clinical care are essential towards quality improvements in stroke care [130] and overall health outcomes [131]. Thus, efforts to provide staff with the opportunity to enhance their competences and knowledge in stroke care is recommended.

Second, the provision of quality stroke care is underpinned by reliable outcome data [132]. As noted in the survey findings, most of the major referral hospitals do not have a stroke register or a well-established database to document data on the incidence, prevalence, outcomes and other clinically relevant information about stroke. This was also evident in the retrospective cohort study where significant gaps in the stroke data records were evident. As a case in point, subtypes for stroke, stroke severity and treatment times were rarely recorded. The paucity of such relevant and standardised data is not only peculiar to the Ghanaian context but characterised in most LMIC regions. In view of this, there is a potential to have most health policy and clinical decisions based on inaccurate and partial data in such contexts. For example, in this thesis, the lack of stroke severity data limited efforts to report with greater certainty the effect of the types of care provided in the three admitting wards on in-hospital mortality. Other data documentation limitations such as limited data on stroke subtypes, or use of broader codes such as cerebrovascular diseases limited data analysis for important clinical and policy insights. The current paucity and compromised nature of available stroke data restricted efforts to advance evidence-based practice for acute stroke care. The need for robust surveillance systems to ensure accurate and consistent documentation of stroke data is essential to support evidencebased health policy decision making process.

As will be discussed subsequently, most HICs (e.g. Australia [133], and USA [134, 135]) have or are currently establishing robust stroke registers which support evidence-based health policy decisions for quality improvement processes. The current Ghanaian government e-health policies [136], could be a relevant guide to inform electronic profiling and documentation of stroke patient records. This should be an important policy imperative given that relevant and appropriate interventions to improve uptake and patient outcomes arguably, cannot be done without reliable data on the burden of stroke. The fragmented and insufficient nature of existing data hinders any informed and meaningful discourse or debate on quality of acute stroke care in Ghana. Hence, it is important to prioritise the collection of stroke data in a more standardised way in order to offer policy makers better insights about the burden and trends of stroke.

Third, based on insights from this thesis, an important component with high potential to support the optimal use of current best practice interventions for acute stroke care is human resource capacity development. As noted earlier, this is a persistent challenge in most LMICs and previous studies have emphasised this issue [40, 137, 138]. Whilst this has been previously highlighted as a major impediment to reducing stroke/NDCs burden in LMICs [137, 139], very little progress has been made in this regard. The findings from the survey and qualitative interviews in this thesis support this position. Any shortfall in policy efforts to address this will continue to perpetuate the current evidence-practice gap in acute stroke care. Although investment in long term efforts to recruit and train stroke care specialists such as neurologists, neurosurgeons, speech and occupational therapists is the logical way to proceed, short term measures need to be explored to mitigate the current deficit in stroke care professionals. As highlighted earlier in this thesis, a potent way could be the introduction of the concept of task shifting to augment the current human resource capacity gap for acute stroke care. This has been proven to be effective in the management of NCDs, stroke in this case [140-142], reduce remunerations and training of specialists and as well promote staff retention [143]. A study in Nigeria has shown how shifting certain tasks from specialised roles to non-specialists staff could potentially address the human resource deficit for acute stroke care [144]. Task shifting played a fundamental part in the prevention and treatment of HIV/AIDS in Africa [145-147], and this could also prove to be worthwhile in acute stroke care. In exploring this, the WHO framework [143] for implementing this policy option could be used to address the shortage of stroke care professionals although note should be taken to contextualise this within acute stroke care domain since these recommendations were situated within new-born and maternal healthcare arena.

With the low application of stroke unit care and thrombolytic therapy, the need to explore alternate models of care interventions for acute stroke within LMICs is imperative. One such approach worth policy consideration is centralising stroke care services. Centralised stroke care services involve rerouting and transferring all suspected stroke cases to a specialist referral centre [148]. This is also particularly important because the health systems of Ghana and most LMICs are highly under-invested and thus often lack the needed resources to provide adequate healthcare. Hence, a strategy to ensure patients are provided optimal stroke care is to centralise stroke services as a short-term measure. This could take the form of demonstration projects where a full range of acute stroke care services are offered by a multidisciplinary team with collegiate support and opportunities for staff professional development in all aspects of stroke care in selected referral sites. Such hospitals are often tertiary hospitals that are well-resourced with stroke specialists experienced in providing evidence-based care for patients. The limited and variable nature of acute stroke care as found in this thesis supports the need for such a policy direction. This has been established to reduce cost, in-patient mortality and reduced length of stay [149]. Uptake of this model of care is also documented even in HICs including the UK [148, 150, 151], Denmark [152, 153] and Australia [154]. However, given that the evidence to date suggests this is feasible in HICs, it is imperative future research examine the possibility of introducing such a model of care in LMICs, Ghana in this instance.

Besides centralising stroke care services and exploring task-shifting as potent measures to addressing current deficits in the delivery of evidence-based care, the implementation of telestroke could also be part of the health system reconfiguration efforts. In simple terms, telestroke refers to the process of remotely identifying, assessing, treating and monitoring stroke patients using internet or telephone based techonological devises. Common in HICs, telestroke has proven to be effective in improving access to specialised evidence-based stroke care resulting in improved outcomes [155-158]. This is also cost effective [157, 159], and thus

could be an important consideration in efforts to improve uptake of best practice services/therapies. Given findings of variability in the available application of evidence-based interventions, inequities in access to services and where most of the few available stroke specialists are concentrated in tertiary-teaching hospitals located in urban centres, telestroke can play a role in ensuring improved and equitable access to stroke care in other areas. With telestroke, patients can be evaluated and treated remotely. This has tremendously improved access to t-PA in most HICs [160, 161].

Furthermore, a potential policy option could be to explore international collaborations and partnerships with HICs where current uptake levels of contemporary acute stroke care interventions are better. Though context and geo-political spaces within which these healthcare systems operate vary considerably, LMICs could explore such partnerships in order to draw from HICs best practice ways of facilitating speedy uptake of existing proven interventions in standard clinical practice. Although this is an underexplored option, a cogent argument in support of this is made based on the observation that, compared to LMICs, HICs are already forerunners and so will have many insights to offer. This action should undoubtedly be preceded by some critical analyses of the context-specific and feasibility issues. In Ghana, evidence of an earlier collaboration to optimise acute stroke care was reported [162]. The results of this partnership are yet to be reported but may offer some vital lessons for other LMICs.

Finally, in this thesis, four thematic and eleven sub-thematic barriers to uptake of evidencebased practice for stroke care were reported. Notably, most of these barriers also underline the key drivers of change or uptake of innovations in clinical practice and healthcare settings, as espoused in the conceptual and theoretical frameworks for the thesis [49, 50, 163]. On the basis of this, future health policy interventions, reforms or implementation strategies to promote the rapid translation of the current best practice interventions for acute stroke care in Ghana and potentially in other LMIC contexts should be carried out with reference to these barriers, especially those unique to LMIC contexts.

5.4 Limitations of this research

This research was conducted in a purposive sample of the main public referral hospitals in the ten administrative regions of Ghana. As a result, the evidence was limited in terms of the broader perspective of evidence-based practice in both public and private hospitals as well as non-referral hospitals. This may limit the external validity and transferability of these results. Although these findings are context-specific and thus may have limited implications and relevance to broader policy reforms on evidence-base practice for acute stroke care, important lessons can be drawn for other LMICs, especially within Africa, where uptake is also documented to be slow. This is because the health system, clinical practice and policy context of Ghana has many similarities with other countries within Africa.

