

Technology to prevent adverse drug events

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Every year, adverse drug events (ADEs)—the harmful and unintended consequences of medications—cause 1.7 million emergency department visits in Canada (Hohl, Dankoff, Colacone, Afilalo, 2001; Zed et al., 2008). ADEs are a leading cause of unplanned hospital admissions, and rank between the fourth and sixth causes of death in North America (Patel et al., 2007; Lazarou, Pomeranz, Corey, 1998).

Up to 70% of all ADEs are consistently identified as preventable, and 30% occur simply because care providers re-prescribe and re-dispense culprit drugs without knowing they had previously caused harm (Classen, Pestotnik, Evans, Lloyd, Burke, 1997; Gurwitz et al, 2003; Zed et al., 2008; Zhang, Holman, Preen, Brameld, 2007; van der Linden et al., 2006). Often, vital information about ADEs and contraindicating medical conditions (e.g., long QT syndrome) is not effectively shared across health care sectors (van der Linden et al., 2010). This is because many ADEs are not documented in medical records, or the ADE information is hidden in inaccessible or unknown locations of patients' charts. Our research team has developed an innovative electronic tool to document ADEs and then generate automated alerts to prevent them from recurring.

A broken system

Presently, only limited information about ADEs is electronically communicated between health care providers within institutions (e.g., between wards) and across health care sectors (e.g., to outpatient pharmacies). In most health regions, health care providers must rely on verbal reports by patients or their families, faxes, paper letters, discharge summaries, or lengthy consultation notes for information

on ADEs that were diagnosed by other health care providers. If the prescribing health care professional is not the patient's family physician or does not have access to the hospital's or family physician's electronic medical record (EMR), then prescribing recommendations may be made without any knowledge of pre-existing contraindications or prior ADEs.

The ADE data will be used to generate automated, patient-specific, medication-level alerts, providing clinicians with succinct and relevant information at the precise points when they are at risk of re-prescribing or re-dispensing culprit drugs.

There are many examples of breakdowns in informational continuity across interfaces of care. When patients must communicate their own ADE information with subsequent care providers, potentially life-saving information can slip through the cracks. Many patients are unable to remember what drugs they are taking, let alone which ones caused adverse events. In other cases, patients might be too sick to remember which medication(s) preceded a serious ADE, be unconscious or delirious when the information is needed, or be unable to share sufficient and accurate information about their ADE due to communication challenges such as hearing deficits or language barriers. An efficient electronic system that could leverage ADE reports to generate patient-specific safety

alerts when medications are prescribed or dispensed would reduce this burden on patients, and facilitate the flow of standardized ADE information across health care sectors to prevent repeat ADEs.

A significant obstacle to effectively sharing relevant information is that the majority of ADEs are not documented in an electronic format that can readily be shared between care providers and across different health care sectors at a time point when it is relevant to the care being provided (e.g., at prescribing or dispensing).

A health care provider's ADE experience

"I saw a diabetic patient today who was discharged from [another local hospital] on Friday, where he was admitted for hypoglycemia due to glyburide [a medication]. The physician there asked him to stop the glyburide, and gave him a prescription for gliclazide, which has a lower risk of hypoglycemia."

"The patient presented here today with a critically low blood sugar of two, was treated, and then became hypoglycemic again. When I looked at the patient's blister pack I was horrified to discover both glyburide and gliclazide. It turns out the patient had been given a discharge prescription for gliclazide, but there was no note on the discharge prescription to discontinue the glyburide, although I wouldn't have

thought that would be necessary. Neither the GP nor the community pharmacist were aware of what had happened."

Clinical pharmacist, Vancouver General Hospital, 2012

Most EMRs do not have standardized, user-friendly data-entry options for ADEs (van der Linden et al., 2013). Even if an EMR includes ADE information, that data is often obscured in lengthy free-text formats, buried in historical notes, or limited to an existing allergy field (most ADEs are in fact not allergies). Our research suggests most health care providers see no patient safety benefits in reporting ADEs outside their own institution's EMR to external databases (e.g., Health Canada's MedEffect) or to patient safety learning systems. That's because those reports are de-identified, cannot be linked to other electronic records, and do not facilitate better care for their patients. Instead, clinicians report that documenting ADEs outside of their institutions detracts from clinical activities, because the extra reports require significant time to complete. As a result, crucial information about ADEs either goes entirely undocumented, or becomes lost within lengthy and often fragmented medical records.

