Medication errors are defined as preventable events that occur during prescribing, dispensing, or administration. If not discovered or corrected, they can lead to inappropriate or harmful medication use.

**EXTRACTING THE FULL VALUE OF CLINICAL DECISION SUPPORT TO ENHANCE PATIENT CARE**

Medication errors remain an unnecessary public health menace. While industry awareness of the problem has existed for some time, efforts to reduce the incidence and impact of medication errors have not yet yielded much success. Consequently, the significant patient harm, death toll, and economic burden caused by these preventable errors persists.

The 2014 National Action Plan for Adverse Drug Event Prevention was introduced to draw national attention to the epidemic, demonstrating the magnitude of the problem and need to prioritize improvement efforts and increase focus on patient safety. A recent literature review further underscored the importance of efforts to address adverse drug events (ADEs), defined as injuries resulting from taking a medication. Encompassing 11 studies related to U.S. incidence and the economic impacts of ADEs, the study uncovered a number of alarming statistics:

- ADEs are one of the three most common and harmful categories of medical errors, causing 7,000 hospital deaths each year.
- Across industry literature, rates of medication errors ran as high as 1.4 per admission.
- At least 1.5 million preventable ADEs occur in the U.S. annually.
- More than $4 billion is spent on preventable ADEs in the U.S. annually, and per hospital costs run as high as $5.6 million.

The National Action Plan, along with existing regulatory initiatives, points to use of clinical decision support (CDS) and alerting mechanisms as an effective way to combat medication errors — specifically those associated with dosing mistakes, drug interactions, drug duplications, or drug allergies. Introduced to augment and be integrated within electronic health records (EHRs) and other healthcare applications, CDS tools are now mainstream across the
provider community and retail pharmacy sector as healthcare organizations work to reduce errors by equipping clinicians with relevant warning information at the point of care. Continued advancement and adoption of clinical decision support systems is expected in the U.S. in the coming years. An analysis from Frost & Sullivan’s Digital Health predicts the CDS market to grow to reach $4.97 billion by 2021.iii

The value proposition of CDS tools extends to all stakeholders — providers, payers, and patients alike — as the industry benefits from more efficient, effective delivery of healthcare services. Early analysis and research regarding the potential of CDS to reduce ADEs pointed to substantial return on investment: One 2000 study pointed to savings of nearly $900 million, equating to $1.3 billion in 2017.iv

However, many CDS initiatives fall short of optimal impact due to alert fatigue, a condition in which over-exposure to unnecessary information frequently causes clinicians to override alerts without serious consideration. Alert fatigue has become commonplace due to information systems firing scores of alerts that are not relevant to a professional’s patient care, prescribing, or dispensing concerns. Industry research points to a direct link between overrides and medication errors, proving this phenomenon is problematic for effective patient care. For example, an analysis of medication errors reported through the Pennsylvania Patient Safety Reporting System identified 583 medication error events in one year in which a clinician overrode an automated alert that could have otherwise helped the clinician avoid the error.v

Technological advances, better collaboration, and a more holistic approach to system and content development are improving the quality and streamlining the quantity of alerts. By combining functionality that considers contextual patient information with better filtering and user input, hospitals, health systems, and retail pharmacies are helping their clinicians make better informed decisions and identify important patient safety issues at the point of care.

**CLINICAL DECISION SUPPORT: THE VALUE PROPOSITION**

Rapid evolution and advancement of health information technology over the past decade has introduced unprecedented opportunities and challenges to the healthcare industry. EHRs, for example, helped pave the way for increased awareness of the scope and effect of medication errors. Electronic drug interaction screening has helped healthcare professionals catch potential errors for over 20 years.

Today, the industry is using its continually expanding knowledge and more sophisticated medication-related alerting systems to focus on key performance improvement efforts, such as drug dosing in pediatric patients, for which body mass index can cause dosing to vary greatly. Another target area identified for improvement is interactions that commonly occur when the wrong combination of drugs impacts the normal metabolism of certain medications. This scenario can lead to less-than-optimal outcomes associated with elevated drug levels and toxicity.

Healthcare stakeholders increasingly recognize the promise of CDS, especially as rapid medical advancement continually introduces new medications to the market. Clinicians working within today’s fast-paced healthcare environment are simply unable to keep up with all the nuances associated with medication efficacy. Consider a recent study conducted by the Chicago Tribune that tested 255 retail pharmacies to see how often
dangerous drug pairs were dispensed without pharmacists warning patients. Overall, 52 percent of the pharmacies tested sold the medications without mentioning any potential interactions, including one large U.S. chain pharmacy, at which pharmacists failed to mention the drug interactions 63 percent of the time. In theory, relevant CDS alerts (i.e., meaningful advisories that are not lost in the noise of irrelevant alerts) could potentially draw needed attention to these dangerous interactions, prompting pharmacists to warn patients.

When CDS is optimally designed and integrated into workflows, a growing body of evidence connects better outcomes with use of CDS and embedded drug data solutions at the point of ordering. Texas Health Resources (THR), for instance, leveraged CDS interventions to reduce rates of venous thromboembolism (VTE), one of the leading causes of preventable hospital deaths. Often associated with subpar medication management, VTE was cut in half through the initiative.

The following are some common applications of CDS:

**Basic dosing/interaction checking:**
Physicians must consider numerous factors pertaining to medication dosing. Differences are often associated with the age and weight of a patient, for instance, or the way medications interact with various disease states. CDS alerts can assist clinicians by considering these factors in real time and alerting them to variances or potentially necessary changes in dosing.

