

**Proactive Prophylaxis: Multidisciplinary Prevention of Pulmonary Embolism and Deep Vein Thrombosis**  
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**Navigating Program Development**  
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**Objectives:**

1. Review literature regarding alerts in computerized physician order entry (CPOE) systems and house staff behavior.
2. Identify goals of program development for enhanced venous thromboembolism (VTE) alert screens
3. Navigate VTE alert improvements
4. Discuss lesson learned

**Abstract:**

During the past 10 years the prevention of medication errors has become a primary focus in healthcare. In 1995 Bates and colleagues published their landmark study demonstrating that 28% of hospital admissions are attributed to preventable medication errors (1). After the Institute of Medicine (IOM) report and studies at Brigham & Women's Hospital CPOE, medical informatics, and computerized alerts became new buzz words among healthcare practitioners (2). However, until recently institutions had not yet critically assessed CPOE and other technology systems.

A recent study conducted at the Veterans Association Medical Center in Salt Lake City, Utah reported 74% of medication errors occurred during prescribing while only 11% occurred during administration and 0% during transcription (3). Compared to the 1995 study by Bates 56% of errors were attributed to the prescribing stage, 24% during administration, and 6% during transcription (1). The VA Medical Center employs CPOE, bar code technology during medication administration, electronic medical records, and computerized drug-drug interaction (DDI) and allergy screening. Researches concluded that their systems were working as designed and CPOE at the VA Medical Center lacked decision support mechanisms that could assist in reducing medication errors.

However, other institutions that utilize decision support and computerized alerts during prescribing have reported high rates of physician override. A study conducted at Beth Israel Deaconess Medical Center (BIDMC) in Boston, MA reported that 94.2% of computerized alerts in the primary care setting were overridden (4). Investigators also concluded that of the 189 computerized rules studied, 36.5% were invalid (4). Researches agreed with the physician's decision to override the alert in 97.9% of cases (4).

From these studies and others, it is evident that CPOE systems must evolve to meet growing demands for medical informatics and technology solutions for the prevention of medication errors. Some next steps may include using algorithms that take into account patient specific factors and that generate prescribing recommendations. In the first generation of VTE alerts at BWH, patient specific algorithms were utilized and house staff physicians prescribed VTE prophylaxis measures in 33.5% of patients in the intervention group (5). After the study was published a multi-disciplinary team was convened consisting of physicians, pharmacists, nurses, research coordinators, and program developers to enhance the VTE alerts at BWH.

One of the major goals was to engage house staff physicians in order to increase acceptance of the alert. We developed interactive techniques that were integrated into the design of the new alerts. Some of these included: providing the house staff with objective data that computerized alerts in this population decreased the incidence of VTE by 41% (5) and creating an opportunity to capture the rationale for declining the alert. We also hypothesized that many house staff physicians may fear a risk of bleeding with pharmacological prevention. We therefore designed a final opportunity to order mechanical prophylaxis before allowing the user to exit the alert. The team also hypothesized that setting the alerts to generate at a consistent time during morning rounds and notification of the attending physician if action was not taken would increase acceptance. The enhanced VTE alerts generate at 8:30 AM each morning and the attending physician receives a text page 24 hours later if action is not taken.

The house staff physicians are first notified of a high-risk patient at the moment of login to the CPOE system. Once the user clicks on the alert, they are presented with multiple options. A physician may choose to review the alert details, which displays the patient specific criteria that

qualified the patient as high-risk. The user is also presented with the results from the original study, access to the DVT prophylaxis order entry template, access to an on-line resource guide, or the option to exit. The DVT prophylaxis template allows the user to select mechanical, pharmacological or a combination of prophylaxis measures. The on-line resource guide provides educational material that is up-to-date with clinical practice. If the user clicks the third option to exit to order entry, escape, or done options they are presented with a screen that prompts selection of a reason for declining the alerts. The reasons provided are patient is already receiving anticoagulants, the risk of bleed outweighs the benefit of anticoagulant therapy, patient is on comfort measures only, scheduled procedure, or other. The user must select a reason in order to proceed. Once a reason is selected, the user has the final opportunity to order mechanical prophylaxis via a second order entry template. The user is reminded that there is not an increased risk of bleeding with mechanical prophylaxis.

Computerized alerts and technology systems require continual quality assurance and maintenance. In order to effectively monitor the enhanced VTE alerts, we have designed weekly reports that are delivered to the core team via email. This allows the core team to review all aspects of the alerts including the type of action taken, rate of overrides, and reasons for declining the alert.

In conclusion an integrated multi-disciplinary team is needed to analyze current computerized alerts and propose strategies for improvements. Over-alerting and invalid computerized alerts are current problems in many CPOE systems. Designing “smart alerts” that take into account patient specific criteria and recommend therapy to house staff are effective. Alerts that engage providers and obtain feedback are vital to a dynamic quality assurance process.

## **REFERENCES**

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