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Venous Thromboembolism Prevention

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Venous Thromboembolism Prevention

A Paper Submitted in Partial Fulfillment of the Requirements

For NURS5382

In the School of Nursing

The University of Texas at Tyler

by

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Executive Summary

Venous thromboembolism (VTE), which includes deep vein thrombosis (DVT) and pulmonary embolism (PE), is a key public health concern that affects 350,000 to 600,000 Americans annually (U.S. Department of Health and Human Services. Surgeon General's Call to Action to Prevent Deep Vein Thrombosis and Pulmonary Embolism, 2018). VTE is a problem primarily of patients currently hospitalized or recently hospitalized and is estimated to be among the most common preventable causes of hospital death (Heit, 2015). Symptomatic DVTs and PEs are linked to prolonged inpatient stays and fatality rates that can be as high as 15% (Heit, 2015). VTEs usually require therapeutic anticoagulation for at least 3 months (Khan et al., 2019). Greater than 20 percent of patients with a proximal DVT/PE will suffer a recurrent event once anticoagulation has stopped (Khan et al., 2019).

Thromboprophylaxis for inpatients at risk for VTE can reduce the rate for VTE by at least 30 % (Khan et al., 2019). Thromboprophylaxis has a small occurrence of significant bleeding complications, plus has known cost-effectiveness for healthcare systems (Khan et al., 2019). Many medical bodies of authority have created guidelines demonstrating the most appropriate use of thromboprophylaxis, but unfortunately study after study reveals inadmissibly low rates of thromboprophylaxis in patients at risk. This compelling mountain of facts poses a persuasive need for improvement which lead to the following PICOT question: In staff nurses (P) how does venous thromboembolism prevention education (I) compared to no venous thromboembolism prevention education (C) affect compliance with the established thromboembolism protocol (O) during the three months following completion of the required education for the intervention group (T)?

This gap in the implementation of VTE prophylaxis between evidence-based best practice and actual practice within Christus Trinity Mother Francs Health System (CTMHS) has not gone unnoticed and is a key prospect for improvement. Therefore, an educational change project that focuses on the bedside nurse and the importance of VTE prevention and protocol compliance is vital for CTMFHS and the patients within the facility. CTMFHS needs to support this project to support its mission of extending the healing ministry of Jesus Christ.

Rationale

Venous thromboembolism (VTE) is a leading cause of death and disability among hospitalized patients. Astonishingly, “the annual incidence rates of VTE among patients range from 104 to 183 per 100,000 person-years, rates that are similar to that of a stroke” (Heit, 2015, p. 464). VTEs are preventable and treatable using suitable prophylaxis. Nurses are pivotal in preventing and treating VTEs due to their innate involvement in a patient’s care. Compliance to appropriate VTE prophylaxis is at the forefront of patient safety. With proper staff education on VTE prophylaxis, compliance with the necessary protocols can improve patient outcomes.

Many hospitals including CTMFHS currently have VTE protocols. However, staff compliance with the protocols varies by institution. According to a study by Haut et al., (2015), patients at risk for VTE received suboptimal care and missed VTE prophylaxis medication doses and thus increased the occurrence of VTEs (Haut et al., 2015). Current rates of VTE protocol compliance must improve for patient safety improvement.

My change project is designed to improve patient safety through the creation, implementation, and evaluation of an education module designed to increase bedside nurse’s education and improve compliance with the healthcare system’s VTE protocols. This educational module will not only improve patient safety, but will also increase revenue for the

health system, because Medicare does not pay for hospital acquired VTEs (Thirukumaran et al., 2018). This means that hospitals can lose an average of \$7,600 for each Medicare beneficiary that gets a hospital acquired VTE (Thirukumaran et al., 2018). This change project can increase the health system's revenue exponentially. In addition, bedside nurses are these delicate patients' last line of defense. Therefore, this change project focuses on frontline nurses and the importance of VTE education.

Literature Synthesis

Strategical Approaches

Strategical approaches are paramount when implementing a successful VTE program. Duff et al., (2011) used audit and feedback, documentation and decision support aids, provider education, and policy/procedure. This provider education proved more effective on physicians than nurses, which raised concern about the quality of education provided to the nurses within the study. An observational study by Cardoso et al. (2016) used multiple strategical approaches to implement a VTE prophylaxis platform. To improve protocol compliance, the researchers used "1) scientific meetings, 2) practical training on computerized tools, and 3) admission and permanent training programs for physicians, nurses, and physiotherapists" (Cardoso et al., 2016, p. 492). Door decals were also identified as helpful aids that assisted staff in increasing VTE bundle compliance (Aberg et al., 2018). Another study discovered significant improvement in critical care nurses' compliance with the clinical practice guidelines in place on DVT prophylaxis and protocols after they received appropriate educational material regarding the importance of VTE prophylaxis and protocols (EL Mokadem & EL-Sayed, 2019). Once the appropriate strategical approaches were identified, VTE compliance rates increased. This is important for patients.

Barriers

A successful VTE education program can only happen once barriers are overcome. Pai et al. (2013) named common barriers to overcome including low staff attendance to educational sessions, heavy workloads during educational opportunities, and information overload. Aberg, Fulkerson, and Altman (2018) recognized significant barriers that affected the VTE compliance rates, such as poor accessibility and poor wording of the VTE bundle algorithm, and reduced availability of sequential compression device supplies and equipment. Lazure et al. noted one of the most common barriers as “lack of educational materials” (Lazure et al., 2018, p. 104). Barriers needed to be overcome before a successful VTE program could be implemented.

