Educational outreach visits to improve nurses' use of mechanical venous thromboembolism prevention in hospitalized medical patients

Duff, Jed, Walker, Kim, Abdulla, Omari, Middleton, Sandy and McInnes, Elizabeth

Duff, J., Walker, K., Abdulla, O., Middleton, S. and McInnes, E. (2013). Educational outreach visits to improve nurses' use of mechanical venous thromboembolism prevention in hospitalized medical patients. *Journal of Vascular Nursing*, 31(4), pp. 139-149. https://doi.org/10.1016/j.jvn.2013.04.002

Educational Outreach Visits to improve nurses' use of mechanical venous thromboembolism prevention in hospitalised medical patients.

ABSTRACT

Venous thromboembolism is a significant cause of morbidity and mortality in hospitalised medical patients. Evidence-based guidelines exist for preventing VTE but unfortunately these guidelines are not always adhered to by clinicians. The aim of this study was to evaluate the acceptability, utility and clinical impact of an Educational Outreach Visit (EOV) on nurses' provision of mechanical prophylaxis to hospitalised medical patients using a prospective uncontrolled before-and-after design. Nurses received a one-to-one educational session on mechanical VTE prevention by a trained nurse facilitator. The EOV intervention was designed by a multidisciplinary group of healthcare professionals using social marketing theory.

Eighty five of the 120 eligible nurses (71%) received the EOV. The median length of each visit was 11.5 minutes (interquartile range 10-15) and the median time spent arranging and conducting each visit was 63 minutes (interquartile range 49-85). Eighty four (98.8%) of the 85 participants gave a verbal commitment to trial the new evidence-based mechanical VTE prevention practices. However, there were no measurable improvements in the proportion of patients risk assessed (-1.7% improvement, 95% CI -7.0 to 10.3, p=0.68) or provided appropriate mechanical prophylaxis (-0.3% improvement, 95% CI -13.4 to 14, p=0.96).

Researchers conclude that EOV should not be used to improve nurses use of mechanical VTE prevention as it has no measurable impact on clinical practice and is resource intensive requiring four and a half minutes of preparation for every minute spent face-to-face with participants. Further research into the specific mechanism of action is required to explain the variability in clinical effect seen with this intervention.

INTRODUCTION

It is internationally acknowledged that hospitalised medical patients receive suboptimal thromboprophylaxis. Nurses play an important role in the provision and management of mechanical prophylaxis but unfortunately they do not always adhere to evidence-based guidelines.[1, 2] Implementation science is the relatively new field of research which studies strategies to promote the systematic uptake of research findings into routine clinical practice.[3] Educational Outreach Visits (EOV) is an implementation strategy that has not often been used to improve VTE prevention practices. The aim of this study was to evaluate the acceptability, utility and clinical impact of EOV on nurses' provision of mechanical VTE prophylaxis to hospitalised medical patients.

BACKGROUND

Deep vein thrombosis (DVT) and pulmonary embolism (PE) are two components of the one disease process known as venous thromboembolism. VTE is a serious vascular condition which is responsible for approximately 5000 deaths in Australia[4]; 25,000 deaths in the United Kingdom[5]; and 300,000 deaths in the united States[6] each year. VTE is also associated with chronic cardiovascular conditions such as post thrombotic syndrome which is characterised by persistent lower limb oedema, pain, inflammation, and ulceration; and thromboembolic pulmonary hypertension, a rare but debilitating condition featuring elevated pulmonary artery systolic pressures.[7]

Hospitalised patients are particularly vulnerable to VTE. Spencer et al[8] estimate that approximately 50% of all VTE related deaths in the community are directly attributable to a recent hospital admission. Within the acute inpatient population, VTE accounts for 10% of all deaths, making it the single most preventable cause of hospital related mortality.[4]

In the last 50 years there has been a great deal of research on the prevention of VTE in hospitalised patients. This research has identified pharmacological and mechanical prophylactic therapies which, when applied appropriately, significantly reduce the incidence of hospital related VTE.[9] Pharmacological therapies recommended by the guidelines are anticoagulants that target the clotting cascade. The classes of drugs include the unfractionated and low molecular weight heparins, heparinoids, factor x inhibitors, and direct thrombin inhibitors. The recommended mechanical therapies, such as graduated compression stockings and pneumatic venous pumping devices, focus on reducing venous stasis through external compression.[10]

Despite evidence-based guidelines, research and clinic audit reveal that prophylactic therapies are underutilised and inconsistently applied.[11-13] One patient group that consistently receives suboptimal thromboprophylaxis is hospitalised medical patients.[1, 2, 14] An international audit of 37,356 medical patients' across 32 countries found that less than 40% of at-risk hospitalised medical patients were receiving the recommended mechanical and pharmacological prophylaxis.[1] This is despite the fact that between 50 and 80% of all hospital related VTE cases occur in the medical inpatient population.[15, 16]

Several strategies to improve VTE prevention in hospitalised patients have been studied.[17, 18] On the whole, the research demonstrates that active strategies such as decision support systems, audit and feedback, or continuing education are more effective than passive strategies such as simple guideline dissemination. EOV is an active implementation strategy that has been used to change clinician behaviour and improve compliance with evidence-based practice. There is evidence that it is particularly effective at influencing prescribing behaviour, but has a more variable effect on other clinical practices.[19]

EOV consists of a one-to-one educational visit by a trained facilitator to a health professional in their own clinical setting.[20] This type of face-to-face visit has also been referred to as university-based educational detailing, academic detailing, and educational visiting.[19] This strategy is one that is widely used by the pharmaceutical industry to influence the prescribing practices of doctors.[21]

