

BMJ Open Quality Improving venous thromboembolism prophylaxis through critical thinking and health informatics

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ABSTRACT

Venous thromboembolism (VTE) is a leading cause of preventable morbidity and mortality in hospitalised patients. Mafraq Hospital, a 450-bed tertiary-level hospital in Abu Dhabi, United Arab Emirates, has identified VTE prevention as a critical patient safety measure and VTE prophylaxis as a key performance indicator (KPI). Mafraq Hospital VTE prevention policy states that all admitted adult patients 18 years and above should receive a VTE risk assessment, and all patients identified at risk of VTE with no contraindications should receive appropriate VTE prophylaxis within 24 hours of admission. In a move towards safer practices, our governing body, Abu Dhabi Health Services SEHA, has raised the VTE prophylaxis KPI target from 85% to 95% for all admitted adult patients within 24 hours of admission. Our average VTE prophylaxis rate was 87%, and achieving this new target was a challenge. We conducted this study on Mafraq Hospital Medical and Surgical wards. The study period was 12 months, from July 2018 to June 2019, and a total of 5475 patients were evaluated. Our aim was to improve VTE prophylaxis rates in order to ensure patient safety and reduce preventable harm. We used Caprini Model electronic VTE risk assessment computerised decision support tool to help identify VTE risk. A multidisciplinary task force team was formed and led this quality improvement project. The purpose of this publication was to indicate the quality improvement interventions implemented to enhance compliance with VTE prophylaxis using integrated critical thinking and health informatics and the outcomes of those interventions. Through implementing critical thinking and health informatics interventions, our VTE prophylaxis within 24 hours of admission rates improved from an average 87% in July 2018 to above 98%, and this improvement was sustained over the last 3 months of the study period April through June 2019.

PROBLEM

Venous thromboembolism (VTE) prevention is a critical patient safety measure. In a move towards safer practices, our governing body, Abu Dhabi Health Services SEHA, has raised the VTE prophylaxis KPI target from 85% to 95% for all admitted adult patients within 24 hours of admission. Our average VTE prophylaxis rate was 87% and achieving this new target was a challenge. Despite having a

VTE risk assessment rate consistently above KPI target of 98% this was not reflected on the VTE prophylaxis rate (figure 1). A VTE prophylaxis improvement multidisciplinary taskforce was formed and included members from physicians, pharmacy, quality and health informatics, and through a collaborative effort led this quality improvement project. The aim of the project was to improve VTE prophylaxis rates from 87% to 95% (new VTE prophylaxis KPI target) through critical thinking and health informatics.

BACKGROUND

VTE is a leading cause of morbidity and mortality in hospitalised medical and surgical patients.¹ The Joint Commission International has identified VTE prevention as a critical patient safety measure.^{2,3} Mafraq Hospital VTE prevention policy states that all admitted adult patients 18 years and above should receive a VTE risk assessment and all patients identified at risk of VTE with no contraindications receive appropriate VTE prophylaxis within 24 hours of admission in order to reduce the occurrence of VTE in hospitalised patients.

MEASUREMENT

The VTE prophylaxis KPI target set by our governing body Abu Dhabi Health Services SEHA is 95%. The average VTE prophylaxis rate preimplementation of interventions was 87%. We used the Caprini model^{4,5} electronic VTE risk assessment computerised decision support tool⁶ to help identify VTE risk (figure 2). VTE prophylaxis rate is the percentage of medical and surgical patients at moderate or high risk (VTE risk assessment score of 3 or more) for whom VTE prophylaxis was administered within 24 hours of admission unless contraindicated. The numerator is the number of adult medical and surgical inpatients at moderate or high

