

**VENOUS THROMBOEMBOLISM (VTE) PREVENTION: AN EXAMINATION
OF THE IMPLEMENTATION OF STANDARDIZED MEDICATION
ADMINISTRATION (SMAT) AND VTE REEDUCATION**

by

Karl Gibson

MHA in Health Policy and Management, University of Pittsburgh, 2019

BPhil in Sociology, University of Pittsburgh, 2016

BS in Natural Science, University of Pittsburgh, 2016

BS in Psychology, University of Pittsburgh, 2016

Submitted to the Graduate Faculty of
the Department of Health Policy and Management of
the Graduate School of Public Health in partial fulfillment
of the requirements for the degree of
Master of Health Administration

University of Pittsburgh

2019

UNIVERSITY OF PITTSBURGH
GRADUATE SCHOOL OF PUBLIC HEALTH

This essay is submitted

by

Karl Gibson

on

April 16, 2019

and approved by

Patty Genday, MBA, MSN, RN, Chief Nursing Officer, Vice President of PCS, UPMC Magee-Womens Hospital; Faculty, Department of Nursing and Allied Health Professions, Indiana University of Pennsylvania

Judith Volkar, MD, Assistant Professor, Department of Obstetrics, Gynecology, and Reproductive Services, School of Medicine, University of Pittsburgh

Essay Advisor: Kevin Broom, PhD, MBA, Vice Chair for Education, Health Policy and Management, Graduate School of Public Health, University of Pittsburgh

Copyright © by Karl Gibson

2019

**VENOUS THROMBOEMBOLISM (VTE) PREVENTION: AN EXAMINATION OF THE
IMPLEMENTATION OF STANDARDIZED MEDICATION ADMINISTRATION
(SMAT) AND VTE REEDUCATION**

Karl Gibson, MHA

University of Pittsburgh, 2019

Abstract

Venous thromboembolisms (VTEs) are blood clots that begin in a vein and include deep venous thromboses (DVTs) and pulmonary embolisms (PEs). VTEs will affect an estimated 71 out of every 100,000 individuals yearly, with 100,000 to 300,000 deaths being attributable to VTEs every year, accounting for 10% of all hospital deaths, killing more people than AIDS, cancer, and auto accidents combined. Ultimately, VTEs are considered the most preventable hospital acquired condition. Using Cerner (an electronic health record) based data, this study investigates the impact of standardizing medication administration times (SMAT). A Chi Square test was used to examine the impact of this intervention. Findings suggest that the SMAT intervention both reduced the percent of pharmacological anticoagulation missed doses as well as the relative rate of patient refusals. This study also proposes a comprehensive VTE reeducation initiative, detailing the structure and evaluation of the initiative as well. The reeducation initiative improves two aspects of the iron triangle, namely improving patient quality and containing costs for VTE treatment, illustrating the public health relevance of the study.

TABLE OF CONTENTS

PREFACE.....	ix
1.0 INTRODUCTION.....	1
1.1 LITERATURE REVIEW AND CURRENT STATE.....	1
1.1.1 Literature Review: Education.....	4
1.1.2 Current State: Education.....	5
1.1.3 VTE Education Initiative: Organizational Chart.....	0
1.1.4 VTE Education Initiative: Return on Investment Analysis.....	11
1.1.5 Literature Review: Standardized Medication Administration Times (SMAT).....	15
1.2 STUDY CONTRIBUTIONS.....	18
2.0 DATA AND METHODS.....	19
2.1 ANTICOAGULATION DEFINITIONS.....	19
2.1.1 Not Done: Pt Refusal.....	19
2.1.2 Not Done: D/C Order.....	20
2.1.3 Not Done: Order/Task Duplication.....	20
2.1.4 Not Done: Not Appropriate at this Time (Details in Comments).....	20
2.1.5 Not Done: Held Per MD.....	20
2.1.6 Not Done: Pt Unavailable/Off Unit.....	20
2.1.7 Not Done: Held for Procedure.....	21
2.1.8 Not Done: Other.....	21
2.2 STATISTICAL ANALYSES.....	21
3.0 RESULTS.....	22
3.1 SAMPLE DESCRIPTIVE STATISTICS OF MISSED DOSES OF PHARMACOLOGICAL ANTICOAGULATION.....	22
3.2 SAMPLE DESCRIPTIVE STATISTICS OF REFUSED DOSES OF PHARMACOLOGICAL ANTICOAGULATION.....	22
3.3 STATISTICAL ANALYSIS OF MISSED DOSES OF PHARMACOLOGICAL ANTICOAGULATION.....	30
3.4 STATISTICAL ANALYSIS OF REFUSED DOSES OF PHARMACOLOGICAL ANTICOAGULATION.....	30
4.0 DISCUSSION.....	32
4.1 PHARMACOLOGICAL ANTICOAGULATION DISCUSSION.....	32
4.2 VTE EDUCATION INITIATIVE DISCUSSION.....	33
4.3 VTE EDUCATION INITIATIVE PROPOSED STRUCTURE.....	34
4.3.1 VTE Education Initiative: Proposed Structure: Part 1: Reeducation.....	34

4.3.2 VTE Education Initiative: Proposed Structure: Part 2: New Hire Education.....	34
4.3.3 VTE Education Initiative: Proposed Structure: Part 3: Enforcement.....	35
4.4 VTE EDUCATION INITIATIVE EVALUATION.....	35
4.4.1 Anticoagulation Missed Dose Report.....	35
4.4.2 Quality Monitoring.....	36
4.5 FUTURE STATE: EDUCATION.....	36
4.6 PUBLIC HEALTH AND IRON TRIANGLE IMPLICATIONS.....	39
4.7 LIMITATIONS.....	40
5.0 CONCLUSION.....	41
APPENDIX A: VTE COMPETENCY VALIDATION FORM AND VTE EDUCATION PACKET.....	42
BIBLIOGRAPHY.....	57

LIST OF TABLES

Table 1. Estimated Costs of the VTE Education Initiative.....	12
Table 2. UPMC Standardized Dosing Schedule.....	16
Table 3. Distribution of Missed Doses by Month and Pre-Post Period.....	24
Table 4. Distribution of Refused Doses by Month and Pre-Post Period.....	27
Table 5. Chi-Square Observed and Expected Results and Analysis of Missed Doses of Pharmacological Anticoagulation.....	30
Table 6. Chi-Square Observed and Expected Results and Analysis of Refused Doses of Pharmacological Anticoagulation.....	31

LIST OF FIGURES

Figure 1. Graph Demonstrating the Rate of PSI-12s per 1000 Surgical Cases for UPMC Magee-Womens Hospital.....	3
Figure 2. Flowchart Depicting Possible Points of Education for Nurses (Left) and PCTs (Right) at UPMC.....	8
Figure 3. Flowchart Depicting Organization of Educator Responsibilities and Organizational Structure.....	10
Figure 4. Graph Depicting the Break-Even Analysis for PSI-12s per 1000 Surgical Cases for UPMC Magee-Womens Hospital.....	14
Figure 5. Visual Representation of the Half Dose Interval Rule.....	17
Figure 6. Graph Displaying the Percent of Total Missed Doses per Month from August 2017 to August 2018.....	25
Figure 7. Graph Displaying the Percent of Missed Prior to and Following the SMAT Intervention from August 2017 to August 2018.....	26
Figure 8. Graph Displaying the Percent of Refused Doses per Month from August 2017 to August 2018.....	28
Figure 9. Graph Displaying the Relative Percent of Missed Prior to and Following the SMAT Intervention from August 2017 to August 2018.....	29
Figure 10. Flowchart depicting the Improved Education Workflow for Nurses (Left) and PCTs (Right) at UPMC.....	38
Figure 11. Image Depicting the Iron Triangle Framework.....	39

PREFACE

I would like to thank all of my faculty, colleagues, and friends at the University of Pittsburgh who aided my pursuit of this research project. First, I would like to express special thanks to my preceptor and mentor, Patty Genday, who offered me guidance on this project, my future career, and addressed my countless questions on this project. She has single-handedly taught me more about the field of hospital administration than anyone else I have worked with during the time in my program. I learned more under her guidance than I thought possible through my residency. Additionally, I would like to thank Dr. Judith Volkar for her guidance, support, and wisdom on this project. I would also like to thank Kevin Broom, who helped me revise this essay and has worked tirelessly to improve the MHA program in his first few years in his position. I want to thank the entire Quality Department (Lisa Manetta, Cindy Swank, Lisa Carozza, Andrea Aber, Michelle Corna, and the “Barbs”). They welcomed me, guided me, and allowed me the freedom to implement a project I hope will improve patient safety and quality of care. In addition to my essay readers and the Quality Department, I would like to thank Cara Morrill-Stoklosa, my co-chair, friend, and moral support through this project; Tanisha Davis, who trained me to use Cerner and established much of the groundwork for my program to be developed; Amy Lukanski, whose tireless efforts at the system level have led to major change. Lastly, I would like to thank my family and friends for their constant support while I balanced work, school, and fellowships. Suffice to say that no successful project is able to be completed in isolation.

1.0 INTRODUCTION

1.1 LITERATURE REVIEW AND CURRENT STATE

Venous thromboembolisms (VTEs) are blood clots that begin in a vein and include deep venous thromboses (DVTs) and pulmonary embolisms (PEs). A DVT refers to a clot deep within a vein. DVTs usually occur in the leg, however, they can also affect arms or other veins in the body. A PE refers to a situation when a clot breaks free and travels to the lungs, blocking a portion or all of the blood supply. The most frequent reason for a VTE to occur is due to a DVT in the leg breaking off and traveling to the lungs.

VTEs impact an estimated 71 out of every 100,000 individuals yearly (Heit et al., 2001) with approximately one third these individuals having a PE and two thirds have a DVT alone (White, 2003). The incident rate for VTE increases with other factors such as age, which has been associated in an increased incidence of 500 per 100,000 individuals over the age of 70 years (ISTH Steering Committee for World Thrombosis Day, 2014). The incidence rate of PE (with or without the presence of a DVT) was found to be 23 per 100,000 with an incidence of 48 per 100,000 for a DVT alone being present (Anderson et al., 1991). VTE has been associated with significant morbidity and mortality. Importantly, the management of VTE is correlated with significant health care costs for both initial hospitalization as well as readmission (LaMori, Shohieber, Mody & Bookhart, 2015; see also Spyropoulos & Lin, 2007).

Postoperative VTEs are a specific category of VTEs for which insurers do not reimburse for services, resulting in a significant financial burden for hospitals. The Agency for Healthcare Research and Quality (AHRQ) defines a PSI-12 (Patient Safety Indicator 12) as:

Perioperative pulmonary embolism or proximal deep vein thrombosis (secondary diagnosis) per 1,000 surgical discharges for patients ages 18 years and older. Excludes discharges with a principal diagnosis of pulmonary embolism or proximal deep vein thrombosis; with a secondary diagnosis of pulmonary embolism or proximal deep vein thrombosis present on admission; in which interruption of the vena cava or a pulmonary arterial thromboectomy occurs before or on the same day as the first operating room procedure; with extracorporeal membrane oxygenation; with acute brain or spinal injury present on admission; and obstetric cases (AHRQ Quality Indicators™ (AHRQ QI™) ICD-10-CM/PCS Specification, 2018).

Currently, the rate of PSI-12s across the UPMC system is 5.46 per 1000 qualifying admissions, while the rate of PSI-12s for UPMC Magee-Womens Hospital is 3.64. The most current national rate of PSI-12s is 3.46 per 1000 qualifying admissions (see Figure 1 for a graph depicting February 2017 through January 2019 PSI-12 data specific to UPMC Magee-Womens Hospital). As a system, UPMC has an opportunity to improve this quality measure, as does UPMC Magee-Womens Hospital. PSI-12s both impact patient care and the system's reimbursement through reductions in payments for Medicare/Medicaid services. Naturally, it negatively impacts the reputation of the organization as well. The cost of a postoperative VTE is estimated to be approximately \$15,123, which means that, based on the most current data available, UPMC Magee-Womens Hospital spent \$483,936.00 on non-reimbursable care between February 2017 and January 2018. For all of these reasons, a stronger education program needs to be established to improve the rate of postoperative VTEs.