EOV has a social marketing framework which differentiates it from other types of education-based implementation strategies.[20] There is little argument that commercial marketing has been highly effective at influencing consumer behaviour.[22] Social marketing attempts to apply this highly successful approach to the promotion of socially desirable behaviours.[22] Most social marketing efforts in healthcare, to date, have targeted consumers and focused primarily on disease prevention. The intervention, for example, has been widely used to improve immunisation rates in the general community.[23] There has been, however, an increasing interest in the ability of social marketing to influence clinician behaviour and improve compliance with evidence-based practice.[19, 24]

Social marketing applies the psychology of persuasion. The focus is as much on the delivery of the message and the recipient's response to it, as it is on the content of the message.[25] Opel et al [26] points out that this is, in fact, a 2000 year old approach first proposed by the Greek philosopher, Aristotle. Aristotle argued that persuasion required not only a reasonable argument and supporting data (logos), but also a messenger who is trustworthy and attentive to the audience (ethos) and a message that resonates with the audience's emotions (pathos). This ancient theory of persuasion now has a substantial body of modern social science research to support it.[27]

The Canadian Agency for Drugs and Technologies in Health's (CADTH) Rx for Change database[28] identified 31 systematic reviews that evaluated the effectiveness of EOV at changing

healthcare practices or improving patient outcomes. Only five of the 31 reviews were assessed as being of a high quality (AMSTAR score >7).[19, 29-32] Of these, two reviews [19, 29] found that EOV was generally effective for improving healthcare practices while the other three reviews had an insufficient number of studies to draw conclusions about the effectiveness of the intervention. The review by O'Brien et al[19] included 69 studies involving more than 15,000 health professional. The authors reported that EOV was consistently effective for prescribing but varied for other types of professional performance. Potential explanatory factors (baseline compliance, complexity, number of visits, study quality, number of clinicians per visit, seriousness of topic) could not explain the variation in adjusted risk difference.

Although there is a growing body of research on the use of EOV to promote evidence-based practices, there have only been two single site studies which have used this strategy to improve VTE prevention.[33, 34] Both studies reported a moderate to large improvement in VTE prophylaxis rates (14 & 21% respectively). The target population in both studies, however, was junior medical officers. To date, there has been no research examining the impact of this intervention on nurses' compliance with mechanical VTE prevention practices.

This study built on a previous VTE evidence implementation project which was conducted at the hospital from July 2009 to July 2010.[12] A planned action implementation science model developed by Grol and Wensing[35] was used to identify, diagnosis, and overcome barriers to practice change. This planned action model was chosen because it provided a logical framework that explained, in a systematic way, the means by which planned change occurs.[36] The initial phase of the project used a multifaceted intervention targeting organisational barriers to evidence uptake. The intervention included audit and feedback; policy development; alerts and reminders; and documentation aids. The project resulted in a 13% improvement in the proportion of medical patients receiving appropriate mechanical prophylaxis (52% compared to 65%). There remained, however, a significant difference between the mechanical

prophylaxis rates of surgical and medical patients on completion of the project (90% compared to 65%).

AIM

To evaluate the acceptability, utility and clinical impact of an EOV on nurses' provision of mechanical prophylaxis to hospitalised medical patients.

Ethics

Ethical approval for this research was obtained from the hospital Human Research Ethics Committee.

METHOD

Design

A prospective uncontrolled before-and-after intervention study with process evaluation using pre and post intervention clinical audits and self-administered surveys.

Setting

The study was conducted in a 250 bed Magnet designated private hospital in Sydney, Australia. The hospital employs 400 nurses who care for approximately 20,000 patients annually. The case mix of the hospital is 70% surgical, 30% medical. The hospital has seven acute inpatient units, four mixed medical-surgical and three surgical which cater for most specialties except paediatric and maternity care.

Target population

The target population for this study was nursing staff who care for medical inpatients. The following inclusion criteria were used to define the target population: Nurses working two or more shifts per week on a unit where >30% of admissions were medical patients.

Eligible medical units were identified by the medical records manager using hospital admissions data. The managers of these units distributed the participant information and consent forms to the eligible nurses. The facilitator then negotiated a convenient time and location to conduct the EOV with the consenting participants.

Target behaviours

The behaviour targeted by this intervention was the provision of mechanical prophylaxis based on the assessment of VTE risk. At the study site there was a policy governing VTE prevention which clearly defined the roles and responsibilities of nursing staff. The policy stated that nursing staff were responsible for the provision and management of mechanical prophylaxis based on the VTE risk assessment. The assessment tool was based on the national guidelines and included the identification of VTE risk factors and contraindications to prophylaxis.

Audited patients

A stratified (by unit) sample of 192 consecutive medical inpatients was audited before and after the two month EOV intervention period. The following exclusion criteria were used for patient selection: Planned or prior (previous 30 days) surgery this admission, admitted <24 hours previously, medical record or patient unavailable, inadequate documentation to complete the risk assessment.

Intervention

EOV was selected as an implementation strategy by the research team because it uses social marketing principles and the science of persuasion to overcome individual clinicians obstacles to practice change.[22] The hospital had previously implemented an intervention targeting organisational barriers to VTE prevention and EOV was chosen to compliment this prior work.

The protocol for the EOV (Figure 1) was developed by a multidisciplinary group of healthcare professionals with expertise in VTE, clinical education, healthcare improvement science, and research. The group included a vascular physician, vascular medicine fellow, nurse educator, clinical nurse specialist, pharmacist, professor of healthcare improvement, and clinical research fellow. A Cochrane systematic review[19] and the social marketing literature.[22, 26, 27] informed the protocol development process.