Proactivity

Proactivity among nurses was noted as a benefit when it came to VTE compliance rates. Adams’ (2015) concept analysis showed how increased VTE prevention use could improve with proactive nursing staff. One insightful fact was that nurses have a reactive response to VTE rather than a proactive one (Adams, 2015). Nurses who took personal initiative to take charge of their patients, by helping the nurse’s defining attributes, and utilizing feedback-seeking behavior (Adams, 2015). Secondly, nurses needed proper instruction to understand the importance of VTE risk assessments and the minute details that must be carried out to fully support and implement a VTE prophylaxis prevention program (Adams, 2015). Thirdly, nurses who felt empowered to own a project, noted more improvement in compliance. “Nurses can receive inordinate amounts of training in VTE prevention, but without making the conscious decision to take charge this training is worthless – they are the key to successful implementation” (Adams, 2015, p. 22). This study helped define the importance that education alone does not change a

nurse's practice but empowering them with appropriate knowledge can improve VTE compliance significantly.

Evaluating how nurse-led involvement advanced VTE compliance was another important topic. Nurses are crucial to executing clinical practice guidelines and embracing preventative programs to improve patient outcomes and reduce VTE (Lockwood, Kable, & Hunter, 2017). Nurses are in a critical position to lead the movement to evidence-based practice regarding VTE prevention (Lockwood, Kable, & Hunter, 2017). With the proper educational approach to the nursing staff, this nurse-led intervention can improve compliance rates of VTE prophylaxis. Nurse proactivity was a valuable point made within the articles to executing a successful VTE program

Educational Approaches

The educational approach used also impacts the VTE program success. Lau et al.'s (2017) randomized clinical trial demonstrates the importance of utilizing the appropriate VTE prevention education. Two different educational approaches, a dynamic module and a static module, were compared to identify which approach improved VTE medication administration practice as well as detect which was more engaging to the nursing staff. The static approach was a question and answer approach, while the dynamic module was significantly more hands-on. VTE prevention compliance improved with both types of education. In comparison, the differences in nurse satisfaction were overwhelmingly higher in the dynamic group than the static group. "Compared with the nurses who completed the static module, significantly more nurses reported that the dynamic module was engaging, was enjoyable, helped to better communicate the importance of VTE to patients, provided the right level of information and resources, and directly applied to their clinical practice" (Lau et al., 2017, p. 6). Great insight was provided on

giving not only the right information to nurses but improving information presentation resulted in improved nursing perception and satisfaction with the education.

In Aberg et al., (2018) the facility utilized unit champions in the chart audit process to raise awareness for VTE prophylaxis. Education was given to non-compliant staff and to safeguard appropriate VTE prevention was implemented (Aberg et al., 2018). The educational level of the nurse effected nursing practice (Lazure et al., 2018) which in turn effected VTE compliance. Nurses needed a wider education than just VTE prophylaxis. Over half (58%) of nurses agreed with the statement that “generally, the educational offerings are not applicable to the daily reality of my practice” (Lazure et al., 2018, p. 105). This statement is frightening especially in light of the importance of VTE prevention for patient safety. On the positive side, however, these same nurses said that there is a high demand for pertinent educational material that would help them by growing competency, self-confidence, and improving patient results (Lazure et al., 2018).

Ma et al. (2018) discovered how nurses’ VTE knowledge affected prophylaxis compliance. Nurse educators needed to provide nursing staff the best most up-to-date inclusive educational material possible to bridge the nursing knowledge gap on VTE prevention and increase VTE compliance rates. Increased proficiency in VTE prophylaxis was noted amongst highly educated nurses, nurses who had more experience, nurses who had received continuous education, ICU nurses, and charge nurses (Ma et al., 2018). This attitude was vital and was only possible with increased experience and education.

Minami et al. (2016) utilized multiple different educational strategies. First the team had two interactive educational meetings with nurses to address what areas they felt that they had knowledge deficits. The first portion of the educational meetings focused on general VTE

education, like the magnitude of the problem nationwide, broad signs and symptoms of VTE, risk factors for acquiring a VTE (Minami et al., 2016). The second portion of the educational meetings focused on myth-busting which included common misunderstandings that frequently obstruct the administration of VTE prophylaxis (Minami et al., 2016). This again supports the importance of education to the compliance of VTE protocols by ensuring that bedside staff are competent in the knowledge base of VTE prevention.

Interventions including computer or human alerts, multifaceted interventions, which could be a combination of education, alerts and audit and feedback, educational interventions, such as grand rounds or self-administered courses and preprinted orders interventions all increased compliance with VTE protocols and increased VTE compliance rates (Kahn et al., 2019). This provides additional support on the importance of VTE education as well as alerts in the performance improvement of nurses regarding VTE compliance. Increased training on VTE improves a nurse's knowledge base and understanding of the importance of VTE preventions. This is pivotal in improving patient safety.

Stakeholders

To ensure cohesive implementation of a VTE project an unclouded vision of the anticipated outcomes is needed to bring stakeholders together (Melnik & Fineout-Overholt, 2015). The VTE change project is no different. The VTE prophylaxis educational module affects many stakeholders and the project team needs to keep each one in mind when decisions are made.

Most importantly are the patients and their families, because an increasing VTE prophylaxis compliance rate will result in a decrease in VTE rate. Patients and their families are the most important stakeholders affected by the devastating effects of VTEs which can include

the death of the patient. VTEs are a prominent cause of unnecessary morbidity and mortality amongst hospitalized patients in the United States (Amin, Neuman, Lingohr-Smith, Menges & Lin, 2019). Even globally, VTEs are a prominent source of death and disability (Amin, Neuman, Lingohr-Smith, Menges & Lin, 2019). These statistics are frightening and preventable. Patients expect protection while under the care of a healthcare provider. This includes protection from a preventable VTE.

Secondly, the proposed change affects bedside nurses who will help the team in determining potential barriers to the educational plan and the best way to ensure project success. Barriers to implementation consist of pessimistic attitudes, no nurse champions, inadequate staff buy in with the project, and lack of resources (Seacrist, Bingham, Scheich & Byfield, 2018). The bedside nurse is at the forefront in making this a successful project. Without bedside nurse support the change project will not be successful. Through staff education on the importance of VTE prophylaxis, healthcare workers will have the tools necessary to increase VTE compliance amongst hospitalized patients.