**Medication reconciliation:**
Medication reconciliation remains a high priority area for improving collaboration between provider organizations to reduce medication errors. Clinical teams need effective tools and processes in place so that an updated medication list follows patients from triage and transfers between departments and organizations throughout the care continuum. CDS helps improve the effectiveness of these processes by guiding clinicians to the best drugs and doses to avoid ADEs when information is incomplete.

**Comparative efficacy:**
Studies are performed on a regular basis that provide insight into drug performance differences that are potentially related to individual patient or health condition characteristics. Providers often need access to this information to compare drugs in the same class or determine which class of drugs is best for a specific condition. CDS and reference tools provide the industry evidence that helps clinicians make better informed clinical decisions.

**Formulary management:**
As one of the highest cost centers in any organization, medications are a focal point of industry efforts to lower costs. Providers and payers increasingly design specific formularies — or lists of approved drugs — to improve this outlook, pointing clinicians to lower-cost or generic options, when appropriate. CDS helps healthcare organizations determine the best value by providing the needed information to compare cost to efficacy information in treating various diagnoses.

While the value proposition of CDS is notable, most systems have historically worked in generalities that were not focused on unique patient characteristics, producing many false-positive alerts that clinicians found irrelevant to their patients. As such, alert fatigue remains one of the greatest hindrances to optimal use of CDS at the point of care.
ALERT FATIGUE: IMPROVING THE OUTLOOK

Industry data estimates that between 40 and 90 percent of alerts are overridden by clinicians. Since it is estimated that 50 percent of alerts are valuable and relevant to patient care, these statistics strongly suggest that clinicians are not maximizing the potential of CDS to help them enhance clinical effectiveness and patient care.

EHR, pharmacy management system, and CDS vendors have struggled to find the right balance of alerts—one that appropriately weighs clinical significance against a clinician’s ability to consume helpful information. The challenge lies in the subjective and complex nature of human interaction with health information technology.

One solution to combating alert fatigue that has emerged in recent years is a vendor-assisted option that leverages evidence-based classifications and guidance for filtering and suppressing irrelevant or unhelpful data. For example, Group Health Cooperative (GHC) of South Central Wisconsin used a filtering mechanism to improve alert logic, prioritizing information that was more relevant for clinicians. The organization classified interactions by severity through its drug reference solution, Facts & Comparisons, assigning an evidence-based significance score between one and five to each alert. Designations of one and two, for example, are backed by credible evidence pointing to an interaction that is “probable” or “suspected.”

Once alerts were appropriately stratified, GHC then utilized this data within Medi-Span, its EHR-integrated drug data solution, to filter out alerts with a significance score of three, four, or five, reducing the number of possible alerts firing from 87 percent to 27 percent. GHC clinicians were receiving approximately 143 alerts per 100 orders at the start of the initiative. Fourteen days later, that number was reduced to 52 alerts per 100 orders. At the 60-day mark, physician override rates decreased from approximately 95 to 100 percent to 92.2 percent.

Ohio-based MetroHealth System embarked on a similar filtering initiative by focusing on drug-dose alerts. A preliminary analysis revealed that alerts were firing on approximately 13 percent of all medication orders, resulting in a preponderance of low-risk alerts. To reduce low-impact drug-dose alerts and address alert fatigue, the team leveraged its Epic EHR and Medi-Span knowledge base to test multiple system-wide and drug-specific filtering strategies to address data that physicians identified as clinically insignificant. By focusing on drug-dose alerts that could potentially cause significant patient harm, baseline drug-dose alerts initially decreased by nearly 80 percent. Primary system approaches decreased alerting to 5 percent of orders, while secondary drug-specific approaches dropped them to 3 percent. As end user feedback was incorporated into the process, alerts declined to under the 3 percent threshold.

OPTIMIZING CDS STRATEGIES TO REDUCE MEDICATION ERRORS

Healthcare organizations can more fully realize the value of CDS applications by taking a holistic approach to combating alert fatigue and introducing more contextual patient information into the alert process. Advanced drug data solutions already exist that address the need to screen drug alerts by patient, age, gender, diagnosis, and medications prescribed. The next steps require teamwork, collaboration, and development of specific functionality.
Going forward, clinical and information technology teams must come together to identify ways to customize, filter, and suppress alerts based on clinical evidence and patient risk. This strategy begins with a basic understanding of how many alerts are firing, factors that contribute to high volumes of alerts, and why alerts are overridden. For instance, project teams can leverage advanced analytics infrastructures to identify the top 80 percent of alerts. Then, patterns related to patient demographics, disease states, provider specialty, and other factors that contribute to alerts can be uncovered.

This process often produces specific patient profiles for which alert suppression makes sense. For example, nephrology patients tend to have complicated problems, leading to patients receiving numerous drugs with multiple compositions. When factored together, these scenarios often create frequent false positive or irrelevant alerts even though the medication combinations, in these specific nephrology cases, are warranted.

There is no “one size fits all” approach to addressing alert fatigue. Some high-level considerations for implementing holistic alert fatigue strategies include the following:

- EHR technology that allows for user controls, whether that be at an organizational, departmental, or end-user level
- System design strategies that consider human factors to guide the presentation of alerts
- Alert customization driven by ongoing analyses of patient populations and clinical workflows
- Identification and deployment of contextual or tiered alerts (using patient data such as age, weight, gender, renal function, etc.)
- Ongoing maintenance and updating of clinical content to deliver current and relevant information at the point of care

Fully Realizing the Value of CDS

When optimally deployed, CDS has potential to significantly help enhance patient care and reduce medication errors. By implementing systems that support a holistic approach to combating alert fatigue, healthcare stakeholders can more fully realize the value of their CDS and EHR investments and notably raise the bar on patient care and safety.

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8. [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1447540/](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1447540/)