PSI 12 (Perioperative PE or DVT) Rate (Jan 17-Dec 18)
Current National Performance PSI 12 Rate = 3.86
Median = 3.64; Average = 4.32

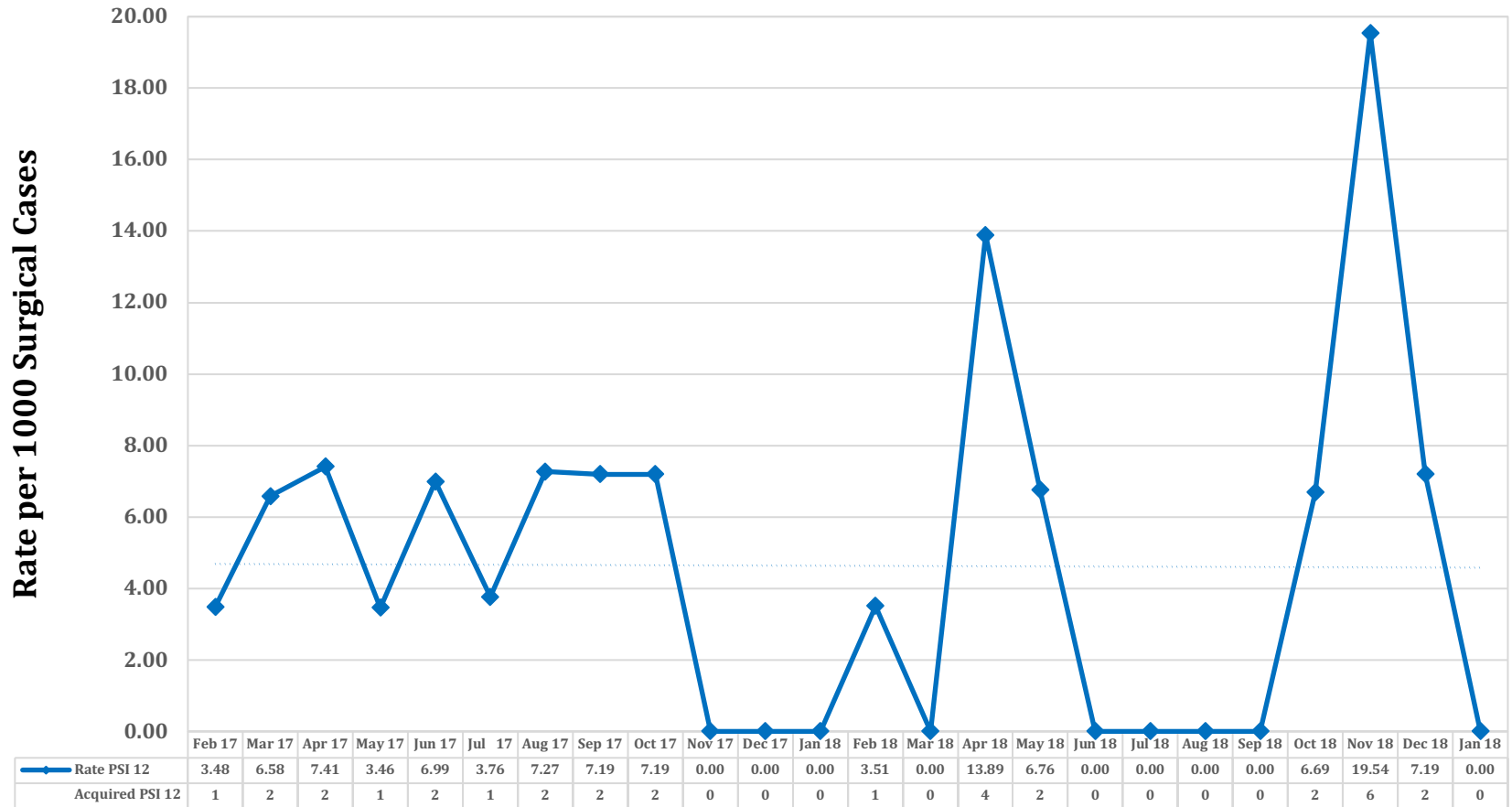


Figure 1. Graph Demonstrating the Rate of PSI-12s per 1000 Surgical Cases for UPMC Magee-Womens Hospital

1.1.1 Literature Review: Education

The goal of this paper is to take a nuanced look at the SMAT intervention as well as take a prospective look at the VTE education initiative being implemented at UPMC Magee-Womens Hospital. Multiple studies have found that 10-12 percent of anticoagulation doses prescribed for VTE prophylaxis are not administered to patients, with the most common reason for this being patient refusals (Shermock et al., 2013; Fanikos et al., 2010; see also Lau et al., 2017). Although a patient may refuse any type of care if they choose to do so, it is the responsibility of healthcare providers to educate patients so that their choice is knowledge based (Lau et al., 2017). Studies have shown that some nurses individually make the clinical decision regarding efficacy and appropriateness of the prescribed pharmacological VTE prophylaxis regiment (Elder et al., 2016; see also Lau et al., 2017). Specifically, Elder et al. (2016) found that low performing floor units contained nurses that were, “more likely to believe that pharmacological venous thromboembolism prophylaxis is ordered for patients who do not require it.” In addition to this barrier to care, despite the availability of evidence-based effective prophylaxis for treating VTEs, many studies have demonstrated that VTE prophylaxis is underutilized in hospitals (Goldhaber, Tapson, and VTE FREE Steering Committee, 2004; Cohen et al., 2008; see also Lau et al., 2017).

One possible reason for underutilization of VTE prophylaxis is inadequate education across nurses and clinical staff throughout the hospital. Studies have found that approximately 70 percent of clinical nurses identified as good/fair level of knowledge about VTE risk assessments, however, this same group of nurses was not confident enough to perform VTE risk assessments themselves (Oh, Boo, and Lee, 2016). An additional study investigating VTE based knowledge/compliance among a group of nurses reported that approximately 65% of these nurses had accurate knowledge of the proper practices regarding VTE prevention (Choi & Min,

2011). A recent study at Johns Hopkins Hospital found that education for nursing significantly improved medication administration practice, and specifically, the nurses found the interactive Dynamic model (an online interactive module) to be more, “engaging, enjoyable, and enable better patient engagement) (Lau et al., 2017). Therefore, an education-based initiative to improve nursing understanding of the VTE initiative and to improve compliance with evidence based best practices will be examined throughout this document.

1.1.2 Current State: Education

Contemporary UPMC system-wide VTE prevention education of new UPMC nurses is limited to 15 minutes of didactic instruction during nursing orientation (RNO), which is considerably less time than the 60 minutes that has been allotted to the current nursing staff under the VTE prevention education. However, it provides a useful cursory introduction to the concept of the importance of VTE prevention. For patient care technicians (PCTs), on the other hand, UPMC-wide education is provided for new PCTs at UPMC Mercy Hospital, called inexperienced nursing assistant (NA) class, which requires a competency completed on SCD use, application, and patient ambulation. However, it does not discuss cover proper documentation of these actions. Once the nurse and/or PCT completes their system-wide orientation, s(he) arrives at UPMC Magee-Womens Hospital for hospital specific orientation, also known as UPMC Beginnings. UPMC Beginnings does not presently include any additional VTE prevention education as the contents have been standardized and do not include significant clinical subject review due to time constraints. Following this, a nurse arrives on his or her unit and is assigned a preceptor, who oversees the nurse’s transition to independent care of the patient. This includes knowledge assessment of policies and procedures and observance of clinical skills. PCTs undergo a hospital-based PCT orientation before matching with their preceptor. Historically, unit

orientation has not focused on VTE prevention with formal emphasis, while hospital-based PCT orientation covered this topic, but did not provide necessary details regarding documentation or specific policy. In the past year, education has been more robustly featured at the unit-level, with encouragement and support proffered by nursing leadership and augmented by a nascent VTE champion group, however, the education has not made the necessary impact on compliance with VTE prevention best practice. Due to the persistent gaps in knowledge regarding VTE prevention, both pharmacologic and mechanical methods, this process flow for education of new nurses demonstrates there exists a perpetual cycle that reinforces a knowledge deficit, both clinically and in the realm of proper documentation in the electronic medical record.

As previously noted, prior education efforts have focused on relying on VTE champions to provide education, who are floor nurses with added responsibilities for VTE prevention, with some support from unit leadership. VTE champions are nurses who choose to devote time to working on this effort and attend monthly meetings for the project. It is unrealistic to expect that these champions have the time to coordinate unit wide competency evaluations of nurses and PCTs, nor are standardized resources available from the system to provide this education to their nurses in a meaningful manner. In addition to this, VTE champions have no reasonable means to educate resource nurses or PCTS, who float across all medical/surgical units.

Currently, all VTE related materials are dispersed to the various hospitals within UPMC from the Wolff Center, a centralized quality department for the system. In order to meet the needs of the system and account for some operating differences between hospitals, information and education is generalized accordingly. Without hospital-based education that specifies documentation and policy requirements, a new nurse has no formal, cohesive source of information they can work from to obtain this information. This realization is what ultimately spawned the VTE reeducation concept and development of this initiative.

In the flowchart below (Figure 2), green signifies the process is adequate, gray signifies that there is no education nor is it appropriate to provide education, yellow signifies possible education with opportunity for improvement, and red signifies a complete absence of education. Importantly, as previously noted, at no point in this education continuum is education sufficient to prepare a nurse to abide by proper VTE prophylactic intervention at UPMC Magee-Womens Hospital. Based on this flowchart, with preceptor nursing/PCT knowledge at various levels throughout the hospital, this cycle for education gaps is only widened. Ultimately, these multiple factors demonstrate why education efforts have previously been unsuccessful at producing a lasting effect of reducing the rate of VTEs. In addition, these factors demonstrate that there is a significant opportunity for improving the education process, which will be explored throughout this document

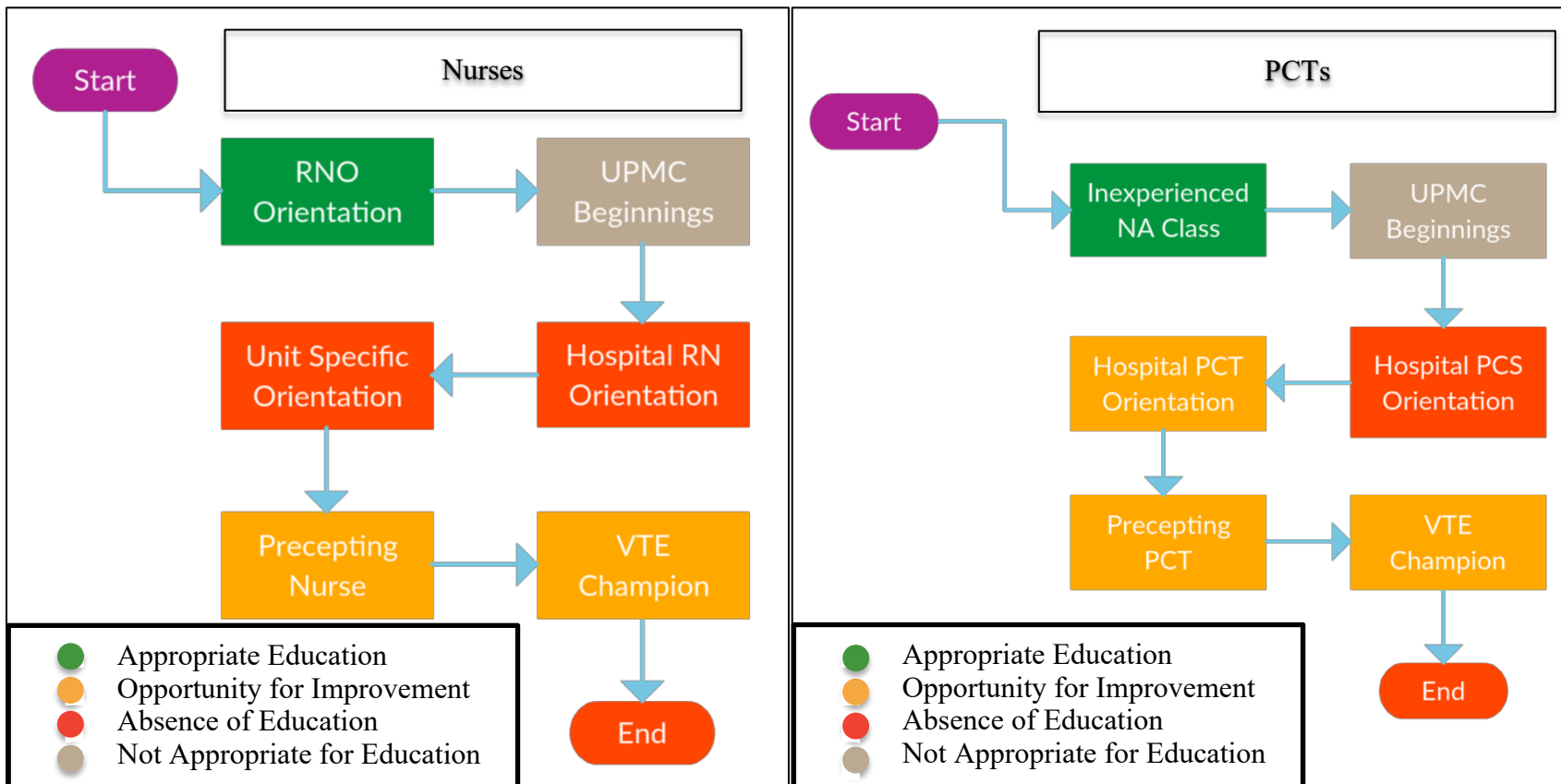


Figure 2. Flowchart Depicting Possible Points of Education for Nurses (Left) and PCTs (Right) at UPMC

1.1.3 VTE Education Initiative: Organizational Structure

UPMC-Magee Womens Hospital's medical/surgical units consists of four units; 4100 (orthopedics and bariatrics), 4800 (adult intensive care), 5300 (medicine), and 5800 (gynecology oncology). In addition to this, there is a resource pool of nurses and PCTs which float between these various units. Each unit is managed by a unit director, who has multiple clinicians under them to delegate various tasks of management. To oversee the education of these nurses, there are 4 educators. One educator oversees 4800, one educator oversees 4100 and 5800, one educator oversees 5300 and PCT new hire education, and the final educator oversees resource nurses and PCTs. The breakdown of the organizational structure that is relevant to the organizational structure can be found on Figure 3 (see following page):