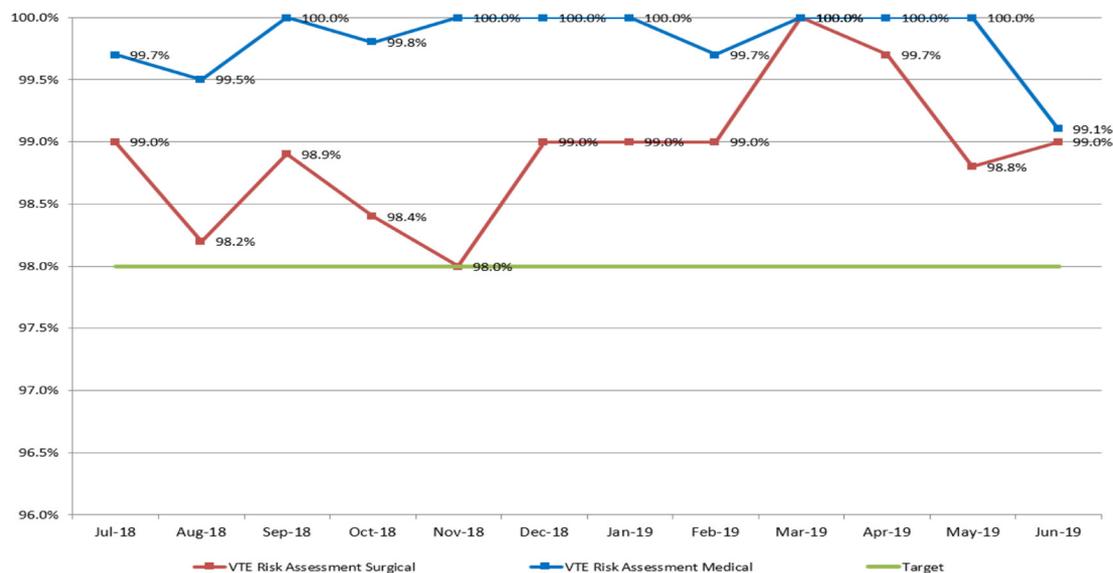


Figure 1 Medical and surgical VTE risk assessment within 24 hours. VTE, venous thromboembolism.

VTE risk and no contraindication for whom VTE prophylaxis was administered within 24 hours of admission. The denominator is the total number of adult medical and surgical inpatients with moderate or high VTE risk and no contraindication. Exclusion criteria are patients less than 18 years of age, those with low VTE risk (VTE risk assessment score of 2 or less) and those with contraindications to VTE prophylaxis. We also looked at the VTE risk assessment rate (figure 1). The numerator is the number of adult medical and surgical inpatients for whom VTE risk assessment was completed within 24 hours of admission. The denominator is the total number of adult medical and surgical inpatients. Exclusion criteria are patients less than 18 years of age. In the 12-month study period from July 2018 until June 2019 a total of 5475 medical and surgical inpatients were evaluated.

DESIGN

The methodology used was a prospective study of VTE prophylaxis compliance in all admitted adult medical and surgical patients 18 years and above admitted to Mafraq Hospital in the study period July 2018–June 2019. A total of 5475 patients were evaluated during the study period. The information was extracted from the electronic medical record by using a specific segmented electronic form that contained all required information, including the medical service, patient name, medical record number, time of admission and time of VTE prophylaxis order. The average VTE prophylaxis rate preimplementation was 87%. Our goal was to improve VTE prophylaxis rates, aiming to achieve the new KPI target of 95% set by our governing body, Abu Dhabi Health Services SEHA. Achieving this newly set target was a challenge. The VTE prophylaxis improvement multidisciplinary taskforce was formed and included members from physicians, pharmacy, quality and health informatics and, through a collaborative effort and a number of interventions, was

able to improve VTE prophylaxis rates exceeding the new KPI target.

STRATEGY

The average VTE prophylaxis rate until the implementation of changes in July 2018 was 87%. VTE prophylaxis improvement multidisciplinary taskforce was formed and included members from physicians, pharmacy, quality and health informatics. Brainstorming sessions were held and root cause analysis was conducted, which identified the areas for improvement placed on the cause and effect diagram (figure 3):

1. Inconsistency in physician documentation in the electronic VTE risk assessment tool.
 2. Inconsistency in physician documentation of VTE prophylaxis contraindications: VTE contraindications were documented in the progress notes and not in the VTE risk assessment tool.
 3. Use of VTE tool-generated risk score rather than the physician-entered risk level as the trigger for VTE prophylaxis.
 4. VTE risk assessment tool not linked to VTE prophylaxis order.
 5. VTE risk assessment tool not updated: new evidence-based medicine American Heart Association/American Stroke Association 2018 guidelines⁷ favouring the use of mechanical rather than chemical VTE prophylaxis in acute ischaemic stroke not reflected.
- Through a collaborative effort, an action plan was developed, and the below key interventions were tested and their impact on improving VTE prophylaxis was measured (figure 4):
1. Quality department in August 2018 started running a concurrent VTE prophylaxis report and shared the data with physicians in order to raise awareness and address concerns. This improved VTE prophylaxis rate from 84% to 93%.

VTE Risk

Initial Evaluation
 Reassessment

Reassessment

No change in Risk
 Change in Risk as below

Female Only

None of the below
 Preg/Postpartum<1m
 Oral Contraceptive/HRT
 Hx unexplained stillborn
 Recurrent miscarriage>3

Patient Age

Age <40 Age 61-74
 Age 41-60 Age 75+

Bedrest Anticipated > 72 hours?