Thirdly, the proposed change project affects nursing leaders who will influence staff support for the project's success. Nursing leadership support is invaluable when evaluating change project success. Nursing leadership will have to consistently support the change project when rounding on the bedside staff to ensure that the staff understands the importance of VTE and protocol compliance.

Lastly, the proposed change project will affect the facility's educational department. The education department will help in the development and implementation of the educational module for the project. The education department is also going to assist in obtaining the

appropriate data from the current electronic medical record to ensure the success or breakdown of the project.

Planned Evaluation

The actualization of the project will take 6 months to create, implement and evaluate. The first step includes 2 weeks to develop an educational module that increases the bedside nurse's knowledge of VTE prophylaxis and the current VTE protocol in place. The educational module will be developed in conjunction with the educational department, specifically Luke Gless, RN. The module will be included within the already used educational program, HealthStream, at Christus Trinity Mother Frances Health System. The first 2 weeks of the project also includes obtaining base-line data from the electronic medical records (EMR) utilized at Christus Trinity Mother Frances Hospital (CTMFHS). Again, Luke Gless RN will be helping in obtaining this information.

The second step includes the following 4 weeks. This step includes staff completion of the educational module which will be administered via HealthStream, which is the educational system already in place at CTMFHS. Educational compliance rate must be 100% to ensure that the VTE prophylaxis educational program is effective among the bedside nurses.

The third step will occur after staff compliance of the required educational module. This is when nurse leadership, who have voiced support of the educational change project as well as demonstrating a strong knowledge base in the matter as well, will encourage support of the educational material for 4 weeks through nurse leadership rounding on the designated units. Leadership support will help hard wire the educational material for bedside staff.

After completion of nursing leadership rounding support, the fourth step includes the next 2 weeks which will consist of data acquisition through the EMR to verify VTE prophylaxis compliance rates have increased. Luke Gless, RN will aid the project team in this process. This data collection is critical to verify the status of the project.

The fifth step in the future change project will consist of acquisition of the same VTE compliance data 3 months later to ensure that VTE prophylaxis rates continue to improve from the data ascertained prior to implementation of the educational module. After data supports compliance rate improvement, the same educational module will be implemented facility wide. This will improve compliance rates even more.

A change project that can positively affect patient outcomes is vital in maintaining healthcare systems. This VTE prevention project can be the change at CTMFHS that positively affects the rates of VTE prevention compliance among bedside nurses. If utilized appropriately, this change project plan can provide a step by step approach that is easy to follow and understand for both the project team as well as the bedside nurses.

Evaluation Timetable/Flowchart

To verify the impact of the benchmark change project, the right statistical analysis must be performed. For the VTE educational change project mean, median, and mode will be used on the grades of the pretest and posttest. This is to get a better understanding of the data obtained from the initial pretest and posttest. Although the mean will have the most impact on our analysis because when it comes to the central tendency it is the most stable index (Polit & Beck, 2017). This information will confirm that the staff initially understood the presented material.

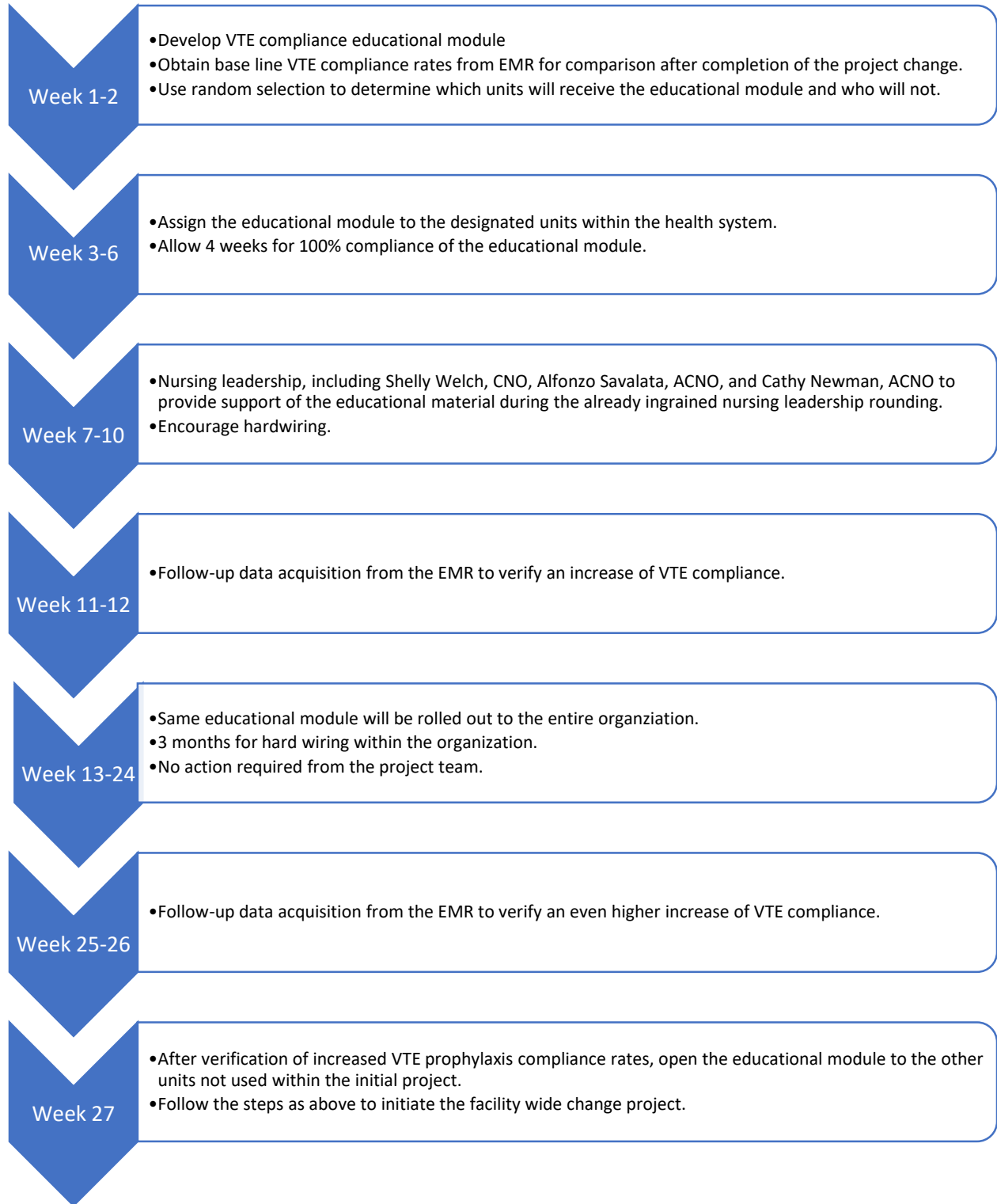
The posttest data will be compiled again three months after completion of the change project. This will once again be a posttest administered to the nursing staff regarding the evidence-based educational module through HealthStream to verify the retention of the information. Once both sets of means, medians, and modes are ascertained, a comparison of the posttest data from the initial group and the 3-month post group will occur. This will allow the project team the opportunity to evaluate the effectiveness of material retention within the bedside nurses.

