Supplemental digital content for Pingleton SK, Carlton E, Wilkinson S. Reduction of venous thromboembolism (VTE) in hospital patients: Aligning continuing education with interprofessional team-based quality improvement in an academic medical center. Acad Med. 2013;88(10).

# Supplemental Digital Appendix 1

**Venous Thromboembolism Interprofessional Team Roster, University of Kansas Hospital**

DO, Assistant Professor, General & Geriatric Medicine

RN, Clinical Nurse Specialist, Nursing Clinical Excellence

RN, Nursing Director, Quality & Regulatory Compliance

MD, Associate Professor, Pathology & Laboratory Medicine

RN, Clinical Nurse II, CTSP

RN, Nursing Informatics Specialist, Nursing Informatics

DO, Internal Medicine Resident

MD, Assistant Professor, General & Geriatric Medicine

MD, Assistant Professor, Anesthesiology

MD, Assistant Professor, Radiology

PharmD, Interim Pharmacy Operations Manager, Pharmacy Inpatient Services

RN, Quality Outcomes Coordinator, Organizational Improvement

RN, Trauma Performance Improvement Coordinator, Trauma Services

RN, Clinical Surveillance Triage Nurse, Outcomes Management

MD, Professor Continuing Education

RN, Nursing Informatics Specialist, Nursing Informatics

Director of Programs, Continuing Education



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Senior Writer, Corporate Communications

RN, Clinical Projects Coordinator, Quality & Safety

MD, Resident, Plastic Surgery

MD, Assistant Professor, Vascular Surgery

PharmD, Assistant Director of Pharmacy, Pharmacy Inpatient Services

MD, Associate Professor, Pulmonary & Critical Care

Director of Quality Outcomes & Public Reporting, Organizational Improvement



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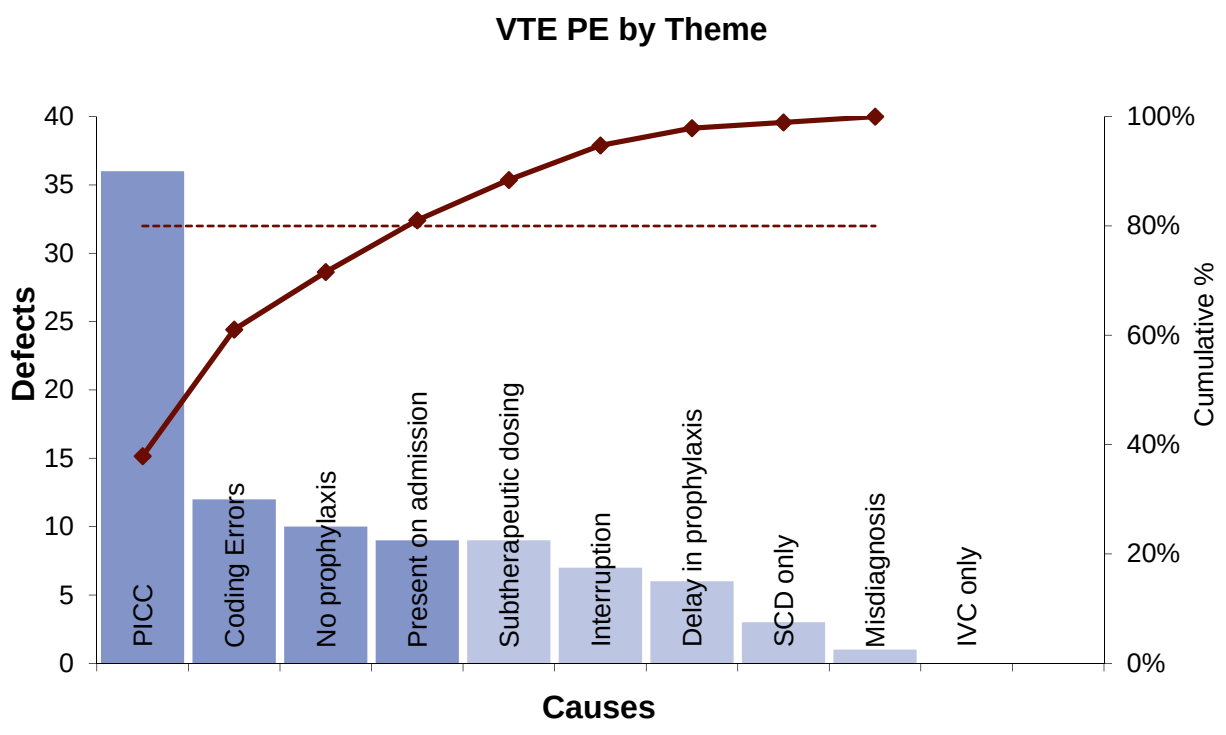
## Supplemental Digital Appendix 2