Key medication-related terms

Best possible medication history (BPMH): A list of all the medications a client is actually taking, including the name, dose, frequency, and route of administration for each, that

is created by consulting with multiple sources (e.g., patients, families, community pharmacists).

Medication reconciliation: The comparison of the BPMH with the current list of medications to identify and resolve medication discrepancies, and communicate a complete and accurate list to the next care provider.

Medication review: Critical evaluation of all the medications a patient is taking, to identify any problems or interactions they may cause.

Adverse drug event reporting: The documentation and communication of harmful and unintended consequences of medications, including information about the type and class of drug taken and other relevant data, to external agencies who capture data for research and surveillance purposes.

The role for technological innovation

Our research explored how health systems can better leverage technology to reduce the number of preventable ADEs and increase patient safety. We invited diverse clinician groups to participate in focus groups and workshops. These confirmed—quite resoundingly—that clinicians are not interested in reporting ADEs to agencies external to their direct clinical care delivery (e.g., patient safety organizations) or using websites external to

their institutions' EMRs for the purpose of generating data. These reporting systems take extra time for clinicians to access and often request information that is already in existing health records (e.g., age, gender, medications). Most importantly, the current external systems do not help clinicians provide safer care, which stresses the need to rethink the rationale and technologies for ADE reporting.

Using workplace observations to ensure our research reflects actual (as opposed to assumed) work practices, we collected data to integrate the perspectives of clinicians in developing a new reporting framework to maximize the relevance of ADE reporting to clinical care.

The resulting technology is an adaptable software application that we call "Pill Talk." It allows clinicians to select a medication in a patient's EMR, and then enter details about the ADE using standardized drop-down fields, including their degree of certainty about the ADE, the patient's diagnosis, symptoms, and the recommended treatment. This software application will be fully integrated into existing EMRs and clinical workflows, and will take advantage of available records to pre-populate and link existing data (e.g., age, gender, medications) with the ADE report. Pill Talk will also enable real-time links between hospitals and community settings, such as pharmacies and general practice offices, to create informational continuity about contraindicated medications across transitions of care.

The ADE data will be used to generate automated, patient-specific, medication-level alerts, providing clinicians with succinct and relevant information at the precise points when they are at risk of re-prescribing or

re-dispensing culprit drugs. In addition, the software will provide high-quality, patient-level health data on ADEs that can be linked to health outcomes and cost data for research and post-market surveillance. Pill Talk is likely to help health institutions comply with new Bill C-17 federal ADE reporting requirements, which mandate that hospitals report serious adverse drug reactions—a subset of ADEs—to Health Canada. Currently, clinicians must submit adverse drug reaction reports through Health Canada's MedEffects website. This lengthy process is not integrated into patient care activities, and quite simply, is almost never done (Wiktorowicz et al., 2010). Using Pill Talk enables clinicians to document ADEs for individual patients during normal care activities in a succinct, standardized, and rapid manner. Confirmed adverse drug reactions can then be easily reported to Health Canada, eliminating the need for redundant documentation.

Figures 1 and 2 are the before and after depictions of how information flows (or doesn't flow) securely and appropriately between providers. [Figure 1: ADE information flow before Pill Talk](#) illustrates the status quo, showing how heavily the current systems rely on patients and paper records for sharing ADE information between care providers. After implementation, [Figure 2: ADE information flow after Pill Talk](#) depicts how Pill Talk will connect all the care providers electronically, to provide clinicians with more complete, accurate, and up-to-date patient-level ADE information.

We have received funding through the Canadian Institutes of Health Research eHealth Innovations Partnership Program (eHIPPP) to implement and evaluate the Pill Talk software application over the next four years.

A key step to eliminating preventable ADEs is to provide clinicians with user-friendly, integrated electronic systems to report, share, and use ADE information. Evidence-based and clinically relevant reporting technology is imperative to ultimately making medications safer for patients. ■

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