Figure 1 Educational Outreach Visit protocol

1. **Plan the visit**
    - Contact the nurse unit manager to gain access to the unit
    - Contact the target population by email, phone, or in person to gain consent
    - Negotiate a convenient time and location for the visit
    - Reconfirm arrangements with prior to the visit
    - Discuss with the research team any difficulties with recruitment
2. **Set the scene**
    - Ensure appropriate space for the discussion
    - Engage in small talk to place the participant at ease
    - Explain the purpose of the visit
    - Negotiate the session length (approximately 20 minutes)
    - Introduce the four key messages and identify participants specific needs
3. **Build trust, credibility and likability**
    - Mention the key opinion leaders in support of the project
    - List the project‘s academic and clinical affiliations
    - Highlight your own clinical expertise in the area

- Attempt to uncover personal similarities between the participant and yourself
- Offer genuine praise where appropriate

4. **Promote two-sided communication**
    - Ask open ended questions
    - Use minimal encouragement techniques
    - Paraphrase and reflect on the participants comments
    - Anticipate and acknowledge controversial issues
    - Overcome any objections and handle challenging responses
5. **Deliver key message(s)**
    - VTE is an important healthcare issue
    - Assess individual patient risk
    - Provide evidence-based VTE prophylaxis and patient education
    - Monitor and reassess each patient during their hospital stay
6. **Wrap-up and reflect**
    - Reflect on the discussion
    - Reiterate the key message(s) discussed
    - Give the participant the printed resource material to keep
    - Gain commitment to trial the new practices
7. **Provide follow-up**
    - Follow-up via email, phone, or in person
    - Fulfil any commitments made during the visit

A registered nurse with expert knowledge in VTE was recruited to the role of EOV facilitator. This person was a senior staff member in the hospital with over twenty years' experience. The EOV facilitator and other members of the research team attended a two day intensive workshop on social marketing and persuasive communication techniques. The workshop was run by an independent, not-for-profit organisation (National Prescribing Service) that uses this intervention extensively to promote the quality use of medicines in Australia. The training involved role play, peer review, and self-reflection techniques.

The specific learning objectives of the workshop were:

- To outline the context in which educational outreach visiting occurs;
- To identify and describe strategies that are effective in promoting behaviour change;
- To demonstrate specific skills development in:
    - One-to-one communication techniques;
    - Relating information clearly;
    - Addressing issues and concerns;
    - Gaining commitment to trialling new practices.

The content of the EOV was limited to four key messages: 1) VTE is an important healthcare issue which results in significant mortality, morbidity and resource expenditure; 2) patients must have their VTE risk assessed including clotting risk, bleeding risk, and contraindications to prophylaxis; 3) patients must receive appropriate prophylaxis based on their risk assessment; and 4) patients must be monitored for signs of VTE or prophylaxis related adverse events. These verbal messages were supported by a concise graphic educational resource given to the participant by the facilitator during the EOV.

The project budget enabled the facilitator to be seconded to the study for a total of 120 hours over the two month intervention period. Two trial visits were conducted prior to the intervention period to identify potential issues and familiarise the facilitator with the protocol. The trial visits were conducted with clinicians from the surgical units who were not participating in the study. During the intervention period, the facilitator received support from the research team in weekly debriefing sessions.

Measures and data collection

Outcome (clinical impact) and process (acceptability and utility) measures were incorporated into the design of this study. Process measures were included to help provide a greater understanding of this complex intervention which is known to have variable effectiveness.[19]

Acceptability

The acceptability of the EOV was measured in post intervention participant and facilitator surveys. The participants' survey and self-addressed envelope were left by the facilitator at the completion of the EOV. The survey contained eight questions in total. Six questions related to the effectiveness of the EOV at increasing the participants' knowledge and addressing their concerns about VTE prophylaxis for medical inpatients. These questions were answered on a five point likert scale (extremely ineffective to extremely effective). Two questions asked how likely was it that they would participate in a program such as this in the future, and how likely was it that the intervention would influence their clinical practice. These questions were answered on a five point likert scale (extremely likely to extremely unlikely). The EOV facilitator also completed a post intervention survey appraising each individual participant's perceived level of interest, participation and comprehension. These three questions were answered on a five point likert scale (very low to very high).

Utility

How the EOV was implemented and the degree to which the intervention was implemented as intended was recorded on a data collection form by the facilitator. The recorded data included the demographic information of participants, the time and effort spent arranging the EOV, the time spent conducting the EOV, the number of interruptions and the time spent on them, the location of the EOV, and whether or not a commitment was gained from the participant to trial

the new practices. The facilitator's self-assessed level of adherence to all of the elements of the study protocol was also collected. The structured protocol (Figure 1) acted as a checklist to aid the reflection process. Two trial visits with self-reflection were also conducted prior to the intervention delivery period.

Clinical impact

Two measures were used to assess the impact of the intervention on clinical practice: 1) the proportion of medical inpatients with a documented VTE risk assessment and 2) the proportion of medical inpatients who received appropriate mechanical VTE prophylaxis. The data were collected in pre and post intervention audits. The audits were conducted using an audit tool based on national VTE prevention guidelines.[9] These guidelines had been endorsed by the hospital's pharmacy and therapeutics committee and formed the basis of the hospital VTE prevention policy. The audit tool had been trialled by the researchers in a prior evidence implementation study.[12] The audits were conducted by a registered nurse who had been trained by the researchers in the use of the tool. The auditor recorded each eligible patient's VTE risk status and contraindications to prophylaxis before observing them to determine the presence or absence of appropriate mechanical prophylaxis measures. The appropriateness of the prophylaxis was assessed against the above mentioned VTE prevention guidelines. Depending on the patients risk status 'appropriate prophylaxis' was either no prophylaxis (low risk and ambulatory); graduated compression stockings (higher risk and ambulatory); or graduated compression stockings and intermittent pneumatic compression device (higher risk and non-ambulatory). The auditor had access to expert adjudication from a consultant vascular physician when required.