**Pareto diagram of themes associated with (causes of) venous thromboembolism (VTE) in hospitalized patients, University of Kansas Hospital. PICC: Peripheral Inserted Central Catheter, SCD: Subcutaneous Compression Devices, IVC: Inferior Venal Caval Device.**



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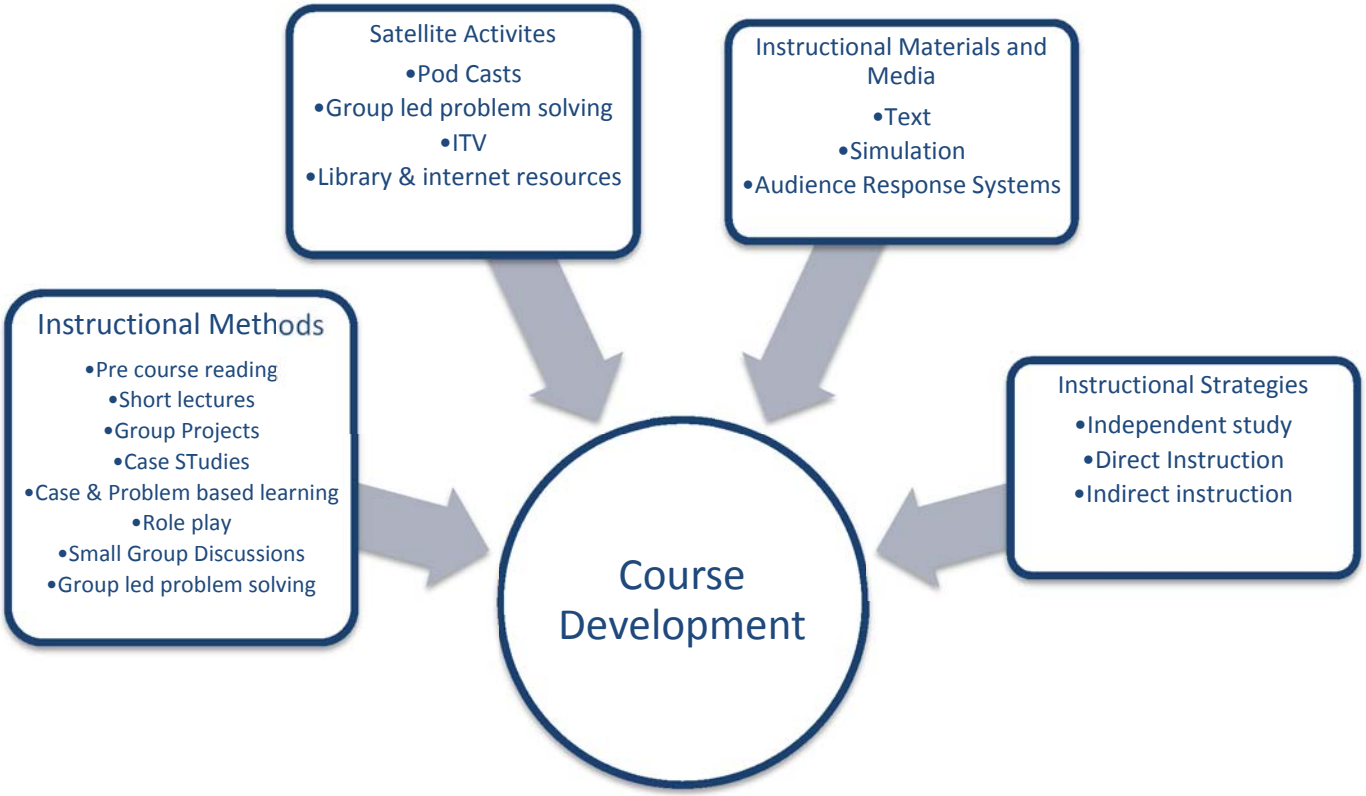
# Supplemental Digital Appendix 3