Another important limitation of this research was the paucity of information on stroke severity which may have affected the mortality outcome of stroke patients in the retrospective cohort study. This is critical because stroke severity is a potential confounding factor for in-hospital mortality and so may have affected in-hospital mortality outcomes in the admitting wards of the study hospitals. However, the use of a strict eligibility criteria applied in the collection of patient clinical data and reporting the results according to the RECORD guideline potentially minimised the risk of any significant bias of the final in-patient mortality outcomes analysis.

In relation to the qualitative in-depth interviews, the views on the barriers to acute stroke care could be compromised on three grounds. First, this thesis highlighted barriers perceived by stroke care professionals but such perspectives may not be representative of the generality of health staff in charge of acute stroke care across Ghanaian hospitals. Second, the use of a semi-

structured interview guide and the role of the researcher in interpreting the data may have affected the quality of the results, hence this should be taken into account in any effort to apply the study findings. Nevertheless, a number of strategies were employed to minimise any potential threat these may have posed. These comprised using the consolidated criteria for reporting qualitative research (COREQ), a well-established reporting guideline for qualitative research, including among others, participant cross-checking of selected transcripts and the continuous use of interview guide in all interviews mitigated subjectivity. Last, the findings from the interviews did not report observational or documentary evidence of the barriers to evidence-based stroke care within the study contexts. This is an area future research should explore since this has the potential to uncover additional relevant information which may not have been reported by participants during the interviews.

The final limitation is the approach of this thesis to employ only three different studies to present the extent to which the best research evidence on acute stroke care can be translated rapidly into clinical practice. Insights from further research on the viewpoints of stroke patients on what impedes their access to stroke care could have provided valuable complementary information. Such insights would have broadened the spectrum of insights to improve uptake and implementation of quality improvement measures given that patient level factors were found to play central roles in the evidence-practice translational process.

5.5 Thesis contribution to knowledge

Largely, to the best of my knowledge, the findings reported in this thesis is about the earliest to present evidence of the extent to which evidence-based interventions for acute stroke care are translated into standard practice drawing from multiple perspectives. Before this study, no study had examined evidence-based practice within the context of acute stroke care in Ghana and most parts of LMICs. The systematic reviews reported in chapter two confirmed the existence of limited empirical studies in relation to this within Africa. Even with the few studies found and reported in the systematic review, a unidirectional approach was taken to only evaluate the effectiveness of specific acute stroke care interventions. Although this is an important consideration in the evidence-based stroke care scholarship and discourse, these have been limited as they only focused on the interventions outcomes but the 'what', 'how' and 'why' aspects integral to the implementation contexts within which evidence-based practice for acute stroke care occurs were not addressed, a gap which has been filled in this thesis through the qualitative study.

An important specific contribution to the stroke care literature is the documentation of evidence providing a wide-ranging picture of different acute stroke care services and interventions in Ghana. To date, such works are only known to be reported from HICs such as the UK, Canada, and Australia, among others. As a result, the findings of this thesis have made an important contribution to knowledge in Ghana and other LMICs. The results have improved understandings of current evidence-based acute stroke care services from a LMIC, and where important gaps in the delivery of evidence-based acute stroke care have been identified for the consideration of health authorities.

Furthermore, findings from the in-depth qualitative interviews in this thesis contribute to original knowledge in many significant ways. First, to my knowledge, and based on information from the systematic review reported in chapter two of this thesis [31], the findings provide the first evidence of the specific barriers to evidence-based acute stroke care from a LMIC setting. Such findings have balanced the current knowledge on this topic which hitherto was limited to only evidence from HICs. Beyond this, the findings in this thesis also extend, empirically and conceptually, the framework on barriers to change in clinical practice for stroke care and overall healthcare. For instance, this research has unraveled certain context specific barriers such as discharge against medical advice and the role of socio-cultural /religious beliefs and practices to the application of evidence-based acute stroke care. These have not been

sufficiently documented in the previous empirical literature on the barriers to acute stroke care, and as a result, their revelation in this thesis is indispensable towards developing well-targeted and contextually appropriate interventions to optimize the provision of acute stroke care. It is important to emphasize that the socio-cultural/religious beliefs and practices aspects of evidence-based acute stroke care revealed in this thesis have somewhat pointed to a theoretical/empirical deficit in the known barriers to evidence-based practice care for stroke patients. As reported in the systematic review in chapter two, the social-cultural aspects of patient care were not emphasized. Thus, this thesis has made a significant conceptual and empirical contribution by underscoring the importance of such contextual factors to evidencebased practice for acute stroke care. Future efforts to optimize care for stroke patients should not ignore the role of such contextual actors because of their potential to compromise the implementation and uptake of evidence-based interventions for stroke care.

There is a large body of research on stroke mortality outcomes and risk factors within the Ghanaian and African contexts. However, data on stroke treatments and the associated outcomes is considerably limited. Thus, this research is an essential advancement of knowledge through the retrospective cohort study in chapter four which has not only contributed to bridging this gap but has at least illuminated health policy makers on the extent of treatment-mortality gaps. The use of data from treatment outcomes serves as an important source of information on matters related to enhancing the quality of care and the performance of healthcare systems worldwide [74, 164]. However, such data are sparse and hard to come by in LMIC settings such as Ghana. Where available, these are often fraught with methodological issues and thus less reliable to support any meaningful decision-making process. For this reason, the findings from this thesis are anticipated to support evidence-based decision-making process related to quality improvement or performance management on stroke care.

Finally, the contribution of this thesis to the field of implementation science, more importantly, within LMICs cannot be overemphasized globally. The field of implementation science is still in a nascent state and this work is among the earliest to have reported evidence on some of its core elements: the nature and state of interventions, the possible factors accounting for the application of evidence-based interventions and the outcomes arising from the implementation of such interventions [165, 166]. In other words, the findings have supported a clearer understanding of the nature of evidence, drivers for evidence implementation in stroke care, implementation outcomes and the likely relationships with outcomes of implemented interventions. The use of theories and conceptual frameworks have been strongly recommended in implementation science towards understanding the nature of interventions, factors influencing the uptake levels of such interventions and the outcomes arising from the implementation of such interventions [167-169]. In keeping with these key traditional attributes of the field of implementation science, this thesis used known and well established theoretical and conceptual frameworks on changing practice or promoting evidence uptake [49, 50]. As has been highlighted by researchers in the field of implementation science [168, 170, 171], the contexts where implementation occurs largely plays an essential role to evidence uptake and insights from the qualitative data have uniquely and unequivocally demonstrated this. The findings and policy/practice implications from this thesis, including highlights of immediate and long-term stop-gap measures to addressing the highlighted gaps could serve as an implementation framework towards best practice for acute stroke care in Ghana and may be the wider LMICs.

5.6 Future research opportunities

The findings from this thesis have important implications for future research in many strands. First, the findings were derived from a focus on only public referral regional and teaching hospitals within the Ghanaian context. Therefore, future studies should focus on both public and private hospitals for greater coverage and clearer picture of the extent to which evidencebased practice for acute stroke care occurs. Such an attempt would undoubtedly extend the potential for generalisability of the findings. As demonstrated within Europe [172], a more ambitious research agenda should be conducted within Africa in order to map and compare current acute stroke care services among hospitals, using the World Stroke Society Service Guidelines as a best practice benchmark. This would bridge a significant gap in the stroke care literature from resource-poor settings.

Another area to consider in future research endeavours is conducting further qualitative indepth interviews with health planners, managers, administrators, health policy advisors especially on the barriers to the prioritization or allocation of resources to support evidencebased acute stroke care stroke care. Due to lack of time and resources, it was not possible to collect data from such participants on these equally essential stakeholders to translating contemporary acute stroke care interventions into standard practice in clinical settings. The need to conduct further in-depth interviews to ensure a clearer and richer understanding of these barriers is indispensable.