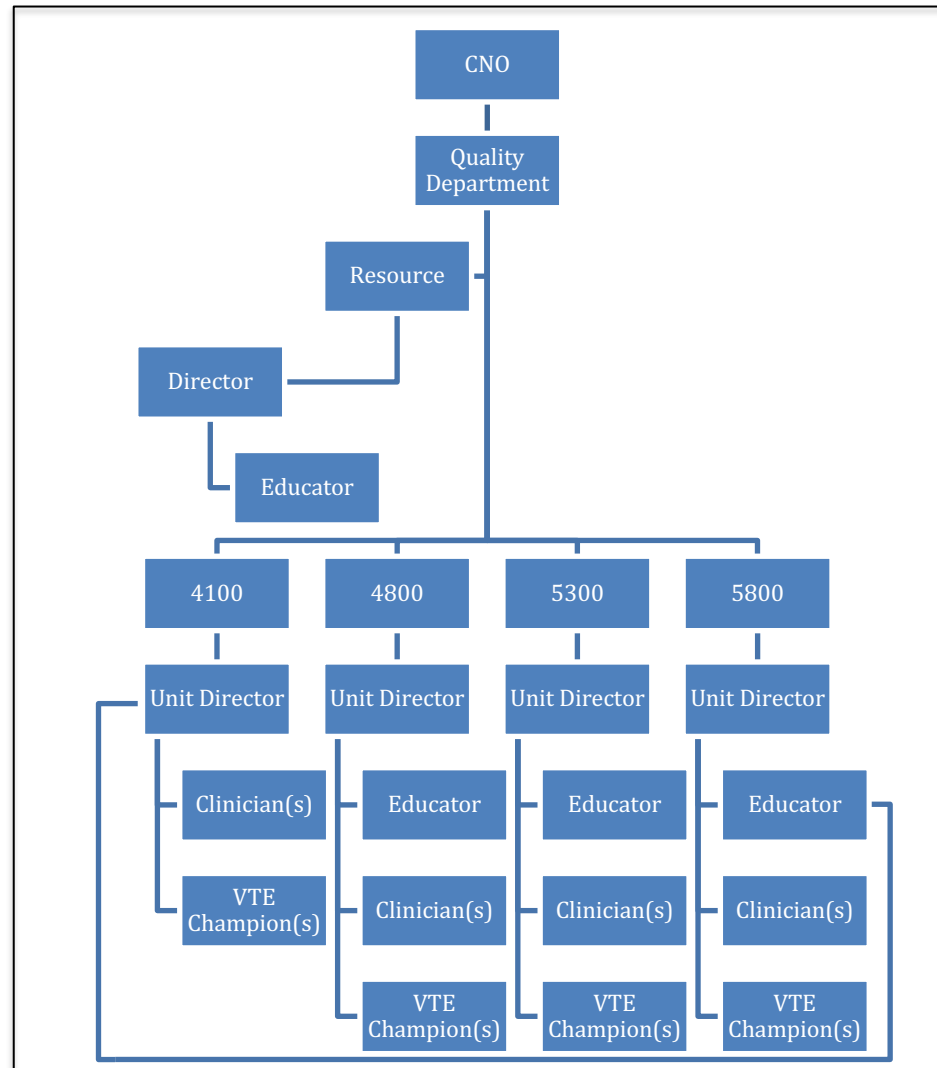


Figure 3. *Flowchart Depicting Organization of Educator Responsibilities and Organizational Structure*
Note: All educators fall under the Director of Education as well as their individual units

1.1.4 VTE Education Initiative: Return on Investment Analysis

The estimated cost of the VTE education initiative includes: educators' time, administrators' time, nurses time, and PCT's time. It is estimated that it will take a maximum of 100 hours of educators' time to perform the competencies, divided among 4 educators. The average cost of this time is \$35.00 an hour, resulting in an approximate cost per hospital of \$3,500. Conservatively, on average, units are staffed by 40 nurses and 20 PCTs, with UPMC Magee-Womens Hospital containing 4 medical/surgical units. In addition to this, there are 8 nurses and 44 PCTs in a resource pool for these units. The education is estimated to take 30 minutes of a nurse's/PCT's time, and the competency is estimated to take the same amount of time. Therefore, the estimated number of hours of nurse-time is estimated to be 168 hours and the estimated number of hours of PCT-time is estimated to be 204 hours. The average cost of this time is \$30.00 an hour for nurses, resulting in an approximate cost of \$5,040. The average hourly salary for a PCT is \$13.00 an hour, resulting in an approximate cost of Quality managers are expected to utilize 0.3 FTE towards this initiative for a 3-month time frame. Using an average yearly salary of \$100,000, the cost of a quality manager would be \$7,500 per hospital. The total projected opportunity cost of this reeducation initiative is estimated to be \$28,038. A summary of these costs can be found below in Table 1, including a 50% contingency (see following page):

Table 1. *Estimated Opportunity Costs of the VTE Education Initiative*

Employee	Hours	Hospital Cost	50% Contingency Cost
Educator (4)	100	\$3,500	\$5,250
Nurse (168)	168	\$5,040	\$7,560
PCT (204)	204	\$2,652	\$3,978
Quality Manager (1)	0.3 FTE	\$7,500	\$11,250
Total	---	---	\$28,038

The break-even analysis indicates that, in order to account for the cost of this education, a reduction of 2 postoperative VTEs would need to occur to experience a cost savings. This break-even analysis does not include savings related to a higher star rating, brand recognition benefits of having better patient outcomes, nor other non-tangible benefits. In 2018, UPMC Magee-Womens Hospital experienced 17 PSI-12 VTEs. If all PSI-12s could be prevented, UPMC Magee-Womens Hospital would see \$229,053 in savings for non-reimbursable services in addition other benefits, after accounting for the cost of the initiative. If the goal of a 50% reduction in VTEs is met, UPMC Magee-Womens Hospital would see a cost savings of \$100,508.50. The break-even analysis can be seen on the following page (Figure 2):

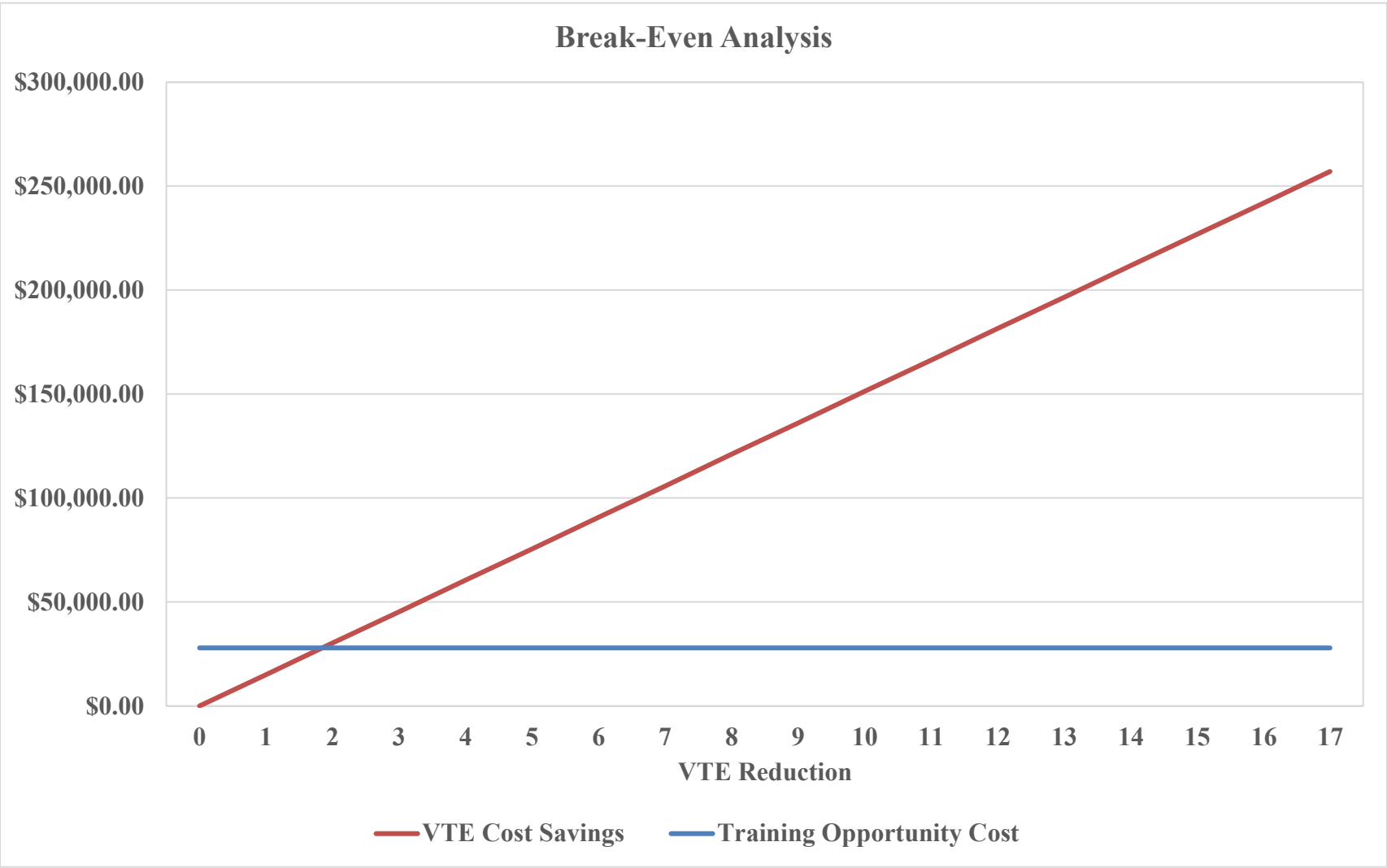


Figure 4. Graph Depicting the Break-Even Analysis for PSI-12s per 1000 Surgical Cases for UPMC Magee-Womens Hospital

1.1.5 Literature Review: Standardized Medication Administration Times (SMAT)

Medication administration timing must account for both the complexity as well as the variability of medications, the indications for which the medications are being prescribed, the clinical situations for which the medications are being prescribed, and the needs of the patient receiving the medications. CMS has guided hospital policies and procedures to specifically address the timing of medication administration. Anticoagulant medications are eligible for scheduled dose timing within a hospital, due to wanting to achieve and maintain a therapeutic blood level of the anticoagulant in the patient over a specified period of time. Therefore, based on these guidelines as well as difficulties ensuring all doses of a scheduled dose medication are given, a Standardized Medication Administration Times (SMAT) intervention was developed to improve adherence of the medication administration process.

According to the Institute for Safe Medication Practices, “Administer [medications administered more frequently than daily but not more frequently than every 4 hours] within 1 hour before or after the scheduled time.” However, strict adherence to this rule would cause many medications to be rescheduled or missed, as a patient may be off of the unit or unable to receive the medication at that time. Therefore, Standardized Medication Administration Time (SMAT) was implemented in an effort to reduce the number of pharmacological anticoagulation missed doses of medication. The dosing schedule utilized by UPMC can be seen below:

Table 2. UPMC Standardized Dosing Schedule

Standardized Dosing Times	
Interval	Standard Times
Daily	6A
2 Times a Day (BID)	6A and 6P
3 Times a Day (TID)	6A, 2P, and 10P

This intervention applies only to prophylactic dosing of Lovenox (30mg Q24H, 30mg Q12H, 40mg Q24H, or 40mg Q12H) and Heparin (5,000units BID or TID or 7,500units TID). In addition to this, this intervention is not intended to be used for subcutaneous therapeutic Heparin dosing used in obstetrical patients.

Another critical component of the SMAT intervention is known as the “Half Dose Interval Rule.” If a patient is off of the unit, a nurse is to administer the medication upon return based on the following two points:

- If at least half of the dosing interval remains give dose and do not change the schedule.
- If greater than half the dosing interval, hold this dose and administer the next scheduled dose.

A visual representation of this rule can be seen in Figure 3 on the following page:

24-Hour Dosing Schedule:

6A	7A	8A	9A	10A	11A	12P	1P	2P	3P	4P	5P	6P	7P	8P	9P	10P	11P	12A	1A	2A	3A	4A	5A
----	----	----	----	-----	-----	-----	----	----	----	----	----	----	----	----	----	-----	-----	-----	----	----	----	----	----

- A patient on a 24-hour dosing schedule can receive **Lovenox** late. The Lovenox can be administered as late as 12 hours after the ordered administration time (i.e. half the dosing interval).
 - **Example:** If a dose is given to a patient at 8A, the next dose can be given at 6A the following day without delaying the medication administration.
- **Note:** Physician or pharmacist discussion encouraged if multiple doses could potentially be given within 12 hours of each other OR if SMAT timing results in significant delay in administration (i.e. post op dose ordered at 9 am and not entered to start until 6 am the next day because the MD didn't specify the time).

12-Hour Dosing Schedule:

6A	7A	8A	9A	10A	11A	12P	1P	2P	3P	4P	5P	6P	7P	8P	9P	10P	11P	12A	1A	2A	3A	4A	5A
----	----	----	----	-----	-----	-----	----	----	----	----	----	----	----	----	----	-----	-----	-----	----	----	----	----	----

- A patient on a 12-hour dosing schedule can receive **Heparin/Lovenox** late. The Heparin/Lovenox can be administered as late as 6 hours after the ordered administration time (half the dosing interval).
 - **Example:** If a dose is given to a patient at 8A, the following dose can be given to the patient at 6P.
- **Note:** Administering Lovenox twice within a 7-hour period could result in significant dose stacking. If necessary, this can be done once or twice, but it should not be done consistently to avoid this risk. Physician discussion and/or retiming encouraged if dosing is consistently late and being given with < 12 hours between dosing.

8-Hour Dosing Schedule:

6A	7A	8A	9A	10A	11A	12P	1P	2P	3P	4P	5P	6P	7P	8P	9P	10P	11P	12A	1A	2A	3A	4A	5A
----	----	----	----	-----	-----	-----	----	----	----	----	----	----	----	----	----	-----	-----	-----	----	----	----	----	----

- A patient on an 8-hour dosing schedule can receive **Heparin** late. The Heparin can be administered as late as 4 hours after the ordered administration time (half the dosing interval).
 - **Example:** If a dose is given to a patient at 8A, the next dose can be given at 2P.