**Evidence-Based Educational Content Delivery Strategies for Health Professionals**



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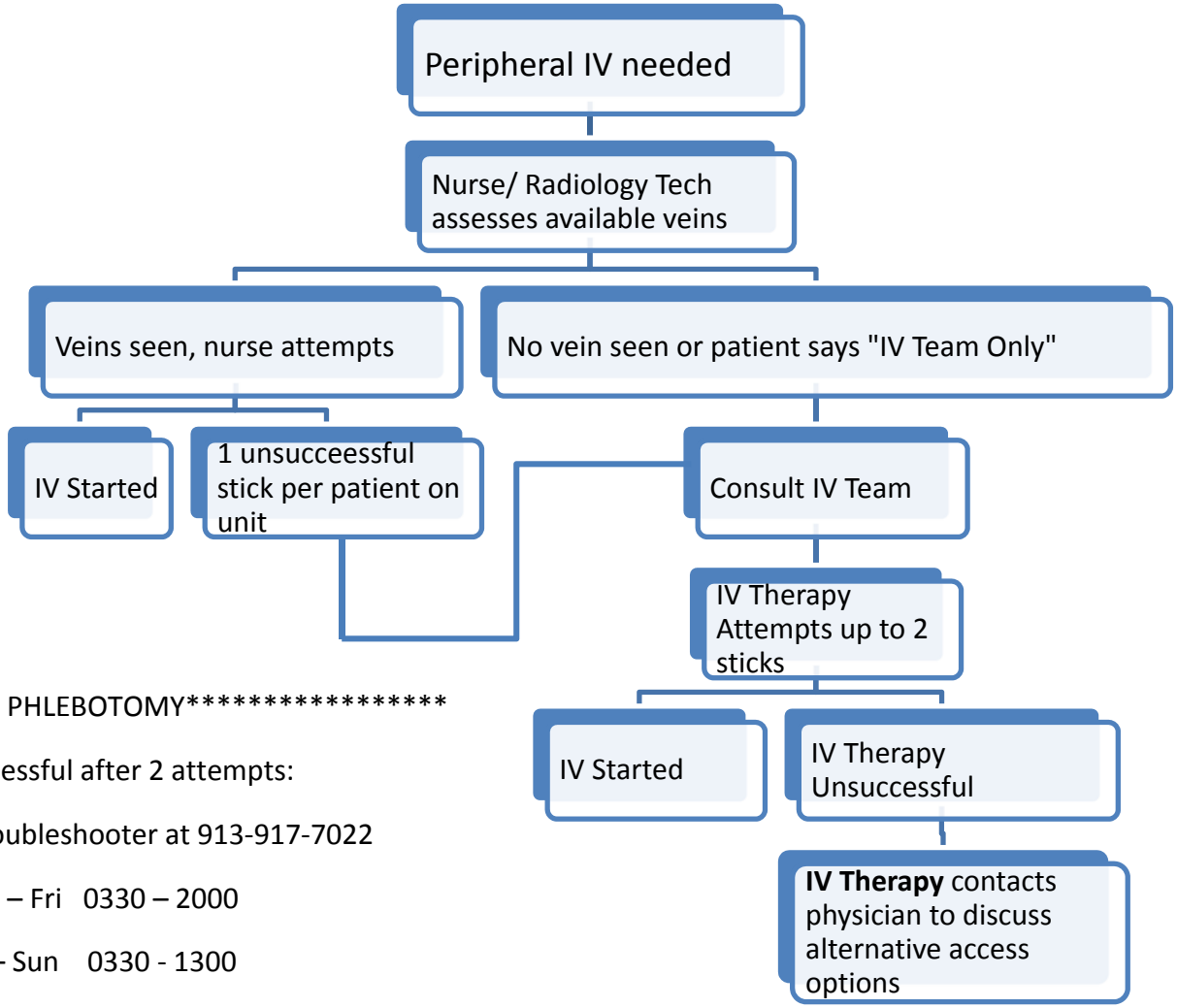
## Supplemental Digital Appendix 4