The perspectives of stroke patients or their carers on the barriers to accessing or adhering to acute stroke care in clinical settings are indispensable to the whole translation process. This point is underscored by the fact that the perspectives of patients on the available treatment options for them occupies a key position in the evidence-based practice paradigm and the field of implementation science [173-175]. However, due to time and resource constraints, this could not be included in the present research scope. In light of this, future studies should consider eliciting the views of patients or their carers on the potential factors affecting access and utilization of acute stroke care services/therapies.

Also, worth considering in future research agenda is the need to conduct controlled prospective studies using larger sample populations and taking into account stroke severity scores to

provide definitive evidence on in-hospital mortality in admitting hospital wards. Although important variables such as in-patient mortality are often relied upon to evaluate the extent of effectiveness of stroke care interventions [74, 176], which this study also incorporated to some extent, this was still limited in the sample for this analysis and the lack of stroke severity data could have also biased the reported outcomes. It is therefore important for future controlled studies to be conducted in order to address this gap.

Although insights from this thesis support pre-existing views about the low application of evidence based interventions for acute stroke care, it further calls into question the external validity of current interventions for acute stroke care. As noted earlier, despite the fact that evidences from the qualitative study and other studies have advanced understandings of the potential reasons for the low uptake, subsequent research efforts should take interest in evaluating the widespread feasibility of applying contemporary interventions in LMICs such as in Africa. This point is important because the studies reported in the pooled analysis which recommended and standardized current acute stroke care interventions were all from HICs [12, 79, 158, 177, 178]. However, it is not known if such interventions or the protocols and clinical guidelines which currently support stroke professionals' incorporation of such interventions into routine practice have been customized to suit varying contexts especially LMICs. Adaption of clinical guidelines to local contexts, has been shown to improve adherence, local ownership and uptake of interventions in general [179-181], thus the need for further investigation into this issue.

5.7 Dissemination plan of research findings

In order to optimize the impact of the research findings with the aim of closing the knowledgepractice gap in acute stroke care, a research dissemination plan is currently being operationalized. First, a dissemination plan in the form of preparing and publishing the research findings in international peer reviewed scientific journals is underway. As noted in chapter two and four of this thesis, parts of the research findings are already published and this is envisioned to illuminate understandings of the current knowledge gaps and recommendations to address these emphasized gaps have been provided. It is envisioned such recommendations will inform new policies and interventions to optimize acute stroke care in Ghana and may be in other LMICs. Second, plans to present the results at peer reviewed scientific conferences are underway. For instance, findings from part of this thesis have already been presented at an international scientific conference and plans are underway to disseminate the results in similar platforms in the future. Third, the dissemination plan will also target stroke care professionals in Ghana and LMICs. This includes plans to hold workshops with acute stroke care providers in the study hospitals to share and engage them on the existing acute stroke care capacity gaps and barriers to acute stroke care and elicit their views on how to optimize care in light of these findings. Finally, particularly for policy makers and health managers, discussion papers and policy briefs on key policy relevant findings will be developed in non-scientific terms. This will particularly focus on disseminating the findings and specific policy-relevant recommendations made in order to address especially the broader national level barriers to acute stroke care.

5.8 Conclusion

This study is the first in Ghana, and among the earliest in the African region to advance understandings on the application of contemporary acute stroke care interventions in routine clinical settings.

In brief, as demonstrated in a systematic review, this thesis reports evidence of apparent gaps in the academic literature on the general uptake of evidence-based interventions for acute stroke care in Africa, Ghana in this context. Evidence on the clinical efficacy of such interventions was also limited and weak in these contexts. Despite, the thesis also found inadequate and imbalanced understandings on the factors underlining the limited uptake of contemporary interventions for optimal patient outcomes as existing studies were reported from only HICs. These critical gaps necessitated the need for three empirical studies in Ghana to bridge these knowledge gaps and the findings of these studies are as follows: The first empirical study found limited availability and application of current hospital-based acute stroke care services and interventions in the Ghanaian contexts. Largely, the findings highlight an overall deficit in the capacity of the healthcare system to implement contemporary acute stroke care interventions for optimal patient outcomes. Second, the thesis also found high in-patient mortality outcomes among stroke patients compared to international standards. The thesis suggests such relatively high mortality outcomes were attributable to the variable and compromised the quality of acute stroke care in the study hospitals. Based on the findings of the qualitative study which sought to provide contextual insights to the findings of the first and second studies, the third study explored and documented multiple and fresh insights regarding the barriers to optimal patient care. Barriers were identified at the patient, stroke care professionals, healthcare system/organizational context and the broader national health policy contexts levels. On the basis of these findings, the thesis proposes the need for broader health system reforms to optimize the application of contemporary interventions for better patient outcomes.

In sum, the push for evidence-based healthcare is longstanding and has continued to gain increased international importance due to the persistent gap where available best practice interventions to improve health outcomes are systemically underutilized. To address the current growing and projected demand for acute stroke care owing to the aging population, increasing risk factors and unplanned urbanization, a health system reform and strengthening is needed. This will require a holistic and system-wide approach where a deeper understanding of the knowledge-practice translation process is developed to inform the development of targeted interventions. This cannot be achieved only by evaluating patient outcomes following prospective studies/clinical trials, or by examining the availability of contemporary interventions for acute stroke care via an organizational/hospital audit or by only exploring evidence of the barriers to translating evidence into practice. An integrated and system-wide approach is advocated which incorporates knowledge from all these components. Arguably, this is the only way current efforts to standardize best practice interventions would yield any material effect and thus close the long-standing gap between evidence and practice.

5.9 References

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Appendix 1: Research Portfolio

List Publications from the thesis

List of Peer Reviewed Journal Publications/International conference presentations

- Baatiema, L., Otim, M. E., Mnatzaganian, G., Aikins, A. D. G., Coombes, J., & Somerset, S. (2017). Health professionals' views on the barriers and enablers to evidence-based practice for acute stroke care: a systematic review. *Implementation Science*, 12(1), 74.
- Baatiema, L., Otim, M., Mnatzaganian, G., Aikins, A. D. G., Coombes, J., & Somerset, S. (2017). Towards best practice in acute stroke care in Ghana: a survey of hospital services. *BMC health services research*, 17(1), 108.
- Baatiema, L., Aikins, A. D. G., Sav, A., Mnatzaganian, G., Chan, C. K., & Somerset, S. (2017). Barriers to evidence-based acute stroke care in Ghana: a qualitative study on the perspectives of stroke care professionals. *BMJ open*, 7(4), e015385

Accepted manuscript with minor revisions

 Baatiema, L., Chan, C. K., Sav, A., & Somerset, S. (2017). Interventions for acute stroke management in Africa: a systematic review of the evidence *BMC Systematic Reviews*

Manuscript prepared for submission

 Baatiema, L, Otim, M, Somerset, S, Aikins. A, d-G, Coombes, J, Mnatzaganian, G. In hospital mortality following acute stroke in Ghana: comparing three admitting wards

Peer Reviewed International Conference Papers

- Baatiema, L., Otim, M., Mnatzaganian, G., Aikins, A. D. G., Coombes, J., & Somerset, S. (2017). Closing the knowledge-practice gap: evidence-based hospital services for acute stroke care in Ghana. 15th World Congress on Public Health. Melbourne
- Baatiema, L., Aikins, A. D. G., Sav, A., Mnatzaganian, G., Chan, C. K., & Somerset, S. (2017). How can acute stroke care professionals provide evidence-based care for optimal patient outcomes? Evidence for health managers and policy makers. *Global Evidence Summit*, Cape Town, South Africa. (Abstract accepted)

PUBLISHED MANUSCRIPT 1

Baatiema, L., Otim, M. E., Mnatzaganian, G., Aikins, A. d-G., Coombes, J., & Somerset, S. (2017). Health professionals' views on the barriers and enablers to evidence-based practice for acute stroke care: a systematic review. *Implementation Science*, *12*(1), 74

Author Statement

Leonard Baatiema (PhD Candidate)

As the principal author, I responsible for the protocol design, literature search of databases, study selection, data extraction processes and classification of the themes. I also wrote the first draft of the manuscript and was also responsible for further revision of the manuscript upon feedback from the journal's peer reviewers. I acknowledge that my contribution to the above paper is 75%.