Sample size

The study was designed to detect a 10% (50% to 60%) improvement in the proportion of medical inpatients receiving appropriate mechanical prophylaxis. An a priori power calculation was performed[37] and a sample size of 180 patients was required to power the study at 80% with a significance level of 5%.

The literature provided limited assistance in estimating the sample size because of the variation in published effect sizes. A pilot study conducted by the researchers enabled a more accurate estimate of the potential effect size in this particular context.[38] The pilot study resulted in a 16% (59% to 75%) improvement in the proportion of medical patients who received mechanical VTE prophylaxis.

Statistical methods

The data were entered into SPSS version 18 for analysis. Continuous data were summarised as median and interquartile range and categorical data were summarised as number and percentage. For comparisons between groups, the Chi-square test was used for dichotomous variables (appropriate prophylaxis, risk assessment, risk factors, sex, specialty unit, admitting specialty, staff designation) and the Mann-Whitney U test was used for non-parametric continuous variables (age, number of years post registration). The differences in pre and post intervention prophylaxis and risk assessment rates were calculated with 95% confidence intervals. The p value for statistical significance was set at <0.05.

RESULTS

Target population

Four units were identified as having a medical population >30%. There were 120 nurses from these units who met the inclusion criteria. Of the eligible nurses, 85 (71%) agreed to participate

in the intervention and 35 (29%) declined or were unavailable. The interventions were conducted over a two month period from August to September 2011. Of the 85 participants who received an EOV intervention, 76 (89.4%) returned the post intervention participant survey. There were no significant differences in sex, number of years post registration, and professional designation between nurses who received the intervention and those who declined it. The number of nurses who declined the intervention differed significantly between units (χ^2 =35.4, df 3, p<0.001). Three units had 11% to 14% of the nurses' decline the EOV while one unit (cardiothoracic/ respiratory) had 63% decline (adjusted residual 5.9) (see table 1).

Table 1 Characteristics of the target population.

Characteristics		Received the intervention (n=85)	Declined or unavailable (n=35)	P value
Age	Median (IQ range)	29 (25-35)	N/A	
Years post registration		5 (2-9)	8 (3-15)	0.069*
Sex	Number (%)			1.0^
Male		12 (14)	5 (14)	
Female		72 (86)	30 (86)	
Specialty unit				<0.001^
Neurology/ oncology		24 (28)	4 (11)	
Vascular/ gastroenterology		26 (31)	4 (11)	
Cardiothoracic/ respiratory		9 (10)	22 (63)	
Cardiology		26 (31)	5 (14)	
Designation				0.275^
Registered Nurse		67 (79)	23 (66)	
Enrolled Nurse		1 (1)	1 (3)	
Clinical Nurse Specialist		17 (20)	11 (31)	

Percentages may not add up to 100 due to missing data. N/A= not available. *Mann-Whitney U test. ^Pearson Chi-square.

Audited patients

The 192 patients who met the criteria were audited before (n=98) and after (n=94) the EOV intervention period. There were no differences between the two groups in age, sex, admitting specialty, and inpatient unit. The overall risk status was comparable with 86 (87.8%) patients at high-risk pre intervention compared to 87 (92.6%) post intervention. The pre intervention group had significantly more patients with two or more additional risk factors (χ^2=6.7, df 1, p=0.01) while the post intervention group had more patients with active cancer (χ^2 =4.4, df 1, p=0.03). There were no other differences between the two samples of patients (see table 2).

Acceptability

Of the 76 nurses who returned the post intervention evaluation, 74 (97.4%) felt that the EOV was effective or extremely effective at increasing their knowledge and addressing their concerns about VTE prophylaxis for medical inpatients. The participants also agreed that the EOV was effective at providing information on the four key messages outlined in the study protocol: Seventy (92.1%) participants reported that the EOV was effective or extremely effective at communicating the significance of VTE; 72 (96%) felt that the importance of VTE risk assessment was effectively or extremely effectively communicated; and 71 (94.7%) agreed that the EOV was effective or extremely effective at providing information on the selection and ongoing monitoring of appropriate prophylaxis. When asked how likely it would be that they would participate in another EOV, 74 (97.4%) participants reported that it would be likely, or extremely likely. The same number (n=74, 97.4%) felt that the EOV was likely, or extremely likely to influence their clinical practice. When the EOV facilitator was asked to rate the participants' perceived interest, participation and comprehension in the EOV, she reported that 79 (95.2%) of the participants had a high or very high level of interest and participation, and 71 (85.5%) had a high to very high level of comprehension (table 3).

Table 2 Characteristics of the audited patients.