Figure 5. Visual Representation of the Half Dose Interval Rule

1.2 STUDY CONTRIBUTIONS

The goal of this paper is to take a nuanced look at the SMAT intervention as well as take a prospective look at the VTE education initiative. It is hypothesized that the SMAT intervention will 1) decrease the rate of pharmacological anticoagulation missed doses and 2) decrease the relative rate of patient refusals as the identified cause of pharmacological anticoagulation missed doses. The VTE education initiative is hypothesized to decrease the PSI-12 measure by positively impacting nursing compliance with the VTE initiative best practices and documentation. Limited research exists regarding the expected impact of a SMAT intervention, and therefore this knowledge will benefit the field of medication timing, extending beyond the VTE intervention. The VTE education initiative will examine the impact of a highly structured education initiative, which can be expanded system-wide if the impact of the program is great enough. The ROI and implications of this initiative are examined as well. Given the complexity of the Half Dose Interval Rule, an education effort may reinforce this initiative, and in turn improve the SMAT initiative further. In addition to this, a reduction in VTEs would ultimately have a significant public health impact on both patient safety and cost savings.

2.0 DATA AND METHODS

2.1 ANTICOAGULATION DEFINITIONS

This study used patient pharmacological anticoagulation data retrieved from Discern Reporting Portal, which is a reporting tool available in the Cerner electronic medical record. The specific report utilized was Anticoagulation Meds Not Given. This report retrieves all ordered doses of pharmacological anticoagulation that were not charted as given to a patient. This report was set to pull information from specific units: 2600 (obstetric ICU), 2700/2800 and 3700/3800 (pre/postpartum), 4100 (orthopedics and bariatric surgery), 4800 (adult ICU), 3200/5300 (medicine), and 5800 (gynecological oncology). Missed doses are categorized into one of eight categories: Not Done: Pt Refusal, Not Done: D/C Order, Not Done: Order/Task Duplication, Not Done: Not Appropriate at this Time (Details in Comments), Not Done: Held Per MD, Not Done: Pt Unavailable/Off Unit, Not Done: Held for Procedure, and Not Done: Other. Six months of data immediately prior to the February SMAT implementation as well as six months of data post implementation was utilized to compile the dataset. As the implementation occurred in February, the entire month of February was excluded from analysis.

2.1.1 Not Done: Pt Refusal

Patient refusals occur when a patient refuses his or her order for pharmacological anticoagulation.

2.1.2 Not Done: D/C Order

An order is categorized as “Not Done: D/C Order,” or discontinued orders, when a physician discontinues the prescription of the pharmacological anticoagulation for the patient. This entry is excluded from analysis as it is not a missed dose.

2.1.3 Not Done: Order/Task Duplication

An order is categorized as “Not Done: Order/Task Duplication” when concurrent orders exist for pharmacological anticoagulation medication for a specified patient. The duplicate entry is excluded from analysis as it is not a missed dose.

2.1.4 Not Done: Not Appropriate at this Time (Details in Comments)

An order is categorized as “Not Done: Not Appropriate at this Time (Details in Comments)” when some aspect of the patient’s care prevents the pharmacological anticoagulation from being administered.

2.1.5 Not Done: Held Per MD

An order is categorized as “Not Done: Held Per MD” when a physician or advanced care practitioner orders the medication be held for a specific patient.

2.1.6 Not Done: Pt Unavailable/Off Unit

An order is categorized as “Not Done: Pt Unavailable/Off Unit” when a patient was not on the unit at the time the pharmacological anticoagulation dose was to be administered.

2.1.7 Not Done: Held for Procedure

An order is categorized as “Not Done: Held for Procedure” when an upcoming procedure, such as a surgical procedure, prevents the pharmacological anticoagulation from being administered to the patient.

2.1.8 Not Done: Other

An order is categorized as “Not Done: Other” when it cannot be categorized into any of the other eight categories of pharmacological anticoagulation missed doses.

2.2 STATISTICAL ANALYSES

A Chi-Square Goodness of Fit test (Chi-Square test) was used to examine the effect of the SMAT intervention. The implementation of SMAT is hypothesized to decrease the percent of pharmacological anticoagulation missed doses. Furthermore, as refusals of anticoagulation are the most common reasons for a dose being missed, a Chi-Square test was used to examine whether the relative percent of refusals was impacted by the implementation of SMAT. Lastly, the Odds Ratio for the refused doses of anticoagulation was examined to better understand the results of the statistical analysis.

3.0 RESULTS

3.1 SAMPLE DESCRIPTIVE STATISTICS OF MISSED DOSES OF PHARMACOLOGICAL ANTICOAGULATION

The results indicated that the average percent of pharmacological anticoagulation missed doses was lower following the implementation of SMAT (See Table 3). During the time period from August 2017 to August 2018, the range of percent of pharmacological anticoagulation missed doses ranged from 5.48 percent to 9.84 percent, with an average of 8.51 percent of pharmacological anticoagulation missed doses occurring prior to the implementation of SMAT, and an average of 6.46 percent of pharmacological anticoagulation missed doses occurring after the implementation of SMAT occurred. Figure 4 displays the percent of pharmacological anticoagulation missed doses over time, while Figure 5 displays the combined pharmacological anticoagulation missed doses prior to and following the SMAT intervention (6 months of data were included in each of these categories).

3.2 SAMPLE DESCRIPTIVE STATISTICS OF REFUSED DOSES OF PHARMACOLOGICAL ANTICOAGULATION

The results indicated that the average percent of patient refusals of pharmacological anticoagulation was lower following the implementation of SMAT (See Table 4). During the time period from August 2017 to August 2018, the range of percent of refused pharmacological anticoagulation doses ranged from 87.96 percent to 60.59 percent, with an average of 83.51 percent of pharmacological anticoagulation missed doses occurring prior to the implementation

of SMAT, and an average of 73.37 percent of pharmacological anticoagulation missed doses occurring after the implementation of SMAT occurred. Figure 6 displays the relative percent of refused pharmacological anticoagulation doses over time, while Figure 7 displays the combined refused pharmacological anticoagulation doses prior to and following the SMAT intervention (6 months of data were included in each of these categories).

Table 3. Distribution of Missed Doses by Month and Pre-Post Period

Variables	Pre (N=14,461)			Post (N=12,561)		
	Missed Doses	Total Doses	% of Missed Doses	Missed Doses	Total Doses	% of Missed Doses
August 2017	235	2387	9.84%	---	---	---
September 2017	206	2588	7.96%	---	---	---
October 2017	242	2444	9.90%	---	---	---
November 2017	191	2466	7.75%	---	---	---
December 2017	206	2103	9.80%	---	---	---
January 2018	151	2473	6.11%	---	---	---
February 2018	---	---	---	---	---	---
March 2018	---	---	---	122	1990	6.13%
April 2018	---	---	---	124	2262	5.48%
May 2018	---	---	---	130	2017	6.45%
June 2018	---	---	---	124	1990	6.23%
July 2018	---	---	---	141	2094	6.73%
August 2018	---	---	---	170	2208	7.70%

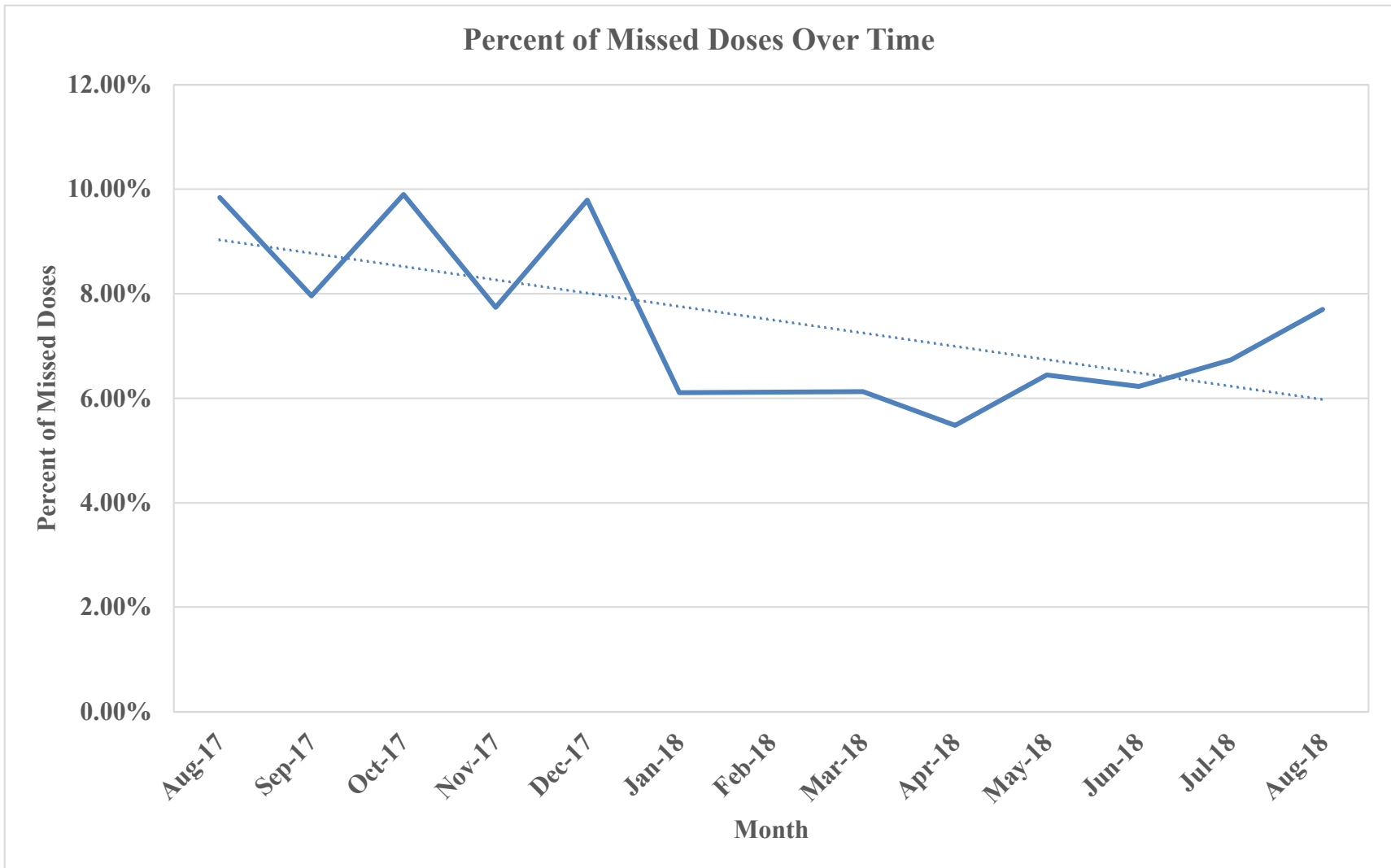


Figure 6. Graph Displaying the Percent of Total Missed Doses per Month from August 2017 to August 2018

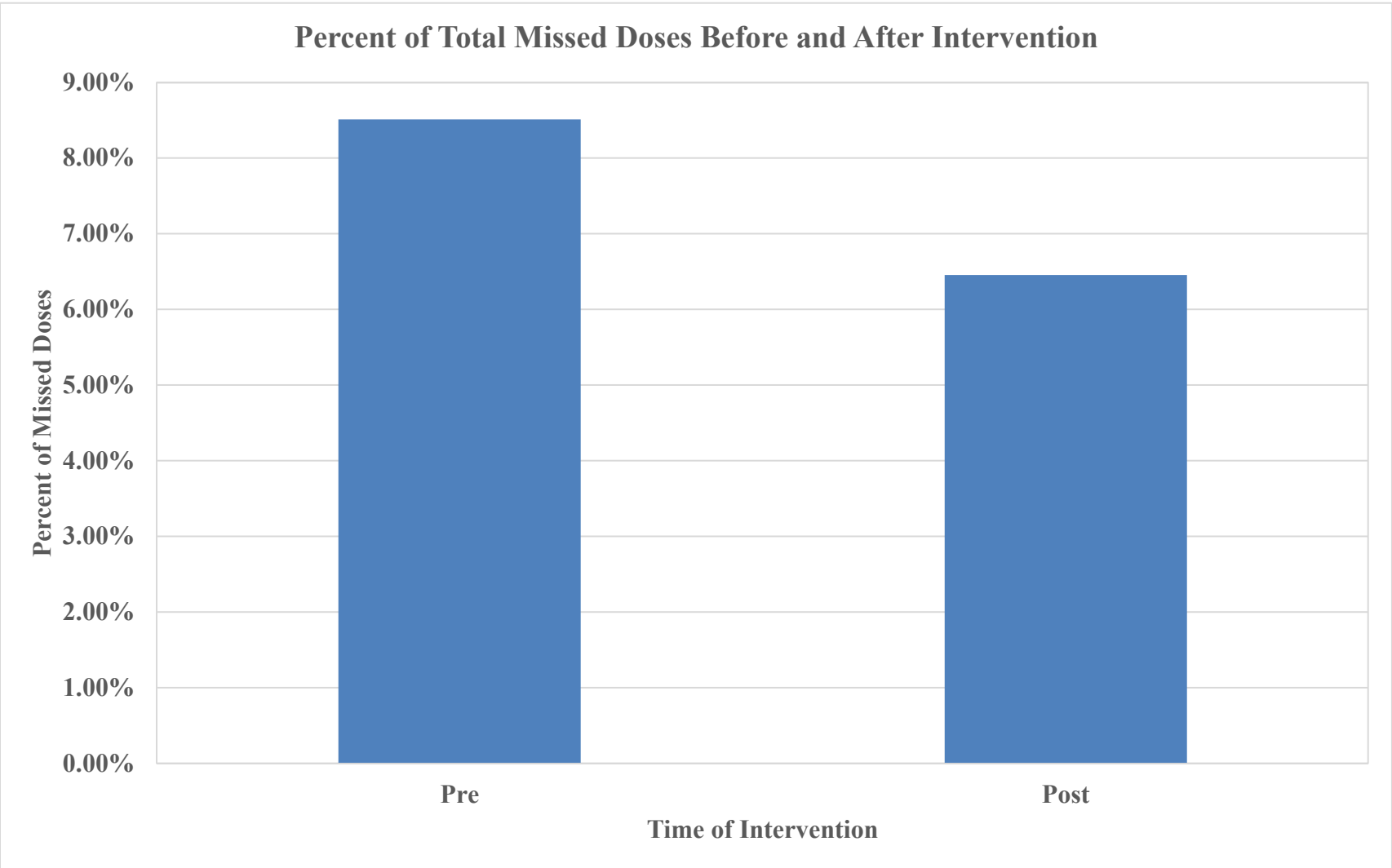


Figure 7. *Graph Displaying the Percent of Missed Prior to and Following the SMAT Intervention from August 2017 to August 2018*