Once the project team has the means of both groups, a *t*-test will be performed to compare these two distinct groups of data. The *t*-test is appropriate in the evaluation of this change project because of the need for analysis of the posttest data which is vital to verify improvement from the change project (Trochim, 2020). It is also the best parametrical statistical tool because it compares the variance among two separate means (Polit & Beck, 2017). This will allow the project team to verify the retention of the educational material previously received through HealthStream.

Through the statistical data obtained during the course of the project, success or failure will be determined. If the project is not effective at this level, then the team will step back and reevaluate the project to determine where the project failed. Opportunities for improvement will be identified and adjustments will be made to the project. After modifications are made to the project, the team will again implement the change project to achieve success.

If statistical success is determined, then the project will be implemented throughout all the units at CTMFHS. If project success is again determined at this level within the healthcare organization, then conversing to the corporate stakeholders to determine buy-in will be the next

step to encompass all the Christus ministries worldwide. This is invaluable to Christus due to the potential fiscal impact this project could make on the healthcare organization.



Data Collection Methods

To appraise the effectiveness of the benchmark venous thromboembolism (VTE) educational change project, a pretest and posttest will be administered to the nursing staff of the designated units throughout Christus Trinity Mother Frances Health System (CTMFHS). First, a pretest will be administered through HealthStream before the administration of the educational module. The educational module will be evidence-based on the 12 scholarly articles discovered through thorough research. All the VTE educational material will be presented through HealthStream to keep with the usual method of presenting material to staff in accordance with the education department at CTMFHS.

This will be followed by a posttest after each staff member completes the VTE educational module. The posttest will be given on HealthStream after the educational module is completed. The success of the evidence-based educational module will be determined once the staff scores 85% on the posttest.

Three months after completion of the change project another posttest will be administered to the same nursing staff on the evidence-based educational module information to verify retention of the material. This will be given on HealthStream like the original posttest. To ensure the success of the educational program the staff must again score 85% or higher on the posttest.

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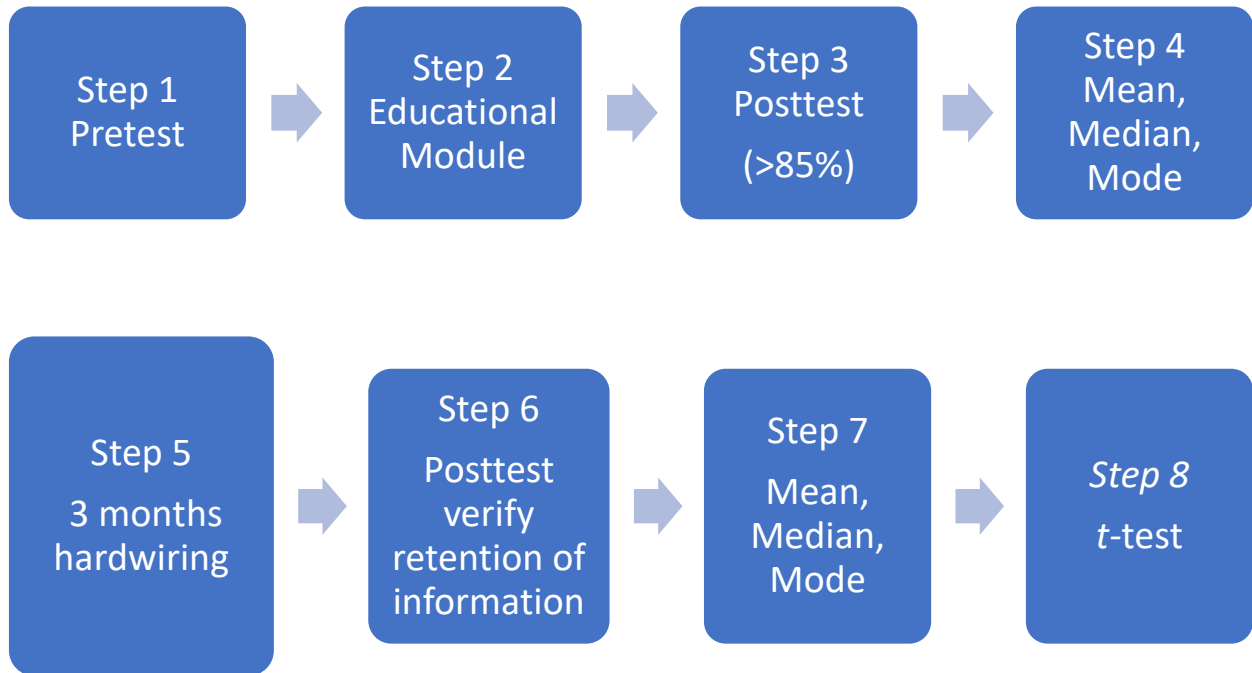
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Data Collection and Analysis Timetable/Flowchart



Cost/Benefit

There will be associated costs to the project's implementation. First is the cost of staff completing the module. Secondly, the time the education department is working on the project module and monitoring completion of the assignment will need to be assessed. These are the only costs associated with implementation of the VTE change project.