Signature:

1 Star

Date: 25/07/2017

Statement of contribution of co-authors

Dr Michael E. Otim

I acknowledge that the above declaration correctly reflects the nature and extent of the candidate's contribution to this manuscript. I contributed in the selection and appraisal of the eligible studies and manuscript review. I acknowledge that my contribution to the above work is 5%.

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Signature:

Date:

11/09/2017
Dr George Mnatzaganian

I acknowledge that the above declaration correctly reflects the nature and extent of the candidate's contribution to this manuscript. I contributed to the selection and data extraction process and manuscript revision. I acknowledge that my contribution to the above work is 6%.

Mnaljayc

Signature:

Date:

28/08/2017

Professor Ama de-Graft Aikins

I acknowledge that the above declaration correctly reflects the nature and extent of the candidate's contribution to this manuscript. I contributed to the selection and data extraction process, classification of the themes and manuscript revision. I acknowledge that my contribution to the above work is 3%.

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Signature:

Date:

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Ms Judith Coombes

I acknowledge that the above declaration correctly reflects the nature and extent of the candidate's contribution to this manuscript. I contributed to the selection and data extraction process and manuscript revision. I acknowledge that my contribution to the above work is 3%.

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Signature:

Date:

Associate Professor Shawn Somerset

I acknowledge that the above declaration correctly reflects the nature and extent of the candidate's contribution to this manuscript. I contributed to the selection and data extraction, quality appraisal process, classification of the themes and manuscript revision. I acknowledge that my contribution to the above work is 8%.

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Signature:

Date:

PUBLISHED MANUSCRIPT 2

Baatiema, L., Otim, M., Mnatzaganian, G., Aikins, A. d-G., Coombes, J., & Somerset, S. (2017). Towards best practice in acute stroke care in Ghana: a survey of hospital services. *BMC health services research*, *17*(1), 108.

Author Statement

Leonard Baatiema (PhD Candidate)

As the principal author, I conceived and designed the study, conducted the data collection and analysis. I also wrote the first draft of the manuscript and subsequently revised the manuscript following feedback from co-authors. In addition, I was responsible for the preparation and submission of the article and later revisions of the manuscript following feedback from the journal's reviewers. I acknowledge my contribution to the above paper is 75 %.

Signature:

Date: 25/05/2017

Statement of contribution of co-authors

Dr Michael E. Otim

I acknowledge that the above declaration correctly reflects the nature and extent of the candidate's contribution to this manuscript. I contributed to the study concept and design, data interpretation and manuscript revision. I acknowledge that my contribution to the above work is 6%.

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Associate Professor Shawn Somerset

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Date:

PUBLISHED MANUSCRIPT 3

Baatiema, L., Aikins, A. d-G., Sav, A., Mnatzaganian, G., Chan, C. K., & Somerset, S. (2017). Barriers to evidence-based acute stroke care in Ghana: a qualitative study on the perspectives of stroke care professionals. *BMJ open*, *7*(4), e015385

Author Statement

Leonard Baatiema (PhD Candidate)

As the principal author, I conceived and led in the design and instrumentation process of the study. I recruited participants and collected the field data (interviews) and analysed the results. Contribution to the interpretation of the results and critical review of the manuscript. In addition, I was responsible for the preparation and submission of the article and later revisions of the manuscript following feedback from the journal's reviewers. I acknowledge that my contribution to the above paper is 76%.

Signature:



Date: 25/07/2017

Statement of contribution of co-authors

Professor Ama de-Graft Aikins

I acknowledge that the above declaration correctly reflects the nature and extent of the candidate's contribution to this manuscript. I contributed to study design, instrumentation, recruitment, data interpretation and manuscript revision. I acknowledge that my contribution to the above work is 6%.

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Dr Adem Sav

I acknowledge that the above declaration correctly reflects the nature and extent of the candidate's contribution to this manuscript. I contributed to data interpretation and manuscript revision. I acknowledge that my contribution to the above work is 4%.

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Dr George Mnatzaganian

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Dr Carina K.Y Chan

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Date: 28/08/2017

Associate Professor Shawn Somerset

I acknowledge that the above declaration correctly reflects the nature and extent of the candidate's contribution to this manuscript. I contributed to the study design and instrumentation, data interpretation and manuscript revision. I acknowledge that my contribution to the above work is 8%.

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MANUSCRIPT UNDER REVIEW (Accepted with Minor revisions)

Baatiema, L., Chan, C. K., Sav, A., & Somerset, S. (2017). Interventions for acute stroke management in Africa: a systematic review of the evidence *BMC Systematic Reviews*

Leonard Baatiema (PhD Candidate)

As the principal author, I conceived and led in the design of the study, developed the systematic review protocol and searched the literature, led in the study selection, quality appraisal and analysis. I wrote the first draft of the manuscript and contributed in critically revising the manuscript for important intellectual content. I was also responsible for further revision of the manuscript upon feedback from the journal's peer reviewers. I acknowledge that my contribution to the above paper is 80%.

Signature:

Date: 18/09/2017

Statement of contribution of co-authors

Dr Carina K.Y Chan

I acknowledge that the above declaration correctly reflects the nature and extent of the candidate's contribution to this manuscript. I contributed in the selection and appraisal of the eligible studies and manuscript review. I acknowledge that my contribution to the above work is 4%.

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Dr Adem Sav

I acknowledge that the above declaration correctly reflects the nature and extent of the candidate's contribution to this manuscript. I contributed in the selection and appraisal of the eligible studies and manuscript review. I acknowledge that my contribution to the above work is 4%.

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Date: 18/09/2017

Associate Professor Shawn Somerset

I acknowledge that the above declaration correctly reflects the nature and extent of the candidate's contribution to this manuscript. I contributed to the design, study selection, appraisal and review of the manuscript. I acknowledge that my contribution to the above work is 12%.

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Date: 18/09/2017

From:	em.sysr.0.559a0a.2d82aa50@editorialmanager.com on behalf of Systematic Reviews Editorial Office
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Interventions for acute stroke management in Africa: a systematic review of the evidence Leonard Baatiema, PhD Candicate; Carina K.Y Chan, PhD; Adem Sav, PhD; Shawn Somerset, PhD Systematic Reviews

Dear Mr Baatiema,

Your manuscript "Interventions for acute stroke management in Africa: a systematic review of the evidence" (SYSR-D-17-00057R1) has been assessed by our reviewers. Based on these reports, and my own assessment as Editor, I am pleased to inform you that it is potentially acceptable for publication in Systematic Reviews, once you have carried out some essential revisions suggested by one of our reviewers.

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Reviewer reports: Reviewer #2: Manuscript Numbers: SYSR-D-17-00057R1 Title: Translating evidence-based acute stroke care interventions to practice in Africa: A systematic review

The authors have made significant changes to the manuscript. They have also made significant attempts to resolve previous issues. I am happy to accept the paper for publication after some minor changes suggested. I do advise the authors to be careful when writing statements in manuscripts to ensure they are clear, factual and supported by the literature, and avoid repetition. There are quite a few sweeping statements, and conclusions made that are not supported by the data presented.

Background.

The background is much improved but is still very challenging to read. Below is some example to highlight this. Introductions need to be clear, concise and structured. The introduction is really just to highlight the high burden; why the research is important/needed; and aims of the study.

Line 70: The authors state: "However, the distribution of the global burden of stroke is inequitable, with LMICs, especially those in Africa being disproportionately affected. Statistics suggest LMICs such as the ones in Africa account for approximately 87% of the global stroke burden ". I don't think the words 'equity' or statistics" are being appropriately used. I would just rephrase to highlight disproportionately high burden in LMIC/Africa... The authors also use the word 'equity' out of context on Line 107.