Table 4. Distribution of Refused Doses by Month and Pre-Post Period

Variables	Pre (N=14,461)			Post (N=12,561)		
	Refused Doses	Total Missed Doses	% of Missed Doses	Refused Doses	Total Missed Doses	% of Missed Doses
August 2017	194	235	82.55%	---	---	---
September 2017	169	206	82.04%	---	---	---
October 2017	211	242	87.19%	---	---	---
November 2017	168	191	87.96%	---	---	---
December 2017	179	206	86.89%	---	---	---
January 2018	107	151	70.86%	---	---	---
February 2018	---	---	---	---	---	---
March 2018	---	---	---	103	122	84.43%
April 2018	---	---	---	101	124	81.45%
May 2018	---	---	---	96	130	73.85%
June 2018	---	---	---	93	124	75.00%
July 2018	---	---	---	99	141	70.21%
August 2018	---	---	---	103	170	60.59%

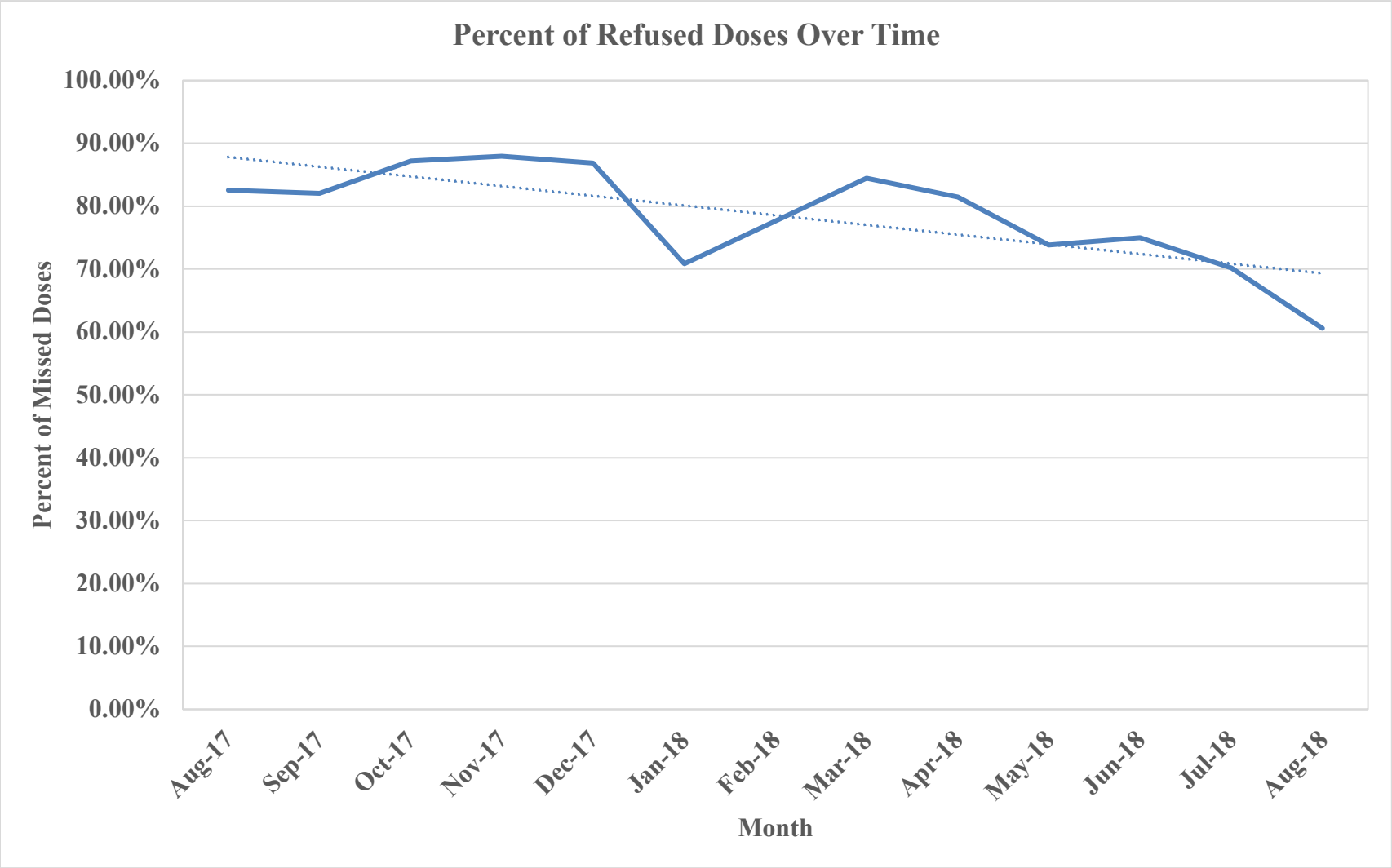


Figure 8. Graph Displaying the Percent of Refused Doses per Month from August 2017 to August 2018

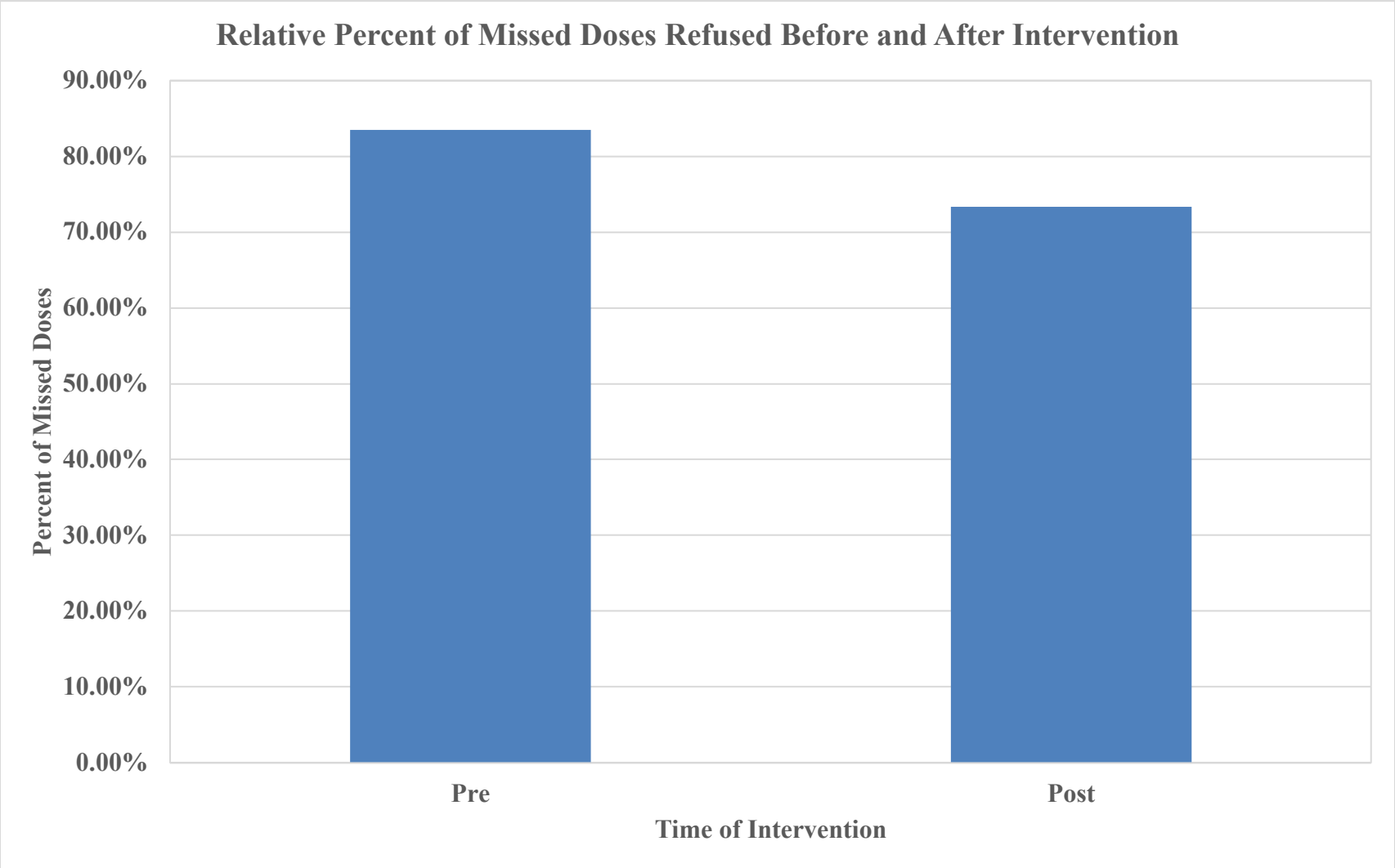


Figure 9. Graph Displaying the Relative Percent of Missed Prior to and Following the SMAT Intervention from August 2017 to August 2018

3.3 STATISTICAL ANALYSIS OF MISSED DOSES OF PHARMACOLOGICAL ANTICOAGULATION

The post intervention period (M = 6.46%, SD = 0.0074) was found to have a lower percent of pharmacological anticoagulation missed doses than the pre intervention period (M=8.51%, SD = 0.016). A Chi-Square test of independence was performed to examine the relation between SMAT intervention and pharmacological anticoagulation missed doses of pharmacological anticoagulation. The results of this relationship confirm that there was a statistically significant difference across the implementations ($\chi^2(2, N = 27,022) = 40.68, p = 1.79 \times 10^{-10}$). See Table 5 for a detailed observed and expected results table.

Table 5. *Chi-Square Observed and Expected Results and Analysis of Missed Doses of Pharmacological Anticoagulation*

		Pre	Post	Total
Missed Dose	Observed	1231	811	2042
	Expected	1093	949	
Dose Given	Observed	13230	11750	24980
	Expected	13368	11612	
Total Doses	Actual	14461	12561	27022
P-Value		1.7947E-10		
Chi-Square		40.67830712		

3.4 STATISTICAL ANALYSIS OF REFUSED DOSES OF PHARMACOLOGICAL ANTICOAGULATION

The post intervention period (M = 73.37%, SD = 0.085) was found to have a relatively lower percent of refused doses than the pre intervention period (M=83.51%, SD = 0.064). A Chi-Square test of independence was performed to examine the relation between SMAT intervention and refused doses of pharmacological anticoagulation. The results of this relationship confirm

that there was a statistically significant difference across the implementations ($\chi^2(2, N = 2,042) = 30.84, p = 2.13 \times 10^{-8}$, odds ratio = 0.53). The odds ratio is reported as a ratio of the pre group relative to the post group.

Table 6 *Chi-Square Observed and Expected Results and Analysis of Refused Doses of Pharmacological Anticoagulation*

		Pre	Post	Total
Missed Dose	Observed	1028	595	1623
	Expected	978	645	
Dose Given	Observed	203	216	419
	Expected	253	166	
Total Doses	Actual	1231	811	2042
P-Value		2.1283E-08		
Chi-Square		30.84223678		

4.0 DISCUSSION

4.1 PHARMACOLOGICAL ANTICOAGULATION DISCUSSION

The first hypothesis regarding the SMAT intervention was that it would decrease the rate of pharmacological anticoagulation missed doses. The second hypothesis was that the SMAT intervention would decrease the relative rate of patient refusals as the identified cause of pharmacological anticoagulation missed doses. The results of Chi Square analysis supported both hypotheses.

Standardizing the time of medication administration creates an expectation as well as a routine for nurses to follow when administering medications in the morning. As evidenced by the results of this study, this standardization has led to a significant decrease in pharmacological anticoagulation missed doses. In conjunction with this expectation is the Half Dose Interval Rule, which states that if a patient is off of the unit, a nurse is to administer the medication upon return based on the following two points:

- If at least half of the dosing interval remains give dose and do not change the schedule.
- If greater than half the dosing interval, hold this dose and administer the next scheduled dose.

The Half Dose Interval Rule was initiated in an attempt to maintain the routine times of administration. Prior to this initiative being implemented, nursing could be giving patients doses of pharmacological anticoagulation at completely disjoint times of day, as the medication would

simply be rescheduled or missed if the ordered time for the medication was not feasible to administer the medication. These disjoint administration times ultimately lead to doses not being administered to the patient. By giving nursing a safe timeframe to administer the medication past the ordered administrative time while keeping the next scheduled dose of pharmacological anticoagulation unaltered, the routine administration times are maximized, less rescheduling needs to occur, and ultimately the percent of missed doses of pharmacological anticoagulation declines.