Benefits include increasing bedside staff knowledge base on VTE prevention. Another benefit includes increased VTE prevention compliance rates. The next benefit is a decrease in VTE rates within CTMFHS. The last and most important benefit of this project is increased patient safety.

Cost versus benefits is a valuable concept to consider when implementing any change project. However, when looking long-term at benefits versus risks/costs, clearly the benefits of the VTE project outweighs the minimal costs associated with the implementation of the educational module. Increased patient safety within CTMFHS is the best benefit there could be.

Overall Discussion/Results

Upon reviewing the available research, VTE prophylaxis prevention education increases staff nurse compliance with necessary protocols. This increase in staff compliance, in turn, decreases patient's risks of VTEs during hospitalization while increasing proper use of VTE prophylaxis. Knowing these correlations exist in research reinforces that best practice within healthcare facilities is to supply staff proper education to increase VTE prophylaxis prevention compliance. The evidence discovered in the research defends the PICOT question by supporting the claim that VTE prevention education does increase staff compliance with VTE prophylaxis protocols. Staff nurses who receive VTE prevention education are more compliant than those

that do not receive VTE prevention. In conclusion, VTE prevention education is a workable evidence-based practice that should be used within every facility to improve VTE compliance.

Recommendations

After looking at the strong support within the research, I would recommend implementing this VTE educational module. Although the project does have costs involved, they are minimal in comparison to the benefits that not only the patients will receive, but also the associates. The facility will also benefit financially from the implementation of the project as well. I also recommend looking at the future of this amazing project, which includes sustainability, because sustainability is key when implementing an evidence-based change project. To ensure sustainability, the project team needs to consistently keep this at the forefront of their minds when setting up, implementing, and evaluating the change project. Each decision made about the change project needs to focus on this necessary piece of the project.

To ensure sustainability within the context of the venous thromboembolism prevention change project multiple avenues will need to be explored. First the team will need to ensure that the bedside staff has yearly competencies related to the importance of venous thromboembolism prevention as well as the protocols in place to prevent them. Secondly the team will need to follow up with the executive nursing leadership team to ensure that they continue to speak on the importance of VTE prevention within the facility during staff rounds. This leadership support is important because it has been found that support from nursing leadership strongly influence nurses and other healthcare professionals' views on evidence-based changes, while absence of leadership support is recognized as a significant barrier to a change project's implementation success (Gifford et al., 2018). Thirdly, continual assessment and evaluation of the electronic medical record needs to be completed at least every 3 months to ensure that nurses are still using

the VTE protocols accurately with each patient that enters the facility. Research supports the fact that ongoing monitoring and evaluation of a new intervention method is an important aspect in sustainability (Levin, Wright, Pecoraro & Kopec, 2016). Lastly, the change project team will continually evaluate the change project to ensure that it is still relevant and accurate with the most up to date information regarding VTE prevention. This is invaluable as to ensure that the bedside staff are truly using the best evidence-based practice available. Sustainability in the VTE change project is vital in saving patient's lives, because venous thromboembolisms are the third most common cause of death and one of the most common conditions within hospitalized patients (Ayad, Patil, Kaushal & Patel, 2017).

These statistics alone shows the necessity of implementing and supporting this change project. Leaders and associates of CTMFHS need to support this change project not only for the potential gains personally and institutionally, but most importantly for the patients that enter the doors of CTMFHS every single day. This is an easy way to extend the healing ministry of Jesus Christ through Northeast Texas.

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Appendix

<p>PICOT Question: In staff nurses (P) how does venous thromboembolism prevention education (I) compared to no venous thromboembolism prevention education (C) affect compliance with the established thromboembolism protocol (O) during the three months following completion of the required education for the intervention group (T)?</p>
<p>PICOT Question Type (Circle): Intervention Etiology Diagnosis or Diagnostic Test Prognosis/Prediction Meaning</p>

Caveats

- 1) The **only studies** you should put in these tables are the ones that **you know answer your question** after you have done rapid critical appraisal (i.e., the keeper studies)
- 2) Include APA reference
- 3) Use abbreviations & create **a legend** for readers & yourself
- 4) Keep your descriptions brief – there should be **NO complete sentences**
- 5) This evaluation is for the purpose of knowing your studies to synthesize.

Place your APA Reference here (Use correct APA reference format including the hanging indentation):

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Citation: (i.e., author(s), date of	Conceptual Framework	Design / Method	Sample/ Setting	Major Variables Studied and	Measurement of Major Variables	Data Analysis	Study Findings	Strength of the Evidence (i.e., level of evidence + quality [study strengths and weaknesses])
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publication, & title)				Their Definitions				
Author, Year, Title	Theoretic al basis for study		Number, Characteristics, Attrition rate & why?	Independent variables (e.g., IV1 = IV2 =) Dependent variables (e.g., DV =)	What scales were used to measure the outcome variables (e.g., name of scale, author, reliability info [e.g., Cronbach alphas])	What stats were used to answer the clinical question (i.e., all stats do not need to be put into the table)	Statistical findings or qualitative findings (i.e., for every statistical test you have in the data analysis column, you should have a finding)	<ul style="list-style-type: none"> • Strengths and limitations of the study • Risk or harm if study intervention or findings implemented • Feasibility of use in your practice • Remember: level of evidence (See Melnyk & Fineout-Overholt, pp. 32-33) + quality of evidence = strength of evidence & confidence to act • Use the USPSTF grading schema http://www.ahrq.gov/clinic/3rduspstf/ratings.htm
Aberg, Fulkerson, & Altman, 2018 Keep calm and stop the clot	None Stated	Practice Improvement	n= All patients admitted to the PICU between the ages of 10-17 years old. No specific information provided. Characteristics: Patients 10-17 years old	IV1 = Staff buy-in IV2 = Potential barriers IV3 = visual risk identifiers DV = VTE bundle compliance	No measurement info noted	Descriptive statistics	Compliance increased = 11% 100% decrease of PICU VTE	Strengths: Easily adaptable; AACN CSI Academy incorporated; Significant increase in compliance Limitations: Little statistical support of data Little/no risk from intervention Feasibility: Easily incorporated LOE: Level 6 USPSTF: B Level of certainty: High
Adams, 2015	Walker and Avant Concept	Concept	n = 24 articles	IV (1) Personal initiative, IV (2) Taking	No measurement info noted	No statistics used	No statistical tests used	Strengths: Increase in compliance; Multiple articles noted Limitations: No statistical support