**Peripheral Catheter Central Line Access Algorithm, University of Kansas Hospital**




**********FOR PHLEBOTOMY**********

If Unsuccessful after 2 attempts:

Contact Lab Troubleshooter at 913-917-7022

Mon – Fri 0330 – 2000

Sat – Sun 0330 - 1300

ADULT NON-EMERGENT VENOUS ACCESS ALGORITHM

# Supplemental Digital Appendix 5

## Venous Thromboembolism (VTE) Badge Buddy, University of Kansas Hospital

Risk Factors

5 Risk Factors

- Acute spinal cord injury w/ paralysis
- Multiple trauma (<1 month)
- Stroke (<1 month)

3 Risk Factors

- Age: >70
- Prior history of thrombosis
- Known thrombophilia
- Shock / Dehydration
- Sepsis

2 Risk Factors

- Age: 61-70
- Central Venous Access
- Immobilization (>72 hours)
- Active malignancy and/or oncologic treatment: surgery, chemotherapy, radiotherapy

1 Risk Factor

- Age: 40-60 years
- Confining air/ground travel (>4h w/in 1 week of admission)
- HRT / oral contraceptive use
- Myeloproliferative disease
- Chronic Heart Failure
- Tobacco Use
- Pregnancy/postpartum (<1 month)
- Inflammatory bowel disease
- Nephrotic syndrome
- Sickle cell disease
- Varicose veins/leg swelling or venous stasis
- Obesity (BMI >29)
- Severe COPD or other serious lung disease

VTE Risk

Moderate (2 factors) = 2-4%
High (3-4 factors) = 4-8%
Very High (5 factors) = 10-20%

Relative or Absolute* Contraindication to Pharmacologic Prophylaxis

- Active bleeding*
- Heparin use with the presence or history if HIT* – Fondaparinux is recommended
- Lumbar puncture or epidural anesthesia within 24 hours
- Coagulopathy (INR >1.5) or thrombocytopenia (platelet count < 60,000)
- Recent intraocular or intracranial surgery or lesions
- Significant renal insufficiency (CrCl < 30 dose carefully) – may also use UFH
- Hypertensive crisis

Special Considerations

Impaired renal function: CrCl <30 ml/min (Use of fondaparinux is contraindicated)

- Enoxaparin dosing: 30 mg Qday

Obesity

- BMI 40-50 kg/m2: Enoxaparin 40 mg BID
- BMI >50 kg/m2: Enoxaparin 60 mg BID

Hemodialysis – UFH is the preferred agent

Weight <50kg – Fondaparinux should not be used in patients <50kg

KUH Agents: Warfarin < Heparin < Enoxaparin 30 < Enoxaparin 40 < Fondaparinux 2.5 (Restricted)

*All Surgical Patients need VTE prophylaxis within 24hrs post-surgery- Refer to Adult VTE Prophylaxis – General Surgery order set or the specific surgery order set for guidelines.*



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# Supplemental Digital Appendix 6

## Practice Management Guideline for Venous Thromboembolism (VTE) Prophylaxis, University of Kansas Hospital

### The University of Kansas Hospital: Practice Management Guideline VTE Prophylaxis

Background: Pulmonary embolism resulting from deep vein thrombosis (DVT) – collectively referred to as VTE – is the most common preventable cause of hospital death. Pharmacologic methods to prevent VTE are safe, effective, cost-effective, and advocated by authoritative guidelines. *The Agency for Healthcare Research and Quality calls thromboprophylaxis against VTE the "number one patient safety practice."*

Standard: Upon admission to The University of Kansas Hospital, the patient will be assessed for risk of VTE by the provider or pharmacist. The provider will order appropriate VTE prophylaxis and document in the medical record if pharmacological prophylaxis is contraindicated. If the patient experiences a change in risk level, condition, or sight/unit of care occurs, the patient will be reassessed for risk of VTE with appropriate prophylaxis ordered.