		Pre intervention (n=98)	Post intervention (n=94)	P Value
Age	Median (IQ range)	72 (58-82)	75.5 (63.5-85)	0.15*
Sex	Number (%)			0.19^
Male		43 (43.9)	50 (53.2)	
Female		55 (56.1)	44 (46.8)	
Admitting specialty				0.67^
Cardiac		36 (36.7)	32 (34)	
Cardiothoracic/ respiratory		9 (9.2)	7 (7.4)	
Gastroenterology		7 (7.1)	12 (12.8)	
Oncology		11 (11.2)	14 (14.9)	
Neurology		16 (16.3)	11 (11.7)	
Renal		11 (11.2)	7 (7.4)	
Vascular		8 (8.2)	11 (11.7)	
Inpatient unit				0.99^
Neurology/ oncology		25 (25.5)	23 (24.5)	
Vascular/ gastroenterology		25 (25.5)	24 (25.5)	
Cardiothoracic/ respiratory		25 (25.5)	25 (26.6)	
Cardiology		23 (23.5)	22 (23.4)	
High risk of VTE		86 (87.8)	87 (92.6)	0.26^
Risk factors present				
Ischaemic stroke		10 (10.2)	17 (18.1)	0.11^
History of VTE		29 (29.6)	20 (21.3)	0.18^
Active cancer		7 (7.1)	16 (17)	0.03^
Decompensated heart failure		17 (17.3)	20 (21.3)	0.49^
Acute on chronic lung disease		11 (11.2)	9 (9.6)	0.7^
Age > 60years and immobile		73 (74.5)	62 (66)	0.19^
Acute inflammatory disease		6 (6.1)	12 (12.8)	0.11^
Multiple additional risk factors		30 (30.6)	14 (14.6)	0.01^
Additional risk factors				
Immobility		26 (26.5)	25 (26.6)	0.99^
Familial history of VTE		12 (12.2)	9 (9.6)	0.55^
Oestrogen therapy		1 (1)	2 (2.1)	0.53^
Obesity		7 (7.1)	9 (9.6)	0.54^
Thrombophilia		1 (1)	1(1.1)	0.97^
Active inflammation		6 (6.1)	4 (4.3)	0.56^

Percentages may not add up to 100 due to missing data. IQ= Inter Quartile range. *Mann-Whitney U test. ^Pearson Chi-square.

Table 3 Acceptability of the Educational Outreach Visit

How effective was the Educational Outreach Visit in...	**Extremely ineffective**	**Ineffective**	**Unsure**	**Effective**	**Extremely effective**
Increasing or refreshing your knowledge about VTE prophylaxis for medical patients?	2 (2.6)	0 (0)	0 (0)	37 (48.7)	37 (48.7)
Addressing concerns you have had about providing VTE prophylaxis to medical patients?	2 (2.6)	0 (0)	0 (0)	40 (52.6)	34 (44.7)
Providing information about the significance of VTE as a healthcare issue?	2 (2.6)	0 (0)	4 (5.3)	28 (36.8)	42 (55.3)
Providing information about VTE risk assessment for medical patients?	1 (1.2)	1 (1.2)	1 (1.2)	29 (38.7)	43 (57.3)
Providing information about selecting appropriate VTE prophylaxis for medical patients?	2 (2.7)	0 (0)	2 (2.7)	36 (48)	35 (46.7)
Providing information about the ongoing monitoring of patients risk and response to prophylaxis?	1 (1.2)	1 (1.2)	2 (2.7)	37 (49.3)	34 (45.3)
How likely is it that...	**Extremely unlikely**	**Unlikely**	**Unsure**	**Likely**	**Extremely likely**
You will participate in another educational program such as this one in the future?	1 (1.2)	0 (0)	1 (1.2)	34 (44.7)	40 (52.6)
This educational visit will influence your clinical practice?	1 (1.2)	0 (0)	1 (1.2)	28 (36.8)	46 (60.5)
What was the participants perceived level of ...	**Very Low**	**Low**	**Average**	**High**	**Very high**
Interest in the topic presented?	0 (0)	0 (0)	4 (4.8)	45 (54.2)	34 (41)
Participation during the visit?	0 (0)	0 (0)	4 (4.8)	45 (54.2)	34 (41)
Comprehension of the information provided?	0 (0)	0 (0)	12 (14.5)	26 (31.3)	45 (54.2)

Utility

Table 4 provides data on the EOV intervention. The median number of times it was necessary to make contact with the participant to arrange an EOV was 2 (interquartile range 1-2) and the median number of cancellations was 0 (interquartile range 0-1). The median time spent on each EOV was 63 minutes (interquartile range 49-85) which was made up of time spent arranging the EOV (median 20 minutes, interquartile range 15-20); customising the material (median 10 minutes, interquartile range 10-15); waiting for the participant (median 20 minutes, interquartile range 0-30) and conducting the EOV (median 11.5 minutes, interquartile range 10-15). The majority of visits was conducted in an office or education room (n=35, 41.2%). The rest were split evenly between the clinical area (n=25, 29.4%) and other public areas (n=25, 29.4%). At the completion of the EOV, 84 (98.8%) of the 85 participants gave a verbal commitment to trial the new evidence-based mechanical VTE prevention practices. The facilitator's self-reported adherence to the EOV protocol was 90% (interquartile range 87.5-92.5).

Clinical impact

There was no measurable improvement in the proportion of patients with a documented VTE risk assessment following the intervention period (10.2% to 8.5%, -1.7% improvement, 95% CI -7.0 to 10.3, p=0.68). There was also no improvement in the proportion of patients who received appropriate mechanical VTE prophylaxis (42.8% to 42.6%, -0.3% improvement, 95% CI -13.4 to 14, p=0.96). Removing patients who were at low-risk of VTE from the analysis made no significant difference to this result (37.2% to 40.2%, 3.0% improvement, 95% CI -11.0 to 17.1, p=0.68) (table 5).

Table 4 Utility of the Educational Outreach Visit.

Number of contacts needed to arrange the EOV	Median (IQ range)	
Number of contacts needed to arrange the visit		2 (1-2)
Number of cancelled visits prior to the visit		0 (0-1)
Time spent arranging and conducting the EOV		
Time spent arranging the visit		20 (15-20)
Time spent customising material		10 (10-15)
Time spent waiting for the participant		20 (0-30)
Time spent with the participant during the visit		11.50 (10-15)
Time spent on interruptions		0 (0-0)
Total time spent on the visit		63 (49-85)
Adherence to the EOV protocol		90 (87.5-92.5)
Location of the EOV	Number (%)	
Clinical area		25 (29.4)
Office or education room		35 (41.2)
Other public area		25 (29.4)
Other private area		0 (0)
Outcome of the EOV		
Participant agreed to trial the new practices		84 (98.8)

Table 5 Clinical impact of the Educational Outreach Visit.