Yes
 No

Genetic/ Family Hx

None of the below
 FHx DVT/PE (1st Deg Rel)

Obesity

BMI < 30 BMI 30 to <= 40
 BMI 40 to <= 50 BMI 50+

BMI **Weight** kg **Height** cm

Medical Conditions

None of the below
 Swollen Legs (current)
 Varicose Veins
 Pneumonia <1m
 Serious lung disease<1m
 COPD Exacerbation
 AMI
 CHF (<1 m)
 Sepsis (<1 month)

Stroke* (<1 m)
 Active Cancer
 Cancer- non active
 Central Venous Access
 Hx DVT/PE
 Hx of Thrombophilia
 Hx of Inflammatory Bowel Disease
 Other

Other: explain

Segue UI 9

Surgical Risks

None of the below
 Maj Low Ext Arthroplasty
 Hip, pelvic or leg fx <1 m
 Mult Trauma with immob<1m
 SpineCordInj_paralysis<1m
 Arthroscopic Surg
 Laparoscopic Surg>60 min

Leg Cast/brace (current)
 Major surgery >3 hours
 Major surgery >2-3 hours
 Major surgery >60 min
 Other

Other: explain

Segue UI 9

Med/Surg RISK SCORE

Med/ Surg Risk Level

Low Risk (0-2)
 Moderate Risk (3)
 High Risk (4+)

Unless Contraindicated

Low Risk --> Early Ambulation
Moderate Risk --> Unfractionated Heparin or LMWH
High Risk --> LMWH

VTE Prophylaxis Contraindicated

Yes
 No

Bleeding Risk Assessment
(Choose all that apply)

Active bleeding
 Acquired bleeding disorder
 Inherited bleeding disorder
 On oral anticoagulants
 Acute Stroke*
 Severe HTN (>=230/120)
 Thrombocytopenia PLT<50k
 History of HIT** Disease
 Other

Other contraindications to prophylaxis: specify

Segue UI 9

Note: For very high risk surgical patients (5 or more), consider adding intermittent pneumatic compression (IPC) and continuing LMWH for at least 2 weeks after discharge.

*** For acute ischemic and hemorrhagic stroke, Intermittent Pneumatic Compression Device is the VTE prophylaxis of first choice. In patients with a contraindication to IPCC or those at particularly high risk of VTE following an ischemic stroke (previous DVT, known thrombophilia or active cancer) prophylactic heparin can be given.**

**** Heparin induced Thrombocytopenia**

Figure 2 VTE risk assessment for medical/surgical patients. AMI, Acute myocardial infarction; BMI, body mass index; CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease; DVT, Deep vein thrombosis; FHx, Family history; HIT, Heparin Induced Thrombocytopenia; HRT, Hormone replacement therapy; HTN, Hypertension; LMWH, low molecular weight heparin; PE, Pulmonary embolism; PLT, Platelet; VTE, venous thromboembolism.

- Pharmacy in December 2018 conducted a real-time audit with phone call physician reminders to place VTE prophylaxis order within 24 hours.
- VTE Prophylaxis Physician Champions in December 2018 conducted physician-targeted training sessions. The physician champions went to the different departments' morning meetings and provided educational presentations on the proper completion of the VTE risk assessment tool and documentation of VTE prophylaxis contraindications within the VTE risk assessment tool in addition to the physician progress notes. Post-training sessions, a multiple-choice test was conducted

to ensure knowledge retention with a success pass rate of 80%.

Physician education sessions and pharmacy real-time audit with physician reminders improved VTE prophylaxis rate from 93% to 95%.

4. Quality department changed the VTE prophylaxis trigger to physician-entered risk level instead of the previous tool-generated risk score (figure 5). This improved VTE prophylaxis from 95% to 96%.

5. Health Informatics linked the VTE risk assessment tool to the VTE prophylaxis order (figure 6) and updated the VTE risk assessment tool to reflect new