Proactivity in VTE prevention : a concept analysis	Analysis Method	analysis	Characteristics: inclusion and exclusion criteria for articles chosen	charge, IV (3) Feedback-seeking behavior DV (1) VTE bundle compliance				Little/no risk from intervention Feasibility: Easily incorporated LOE: Level 2 USPSTF: B Level of certainty: High
Cardoso et al., 2016 Results of a venous thromboembolism prophylaxis program for hospitalized patients	None Stated	Prospective observational study	<i>n</i> = 56,834 pts 52.2% male, 47.8% female; age: <40 18.1%, > 40 & < 60 32.4%, >60 & < 75 29.1%, > 75 20.4%; also separated by med/surg area	IV (1) = initial VTE risk assessment w/in 24 hrs IV (2) = appr. VTE prophylaxis prescribed DV (1) – VTE adherence in high-risk pts DV (2) = VTE rates @ DC	No measurement info noted	Mantel-Haenszel chi-square test	VTE 24 hrs assessment = 86.4%; adherence to prophylaxis recs 66.8%; adherence to protocols 63.8%(beginning) to 75%(completion). <i>p</i> <0.001. DC VTE occurrence 2.10%(beginning) to 1.69% (conclusion) <i>p</i> =0.033	Strengths: Large sample size; increase in VTE protocol compliance when comparing baseline to follow-up: QI project Limitation: can't determine which strategy was most effective Feasibility: Easily incorporated LOE: For intervention PICOT, a qualitative study is a Level 6 USPSTF: B; Level of certainty = High
Duff, Walker & Omari, 2010 Translating venous thromboe	None Stated	Practice improvement	<i>n</i> =149; separated by specialty & clinical unit Setting: from 9/2008-	IV (1) = audit and feedback IV (2) = documentation & decision support aids	No measurement info noted	Fisher's exact test	Before and after comparisons <i>p</i> <0.001 pts assessed @; <i>p</i> <0.001 surgical pts assessment; <i>p</i> =0.58 medical pts assessment	Strengths: Significant improvement in compliance when comparing baseline and follow-up; EBP implementation project Limitation: unable to know which intervention was most effective; uncontrolled design; small sample size

<p>mbolism (VTE) prevention evidence into practice: A Multidisciplinary Evidence Implementation Project</p>			<p>8/2009 in a 250-bed acute care hospital in Sydney, Australia; No attrition rate noted d/t being based on historical data form EMRs</p>	<p>IV(3) = provider education IV (4) = policy/procedure DV (1) = pts receiving proper VTE prophylaxis DV (2) = risk assessments performed on adult inpatients</p>			<p>$p=0.02$ surgical pts receiving appropriate prophylaxis; appropriate pharm prophylaxis = $p=0.01$; mechanical prophylaxis $p=0.54$</p>	<p>No risk/harm noted Feasibility: easily adaptable LOE: Level 6 USPSTF: B; Level of certainty = Moderate</p>
<p>EL-Mokadem & EL-Sayed, 2019; Effect of educational intervention on critical care nurses' adherence to the critical practice guidelines for</p>	<p>None Stated</p>	<p>Quasi-experimental project</p>	<p>$n = 192$ critical care nurses age: 20-40 years old; 67.1% female/32.9% male; educational level: diploma 74.9%/bachelor 25.1%; years of experience: < 1 year: 43.1%, 1-5</p>	<p>IV (1): age IV (2): ed. level IV (3): yrs. of experience DV (1): observance to clinical procedure for VTE prevention</p>	<p>No measurement info noted</p>	<p>Spearman Rho, P value</p>	<p>Pre and post intervention comparison compared by age, ed.level & yrs of exp.clinical practice guidelines adherence Age: pre $r=0.97$, $p \leq 0.001$; post $r=0.96$, $p \leq 0.001$; level of ed: $r=-0.9$, $p \leq 0.001$ post: $r=-0.87$; $p \leq 0.001$; yrs of exp: $r=-0.85$, $p \leq 0.001$, post: $r=-0.82$, $p \leq 0.001$; adherence(Mean \pm SD: good: pre:</p>	<p>Strengths: Significant improvement in compliance when comparing baseline and follow-up; quasi-experimental Limitation: Unable to determine if same material was used in each group presentation No risk/harm noted Feasibility: easily adaptable LOE: Level 3 USPSTF: B; Level of certainty = Moderate</p>