	Pre (*n*= 98) *n* (%)	Post (*n*=94) n (%)	% Improvement (95% CI)	P =
Documented VTE risk assessment	10 (10.2)	8 (8.5)	-1.7 (-7.0 to 10.3)	0.68
Appropriate mechanical VTE prophylaxis	42 (42.9)	40 (42.6)	-0.3 (-13.4 to 14.0)	0.96
Appropriate mechanical VTE prophylaxis (high-risk)	32 (37.2)	35 (40.2)	3.0 (-11.0 to 17.1)	0.68

DISCUSSION

Improving VTE prophylaxis in hospitalised patients is a particularly challenging task. Our study has produces new knowledge on the acceptability, utility and clinical impact of EOV on nurses' provision of mechanical prophylaxis to hospitalised medical patients. We found that there were no measurable improvements in VTE prevention practices despite the use of this highly targeted implementation strategy. In fact, the proportion of medical inpatients assessed for their risk of VTE decreased by 1.7% and the proportion of medical patients provided appropriate mechanical prophylaxis decreased by 0.3% following the intervention period. These results are indicative of the variability in effectiveness of EOV reported in the literature.[19] The adjusted difference in compliance with desired practices in the Cochrane systematic review by O'Brien et al[19] ranged from -3% to 64%. The authors concluded that EOV is an intervention of varying effectiveness with outcomes highly dependent on the specific targeted population and target behaviour.

Studies examining the use of EOV for VTE prevention clearly demonstrate this variability in effectiveness. Two previous studies[33, 34] which both reported significant improvements targeted the prescription of pharmacological prophylaxis by junior doctors, while our study targeting nurses' use of mechanical prophylaxis, found no significant improvement in practice. It is difficult to fully explain the reason for this significant variation in effect, although it is clear from our results that it is not related to the perceived acceptability of the intervention to nurses. O'Brien[19] recommends that future studies on EOV integrate a process evaluation into the design to provide greater insight into this complex intervention.

There has been much criticism of implementation science studies which have not included process evaluation.[39] A strength of our study was that it incorporated a process evaluation which was based on United Kingdom Medical Research Council guidance on evaluation of

complex interventions[40]. Stetler[41], a nurse and implementation researcher describes the importance of process evaluation in implementation research:

> Evaluative information is needed beyond clinical impact of the change effort and beyond discovering whether a chosen adoption strategy worked. Implementation researchers need to answer critical questions about the feasibility of implementation strategies, degree of real-time implementation, status and potential influence of contextual factors, response of project participants, and any adaptations necessary to achieve optimal change.

The data collected in the process evaluation enabled a much greater assessment of the effectiveness of the intervention in this particular context. An important point and one that will benefit clinicians and researchers who wish to use this strategy, is our finding that four and a half minutes of organisation and preparation was required for every minute spent face-to-face with participants. The data also revealed that the median time spent with each participant was only 11.5 minutes (interquartile range 10-15) and not the 20 minutes proposed in the protocol. The exposure of the participants to the intervention was therefore considerably less than expected which may have had a bearing on the overall results. Importantly, although there was no discernible improvement in patient care, our study did find that nurses felt the intervention was an acceptable evidence implementation strategy which would positively influence their clinical practice. They felt the EOV was effective at increasing their knowledge and addressing their concerns about VTE prophylaxis for medical inpatients.

Having both process and outcome data should inform researchers and clinicians assessment of the overall benefit of a particular intervention in a given context.[39] The disparity between the process and outcome results in this study does potentially

complicate this task. Barry[42] points out, in his history of the evolution of marketing theory, that commercial marketing has similarly struggled with assessing the benefit of marketing campaigns. To directly measure the improvement in sales and profits produced by marketing is highly complex, if indeed, possible at all. Instead, marketers have contended that the effectiveness of a marketing campaign should be measured by its impact on a hierarchy of positive responses such as the ability to recognise brand names, recall main copy points, generate positive attitudes, or change an image.

The 'hierarchy of effects' model has been used by marketers as a framework for assessing the overall benefit of a campaign. The model describes the six stages a person moves through when making a purchase. The stages are awareness; knowledge; liking; preference; conviction; and purchase.[42] A marketing campaign may, for example, progress a consumer group from the awareness stage to the liking stage and this may well be considered a beneficial outcome.

The 'hierarchy of effects' model is similar to a number of stages of change models theorised by implementation researchers[43-45]. Pathman's[45] 'awareness-to-adherence' model, for example, describes four very similar stages that a clinician moves through when adopting a new clinical practice. These stages are awareness; agreement; adoption; and adherence. With these models in mind, an implementation strategy could be said to have a positive effect on evidence uptake without necessarily producing a measurable improvement in clinical practice. For example, an intervention may successfully shift a target population from an awareness stage to an agreement stage of change. Stages of change theory may help explain the results of this study and the variability in the effectiveness of EOV in general. This theory should be included in the design and evaluation of future studies that include social marketing based interventions such as EOV.

Strengths and limitations

Due to the resource-intensive nature of this implementation strategy participants were only able to receive one EOV during the intervention period. Previous studies have reported a greater clinical impact when multiple visits were performed with the same participants.[19] Future studies in this field should evaluate the accumulative effect of multiple visits to this target population and include a more in depth follow up of the nursing staff to better understand why the intervention did or did not change practice

The uncontrolled before and after design is another potential weakness as it is known to be vulnerable to the influence of fluctuating trends or sudden organisational changes which make it difficult to attribute improvements solely to the intervention. Having only one post-implementation data point also means that it is unknown whether the observed improvements in practice would be sustained or improved upon over time. There is also some evidence to suggest that the results of uncontrolled before and after studies may overestimate the effects of interventions[46] although there is no evidence of that in this study.