Line 73: the use of the word 'uncontrollable' seems strange. I would remove.

Line 73: I don't understand what this other evidence is. What is this other evidence? I would suggest removing the sentence: "These and other evidences [8-11], suggest an increasing burden of stroke within the African region." It is clear from preceding sentences that stroke burden is going to increase, why labour the point.

Line 74: "This notwithstanding, the nature of acute stroke care in such countries is often poor." The sentence is not supported by a reference. Additionally the authors repeat themselves on Line 99: "Overall, despite the established evidence base of the widespread health benefits of the above interventions, global uptake is limited and inconsistent."

Line 119: "these works did not focus exclusively on Africa" should probably read: "this work did not

Line 119: The authors state "also used search strategies which were arguably, less comprehensive and insufficiently sensitive to African-based studies". I don't think it is appropriate to criticise another study without providing details. How do we know this other study used 'less comprehensive or sensitive'' search strategies. Please remove the statement unless you provide a detailed description of why this other study has a less comprehensive search strategy. I think highlighting the previous study did not focus on Africa is sufficient.

Methods

Line 134: change "Study Designs" to "Study Design"

Line 186-188: Can authors reference the Joanna Briggs tool

Results

Typo on Line 230: "..respectively per the Oxford..."

Unclear sentence on Line 270: "This study also found 4.8% patients experienced SICH and mortality outcomes following thrombolysis were in 7.1% of the patients."

Typo on Line 273: "The study outcomes include SICH, deaths,..", should read 'included'

In the results section where they state % of patients with event, for example: "Overall, the study showed 4.9% patients experienced SICH, (95% CI: 0-11.5%) representing 5.1% for SITS-SICH and 6.5% for the SEDAN cohorts.". I think it would be useful to numbers in brackets. For example 5% (2/40) of patients.....Especially as later on they write: "The evidence showed 25 (48%) patients had significant early clinical improvements within 24 hours, 21 (40.3%) at 3 months and 15 (29%) in-patient mortality cases." I would suggest the authors are consistent in how the report the results so that it is easier for readers to follow. Ideally this should involve providing both the percentages and actual number.

Discussion

Like the background section, the discussion is far too long and repetitive, could be concise down.

Line 91 typo: "this review presents about the earliest work on 'best practice'"

Line 294 states: "Overall, despite advancement in medical technology and research in the development of best practice interventions for acute stroke care, translation into standard practice continues to be a challenge." I am not sure from the work presented you can conclude this. To make this conclusion you would need to survey all hospitals in the region and find out what type of care they are providing for this population. I think the most important thing the review highlights is that there has been very little research in Africa exploring how best to manage acute stroke.

Line 330: unclear sentence. Relatively lower what?: "The study by de Bryer et al [49], for instance, on thrombolytic therapy showed a relatively lower SICH and deaths."

Line 330: In their discussion about thrombolytic therapy I think it should be highlighted the challenges of thrombolysis in a setting where there will be delays in accessing care, even acute care, which may impact on effectiveness.

Line 336: The authors state aspirin is commonly used in Africa. How do they know this?: "(a common cardiovascular therapy in LMICs due to low cost and ease of usage)". I would rephrase to highlight somewhere that the low cost should 'potentially' lead to its use, unless of course they have data on Aspirin usage in LMICs that they can reference.

Line 344: suggest change word from 'threat' 'problem'.

Line 351: "Although multiple barriers may account for such low uptake according to a recent study in Ghana [40]". Instead of just stating 'multiple barriers' it may be useful to highlight some of these barriers to the reader.

Line 360: The authors state: "the limited evidence of stroke unit care uptake". Again there study did not assess uptake but effectiveness. Please be careful with statements not supported by the data presented in paper.

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Please also take a moment to check our website at <u>http://sysr.edmgr.com/l.asp?i=25860&l=SLPC33PC</u> for any additional comments that were saved as attachments. Please note that as Systematic Reviews has a policy of open peer review, you will be able to see the names of the reviewers.

If improvements to the English language within your manuscript have been requested, you should have your manuscript reviewed by someone who is fluent in English. If you would like professional help in revising this manuscript, you can use any reputable English language editing service. We can recommend our affiliates Nature Research Editing Service (<u>http://bit.ly/NRES-HS</u>) and American Journal Experts (<u>http://bit.ly/AJE-HS</u>) for help with English usage. Please note that use of an editing service is neither a requirement nor a guarantee of publication. Free assistance is available from our English language tutorial (<u>https://www.springer.com/gb/authors-editors/authorandreviewertutorials/writinginenglish</u>) and our Writing resources (<u>http://www.biomedcentral.com/getpublished/writing-resources</u>). These cover common mistakes that occur when writing in English.

MANUSCRIPT PREPARED FOR SUBMISSION

Baatiema, L, Somerset, Otim, M, S, Aikins. A, d-G, Coombes, J, Mnatzaganian, G. In hospital mortality following acute stroke in Ghana: comparing three admitting wards

Author Statement

Leonard Baatiema (PhD Candidate)

As the principal author, I led in the study design and conception process. I designed the data collection instrument, conducted field data collection, carried out data inputting and analysis. I interpreted the data and drafted the first manuscript. I acknowledge that my contribution to the above paper is 70%.

Signature:

Date: 25/07/2017

Statement of contribution of co-authors

Associate Professor Shawn Somerset

I acknowledge that the above declaration correctly reflects the nature and extent of the candidate's contribution to this manuscript. I contributed to the study design and conception process, data interpretation and manuscript revision. I acknowledge that my contribution to the above work is 8%.

Elen Dan

Signature:

Date:

Dr Michael E. Otim

I acknowledge that the above declaration correctly reflects the nature and extent of the candidate's contribution to this manuscript. I contributed to the study design and conception process, data interpretation and manuscript revision. I acknowledge that my contribution to the above work is 5%.

tolm

Signature:

Date:

11/08/2017

Professor Ama de-Graft Aikins

I acknowledge that the above declaration correctly reflects the nature and extent of the candidate's contribution to this manuscript. I contributed to the study design and conception process, data interpretation and manuscript revision. I acknowledge that my contribution to the above work is 3%.

Signature:

Atut

Date:

12/09/2017

Ms Judith Coombes

I acknowledge that the above declaration correctly reflects the nature and extent of the candidate's contribution to this manuscript. I contributed to the study design and conception process, data interpretation and manuscript revision. I acknowledge that my contribution to the above work is 4%.

ht a

Signature:

Date:

Dr George Mnatzaganian

I acknowledge that the above declaration correctly reflects the nature and extent of the candidate's contribution to this manuscript. I contributed to the study design and conception process, data analysis, interpretation and manuscript revision. I acknowledge that my contribution to the above work is 10 %.

Mnaljoyc

Signature:

Date:



Human Research Ethics Committee Committee Approval Form

Principal Investigator/Supervisor: Dr Michael Otim

Co-Investigators: Assoc Prof Shawn Somerset, Dr George Mnatzaganian, Ama de-Graft Aikins

Student Researcher: : Mr Leonard Baatiema

Ethics approval has been granted for the following project:

Examining the Use of Evidence-Based Hospital Services for Acute Stroke Care in Ghanaian Hospitals

for the period: 18/08/2015-31/08/2016

Human Research Ethics Committee (HREC) Register Number: 2015-154H

Special Condition/s of Approval

Prior to commencement of your research, the following permissions are required to be submitted to the ACU HREC:

Ghana Health Service Ethics Committee

The following <u>standard</u> conditions as stipulated in the *National Statement on Ethical Conduct in Research Involving Humans* (2007) apply:

- (i) that Principal Investigators / Supervisors provide, on the form supplied by the Human Research Ethics Committee, annual reports on matters such as:
 - security of records
 - compliance with approved consent procedures and documentation
 - compliance with special conditions, and
- (ii) that researchers report to the HREC immediately any matter that might affect the ethical acceptability of the protocol, such as:
 - proposed changes to the protocol
 - unforeseen circumstances or events
 - adverse effects on participants

The HREC will conduct an audit each year of all projects deemed to be of more than low risk. There will also be random audits of a sample of projects considered to be of negligible risk and low risk on all campuses each year.