preventing venous thromboembolism in critically ill patients			yrs:20.4%, 6-10 yrs: 28.7%, >10 yrs:7.8%; ICU: trauma ICU: 52.1%, medical ICU: 19.7%, surgical ICU: 15%, cardiac ICU: 13.2%				15.66+-1.84; post = 18.38+-1.20; average: 8.53+-1.63, post:8.79+-2.03; poor: pre:1.71+-2; post: 1.53+-1.52; p=<=0.001	
Kahn et al., 2019 Effectiveness of interventions for the implementation of thromboprophylaxis in hospitalized patients at risk of venous thromboembolism: an updated abridged	None Stated	Meta-analyses	n = 11 RCTs; involving 35997 participants ; 1. Study design, population and intervention clearly defined. 2. Data provided from study was divided by intervention group. 3. The diagnosis	(IV1): Multifaceted intervention, (IV2): Computer Alert, (IV3) Preprinted order forms, (IV4):Human alert; DV(1): Noticeable increase in patients receiving medication/mechanical VTE prophylaxis. (DV2): VTE prevention used for	No measurement info noted	CI, I ² ; RD	Alerts interventions: RD Rec'd pro 0.21 (0.15 to 0.27) 75%; rec'd app. pro: RD 0.16 (0.12to 0.) 0%; multifaceted interventions: rec'd pro. RD 0.04 (0.00 to 0.06) 0%	Strengths: Compares multiple studies with different interventions Limitation: Took studies out that meta-analysis could be completed No risk/harm noted Feasibility: easily adaptable LOE: Level 1 USPSTF: A; Level of certainty = Moderate

<p>Cochrane systematic review and meta-analysis of randomized controlled trials</p>			<p>of VTE was formulated using acceptable objective criteria. 4. Any language.</p>	<p>patient. (DV3): Reduction in the percentage of patients who develop a VTE, either symptomatic or asymptomatic. (DV4): Reduction in VTE death rates. (DV5): Intervention safety</p>				
<p>Lau et al., 2017 Effectiveness of two distinct web-based education tools for bedside nurses on medication administration practice for venous thromboembolism prevention : A</p>	<p>None Stated</p>	<p>Randomized clinical Trial</p>	<p>n = 933 nurses; dynamic education = 488 nurses and 11 floors; static education = 445 nurses and 10 floors</p>	<p>IV (1) Linear static education (static) module with voiceover, IV (2) Interactive learner-centric dynamic scenario education (dynamic) module DV (1) Non-administration of prescribed VTE prophylaxis,</p>	<p>No measurement info noted021</p>	<p>Intention to treat Per protocol, analysis, Odds Ratio</p>	<p>non-administration improved following education (12.4% vs. 11.1%, cOR: 0.87, 95% CI: 0.80±0.95, p = 0.002) decrease in non-administration > for Dynamic arm (10.8% vs. 9.2%, cOR: 0.83, 95% CI: 0.72±0.95) vs Static arm (14.5% vs. 13.5%, cOR: 0.92, 95% CI: 0.81±1.03), difference b/w arms not statistically significant (p =0.26) Satisfaction scores</p>	<p>Strengths: Significant increase in education satisfaction Limitation: None Noted No risk/harm noted Feasibility: easily adaptable LOE: Level 2 USPSTF: A; Level of certainty = High</p>

randomized control trial				DV (2) Nurse-reported satisfaction with education modules			higher (p<0.05) for all Dynamic arm	
Lazure et al. (2018) Education needs of nurses in thrombosis and hemostasis: An international, mixed-methods study	None Stated	Mixed-methods study	Participants (n=234) nurses (n=212; n = 22 qualitative; n = 190 quantitative); patients/caregivers (n = 22 qualitative only)	IV (1) Country, IV (2) level of experience, IV (3) organizational membership challenging areas DV (1) von Willebrand disease, DV (2) anticoagulant safety profile in specific patients, DV (3) understanding the treatment of patients with inhibitors, DV (4) patient risk assessments, DV (5) accessing and implementin	No measurement info noted	Qualitative = thematic analysis Quantitative = frequency tables, chi-squares, standard deviation	Suboptimal skill sets: Assessing bleeding 46% Assessing pts w/ ? hemarthrosis 50%; p=0.044, Assessing menorrhagia = 42%, p=0.049, epistaxis = 32%, p=0.028, hematuria = 34%, p=0.022, Hemophilia = 41%, p=0.012, VWD = 50%, p=0.032	Strengths: Demonstrated educational opportunities Limitation: None Noted No risk/harm noted Feasibility: easily adaptable LOE: Level 6 USPSTF: A; Level of certainty = High

				g relevant professional education. DV (6) individualization of care and communicating w/ pts & caregivers				
Lockwood, Kable, & Hunter, 2017 Evaluation of a nurse-led intervention to improve adherence to recommended guidelines for prevention of venous thromboembolism for hip and knee arthroplasty patients: A quasi-	None Stated	A quasi-experimental study	Sample Size: Intervention group: <i>n</i> = 196; Control: <i>n</i> = 178; Total = 383 Characteristics: Age: Mean (Intervention)= 66 (Control)= 69.1; Height: Mean (Intervention)= 1.68, (Control)= 1.67; Sex: Female (Intervention)=98 (Control)= 113, Male (Intervention)	IV (1) = nurse-led VTE prevention evidence-based guideline; IV (2) = No current change DV (1) = postop VTE dx DV (2) Readmission to same hospital	No measurement info noted	Fischer exact test; t-test; p-value	1.Risk assessment conducted Intervention=194/1/199.0 Control=0/170/170 <.001* 2 VTE education provided Intervention=195/0/199.5 Control=139/30/1874.3 <.001* 3 Preoperative anticoagulant provided Intervention= 194/0/299.0 Control=37/1/14919.8 <.001* 4 Preoperative graduated compression stockings (GCS) applied	Strengths: Showed a positive correlation between the nurse-led intervention to compliance with VTE protocols Limitation: None Noted No risk/harm noted Feasibility: easily adaptable LOE: Level 5 USPSTF: A; Level of certainty = High