Our study was limited by the fact that it was conducted at one site, a metropolitan private hospital. As a result, it is difficult to ascertain how these results were influenced by previous VTE implementation efforts undertaken at the hospital. What can be said is that in this context it is clear that the EOV provided no additional benefit over and above the improvements produced by previous implementation efforts. This could be addressed by repeating the study at a number of sites using a cluster randomised controlled design which is the gold standard method for evaluating implementation strategies.[47] This trial should also include an evaluation of the ongoing sustainability of the intervention.

While the study was limited in size (the number of sites and participants) it did include a process evaluation which provided an extra degree of depth to the research. Future research

should include qualitative methods to follow up the nursing staff to better understand why the intervention did or did not change practice.

CONCLUSION

This is one of only a three studies to evaluate the use of EOV to improve VTE prophylaxis and it is the only published study to focus specifically on medical inpatients and nurses use of mechanical prophylaxis. This study found that nurses reported_EOV to be an acceptable strategy with a majority of nurses reporting that it increased their knowledge and addressed their concerns about mechanical prophylaxis. Importantly, they also expressed a willingness to adopt the new evidence-based practices. However, the acceptability of an intervention should also be considered in relation to its utility and clinical impact. Our study confirmed the resource intensive nature of EOV: Four and a half minutes of preparation was required for every minute of time spent face-to-face with participants. We also found that, despite the participants' willingness to trial the new practices, there was no measurable improvement in patient care following the EOV. Further research into the specific mechanism of action is required to explain the variability in clinical effect seen with this intervention.

REFERENCES

1. Bergmann JF, Cohen AT, Tapson VF, Goldhaber SZ, Kakkar AK, Deslandes B, et al. Venous thromboembolism risk and prophylaxis in hospitalised medically ill patients. The ENDORSE Global Survey. Throbosis and Haemostasis. 2010;103:736-48.

2. Rothberg MB, Lahti M, Pekow PS, Lindenauer PK. Venous thromboembolism prophylaxis among medical patients at US hospitals. Journal of General Internal Medicine. 2010;25:489-94.

3. Wallin L. Knowledge translation and implementation research in nursing. International Journal Of Nursing Studies. 2009;46:576-87.

4. Access Economics. The burden of venous thromboembolism in Australia, Report for The Australia and New Zealand Working Party on the Management and Prevention of Venous Thromboembolism. Sydney: Access Economics; 2008.

5. National Institute of Health and Clinical Excellence. Reducing the risk of venous thromboembolism in patients admitted to hospital. London2010.

6. Heit JA, O'Fallon WM, Petterson TM, Lohse CM, Silverstein MD, Mohr DN, et al. Relative impact of risk factors for deep vein thrombosis and pulmonary embolism: a population-based study. Archives Of Internal Medicine. 2002;162:1245.

7. Mason C. Venous thromboembolism: A chronic illness. Journal of Cardiovascular Nursing. 2009;24:s4-s7.

8. Spencer FA, Lessard D, Emery C, Reed G, Goldberg RJ. Venous thromboembolism in the outpatient setting. Archives Of Internal Medicine. 2007;167:1471.

9. The Australian and New Zealand Working Party on the Management and Prevention of Venous Thromboembolism. Prevention of Venous Thromboembolism: Best Practice Guidelines for Australia and New Zealand (5th ed). Sydney: Health Education and Management Innovations; 2010.

10. National Health and Medical Research Council. Clinical practice guideline for the prevention of venous thromboembolism (deep vein thrombosis and pulmonary embolism) in patients admitted to Australian hospitals. Melbourne: National Health and Medical Research Council; 2009.

11. Cohen AT, Tapson VF, Bergmann J-F, Goldhaber SZ, Kakkar AK, Deslandes B, et al. Venous thromboembolism risk and prophylaxis in the acute hospital care setting (ENDORSE study): a multinational cross-sectional study. Lancet. 2008;371:387-94.

12. Duff J, Walker K, Omari A. Translating venous thromboembolism (VTE) prevention evidence into practice: a multidisciplinary evidence implementation project. Worldviews Evid Based Nurs. 2011;8:30-9.

13. Clavijo-Alvarez JA, Pannucci CJ, Oppenheimer AJ, Wilkins EG, Rubin JP. Prevention of venous thromboembolism in body contouring surgery: A national survey of 596 ASPS surgeons. Ann Plast Surg. 2011;66:228.

14. Vardi M, Dagna L, Haran M, Duckit R. Attitudes towards and practice of venous thromboembolism prevention in general internal medicine wards: A multinational survey from member countries of the European Federation of Internal Medicine. Thrombosis research. 2011;129:573-6.

15. Alikhan R, Peters F, Wilmott R, Cohen A. Fatal pulmonary embolism in hospitalised patients: a necropsy review. J Clin Pathol. 2004;57:1254.

16. Goldhaber SZ, Tapson VF. A prospective registry of 5,451 patients with ultrasound-confirmed deep vein thrombosis. The American journal of cardiology. 2004;93:259-62.

17. Tooher R, Middleton P, Pham C, Fitridge R, Rowe S, Babidge W, et al. A systematic review of strategies to improve prophylaxis for venous thromboembolism in hospitals. Ann Surg. 2005;241:397-415.

18. Amin AN, Deitelzweig SB. Optimizing the prevention of venous thromboembolism: recent quality initiatives and strategies to drive improvement. Joint Commission journal on quality and patient safety / Joint Commission Resources. 2009;35:558-64.