In addition to reducing the percent of pharmacological anticoagulation missed doses, the initiative was found to reduce the relative percent of refused doses. Prior to this initiative, nursing could potentially reschedule a medication so that one of the administration times was 2:00 in the morning. Patients are much more likely to refuse a dose, in particular a medication that must be injected, at a time when they want to be sleeping than 6:00 in the morning, when nursing is doing bloodwork anyway. The results of the odds ratio found that the pre implementation group relative to the post implementation group was 0.53, meaning that the post implementation group was approximately half as likely as the pre implementation group to refuse pharmacological anticoagulation.

4.2 VTE EDUCATION INITIATIVE DISCUSSION

The VTE education initiative discussion will be prospective, as the initiative has not yet occurred, and no data is available to examine. In order to standardize nursing knowledge and competency within the hospital, it is first necessary to create a standardized education toolkit nurses can read and reference when they are unsure of the proper treatment for one of their patients. This tool would have to cover topics identified by the system as best practice for VTE prevention. Generally, these topics include: patient education of VTE prevention, sequential

compression device (SCD) utilization, and ambulation policies of the system. In addition to these topics, understanding of pharmacologic DVT prophylaxis and proper documentation of these best practices are necessary to successfully care for a patient. After numerous meetings and rounding with various nursing units, an educational guide was created by the author of paper for this VTE education initiative (see Appendix A).

4.3 VTE EDUCATION INITIATIVE PROPOSED STRUCTURE

4.3.1 VTE Education Initiative: Proposed Structure: Part 1: Reeducation

In the proposed structure to the VTE education initiative, a competency would be designed and utilized by nurse educators across all medical/surgical units of UPMC Magee-Womens Hospital. Nurse educators would be trained by their hospital's quality manager using the evidence-based standardized curriculum, ensuring their knowledge and teaching style is standardized. Nurse educators would then take a one-month period to educate all of their staff through half hour small group sessions (5-10 nurses a session). One month later, nurse educators would return to complete competencies in an effort to validate the nurses understood the education.

4.3.2 VTE Education Initiative: Proposed Structure: Part 2: New Hire Education

Once the proposed VTE reeducation effort has been completed, a process for educating new hires must occur to prevent the knowledge gained by this initiative from regressing back to the previous state. Therefore, the second component of this VTE education initiative would be built into unit-based orientation as well as yearly competencies to ensure the education has had an enduring, consistent effect.

4.3.3 VTE Education Initiative: Proposed Structure: Part 3: Enforcement

Once the proposed VTE reeducation effort and new hire education have been established, a process for enforcement of these policies must be put in place to ensure adherence to the evidence based best practices for VTE prevention. Therefore, the third component of this VTE education initiative would consist of tracking the competency validation of nurses as well as disciplining nurses who frequently are not meeting best practices for their patients. Competency validation forms can be sent to the hospital-based Quality Department, where tracking of competency completion may occur. Unit directors would be tasked with disciplining nurses who have completed the VTE competency yet continue to fail to meet best practices for VTE prevention.

4.4 VTE EDUCATION INITIATIVE EVALUATION

Once the VTE education initiative has been completed, a means of evaluation must be established the effectiveness of the intervention. There are multiple key performance indicators (KPIs) that are currently monitored by the Quality Department that could be utilized for this component of the initiative, which will be discussed in further detail below:

4.4.1 Anticoagulation Missed Dose Report

Once per week, floor units receive a report that identifies all missed doses of pharmacological anticoagulation and the reasons associated with each incident. In addition to this, units receive a monthly report that details the monthly percent of pharmacological anticoagulation missed doses, detailing a rolling two years of data. This information would be useful to examine following the implementation of this initiative. It would be hypothesized that the number of missed doses would decrease even further as knowledge of medications as well as the SMAT initiative

increases. It would also be hypothesized that the compliance with proper documentation of a pharmacological anticoagulation missed dose would increase after nursing has been educated.

4.4.2 Quality Monitoring

Floor units receive a monthly report detailing compliance across a variety of quality measures. From a VTE perspective, this report includes compliance audits of the following measures: 1) Whether VTE orders were addressed for patients on the floor; 2) Nursing charting on SCD orders; and 3) Visual audits of whether SCDs are actually being worn by patients. It would be hypothesized that all three of these measures would improve as knowledge of VTE prevention is standardized across nursing within the hospital.

4.5 FUTURE STATE: EDUCATION

Contemporary UPMC system-wide VTE prevention education of new UPMC nurses will continue to contain 15 minutes of didactic instruction during nursing orientation (RNO), in order to provide a useful cursory introduction to the concept of the importance of VTE prevention. As previously stated, patient care technicians (PCTs) will continue to receive new hire PCT education at UPMC Mercy Hospital, called inexperienced nursing assistant (NA) class, which requires a competency completed on SCD use, application, and patient ambulation. Once the nurse and/or PCT completes their system-wide orientation, s(he) will still arrive at UPMC Magee-Womens Hospital for UPMC Beginnings. Following this, a nurse will arrive on his or her unit and be assigned a preceptor while PCTs will continue to undergo a hospital-based PCT orientation before matching with their preceptor. Following the VTE reeducation implementation, unit orientation and hospital-based PCT orientation will now cover VTE prevention in detail, educating on details regarding documentation and specific policies.

Precepting nurses and precepting PCTs will now be better educated and have completed the VTE reeducation competency, better preparing the preceptor to educate on the topic of VTE prevention. VTE champions will continue to both audit and reinforce this education. The improved process flow can be seen on the following page (see Figure 10 on the following page):

4.6 PUBLIC HEALTH AND IRON TRIANGLE IMPLICATIONS

Nearly everyone in healthcare is familiar with the Iron Triangle, which was first introduced in William Kissick's book *Medicine's Dilemmas: Infinite Needs Versus Finite Resources* in 1994 (see Figure 10 below):



Figure 11: *Image Depicting the Iron Triangle Framework*

The Iron Triangle includes three key components: improving quality of care being delivered, cost containment, and expanding access to care. Ultimately, investments by healthcare organizations should seek to meet multiple aspects of this framework. The VTE reeducation initiative meets two aspects of this triangle, namely improving quality and containing costs. First, by improving compliance with best practices, the quality of care provided to patients is maximized, with high risk patients being identified, appropriately cared for, and being sent home with appropriate preventative medications to prevent readmissions. Second, the VTE reeducation initiative aims to reduce costs both of the organization as well as having implications for reducing the costs of healthcare generally. By reducing the rate of PSI-12s by 50%, over \$100,000 of treatment costs can be avoided. When factoring in the cost of nonsurgical VTEs, single hospitals can prevent hundreds of thousands of healthcare dollars from being spent.

4.7 LIMITATIONS

The primary limitation of the present study was that this study was not possible to complete in isolation. There is information being distributed through multiple venues, and there are efforts being made to improve VTE prevention within the hospital setting. Feedback is constantly given to unit directors to pass on to their staff with the hopes of improvement. This could bias the results of the study, as these efforts could produce similar effects to the desired effect of the SMAT intervention. Nonetheless, the effect size was so strong that the author believes that the SMAT intervention would still likely be highly significant even if it were possible to test this intervention in isolation. Another limitation of this paper is that there was no data yet available on the VTE education initiative as it is currently in the process of being implemented. Once sufficient data has been collected, the impact of this initiative may be examined.

5.0 CONCLUSION

Together, the findings of the SMAT initiative demonstrate that the program was a definite success. Not only was it successful at decreasing the percent of pharmacological anticoagulation missed doses, but it was successful at decreasing the relative rate of patient refusals as well. This program could arguably become more successful as the education initiative is implemented, as knowledge of the Half Dose Interval Rule will improve across nurses in the hospital setting. The VTE education initiative is an evidence-based program with potential to greatly impact nursing compliance with VTE prevention best practices. Future research is indicated to examine possible improvements to the SMAT intervention, specifically regarding the ideal times to administer medications.

**APPENDIX A: VTE COMPETENCY VALIDATION FORM AND VTE EDUCATION
PACKET**

Prior to Competency Validation All Prerequisite Reading Has Occurred	Verbalizes (Date/Initials) Yes/No	Demonstrates (Date/Initials) Yes/No	Needs further review (Y/N) (Date/Initials)	Comments
Patient Education (PCTs can reiterate education by nursing)				
<input type="checkbox"/> Provide patient with VTE education on admission.				
<input type="checkbox"/> Reeducate patient regarding VTE upon refusal.				
SCDs				
<input type="checkbox"/> Selects Sequential Compression Device (SCD):				
• Demonstrates sizing/application				
• Verbalizes contraindications				
• Verbalizes skin assessment/care				
Ambulation				
<input type="checkbox"/> Describes minimum frequency.				
<input type="checkbox"/> Describes acceptable minimum distance.				
Pharmacologic DVT Prophylaxis (Nursing only)				
<input type="checkbox"/> Verbalizes Standardized Medication Administration Times (SMAT).				
<input type="checkbox"/> Describes when medication should be re-scheduled.				
<input type="checkbox"/> Verbalizes when medication should be held.				
<input type="checkbox"/> Describes how to chart the correct "Reason Not Done" for medication administration.				
VTE IPOC (Nursing only)				
<input type="checkbox"/> Describes location and purpose of IPOC.				
<input type="checkbox"/> Verbalizes frequency of completion/revision.				
Documentation				
<input type="checkbox"/> Demonstrates/verbalizes use of SCD Task				
<input type="checkbox"/> Demonstrates/verbalizes use of IView/I&O				
• Pharmacologic documentation and information requirements of comments.				
• SCD frequency and documentation.				
• SCD application length of time.				
• Ambulation frequency and documentation.				
• Knowledge of proper ambulatory documentation of distance.				
• VTE/Anticoagulation education.				

Educator: Name _____ Signature _____ Date _____

Nurse: Name _____ Signature _____ Date _____

VTE Education Packet

Background: VTE Statistics:

- 350,000-650,000 Americans are diagnosed with a VTE every year.
- 100,000-300,000 deaths are related to VTEs every year.
- VTEs account for 10% of all hospital deaths.
- VTEs kill more people than AIDS, cancer, and car accidents combined!
- **VTE is the MOST preventable hospital acquired condition (HAC).**

Background: VTE Associated Costs:

- Each hospital-associated DVT event costs, on average, \$7,700-\$10,800.
- Each hospital associated PE event costs, on average, \$9,500-\$16,600.

Three Questions Every Nurse Should Ask Himself/Herself:

- 1) Did my patient refuse VTE prevention? If so, did I leave details in my documentation?
- 2) Did I document SCDs and clear my pumps appropriately?
- 3) Did I ambulate my patient twice today?

VTE Education Packet

Section 1: Patient Education:

- Upon admission, nurses are to provide their patients (and the patients' families) with VTE education.
- The Blood Clot Prevention Flier (see below) should be provided with the welcome guide for every patient.

Blood Clots: What You Can Do to Prevent Them:

You are at risk for a blood clot. Surgery, infections, lack of movement, and being in a hospital are risk factors for a blood clot. A blood clot is when blood does not flow normally through your blood vessels. This can be very serious and can even cause death. Blood clots affect 900,000 Americans and are responsible for over 100,000 deaths each year.

Other Names for Blood Clots:

- Deep vein thrombosis (DVT) is a clot in the leg or arm.
- Pulmonary embolism (PE) is a clot in the lungs.

What You Can Do to Prevent a Blood Clot:

- **Take Medicines that Thin Your Blood (Called Anticoagulants):**
 - You may need to get this medicine as shots, pills, or both. Please talk to your care team if this is not a good choice for you.
- **Use the Sequential Compression Device, or SCD:**
 - Your doctor may recommend this machine to improve blood flow in your legs. The sleeves wrap around your legs and connect to a machine that fills and then removes air from the sleeves.
 - It is very important to always use the machine when you are in bed or in a chair. Ask someone to remove the sleeves before walking.
- **Wear TED Hose:**
 - These stockings are given to some patients to push blood toward their heart.
- **Walk/Exercise Your Legs:**
 - Get out of bed and walk as many times a day as you can because exercise/movement helps your blood to flow.
 - Point your toes up to tighten your calves and then relax them. Do this as many times a day as you can.



When you leave the hospital, you are still at risk. It is important to take your medications, walk, and exercise your legs.

Learn more about blood clot prevention by watching a video at www.UPMC.com/healthlibrary on your phone or when you get home. Search for blood clot video in the search bar. Select "Preventing Blood Clots in Leg Veins Video."

VTE Education Packet

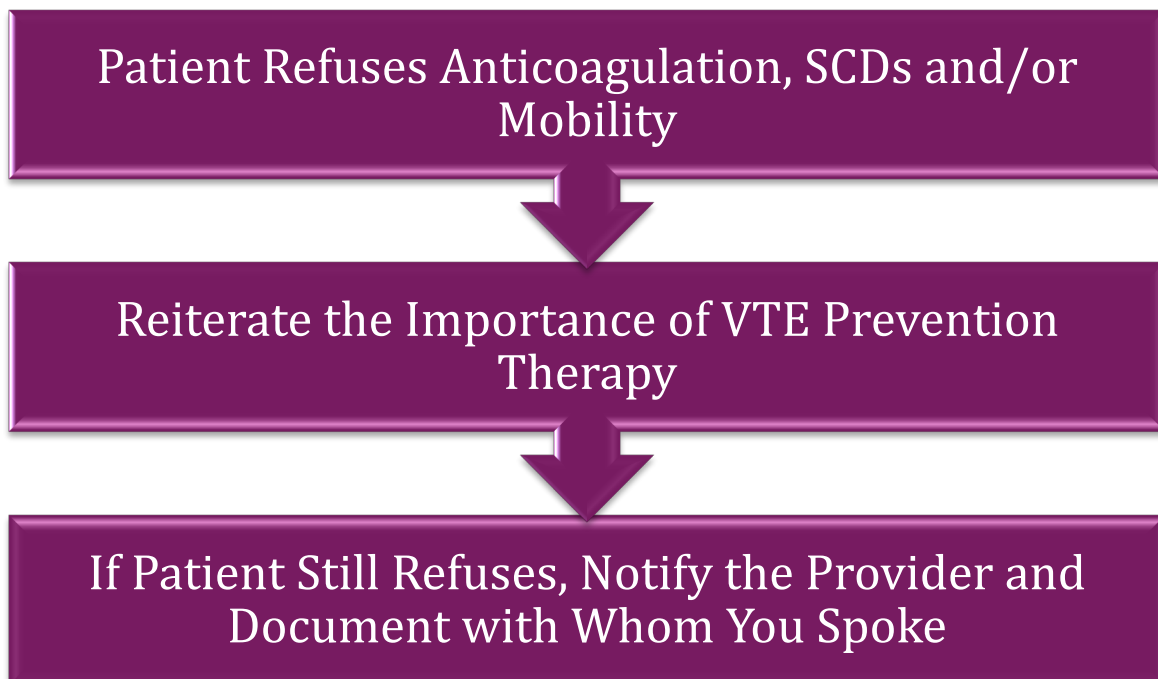
Section 1: Patient Education (Continued):

- Upon refusal, patient (and family) should be reeducated regarding the importance of VTE Education.
- If reeducation is unsuccessful and the patient continues to refuse, please make sure to reach out to the provider to see if they want the order D/Ced or if they want you to continue documenting the orders as "refused."