| VTE PROPHYLAXIS ASSESSMENT | | | |
|---|---|---|---|
| Low Risk<br>VTE Risk = 0.4% | Moderate Risk<br>VTE Risk = 2-4% | High Risk<br>VTE Risk = 4-8% | Very High Risk<br>VTE Risk = 10-20% |
| One risk factor<br>OR | Two risk factors<br>OR | Three to four risk factors<br>OR | Five risk factors<br>OR |
| Outpatient/ minor surgery <40 years of age | One risk factor and<br>• Minor general surgery | One risk factor and<br>• General moderate/major surgery in patient 40 - 60 years of age | Elective major lower extremity arthroplasty (hip or knee) |
| In dependently ambulatory medical patient with no other risk factors | One risk factor and<br>• Laparoscopic procedures | One risk factor and<br>• Major gynecological surgery for benign diseases | Non-elective hip, pelvic or other lower extremity orthopedic procedure |
| | General moderate/major surgery in patients 40 - 60 years of age | General moderate/major surgery in patients > 60 years of age | Acute spinal cord injury with paresis |
| | Major gynecological surgery for benign disease with no additional risk factors | Major gynecologic surgery for malignant disease | |
| | Non – surgical patients with high risk medical conditions such as:<br>• Ischemic CVA with limited mobility<br>• ICU admission with two or more risk factors | | Multiple major trauma |
| **RECOMMENDED PROPHYLAXIS** | | | |
| Low Risk | Moderate/ High Risk | | Very High Risk |
| Early aggressive ambulation | Intermittent pneumatic compression devices (must be in use 20/24 hours for effectiveness; usage alone is clearly inferior to chemical prophylaxis and should be reserved for patients who have contraindications to therapy)<br>Early aggressive ambulation AND | | Intermittent pneumatic compression devices,<br>Early aggressive ambulation AND |
| | Enoxaparin 40 mg SC Qday OR | | Enoxaparin 40 mg SC Qday OR |
| | Heparin 5,000 SC Q8 hours OR | | Heparin 5,000 SC Q8 hours OR |
| | Heparin 5000 units SC Q12 hours if > 75 years of weight < 50 kg | | Fondaparinux 2.5 mg SC Qday OR |
| | | | Warfarin INR 2-3 |



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| *RISK FACTORS | | | |
|---|---|---|---|
| • Age: 40-60 years (1 risk factor)<br>• Age: 61- 70 (2 risk factors)<br>• Age: > 70 (3 risk factors)<br>• Recent or present immobilization (>72 hours)<br>• Prior history of thrombosis (3 risk factors)<br>• Confining air/ground travel (>4h within one week of admission) | • Hormonal replacement therapy/ oral contraceptive use<br>• Myeloproliferative disease<br>• Known thrombophilia<br>• Chronic Heart Failure<br>• Tobacco use<br>• Spinal cord injury w/ paralysis (3 risk factors) | • Pregnancy/postpoartum (< 1 month)<br>• Inflammatory bowel disease<br>• Nephrotic syndrome<br>• Sickle cell disease<br>• Active Malignancy and/or oncologic treatment: surgery, chemotherapy, radiotherapy | • Dehydration<br>• Varicose veins/leg swelling or venous stasis<br>• Obesity (BMI > 29)<br>• Central Venous Access<br>• Severe chronic obstructive pulmonary disease<br>• Sepsis |

| RELATIVE OR ABSOLUTE CONTRAINDICATION TO PHARMACOLOGIC PROPHYLAXIS | |
|---|---|
| • Lumbar puncture or epidural anesthesia within 24 hours<br>• Active bleeding<br>• Coagulopathy (INR > 1.5) or thrombocytopenia (platelet count < 60,000) | • Presence or history of HIT (Heparin induced thrombocytopenia) – *fondaparinux recommended*<br>• Recent intraocular or intracranial surgery or lesions<br>• Significant renal insufficiency (Creatinine clearance < 30 dose carefully) – *may also use UFH*<br>• Hypertensive crisis |
| **SPECIAL CONSIDERATIONS:**<br>Impaired renal function: CrCl <30 ml/min<br>• Enoxaparin dosing : 30 mg Qday<br>• Use of fondaparinux is contraindicated in patients<br>Hemodialysis<br>• UFH preferred agent | **SPECIAL CONSIDERATIONS:**<br>Obesity<br>• BMI 40-50kg/m2: Enoxaparin 40 mg BID<br>• BMI > 50kg/m2: Enoxaparin 60 mg BID<br><50 kg<br>• Fondaparinux should not be used in patients <50 kg<br>Surgical Care Improvement Project (SCIP) CONSIDERATIONS: Select surgical procedures have specific VTE Recommendations for prophylaxis ordered anytime from hospital arrival to 24 hours after *Anesthesia End Time*. Please refer to VTE prophylaxis options for surgery on back. |