19. O'Brien M, Rogers S, Jamtvedt G, Oxman A, Odgaard-Jensen J, Kristoffersen D, et al. Educational outreach visits: effects on professional practice and health care outcomes. Cochrane Database of Systematic Reviews. 2007;4.

20. Soumerai S, Avorn J. Principles of educational outreach ('academic detailing') to improve clinical decision making. JAMA. 1990;263:549-56.

21. Avorn J, Choudhry NK. Funding for medical education: maintaining a healthy separation from industry. Circulation. 2010;121:2228-34.

22. Morris ZS, Clarkson PJ. Does social marketing provide a framework for changing healthcare practice? Health Policy. 2009;91:135-41.

23. Szilagyi P, Vann J, Bordley C, Chelminski A, Kraus R, Margolis P, et al. Interventions aimed at improving immunization rates. The Cochrane Library. 2004.

24. Luck J, Hagigi F, Parker LE, Yano EM, Rubenstein LV, Kirchner JAE. A social marketing approach to implementing evidence-based practice in VHA QUERI: the TIDES depression collaborative care model. Implementation Science. 2009;4:64.

25. Evans WD, McCormack L. Applying social marketing in health care: communicating evidence to change consumer behavior. Med Decis Making. 2008;28:781-92.

26. Opel DJ, Diekema DS, Lee NR, Marcuse EK. Social marketing as a strategy to increase immunization rates. Arch Pediatr Adolesc Med. 2009;163:432-7.

27. Cialdini RB. Harnessing the Science of Persuasion. (cover story). Harv Bus Rev. 2001;79:72-9.

28. Canadian Agency for Drugs and Technologies in Health. Rx for Change Database. Canada: CADTH; 2012.

29. Nkansah N, Mostovetsky O, Yu C, Chheng T, Beney J, Bond CM, et al. Effect of outpatient pharmacists' non-dispensing roles on patient outcomes and prescribing patterns. Cochrane Database Syst Rev. 2010;7.

30. Faulkner A, Mills N, Bainton D, Baxter K, Kinnersley P, Peters TJ, et al. A systematic review of the effect of primary care-based service innovations on quality and patterns of referral to specialist secondary care. The British Journal of General Practice. 2003;53:878.

31. Forsetlund L, Bjørndal A, Rashidian A, Jamtvedt G, O'Brien M, Wolf F, et al. Continuing education meetings and workshops: effects on professional practice and health care outcomes. Cochrane Database of Systematic Reviews. 2009;2.

32. O'Brien MA, Freemantle N, Oxman AD, Wolfe F, Davis D, Herrin J. Continuing education meetings and workshops: effects on professional practice and health care outcomes. The Cochrane Library. 2004.

33. Roberts G, Adams R. Impact of introducing anticoagulation-related prescribing guidelines in a hospital setting using academic detailing. Therapeutics and Clinical Risk Management. 2006;2:309-16.

34. Grupper A, Rudin D, Drenger B, Varon D, Gilon D, Gielchinsky Y, et al. Prevention of perioperative venous thromboembolism and coronary events: differential responsiveness to an intervention program to improve guidelines adherence. International Journal for Quality in Health Care. 2006;18:123-6.

35. Grol R, Wensing M. Effective implementation: A model In: Grol R, Eccles M, Wensing M, editors. Improving patient care : the implementation of change in clinical practice Edinburgh: Elsevier 2005. p. 41-57.

36. Grol R, Bosch M, Hulscher M, Eccles M, Wensing M. Planning and Studying Improvement in Patient Care: The Use of Theoretical Perspectives. Milbank Quarterly. 2007;85:93-138.

37. Faul F, Erdfelder E, Lang A-G, Buchner A. G*Power 3: a flexible statistical power analysis program for the social, behavioral, and biomedical sciences. Behavior Research Methods. 2007;39:175-91.

38. Li F, Walker K, McInnes E, Duff J. Testing the effect of a targeted intervention on nurses' compliance with "best practice" mechanical venous thromboembolism prevention. Journal of Vascular Nursing. 2010;28:92-6.

39. Glasziou P, Chalmers I, Altman DG, Bastian H, Boutron I, Brice A, et al. Taking healthcare interventions from trial to practice. BMJ. 2010;341:384-7.

40. Craig P, Dieppe P, Macintyre S, Michie S, Nazareth I, Petticrew M. Developing and evaluating complex interventions: the new Medical Research Council guidance. British Medical Journal. 2008;337:a1655.

41. Stetler C, Legro M, Wallace C, Bowman C, Guihan M, Hagedorn H. The role of formative evaluation in implementation research and the QUERI experience. J Gen Intern Med. 2006;21:S1 - S8.

42. Barry TE. The development of the hierarchy of effects: An historical perspective. Current issues and Research in Advertising. 1987;10:251-95.

43. Grol R. Implementing guidelines in general practice care. Quality in Health Care. 1992;1:184-91.

44. Prochaska JO, Redding CA, Evers K. The transtheoretical model and stages of change. Health behavior and health e—ducation San Francisco. 1997:61-83.

45. Pathman DE, Konrad TR, Freed GL, Freeman VA, Koch GG. The awareness-to-adherence model of the steps to clinical guideline compliance: the case of pediatric vaccine recommendations. Medical Care. 1996;34:873.

46. Grimshaw J, Campbell M, Eccles M, Steen N. Experimental and quasi-experimental designs for evaluating guideline implementation strategies. Family Practice. 2000;17:11-6.

47. Eccles M, Grimshaw J, Campbell M, Ramsay C. Research design for studies evaluating the effectiveness of change and improvement strategies. In: Grol R, Baker R, Moss F, editors. Quality improvement research : understanding the science of change in health care London :: BMJ Books; 2004. p. 97-114.