Verbiage to Set You Up for Patient Acceptance:

- **Anticoagulation Medication Administration:** *“Mr. Jones, I have your Heparin/Lovenox injection that Dr. Smith ordered for you. You are at high risk of developing blood clots and this will help prevent you from getting one. I see that you had the last injection on the right side of your stomach. Apart from the right side, where would you like this injection to be?”*
 - The above example still gives the patient a choice in their care, but also does not ask the patient if they want the medication, which could result in more patient refusals.
- **Anticoagulation Medication Refusal:** *“Mr. Jones, this injection is important to prevent you from developing a blood clot which can travel to your lungs and cause your condition to become worse or even lead to death.”*
 - The above example ensures the patient understands the danger of refusing medications.
- **Anticoagulation Medication Refusal:** *“Mr. Jones, although walking helps prevent blood clots, it is important that we use all options to prevent you from developing a blood clot. If you are uncomfortable with getting this injection, I will call Dr. Smith and ask if there is an alternative medication you can use.”*
 - The above example emphasizes the importance of a comprehensive VTE prevention plan as well as helps you appear to be attempting to customize their prevention plan to their interests.

VTE Escalation Protocol:



VTE Education Packet

Section 2: Sequential Compression Devices (SCDs):

- SCDs should be sized and applied appropriately by following the manufacturing guidelines.
- SCDs should be removed during the head-to-toe assessment and skin integrity should be checked.

General Application Guidelines for SCDs:

- Determine the correct sleeve size by measuring the extremity of the patient.
- The ankle should line up with the ankle indication on the sleeve.
- Wrap the sleeve around the patient's leg and secure it.
- **Rule of Thumb:** Place two fingers between the patient's leg and the sleeve to ensure a correct fit.
- Check the connections are attached properly.
- Turn the SCD pump on and ensure its working properly.
- **Goal:** Patient should wear SCDs for 18 hours every 24-hour period.

Contraindications:


- If your patient is admitted with new-onset LE swelling and is awaiting testing to rule out a DVT, do not use an SCD on that extremity until the exam has been completed and is negative.
- If the patient has a DVT in one LE, you can still apply an SCD to the opposing leg if appropriate.
- If the patient, at any time during their stay, starts to complain of calf pain or has a Homan's sign, please remove the SCD and alert the provider to see if s/he wants to obtain a Doppler to rule out a DVT.
- If the patient has had recent surgery on that extremity, SCDs should only be applied if cleared by a provider.
- For cellulitis and wounds, unless stated otherwise by the provider, do not prohibit the use of SCDs.
- If your patient has had an amputation of one extremity, the other extremity can still have an SCD applied if cleared by the provider.
- Do not use SCDs in conjunction with TED hose.

VTE Education Packet

Section 2: Sequential Compression Devices (SCDs) (Continued):

SENTARA


Operation of the Kendall SCD™ 700 Compression System with Compliance Meter

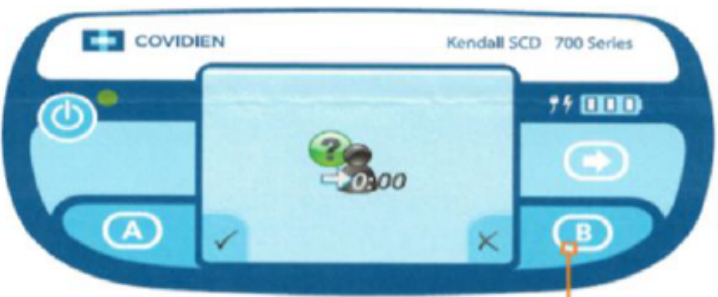


Top Number
Shows hours and minutes the controller has been operating

Bottom Number
Shows total number of hours since compliance meter has been reset

Shift Selector Feature
Press the "A" button to toggle through shift modes (in 8 hour, 10 hour, 12 hour, 24 hour selections; sum view displays total operating time)

Access the Compliance Meter
Press the  button



Reset Compliance Meter
Press the "B" button to reset compliance meter. Confirm reset by selecting the "A" button. (0 hours, 0 minutes)

Recording Hours SCDs Worn & Resetting the Compliance Meter Every 12 Hours

1. Access the Compliance Meter (# of hours SCDs worn by patient) by pressing the "Right Arrow".
2. At EVERY shift change, record in EPIC the number of hours (Top Number) SCDs worn by patient.
Remember: Patients should wear their SCDs 18 out of 24 hours each day.
3. Reset the Compliance Meter EVERY shift during Effective Handoff by pressing button "B".
4. Confirm the Compliance Meter has been reset by pressing button "A".
5. Allow patients to wear SCDs during diagnostic testing if not contraindicated and for unit-to-unit transfers. Do NOT discard SCDs during transfers.

*Though the image states EPIC, this applies to both Cerner and EPIC.

VTE Education Packet

Section 3: Ambulation:

- **UPMC System Policy:** Provided ambulation is not contraindicated, ambulation should occur and be documented BID.
- SCDs may be removed while ambulating, however, they should immediately be reapplied once the patient returns to the bed or chair.
- Ambulation is defined as the ability to walk for 32 feet (Amin, Girard, and Samama 2010).
- **Refusals:** Per *Section 1: Patient Education*, the patient should be educated on the importance of ambulation.
- **Myth:** *I can't ambulate my patient because he has a DVT.* Studies have actually shown that ambulation reduces swelling and does not increase the chance that a patient will develop a PE. Only SCDs are contraindicated on the leg with an active DVT.

MOBILITY: One Patient, Everyone's Responsibility



STANDARD OF CARE

All UPMC staff are expected to mobilize all patients who are medically appropriate and can safely be out of bed according to the following guidelines:

1. Out of bed BID to TID for meals
2. Ambulate BID and to bathroom

VTE Education Packet

Section 4: Pharmacologic DVT Prophylaxis:

- **Note:** This guide applies only to prophylactic dosing of Lovenox (30mg Q24H, 30mg Q12H, 40mg Q24H, or 40mg Q12H) and Heparin (5,000units BID or TID or 7,500units TID). This guide is NOT intended to be used for SubQ therapeutic Heparin dosing used in obstetrical patients.
- **Standard Medication Administration Times (SMAT) of Heparin and Lovenox:** Strategy implemented to increase the number of anticoagulation doses given:
 - **Daily:** 6A
 - **BID:** 6A and 6P
 - **TID:** 6A, 2P, and 10P
- **½ Dose Interval Rule:** If patient is off the unit, administer the medication upon return. If at least half of the dosing interval remains give dose and do not change the schedule. If greater than half the dosing interval, hold this dose and administer the next scheduled dose.

24-Hour Dosing Schedule:

6A	7A	8A	9A	10A	11A	12P	1P	2P	3P	4P	5P	6P	7P	8P	9P	10P	11P	12A	1A	2A	3A	4A	5A
----	----	----	----	-----	-----	-----	----	----	----	----	----	----	----	----	----	-----	-----	-----	----	----	----	----	----

- A patient on a 24-hour dosing schedule can receive **Lovenox** late. The Lovenox can be administered as late as 12 hours after the ordered administration time (i.e. half the dosing interval).
 - **Example:** If a dose is given to a patient at 8A, the next dose can be given at 6A the following day without delaying the medication administration.
- **Note:** Physician or pharmacist discussion encouraged if multiple doses could potentially be given within 12 hours of each other OR if SMAT timing results in significant delay in administration (i.e. post op dose ordered at 9 am and not entered to start until 6 am the next day because the MD didn't specify the time).

12-Hour Dosing Schedule:

6A	7A	8A	9A	10A	11A	12P	1P	2P	3P	4P	5P	6P	7P	8P	9P	10P	11P	12A	1A	2A	3A	4A	5A
----	----	----	----	-----	-----	-----	----	----	----	----	----	----	----	----	----	-----	-----	-----	----	----	----	----	----

- A patient on a 12-hour dosing schedule can receive **Heparin/Lovenox** late. The Heparin/Lovenox can be administered as late as 6 hours after the ordered administration time (half the dosing interval).
 - **Example:** If a dose is given to a patient at 8A, the following dose can be given to the patient at 6P.
- **Note:** Administering Lovenox twice within a 7-hour period could result in significant dose stacking. If necessary, this can be done once or twice, but it should not be done consistently to avoid this risk. Physician discussion and/or retiming encouraged if dosing is consistently late and being given with < 12 hours between dosing.

8-Hour Dosing Schedule:

6A	7A	8A	9A	10A	11A	12P	1P	2P	3P	4P	5P	6P	7P	8P	9P	10P	11P	12A	1A	2A	3A	4A	5A
----	----	----	----	-----	-----	-----	----	----	----	----	----	----	----	----	----	-----	-----	-----	----	----	----	----	----

- A patient on an 8-hour dosing schedule can receive **Heparin** late. The Heparin can be administered as late as 4 hours after the ordered administration time (half the dosing interval).
 - **Example:** If a dose is given to a patient at 8A, the next dose can be given at 2P.

VTE Education Packet

Section 5: VTE IPOC

- Nurses should be familiar with the VTE IPOC and its purpose of providing individualized patient care:
 - Problem, status, interventions, and goals.
- The nurse will be tasked once a patient is identified as Moderate or High Risk for developing a VTE when the provider completes the risk assessment.
- The VTE IPOC should be completed on admission and then updated throughout hospitalization.

The screenshots show the IView/I&O software interface for the VTE IPOC form. The interface is divided into several sections:

- View Testing:** A list of various I/O items including Living Situation (IPOC), Discharge Planning (IPOC), Core Measure (IPOC), Infection (IPOC), Nutrition (IPOC), Elimination (IPOC), Pain (IPOC), Patient Safety (IPOC), Wandering (IPOC), Psychosocial (IPOC), Cardiovascular (IPOC), VTE (IPOC), Neurological (IPOC), Stroke (IPOC), Respiratory (IPOC), Restraints Violent (IPOC), Restraints Non-Violent (IPOC), Skin/Wound (IPOC), Obstetrical (IPOC), Newborn (IPOC), Priority Need 1 (IPOC), Priority Need 2 (IPOC), Priority Need 3 (IPOC), Priority Need 4 (IPOC), and Additional Interdisciplinary Comments.
- Condition A and C Documentation:** A section for documenting specific conditions and comments.
- IPOC (Individualized Patient Care):** The main form area, which includes:
 - Find Item:** A dropdown menu to search for items.
 - Result:** A table with columns for Result, Comments, Flag, Date, and Performed By.
 - VTE problem:** A section for defining the VTE problem, including checkboxes for 'Treatment for blood clots' and 'At risk for blood clots'.
 - VTE planned interventions:** A section for selecting interventions, such as 'Ambulation as ordered', 'Assure Correct Size - Proper Application of Mech Prophylaxis', 'Maintain VTE Prophylaxis', 'Monitor Renal Function', 'Monitor signs/symptoms for bleeding and/or wound hematoma', 'Pharmacologic Prophylaxis', and 'Verbalizes Understanding of VTE Education'.
 - VTE goals:** A section for selecting goals, such as 'Patient will be compliant with pharmacologic interventions', 'Patient will be compliant with mechanical interventions', 'Patient will be compliant with ordered ambulation', 'Patient will show no signs of hemorrhage', 'Patient will maintain adequate renal function', 'Patient will show no signs of blood clots', 'Pt will exp understanding of risk factors for blood clot edu', and 'Pt will exp understanding of prevention of blood clots edu'.
 - VTE Goal Timeframe IPOC:** A dropdown menu to select the goal timeframe, such as 'Within current shift' or 'Prior to discharge'.
 - VTE Comments IPOC:** A section for providing additional comments.

VTE Education Packet

Section 5: Documentation:

- It is critical that nurses fully understand what is expected of them from a documentation standpoint. Specifics regarding documentation can be found below.

Pharmacologic Documentation:

- Pharmacologic documentation should occur in the EMAR for the patient.
- Below are possible categories for missed doses and examples of what documentation is considered acceptable:
 - **Not Done: Pt Refusal: Provider (by name) notified/aware, patient education, and reason for refusal should be included for each dose being refused.** The first refusal should always have a provider notified, while subsequent refusals should keep the current provider aware of the refusal. If the patient will not disclose why he or she is refusing, “Unknown why patient is refusing” would be sufficient.
 - **Not Done: D/C Order:** No comment needed.
 - **Not Done: Order/Task Duplication:** No comment needed.
 - **Not Done: Not Appropriate at this Time (Details in Comments):** Must provide reason for missed dose for each instance.
 - **Not Done: Held Per MD:** Must provide reason for missed dose for each instance as well as provider name.
 - **Not Done: Pt Unavailable/Off Unit:** Must state that this dose is past ½ the interval between current and next dose.
 - **Not Done: Held for Procedure:** Must state “Verified by provider (by name) for procedure (state procedure).”
 - **Not Done: Other:** Must provide reason for missed dose for each instance.