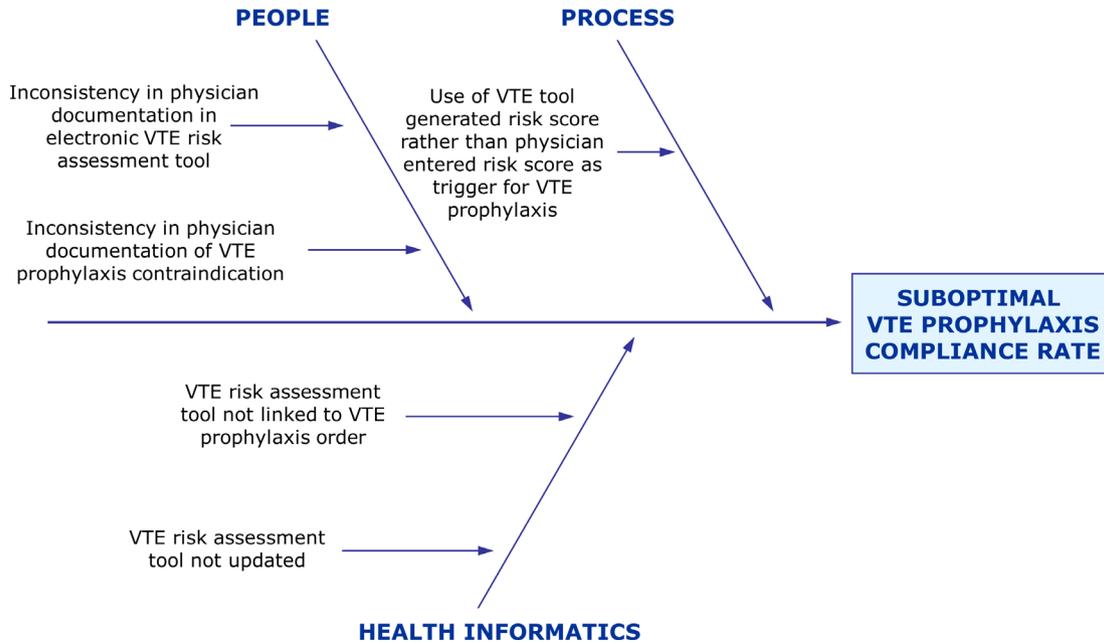


Figure 3 VTE prophylaxis cause and effect diagram. VTE, venous thromboembolism.

evidence-based medicine American Heart Association/American Stroke Association 2018 guidelines for VTE prophylaxis in acute ischaemic stroke⁷; in the VTE contraindication list, ‘acute haemorrhagic stroke’ was replaced with ‘acute stroke’ to include acute ischaemic stroke as well (figure 5). Those health informatics interventions improved VTE prophylaxis from 96% to 98%.

the medical and surgical VTE prophylaxis rates from an average of 87% in July 2018 to above 98% in April 2019, and this improvement was sustained over the last 3 months of the study period April through June 2019.

RESULTS

With the implemented performance improvement interventions, there was remarkable improvement in

LESSONS AND LIMITATIONS

Health informatics and automation can play a key role in performance improvement projects. A limitation of this project is that it focused on the process measure VTE prophylaxis rate and did not include the outcome measure VTE rate.

