Primary Intended Outcomes

1. Decrease and prevent near misses and adverse events involving warfarin therapy,

2. Improve compliance of warfarin patient education and documentation,

3. Develop a culture of multidisciplinary collaboration to include pharmacists in warfarin therapy management, and

4. Provide safe use of warfarin therapy throughout the medication-use system.

Relevant PPMI Recommendation

B24. Every pharmacy department should:

B24h. Track and trend adverse drug events in the hospital or health system.

Situation Analysis

Vanderbilt University Medical Center is a comprehensive health care facility dedicated to patient care, research, and education. The Medical Center has more than 900 licensed beds divided between a main hospital campus, the Monroe Carell Jr. Children’s Hospital at Vanderbilt, and the Psychiatric Hospital at Vanderbilt. Pharmacists are divided between adult, pediatric, and outpatient areas. Pharmacy practice specialties for adult inpatients include anticoagulation, cardiology, hemophilia, infectious disease, oncology, transplantation, and surgical, medical, and trauma intensive care.

Upon evaluation of internal adverse drug events (ADEs) and near misses involving warfarin and following completion of an Institute for Safe Medication Practices (ISMP) self-assessment for antithrombotic therapy, process improvements related to warfarin therapy were identified. In conjunction, routine review of external ADE reports, ISMP best practices, and in accordance with Joint Commission Medication Management Standards related to anticoagulants, a gap analysis of each component of the medication-use system consequently revealed additional opportunities to improve patient safety.

Beginning with the ordering/prescribing process, examples described below illustrate where identi-
fication of an ADE, near miss, ISMP best practice, or Joint Commission standard resulted in pharmacist-led collaborative efforts to execute safety strategies within our systems.

Our computerized provider order entry (CPOE) system was previously unable to electronically manage multi-day/alternate-day warfarin dosing without manipulation of the order during the pharmacist order review process. If a prescriber ordered warfarin 2.5 mg on Monday, Wednesday, and Friday, in addition to 5 mg the remaining days of the week, the first warfarin order was entered appropriately, but the subsequent order was routinely free-texted into the comment field. This process required the pharmacist to interpret the comment and manually enter the second order, which increased the potential for error during pharmacist order review.

In another instance, a “dose” of 0 (zero) mg was ordered in CPOE in an attempt to hold a warfarin dose due to a lab result or a scheduled surgery. A near miss resulted during the order translation into the pharmacy system, which defaulted to the 10 mg drug file and dose because 0 mg was not an available strength.

Additionally, during order entry, in some instances, patients were admitted on warfarin without a documented baseline INR. By requiring pharmacists to document the baseline INR for new profile orders and to obtain an order for a stat INR if baseline INR is unavailable, improvements in patient safety and in pharmacist surveillance of warfarin patients will likely be recognized.

While nursing and pharmacy have a joint responsibility for providing education to patients receiving warfarin prior to discharge, we discovered that measuring the compliance rate was difficult due to the inability to prompt staff to provide education as well as the lack of a standardized documentation system.

**Service Description**

Although process improvements were identified, many safety strategies were already in place at our organization. We feel the existing strategies, combined with identified gaps, summarized below, have resulted in safe practices related to warfarin therapy across the continuum.

**Ordering/Prescribing:** Inpatient warfarin is ordered via a Pharmacy and Therapeutics Committee-approved CPOE ordering advisor. Multi-day/alternate-day orders are submitted through advanced ordering advisor. CPOE exit checks for warfarin orders require users to confirm or discontinue high warfarin dose or multiple warfarin orders (unless from the multi-day ordering advisor). Zero mg warfarin orders cannot be entered into the CPOE.

**Order Processing/Dispensing:** Pharmacists document baseline INR for new profile orders prior to dispensing. If the INR is not available, order for stat INR is obtained. Warfarin is not loaded into automated dispensing cabinets and is instead dispensed in ready-to-administer form from the pharmacy. Distinct dispensing files are available for all possible warfarin doses, directly defaulting to the ordered dose/file and little to no order manipulation is required during pharmacist order review.

**Administration:** Warfarin is administered via barcode medication administration (BCMA) system at a standard time each day.
**Monitoring:** A dashboard is assigned to a pharmacist daily for review of patient profiles with INR >3, INR increase of >0.4 within 24 hours, or no INR obtained within 72 hours. Reporting adverse events in the occurrence reporting system is strongly encouraged. A peer review committee reviews anticoagulation event trends to identify process improvements.

**Education:** Nearly all inpatients receive warfarin education through our use of standardized educational tools. Documentation of education is achieved via an electronic indicator viewable in the clinical dashboard. (See Figure 1.)

**Key Elements for Success**
1. Buy-in from administrators, pharmacy directors, Medication Use and Safety Improvement Committee, Pharmacy and Therapeutics Committee, Informatics, and Anticoagulation Practice Oversight Committee;
2. Collaboration with Pharmacy Informatics and other disciplines; and
3. Ongoing vigilance in reviewing national standards, best practices, and internal and external ADE reports.
Resource Utilization

Personnel: This was a long-term, multidisciplinary effort involving pharmacy, nursing, prescribers, and pharmacy informatics staff, as well as pharmacist/pharmacy student resources to provide warfarin education to patients.

IT and other infrastructure: Informatics and pharmacy operations support with CPOE, pharmacy order entry system, BCMA system, and staff education.

Recognized Intangible Benefits

Anecdotally, it appears errors have decreased with warfarin across the medication-use system.

Patients have a better understanding of warfarin therapy as a result of improved compliance with patient education provided by pharmacists and nurses. Theoretically, with enhanced education, readmission rates due to patient compliance issues will be reduced.

Outcome Measures

1. Increased number of inpatients receiving ready-to-administer warfarin dose dispensed from pharmacy. Since 2010, pharmacy has dispensed warfarin doses.

2. Increased number of patients who receive warfarin education prior to discharge. Sustained compliance with patient education has been greater than or equal to 95% since August 2011.

3. Increased number of patients with documented baseline INR.

4. Improved functionality with prescriber ordering of warfarin in CPOE and pharmacist review of orders in pharmacy system.

Lessons Learned

With respect to medication safety, we learned that it is not possible to fix just one problem and move on. An organization must look at the medication-use system as a sum of its components, and identify process improvements within each step of the medication-use process. It is an ongoing collaborative effort. Data has to be gathered, managed, and acted upon to improve outcomes.

Suggestions for Other Hospitals/Health Systems

Designate staff to review and trend internal and external error reports and best practices. Designate staff to oversee compliance-related efforts. If possible, designate a pharmacist and oversight committee for anticoagulation management. A multi-disciplinary approach in conjunction with key safety and therapeutics committees, pharmacy informatics, and pharmacy operations is imperative.

Helpful References


Team Members

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