Within one month of the conclusion of the project, researchers are required to complete a *Final Report Form* and submit it to the local Research Services Officer.

If the project continues for more than one year, researchers are required to complete an *Annual Progress Report Form* and submit it to the local Research Services Officer within one month of the anniversary date of the ethics approval.

K. Pashlug.

Signed:

..... Date: 24/08/2015..... (Research Services Officer, McAuley Campus)

GHANA HEALTH SERVICE ETHICS REVIEW COMMITTEE

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In case of reply the number and date of this Letter should be quoted.

My Ref. :GHS-ERC: 3 Your Ref. No.

Leonard Baatiema Australian Catholic University Faculty of Health Sciences School of Allied and Public Health

ETHICS APPROVAL - ID NO: GHS-ERC: 11/07/15

The Ghana Health Service Ethics Review Committee has reviewed and given approval for the implementation of your Study Protocol titled:

"Treatment and Management of Acute Stroke in Selected Ghanaian Hospitals"

CH4N,

Your Hadth - Dur Generan

This approval requires that you inform the Ethics Review Committee (ERC) when the study begins and provide Mid-term reports of the study to the Ethics Review Committee (ERC) for continuous review. The ERC may observe or cause to be observed procedures and records of the study during and after implementation.

Please note that any modification without ERC approval is rendered invalid.

You are also required to report all serious adverse events related to this study to the ERC within three days verbally and seven days in writing.

You are requested to submit a final report on the study to assure the ERC that the project was implemented as per approved protocol. You are also to inform the ERC and your sponsor before any publication of the research findings.

Please note that this approval is given for a period of 12 months, beginning October 19th, 2015 to October 18th, 2016.

However, you are required to request for renewal of your study if it lasts for more than 12 months.

Please always quote the protocol identification number in all future correspondence in relation to this approved protocol



1

Cc: The Director, Research & Development Division, Ghana Health Service, Accra

Research & Development Division Ghana Health Service P. O. Box MB 190 Acera Tel: +233-302-681109 Fax + 233-302-685424 Email: Hannah. Frimpong@ghsmail.org

19th October, 2015



KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY COLLEGE OF HEALTH SCIENCES

SCHOOL OF MEDICAL SCIENCES / KOMFO ANOKYE TEACHING HOSPITAL COMMITTEE ON HUMAN RESEARCH, PUBLICATION AND ETHICS

Our Ref: CHRPE/AP/141/16

24th March, 2016.

Dr. Michael E. Otim Australian Catholic University Faculty of Health Sciences School of Allied Health SYDNEY-AUSTRALIA.

Dear Sir,

LETTER OF APPROVAL

Protocol Title: "Hospital-Based Services for the Treatment and Management of Acute Stroke Patients at Komfo Anokye Teaching Hospital."

Proposed Site: Komfo Anokye Teaching Hospital (KATH).

Sponsor: Principal Investigator.

Your submission to the Committee on Human Research, Publications and Ethics on the above named protocol refers.

The Committee reviewed the following documents:

- A notification letter of 22nd March, 2016 from Komfo Anokye Teaching Hospital (study site) indicating approval for the conduct of the study in the Hospital.
- A Completed CHRPE Application Form.
- Participant Information Leaflet and Consent form.
- Research Protocol.
- Questionnaire.

The Committee has considered the ethical merit of your submission and approved the protocol. The approval is for a fixed period of one year, renewable annually thereafter. The Committee may however, suspend or withdraw ethical approval at anytime if your study is found to contravene the approved protocol.

Data gathered for the study should be used for the approved purposes only. Permission should be sought from the Committee if any amendment to the protocol or use, other than submitted, is made of your research data.

The Committee should be notified of the actual start date of the project and would expect a report on your study, annually or at the close of the project, whichever one comes first. It should also be informed of any publication arising from the study.

Thank you Sir, for your application.

Yours faithfully,

Osomfuor Prof. Sir J. W./Acheampong MD, FWACP Chairman



Institutional Review Board 37 Military Hospital Neghelli Barracks ACCRA Tel: 0302-775958 Email: <u>irb37milhosp@hotmail.com</u>

November 2015

Our Ref: IRB/37MH/94/15

ETHICAL CLEARANCE

37MH-IRB IPN 035/2015

3 On 27th October 2015 the 37 Military Hospital (37MH) Institutional Review Board (IRB) at Board meeting reviewed and approved your protocol.

TITLE OF PROTOCOL: TREATMENT AND MANAGEMENT OF ACUTE STROKE CARE IN GHANAIAN HOSPITALS

PRINCIPAL INVESTIGATOR: LEONARD BAATIEMA

Please note that a final review report must be submitted to the Board at the completion of the study. Please report all serious adverse events related to this study to 37MH-IRB within seven (7) days verbally and fourteen (14) days in writing.

This certificate is valid till 27th October 2016

DR EDWARD ASUMANU (37MH-IRB, Vice Chairperson)

37 MILITARY HOSPITAL INSTITUTIONAL REVIEW BOARD DATE 12 N 5N 2815

Cc: Brig Gen (Dr) Ralph Ametepi

Appendix 2: Data Collection Instruments

1. Survey instrument/questionnaire

Introduction

My name is Leonard Baatiema, a research student with the Australian Catholic University undertaking this research as part of the requirements for my PhD in Public Health. This survey seeks to understand the nature of current acute stroke care services in the main referral hospitals in Ghana. For this purpose, I seek to gather information from you about the nature of acute stroke services in your hospital. Please note that this survey is not a test or assess your clinical knowledge of acute stroke care or the decisions you make in relation to the provision of acute stroke care. Results from this survey will help characterise the picture of acute stroke services in the hospitals, identifying gaps in acute stroke care services and consequently make recommendations for a clear evidence-based health policy action to improve acute stroke care.

In addition, participation in this survey is voluntary and if you do not feel like answering any question, kindly let me know so I can skip to the next question; or you can stop the interview at any time. However, I hope you will participate in the survey since your views are important. The information collected will be strictly confidential. I will not give your name or information to anyone outside this research project. There are no known risks to participating in this survey. With your permission, I would like to ask you a series of questions that will take approximately 45 minutes. Thank you for taking time from your busy schedules to participate in this survey

	SECTION A: RESPONDENT'S INFORMATION	
1	Position of Respondent	
2	Gender	Male1
		Female2
3	Years of work experience	0-5yrs1
		6-10yrs2
		11-15yrs
		16years and above4
	SECTION B: HOSPITAL DATA	
4	Name of Hospital	
5	Status of Hospital	Regional Hospital1
		Teaching Hospital
6	Number of beds in the hospital	
7	How many acute stroke patients were admitted	
	in your hospital in the last year (2015)	
	SECTION C: ACUTE	PRESENTATION AND EARLY ASSESSMENT
8	Which ward is a patient with acute stroke	Accident and Emergency Department1
	symptoms most likely to be admitted first?	General medical ward2
		Neurology ward
		Intensive Care Unit (ICU)4
		Medical Ward5