<p>experimental study</p>			<p>n)=96 (Control)= 74; Weight Mean (Interventio n)=91.16, (Control)= 84.8; BMI: (Interventio n)= 32.28, (Control)= 30.84, Admission diagnosis</p>				<p>Intervention 142/8/5 91.6 Control= 132/44/11 70.6</p> <p>Preoperative nurse adherence (Items 1– 4) 3.7 (93) 1.65 (41) 2.1 (1.92 to 2.18) <.001* 2.1 (2.0–2.27) <.001*</p> <p>Postoperative nurse adherence (Items 5– 13) 7.4 (82) 5.55 (62) 1.8 (1.62 to 2.07) <.001* 1.9 (1.65– 2.08) <.001*</p> <p>Overall nurse compliance during hospitalization (Items 1–13)</p> <p>11.1 (85) 7.19 (55) 3.9 (3.62 to 4.18) <.001* 4.0 (3.70– 4.30) <.001*</p> <p>Post discharge patient score (Items 1–4) 2.5 (63) 2.51 (63) 0.004 (2.1 to 0.22) .97 0.03 (0.19 to 0.26)</p>	
<p>Ma et al, 2018 Nurses' objective knowledge</p>	<p>None Stated</p>	<p>Survey</p>	<p>n = 5271 6237 nurses received an</p>	<p>IV: N/A. DV (1): Knowledge of VTE prophylaxis,</p>	<p>No measurement noted</p>	<p>Descripti ve statistics; Chi- square;</p>	<p>More knowledge noted in higher ed, more experienced, continuing ed groups.</p>	<p>Strengths: Showed correlation b/w ed level & level of experience w/ increased VTE knowledge Limitation: None Noted</p>

<p>regarding venous thromboembolism prophylaxis: A national survey study</p>			<p>invitation (84.51%); characteristics: 5097 women, 121 men; average age: 3029 +/- 8.60 yrs. Mean nursing yrs: 8.96 +/- 7.37. 58.37% received continuing education, but only 2.68 in nationally recognized</p>	<p>DV (2) basic knowledge, DV (3) risk assessment, DV (4) basic prophylaxis, DV (5) physical prophylaxis, DV (6) pharmacological prophylaxis</p>		<p>analysis of variance</p>		<p>No risk/harm noted Feasibility: easily adaptable LOE: Level 5 USPSTF: A; Level of certainty = High</p>
<p>Minami, et al., 2016 Evaluation of an institutional project to improve venous thromboembolism prevention</p>	<p>None Stated</p>	<p>Quality Improvement Project</p>	<p>n = 1679 pre-intervention EMR reviewed; n = 1424 post-intervention; all were hospitalized patients with no further characteristics noted</p>	<p>(IV1): EMR alerts; (IV2): Ed initiatives (IV3): New EMR order sets (IV4): Other EMR changes (DV1) Total VTE prophylaxis imp. (DV2): ICU VTE pro imp (DV3): VTE pts w/</p>	<p>No measurement noted</p>	<p>Binomial w/ p value</p>	<p>VTE Pro: Pre 86.6%, Post 93.6%; All pts: Pre 94.4%, Post 97.6%, ICU VTE pro: Pre 100% post 95.8%; VTE pts w/overlap pre95.3% post 100%; VTE pts w/ anticoagulation overlap therapy pre 73.7% post 100%; p = <0.05</p>	<p>Strengths: pro compliance increased Limitation: Possible sampling error, surveillance bias No risk/harm noted Feasibility: Not easily adaptable d/t EMR platform LOE: Level 6 USPSTF: B; Level of certainty = Low</p>

				anticoagulation overlap therapy. (DV4): VTE pts receiving unfractionated dosages/platelet count monitoring by protocol or nomogram				
Pai et al., 2013 Strategies to enhance venous thromboprophylaxis in hospitalized medical patients (SENTRY): a pilot cluster randomized trial	None Stated	RCT	n = 6 1 Academic hospital in each group; 1 Community hospital >100 beds in each group; 1 Community hospital < 100 beds in each group; 1 Hospital with a consultative thromboembolism service in each group; no attrition	IV (1) Multicomponent interventions which included a) clinical education b) a paper based VTE risk assessment algorithm c) printed physicians' orders d) audit sessions e) feedback sessions IV (2) Usual care (no active strategies for VTEPro in place) DV (1)	Correlation coefficient (Pearson's r); 0.022	Descriptive statistics; Odds Ratio; GEE; ICC	OR = 0.80; 95% CI: 0.50, 1.28; p = 0.36; ICC = 0.022 appropriate thromboprophylaxis b/w groups (OR = 0.80 intervention vs control; 95% CI: 0.50, 1.28; p = 0.36 after clustering adjustment; ICC = 0.022; VIF = 10.55 rates of errors commission/omission errors of omission: OR = 1.30 intervention vs control; 95% CI: 0.68, 2.50; p = 0.43, after clustering adjustment; errors of	Strengths: equal distribution of groups Limitation: small sample size; lack of administrative assistance; not appropriately implanted; ambiguity of some variables Feasibility: Not feasible LOE: Level 2 USPSTF: C; Level of certainty = Low

				feasibility of SENTRY implementation (primary goal) DV (2) at-risk patients received appropriate VTEPro w/in 24 hours of admission DV (3) rate of patients receiving VTEPro that didn't need it DV (4) rate of patients that are not receiving VTEPro that needed it			commission: OR = 1.01 intervention vs control; 95% CI: 0.43, 2.37; $p = 0.97$, after clustering adjustment	
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Legend: appr: appropriate; AACN: American Association of Critical-Care Nurses; CI: confidence interval; cOR: Conditional Odds Ratio; CSI: Clinical Scene Investigation; DC: discharge; d/t: do to; hrs: hours; Ed: education; EMR: electronic medical records; Exp: experience; imp: improvement; ICC: intra-class correlation; ICU: Intensive care unit; LOE: level of evidence; med/surg: medical/surgical; OR: Odds Ratio; p: probability; pharm: pharmacological; PICU: pediatric intensive care unit; post: post intervention; pre: preintervention; pro: prophylaxis; pts: patients; RCT: randomized control trial; RD: risk difference; recs: recommendations; QI: quality improvement; VTE: Venous thromboembolism; VTEPro: VTE Prophylaxis; yrs: years