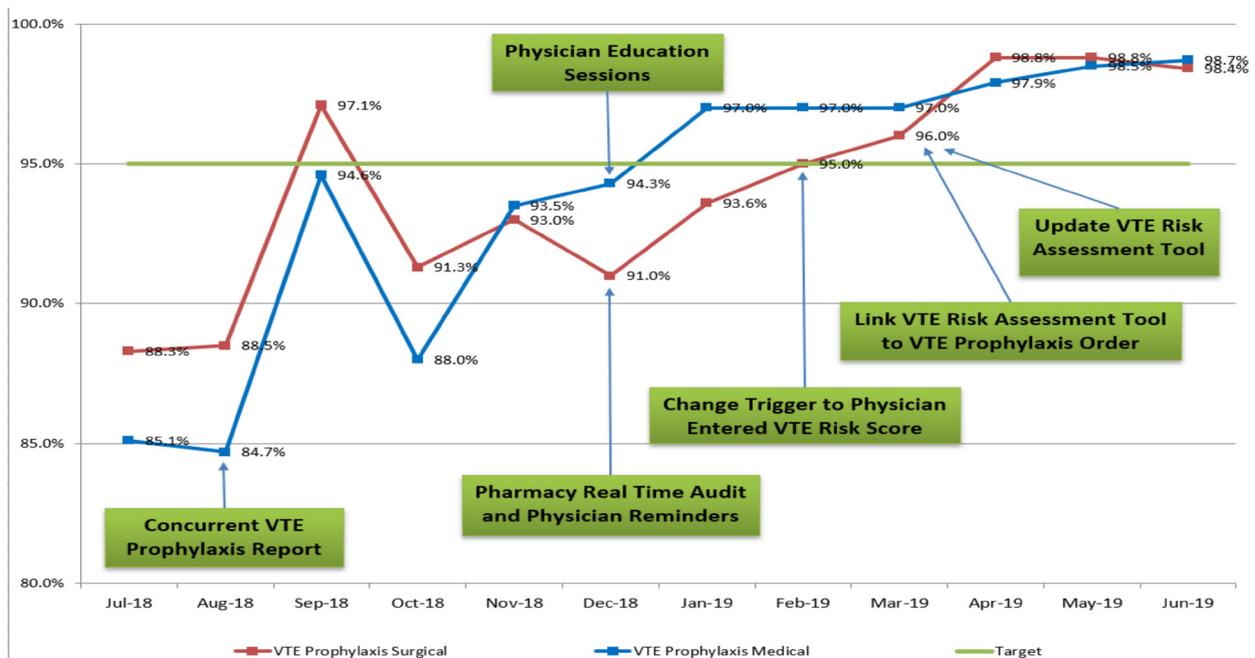


Figure 4 Medical and surgical VTE prophylaxis within 24 hours. VTE, venous thromboembolism.

Med/Surg RISK SCORE

Med/ Surg Risk Level

Low Risk (0-2)
 Moderate Risk (3)
 High Risk (4+)

Unless Contraindicated

Low Risk --> Early Ambulation

Moderate Risk --> Unfractionated Heparin or LMWH

High Risk --> LMWH

Note: For very high risk surgical patients (5 or more), consider adding intermittent pneumatic compression (IPC) and continuing LMWH for at least 2 weeks after discharge.

VTE Prophylaxis Contraindicated

 Yes
 No

Bleeding Risk Assessment
(Choose all that apply)

Active bleeding
 Acquired bleeding disorder
 Inherited bleeding disorder
 On oral anticoagulants
 Acute Stroke*
 Severe HTN (>=230/120)
 Thrombocytopenia PLT <50k
 History of HIT** Disease
 Other

Other contraindications to prophylaxis: specify

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* For acute ischemic and hemorrhagic stroke, Intermittent Pneumatic Compression Device is the VTE prophylaxis of first choice. In patients with a contraindication to IPCC or those at particularly high risk of VTE following an ischemic stroke (previous DVT, known thrombophilia or active cancer) prophylactic heparin can be given.

Figure 5 VTE Risk Assessment Score. DVT, Deep vein thrombosis; HIT, Heparin induced thrombocytopenia; HTN, Hypertension; LMWH, Low molecular weight heparin; PLT, Platelet; VTE venous thromboembolism.

CONCLUSION

The multidisciplinary VTE prophylaxis improvement taskforce managed to implement quality improvement interventions that resulted in significant improvement in VTE prophylaxis rate for admitted medical and surgical patients. Those interventions resulted in a remarkable improvement in medical and surgical VTE prophylaxis rates from an average of 87% in July 2018 to above 98% in April 2019, and this improvement was sustained over the last 3 months of the study period from April to June 2019. This performance improvement project shows that critical thinking and multidisciplinary team approach using

information technology and collaboration between physicians, pharmacy, quality and health informatics can result in significant sustained performance improvement. The outcomes of the project and lessons learnt were shared throughout the organisation. Implemented interventions are generalisable and can be replicated in other wards and organisations.

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Patient Care Orders

Intermittent Pneumatic Compression Device

Medication Orders to Placed

Yes
 No

Figure 6 Venous thromboembolism orders.



Contributors HT participated in the brainstorming sessions and root cause analysis; provided education and training to physicians on proper VTE risk assessment tool documentation; planned the study, and prepared and submitted the study manuscript; was responsible for the overall content. EG participated in brainstorming sessions and root cause analysis, ran concurrent VTE prophylaxis report and shared the data with physicians in order to raise awareness, provided the VTE risk assessment and VTE prophylaxis run charts. FJ participated in brainstorming sessions and root cause analysis, ran concurrent VTE prophylaxis report and shared the data with physicians in order to raise awareness. GS participated in brainstorming sessions and root cause analysis, conducted a real-time audit with phone call physician reminders to place VTE prophylaxis order within 24 hours. BK participated in the brainstorming sessions and root cause analysis, changed the VTE prophylaxis trigger to physician-entered risk level instead of the previous tool-generated risk score. SK participated in the brainstorming sessions and root cause analysis, and linked the VTE risk assessment tool to the VTE prophylaxis order and updated the VTE risk assessment tool. WKH participated in brainstorming sessions and root cause analysis, provided education and training to physicians on proper VTE risk assessment tool documentation and participated in preparing the study manuscript.

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Competing interests None declared.

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Patient consent for publication Not required.

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Data availability statement All data relevant to the study are included in the article.

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