		If others, specify
9	Are there accident and emergency department	Yes1
	protocols for rapid triage for patients	No2
	presenting with acute stroke in your hospital?	
	Are there arrangements in place with local	Yes1
10	ambulance services to fast-track patients	No2
	presenting with acute stroke?	
	If no to Q10, what is the common means of	Taxi /private arrangements1
	transport for rapid patient transfer to your	Others2
11	hospital?	If others, please specify
12	Are there protocols for transfer of stroke	Yes1
	patients to other hospitals for care?	No2
		Don't know3
13	Are there clinical management guidelines for	Yes1
	acute stroke care	No2
	If yes to Q13, which clinical management	National clinical guideline for stroke1
14	guidelines is/are used for acute stroke care in	Standard Treatment Guideline2
	the hospital?	World Stroke Society Clinical guideline3
		NICE Clinical Guideline4
		If others, specify5
	SECTION D: DIAGNOSIS AND SCREENIN	IG SERVICES
15	Does your health service have access to	Yes1
	functional CT scanner?	No2
16	If yes to Q15, what hours is the service	Monday – Friday, 9am – 5pm1
	available? (Select one option only)	Monday – Friday, extended hours2

		Extended hours including weekends3
		24 hours a day, 7 days a week4
17	If no to Q15, can you get CT offsite within 24	Yes1
	hours of stroke presentation to your hospital?	No2
18	Does your health service have access to	Yes1
	functional MRI services?	No2
19	If yes to Q18, what hours is the service	Monday – Friday, 9am – 5pm1
	available? (Select one option only)	Monday – Friday, extended hours2
		Extended hours including weekends
		24 hours a day, 7 days a week4
20	If no to Q18, can you get MRI offsite within	Yes1
	24 hours of stroke presentation to your	No2
	hospital?	
21	Do you have neurovascular ultrasound	Yes1
	diagnostic services such as Carotid Doppler	No2
	Services in the hospital?	
22	If yes to Q21, can you access this service	Yes1
	onsite within 24 hours of stroke presentation to	No2
	your hospital?	
23	If no to Q21, can you access this service offsite	Yes1
	within 24 hours of stroke presentation to your	No2
	hospital?	
24	Do you have Electrocardiogram (ECG)	Yes1
	services in the hospital?	No2
25	If yes to Q24, can you access this service	Yes1
	onsite within 24 hours of stroke presentation to	No2
	your hospital?	

26	If no to Q24, can you access this service offsite	Yes1
	within 24 hours of stroke presentation to your	No2
	hospital?	
27	Do you have Electroencephalogram service in	Yes1
	this hospital?	No2
28	If yes to Q27, can you access this service	Yes1
	onsite within 24 hours of stroke presentation to	No2
	your hospital?	
29	If no to Q27, can you access this service offsite	Yes1
	within 24 hours of stroke presentation to your	No2
	hospital?	
30	Do you have Magnetic Resonance	Yes1
	Angiography services in this hospital?	No2
31	If yes to Q30, can you access this service	Yes1
	onsite within 24 hours of stroke presentation to	No2
	your hospital?	
32	If no to Q30, can you access this service offsite	Yes1
	within 24 hours of stroke presentation to your	No2
	hospital?	
33	Do you have Computed Tomographic	Yes1
	Angiography services in this hospital?	No2
34	If yes to Q33, can you access this service	Yes1
	onsite within 24 hours of stroke presentation to	No2
	your hospital?	
35	If no to Q33, can you access this service offsite	Yes1
	within 24 hours of stroke presentation to your	No2
	hospital?	

36	Do you have functional acute stroke	Yes1
	assessment scales?	No2
	If yes to Q36, which of the following are used	National Institutes of Health Stroke Scale NIH1
	in the hospital?	Scandinavian Stroke Scale2
		Canadian Neurological Scale
37		European Stroke Scale4
		Oxfordshire Community Stroke Project Classification
		(Bamford)5
		If others, specify
38	If no to Q36, how do you conduct patient	Previous knowledge or experience1
	assessment without the use of the	Others, specify2
	recommended tools?	
39	Does your health service have a dedicated	Yes1
	stroke unit (ward)?	No2
		Stand-alone1
40	If yes to Q39, is it a	Within another ward2
		Combined acute and sub-acute care (e.g. includes
		rehabilitation)
		If others, specify4
41	If yes to Q39, please describe what this is	
	comprised of	
42	If yes to Q39, how many beds are in the stroke	
	unit?	
	How adequate are the number of beds?	Very adequate1
43		Adequate2
		Inadequate

		Very inadequate4
	If no to Q39, dedicated stroke unit, does your	Yes1
44	hospital have a dedicated, multidisciplinary	No2
	stroke team?	
45	If no dedicated stroke unit as asked in Q39,	General wards1
	which wards are mostly used to admit stroke	Neurological wards2
	patients.	Intensive Care Unit
		Others (specify)4
	Can you briefly describe what this consists of?	· · · · · · · · · · · · · · · · · · ·
46		
47		
	Which of the following factors account for the	Inadequate stroke clinical staff1
	lack of or absence of a stroke unit care?	Financial constraints2
		Lack of administrative, policy support3
	(Tick where applicable)	unware of the use of stroke unit care4
		If others, specify5
48	Will you recommend the provision of a stroke	Yes1
	unit in this hospital?	No2
		Not sure
	Is your hospital able to provide thrombolytic	Yes1
49	therapy using intravenous recombinant tissue	No2
	plasminogen activator (t-PA or alteplase) for	
	ischemic stroke patients?	

50	If yes to Q49, is there a standardised protocol	Yes1
	or treatment guideline to guide administering	No2
	of t-PA?	
51	If no to Q49, thrombolytic therapy, what is	Inadequate stroke clinical staff1
	your opinion about the following factors	Financial constraints2
	accounting for the non-use of thrombolytic	inadequate administrative or policy support3
	therapy for acute stroke care?	unware of the use of thrombolysis4
	(Tick where applicable)	If others, specify
	Does your hospital provide aspirin for stroke	Yes1
52	patients eligible for this type of treatment?	No2
53	If yes to Q52, do you use a standardized	Yes1
	protocol when administering aspirin?	No2
54	If no to Q52, aspirin therapy, do you agree the	Inadequate stroke clinical staff1
	following factors account for the non-use of	Financial constraints2
	aspirin therapy for acute ischemic stroke care?	inadequate administrative, policy support3
	(Tick where applicable)	unware of the use of aspirin4
		If others, specify5
55	If no to Q52, would you consider	Yes1
	recommending the use of aspirin?	No2
56	Does your hospital carry out surgical	Yes1
	treatments for acute stroke patients?	No2
57	If yes to Q56, what surgical treatments or	Revascularization (Carotid Endarterectomy)1
	procedures are conducted in the hospital?	Surgery for Aneurysm2
		Arteriovenous malformation treatment3
		Decompressive craniotomy4
		If others (specify)5
	1	1

SEC	SECTION F: STROKE REHABILITATION SERVICES		
58	Does your hospital have effective	Yes1	
	rehabilitation services on the same site?	No2	
59	If no to Q58, on-site rehabilitation service, do	Yes1	
	you have access to off-site rehabilitation	No2	
	service?		
60	If yes to Q58, please indicate the nature of the	Public Facility1	
	rehabilitation service	Private Hospital2	
		If others, specify	
61	Do you have hospital discharge care plans for	Yes1	
	stroke patients?	No2	
62	If yes to Q61, what do they include?	Self-management strategies1	
		Out-patient Appointments2	
		If others, specify	
63	At discharge, are patients or carers provided	Yes1	
	with a hospital staff contact number at	No2	
	discharge?		
64	Is there patient information leaflets/literature	Stroke condition1	
	available/offered on the following topics	Local community care arrangements2	
	during admission and at discharge	Local voluntary associations	
		Community stroke support groups4	
	SECTION G: ORGANISATION OF WORK	FORCE	
		Clinical psychologist1	
	How many of the following professionals do	Nurse2	
	you have in your stroke team at your health	General practitioner	
65	institution	Neurologist4	
		Neurosurgeon5	

	(Tick where applicable)	Physician specialist
		Medical Officer7
		Stroke care coordinator8
		Trained stroke nurses
		Emergency department staff10
		Occupational therapist11
		Physiotherapist12
		Speech pathologist13
		Social worker14
		Dietician15
		If others, specify16
		None17
66	Is there a physician specialist as the principal	Yes1
	person for stroke at your hospital?	No2
67		Doctor1
	If yes to Q66, please select one option	Nurse2
		Therapist
		If others, specify4
	SECTION H: CONTINUING EDUCATION	AND QUALITY IMPROVEMENT
68	Is there a program for the continuing education	Yes1
	and professional development of staff on	No2
	stroke clinical care	
69	Has the stroke team in the hospital been	Yes1
	involved in quality improvement activities and	No2
	on strategies to improve care?	