SCDs:

- **3x per day (4A, 12P, and 8P):** SCDs must be documented applied/intact, refused, or other (reason) for SCDs.
 - **Note:** Comments should be included for anything except for applied/intact.
 - **Note:** Removal documentation will not count towards 3x per day.
- **Active DVT:** SCDs can be applied to unaffected leg if appropriate:
 - **Note:** Document as one leg applied/intact, one leg as removed, and “Other: [Reason]”
- At the end of your shift, you must document the time that SCDs have been worn. If your patient is refusing SCDs, you need to document 0000/1200 in the “Other” section of “Treatment” under Care Interventions.

Ambulation:

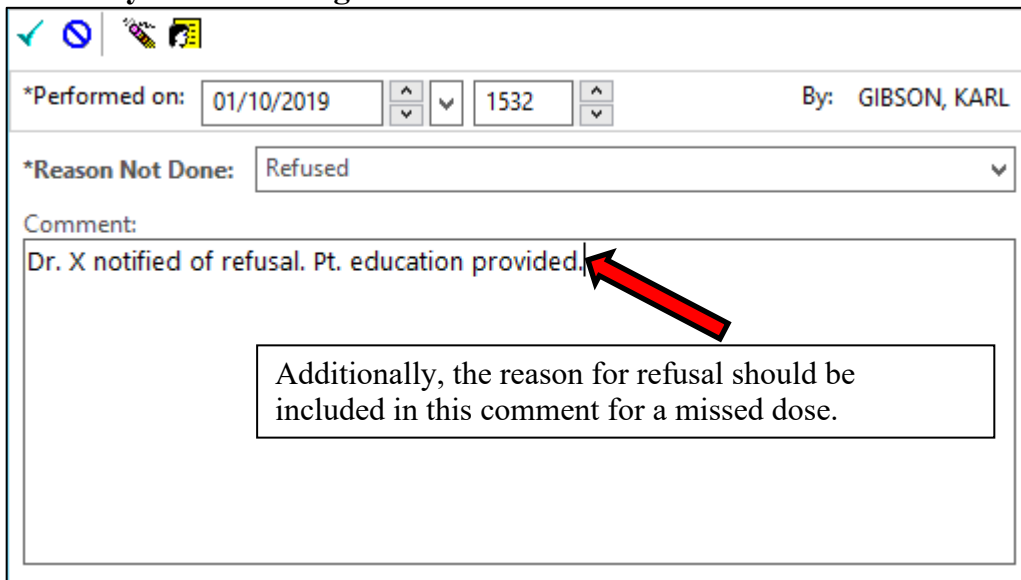
- **2x per day.**
- Refusals or issues with ambulating the patient should be documented under “Other.”
- Documentation of distance must occur under “Distance Ambulated:”
 - **Note:** Distances of less than 32 feet are not considered ambulation.
 - **Note:** No documentation of distance will assume 0-20 feet, and thus not be considered ambulation.

Education:

- Initial education should be completed under the VTE/Anticoagulation education.
- Reeducation can be completed within the “other” comments for their respective areas (see above).

VTE Education Packet

Correctly Documenting Missed Doses:



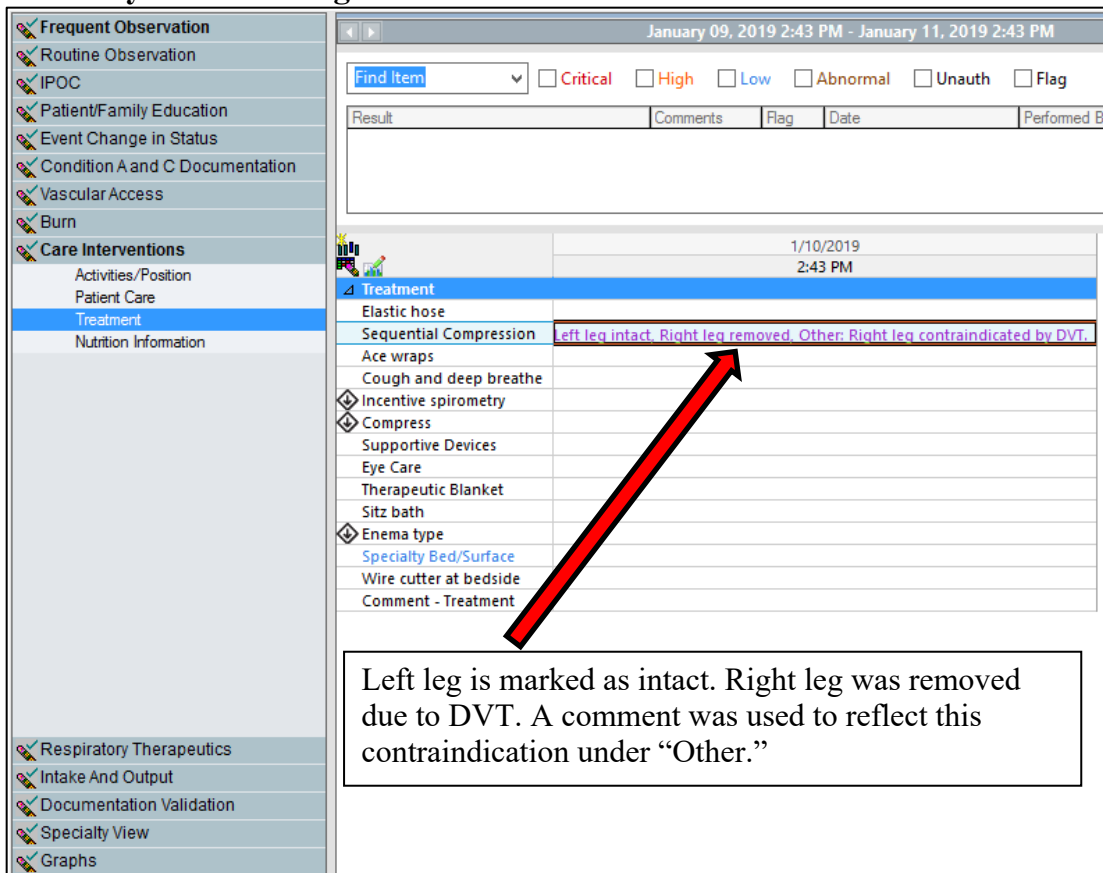
*Performed on: 01/10/2019 1532 By: GIBSON, KARL

*Reason Not Done: Refused

Comment:
Dr. X notified of refusal. Pt. education provided.

Additionally, the reason for refusal should be included in this comment for a missed dose.

Correctly Documenting SCDs:



January 09, 2019 2:43 PM - January 11, 2019 2:43 PM

Find Item Critical High Low Abnormal Unauth Flag

Result	Comments	Flag	Date	Performed By
			1/10/2019	2:43 PM
	Treatment			
	Elastic hose			
	Sequential Compression			Left leg intact. Right leg removed. Other: Right leg contraindicated by DVT.
	Ace wraps			
	Cough and deep breathe			
	Incentive spirometry			
	Compress			
	Supportive Devices			
	Eye Care			
	Therapeutic Blanket			
	Sitz bath			
	Enema type			
	Specialty Bed/Surface			
	Wire cutter at bedside			
	Comment - Treatment			

Left leg is marked as intact. Right leg was removed due to DVT. A comment was used to reflect this contraindication under "Other."

VTE Education Packet

Correctly Documenting SCDs (Continued):

The screenshot shows a software interface with a left-hand navigation menu and a main data table. The menu includes categories like 'Frequent Observation', 'Care Interventions', and 'Respiratory Therapeutics'. The main table displays data for January 10, 2019, at 2:43 PM. Under the 'Treatment' section, 'Sequential Compression' is listed with the value 'Other: 0900/1200'. A red arrow points from a text box to this entry.

The amount of time the SCD was intact is correctly documented under “Other” within “Sequential

The screenshot shows a software interface similar to the one above, but for January 09, 2019, from 2:43 PM to January 11, 2019, at 2:43 PM. The 'Sequential Compression' entry is highlighted with a red arrow pointing to the text 'Left leg refused, Right leg refused, Other: Pt. refusing SCDs, Dr. X notified of refusal, Patient education provided.'.

This was the first instance of a patient refusal. Proper documentation (physician notification [by name] and patient education) for refusals provided

VTE Education Packet

References

Addendum of Newer Anticoagulants to the SIR Consensus Guideline (2013). *Journal of Vascular and Interventional Radiology*, 24, 641-645.

Amin, A. N., Girard, F., & Samama, M. M. (2010). Does ambulation modify venous thromboembolism risk in acutely ill medical patients? *Thrombosis and Hemostasis*, 104(5), 955-961.

Consensus Guidelines for Periprocedural Management of Coagulation Status and Hemostasis Risk in Percutaneous Image-guided Interventions (2012). *Journal of Vascular and Interventional Radiology*, 23, 727-736.

Interventional Spine and Pain Procedures in Patients on Antiplatelet and Anticoagulant Medications (2015). *Regional Anesthesia and Pain Medicine*, 40, 182-212.

Kendall SCD 700 Series Controller. Covidien Mansfield, MA www.covidien.com.

BIBLIOGRAPHY

- AHRQ Quality Indicators™ (AHRQ QI™) ICD-10-CM/PCS Specification, 2018. Content last reviewed April 2019. Agency for Healthcare Research and Quality, Rockville, MD. <https://www.qualityindicators.ahrq.gov>
- Anderson F., Jr., Wheeler, H., Goldberg, R., et al. (1991). A population-based perspective of the hospital incidence and case-fatality rates of deep vein thrombosis and pulmonary embolism. The Worcester DVT Study. *Arch Intern Med.*, 151(5), 933-938.
- Choi, D. & Min, H. (2011). Nurses knowledge and compliance on deep vein thrombosis. *Journal of Korean Critical Care Nursing*, 4, 75-87.
- Cohen, A., Agnelli, G., Anderson, F. et al. (2007). Venous thromboembolism (VTE) in Europe. *Thromb. Haemost.*, 98, 756-764.
- Cohen, A., Tapson, V., Bergmann, J., Goldhaber, S., Kakkar, A., Deslandes, B., et al. (2008). Venous thromboembolism risk and prophylaxis in the acute hospital care setting (ENDORSE Study): A multinational cross-sectional study. *The Lancet*, 371, 387-394.
- Elder, S., Hobson, D., Hobson, R., Hobson, C., Streiff, M., Haut, E., Efirid, L., et al. (2016). Hidden barriers to delivery of pharmacological venous thromboembolism prophylaxis: The role of nursing beliefs and practices. *J Patient Saf.*, 12, 63-68.
- Fanikos, J., Stevens, L., Labreche, M., Piazza, G., Catapane, E., Novack, L., et al. (2010). Adherence to pharmacological thromboprophylaxis orders in hospitalized patients. *Am J Med.*, 123, 536-541.
- Goldhaber, S., Tapson, V., & DVT FREE Steering Committee (2004). A prospective registry of 5,451 patients with ultrasound-confirmed deep vein thrombosis. *The American Journal of Cardiology*, 93, 259-262.
- Heit, J., Melton, L., 3rd, Lohse, C., et al. (2001). Incidence of venous thromboembolism in hospitalized patients vs. community residents. *Mayo Clin. Proc.*, 76(11), 1102-1110.
- Hyunjin, O., Boo, S., & Lee, J. (2016). Clinical nurses' knowledge and practice of venous thromboembolism risk assessment and prevention in South Korea: A cross-sectional survey. *Journal of Clinical Nursing*, 26 (3-4).
- ISTH Steering Committee for World Thrombosis Day (2014). Thrombosis: A major contributor to global disease burden. *Thromb. Res.*, 134, 931-938.

- LaMori, J., Shohieber, O., Mody, S., Bookhart, B. (2015). Inpatient resource use and cost burden of deep vein thrombosis and pulmonary embolism in the United States. *Clin. Ther.*, 37, 62-70.
- Lau, B., Shaffer, D., Hobson, D., Yenokyan, G., Wang, J., et al. (2017). Effectiveness of two distinct web-based education tools for bedside nurses on medication administration practice for venous thromboembolism prevention: A randomized clinical trial. *PLoS One*, 12(8).
- Shermock, K., Lau, B., Haut, E., Hobson, D., Ganetsky, V., Kraus, P., et al. (2013). Patterns of non-administration of ordered doses of venous thromboembolism prophylaxis: Implications for novel intervention strategies. *PLoS One*, 8(6).
- Søgaard, K., Schmidt, M., Pedersen, L., Horváth-Puhó, E., Sørensen, H. (2014). 30-year mortality after venous thromboembolism: A population-based cohort study. *Circulation*, 130, 829-836.
- Spyropoulos, A. & Lin, J. (2007). Direct medical costs of venous thromboembolism and subsequent hospital readmission rates: An administrative claims analysis from 30 managed care organizations. *J. Manag. Care Pharm.*, 13, 475-486.
- Streff, M., Segal, J., Tamariz, L., et al. (2006). Duration of vitamin K antagonist therapy for venous thromboembolism: A systematic review of the literature. *Am. J. Hematol.*, 81(9), 684-691.
- White, R. (2003). The epidemiology of venous thromboembolism. *Circulation*, 107(23), 14-18.