| DRUG COST | | | | |
|---|---|---|---|---|
| Warfarin 5mg $ | Heparin 5,000 units $ | Enoxaparin 30 mg $$ | Enoxaparin 40 mg $$ | Fondaparinux 2.5 mg $$$ |
| Warfarin<Heparin<Enoxaparin 30<Enoxaparin 40<Fondaparinux 2.5 | | | | |

| VTE Prophylaxis Options for Surgery | |
|---|---|
| Surgery Type | Recommended Prophylaxis Options[1] |
| Intracranial Neurosurgery | Any of the following:<br>• Intermittent pneumatic compression devices (IPC) with or without graduated compression stockings (GCS)<br>• Low – dose unfractionated heparin (LDUH)<br>• Low molecular weight heparin (LMWH)[2]<br>• LDUH or LMWH[2] combined with IPC or GCS |
| General Surgery | Any of the following:<br>• Low – dose unfractionated heparin (LDUH)<br>• Low molecular weight heparin (LMWH) |



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| | |
|---|---|
| | • LDUH or LMWH combined with IPC or GCS |
| Gynecologic Surgery | Any of the following:<br>• Low – dose unfractionated heparin (LDUH)<br>• Low molecular weight heparin (LMWH)<br>• Intermittent pneumatic compression devices (IPC)<br>• LDUH or LMWH combined with IPC or GCS |
| Urologic Surgery | Any of the following:<br>• Low – dose unfractionated heparin (LDUH)<br>• Low molecular weight heparin (LMWH)<br>• Intermittent pneumatic compression devices (IPC)<br>• LDUH or LMWH combined with IPC or GCS |
| Elective Total Hip Replacement | Any of the following WITHIN 24 hours of surgery:<br>• Low molecular weight heparin (LMWH)<br>• Factor Xa Inhibitor (fondaparinux)<br>• Oral Factor Xa Inhibitor [3] |
| Elective Total Knee Replacement | Any of the following:<br>• Low molecular weight heparin (LMWH)<br>• Factor Xa Inhibitor (fondaparinux)<br>• Oral Factor Xa Inhibitor [3]<br>• Warfarin<br>• Intermittent pneumatic compression devices (IPC)<br>• Venous foot pump |
| Hip Fracture Surgery | Any of the following:<br>• Low – dose unfractionated heparin (LDUH)<br>• Low molecular weight heparin (LMWH)<br>• Factor Xa Inhibitor (fondaparinux)<br>• Warfarin |

[1] Patients who receive neuroaxial anesthesia or have a documented reason for not administering pharmacologic prophylaxis may pass the performance measure if either appropriate pharmacologic or mechanical prophylaxis is ordered.
[2] Current guidelines recommend postoperative low molecular weight heparin for Intracranial Neurosurgery.
[3] The US Food and Drug Administration has approved Xarelto (rivaroxaban) to reduce the risk of blood clots, deep vein thrombosis (DVT) and pulmonary embolism (PE) following hip or knee replacement surgery ONLY.



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# Supplemental Digital Appendix 7

**Pharmacy - Patient Acuity Score Card, University of Kansas Hospital**

Legend:

Screen shot of Pharmacy patient acuity score card. The left most column lists patients pharmacy related calculated score. Red arrow indicate worsening of pharmacy score, i.e. score change, = maintenance of acuity score and green arrows improvement. The middle column scores clinical patient data, i.e. obtained drug levels for needed drugs (ie antibiotic drug level), monitored drugs, creatinine clearance, drugs resulting in needed laboratory results (i.e. anticoagulation) and drug change from IV to PO. The right most column is the active surveillance of the organization's key initiative, i.e. Venous Thromboembolism (VTE) prophylaxis, vaccinations, medicine reconciliation, discharge orders, etc.

Pharmacists utilize this comprehensive acuity score card to surveil appropriate VTE prophylaxis for each patient.



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