	SECTION I: HEALTH SYSTEM POLICY S	UPPORT FOR STROKE CLINICAL CARE
70	Are there some specific health policies or	Yes1
	interventions (national or hospital specific)	No2
	meant to improve stroke care?	
71	If yes to Q70, which of the following do you	National health policy for stroke1
	have in your hospital?	Hospital interventions and initiatives to support stroke
		care2
		Donor interventions to support stroke care
		If others, specify4
		None5
72	How will you describe the current level of	Limited support1
	health policy support (oversight) from the	Average support
	national level for acute stroke care?	High support3
		Low support4
		No support5
73	How will you describe the current level of	Limited support1
	health policy support (oversight) at the hospital	Average support2
	level for acute stroke care?	High support3
		Low support4
		No support5
74	What do you see as the current limitations of	No stroke unit (ward)1
	the acute stroke services package?	Inadequate stroke clinical staff2
		Financial constraints
		Health-policy support4
		Lack of political will5
		If others, specify

75	What plans does the hospital have to promote		
	acute stroke care?		
	SECTION J: STROKE DATA		
76	Do you have a stroke register or database	Yes1	
		No2	
77	If yes to Q76, is it	Electronic stroke data filing system1	
		Manual/facility based paper register2	
		None of the above	
		If others, specify4	
78	In what ways is the stroke register important?	To identify stroke or other ill-health determinants1	
	Select where applicable	To assess the health system performance2	
		To assess the health status of patients	
		None	
		Others5	
79	Are there community or hospital	Yes1	
	programs/interventions to promote stroke	No2	
	awareness?		
80	Are there community stroke rehabilitative	Yes1	
	programs?	No2	
	SECTION K: CONCLUSION		
81	Do you have any final comments on any specific section or the interview overall? Any suggestions or		
	ideas?		
83	Contact email (optional)		
84	Telephone number (optional)		

2. Instrument for Retrospective Chart Review

	SECTION A: HEALTH FACILITY DATA		
1	Name of Hospital		
2	Status of Hospital	Regional Hospital1	
		Teaching Hospital	
3	Department/Unit of Admission		
	SECTION B: PATIENT DATA		
4	Age:		
5	Sex:	Male1	
		Female2	
6	Employment Status		
7	Stroke onset date		
8	Date of Admission		
9	Time of stroke	Accurate1	
		Estimate 2	
10	Was the patient discharged alive	Yes 1	
10	after acute care?	105	
		No2	
11	If yes, date of discharge		
12	Destination at Discharge	Discharged home1	
		Referred to a different hospital2	
		Discharged against medical advice	
13	Did the patient die during acute	Yes1	
	care?		
1.4		No2	
14	If yes, date of death		
SECTION C: PROCESSES OF CARE			
		Yes1	
15	Did the natient have a brain scan	No 2	
15	at the hospital		
		Not documented	
	If yes, what type of scan was	CT1	
	performed?		
16		МКІ2	
		Both3	
17	If yes, date of brain scan		

		Yes1
18	Stroke Unit Care	No2
		Yes1
19	Treatment with t-PA	No2
20	If yes, date of treatment	
21	Use of Aspirin	Yes1
	x a x a	No2
22	If yes, date of treatment	
		Yes1
23	Multidisciplinary acute stroke	No2
	care	Not documented
24	24 If yes, choose which of the following provided multidisciplinary care?	PhysiotherapistI
		Dietitian2
		Clinical Psychologist3
		Speech therapist4
		Social Worker5
	SECTION D:	DETAILS OF STROKE
		Hemorrhagic1
25	Type of stroke	Ischemic
		Not documented
	Known stroke risk factors at admission	Hypertension1
26		Diabetes Miletus2
		Smoking
	(Tick where applicable)	Obesity4
		Family history of stroke5
		Atrial Fibrillation6

		Alcohol Intake
		Asthma
		Others9
		Not documented10
	Was the patient hypertensive prior to stroke?	Yes1
27		No2
		Not documented
		Yes1
28	Was the patient on anti- hypertensives prior to the stroke?	No2
		Not documented3
29	Reported complications and impairment during admission	Aspiration pneumonia1
		Pressure sores
		Incontinence
		Unable to walk independently4
		Visual5
		Cognitive impairment
		UTI7
		Others
		Not documented9

3. Interview guide for qualitative study

In-depth qualitative interviews guide on barriers to acute stroke care

Introductory Remarks

Let me first thank you for agreeing to participate in this interview today. My name is Leonard Baatiema, a research student with ACU undertaking this research as part of the requirements for my PhD in Public Health. This interview will take about 45minutes and will focus on questions regarding your work experience in providing clinical care for acute stroke patients and more importantly the barriers affecting optimal delivery of clinical care for acute stroke patients.

Although notes will be taken during the interview, this will not be at a fast pace to capture all your comments so I will be grateful if you grant me the permission to audio-record our discussion in order to enable me capture accurately and correctly all information you will be having with me. This interview is done at your volution and so you are at liberty to ask me to stop with the recording or the entire interview in the course of the interview if you so wishes. All information shared is strictly confidential and will be used purposely for the research and not for any other purpose. Any information to be included in this research will de-identify you as the participant.

Do you have any questions, clarifications at this point before we commence the interview? If none then I will humbly request we begin the interview.

Thank you
Interview Guide

- a. Let's start with a brief explanation of what you do in this hospital in terms of stroke care? Kindly explain to me what you are expected to do when a stroke patient has been transferred or report to the hospital with a stroke-like symptoms?
- b. What different acute stroke care services or treatments are provided for the care of acute stroke patients in this hospital? (Probe for the awareness and use of stroke unit care, aspirin therapy or thrombolytic therapy, etc.)
- c. Do you perceive the current acute stroke care services and therapies for stroke patients as helpful in providing care or there are some challenges in using them?
- d. What guides the provision of acute stroke care in this hospital? If a clinical guidelines or protocols are used, probe for the types of guidelines or protocols used.
- e. Do you find these guidelines helpful in providing care or face some challenges in trying to use them? Where they exist, probe on the following: (their clarity and relevance to stroke clinical care, stroke care professionals familiarity with and confidence in clinical guidelines usage, their attitudes towards clinical guidelines and the perceived barriers of these guidelines in clinical decision-making
- f. Now let's discuss the current practical challenges which hinder the delivery of optimal care to stroke patients? Could you elaborate on some of the barriers you face on daily bases? Probe on the following: Guideline factors, health staff level barriers, patient factors, incentives and resources, policy decisions/contexts, national level factors, etc.
- g. How do you cope or manage to provide stroke care in the midst of such barriers?
- h. What recommendations will you like to make to the hospital authorities on how to improve acute stroke care in the hospital?
- i. Is there anything you will like to share, either audio-recorded or off audio recorded in relation to the issues we have just discussed?
- j. I will be transcribing the recording and if you don't mind I will be happy to share the interview transcript with you to cross check to be sure what is transcribed reflects your views?
- k. Thank you for your time