The Development of the Canadian Paediatric Trigger Tool for Identifying Potential Adverse Events

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Introduction

Research on adverse events (AEs) has highlighted the need to improve patient safety. The Canadian Adverse Events Study: the incidence of adverse events among hospital patients in Canada (CAES) reported that 7.5% of the annual medical and surgical, adult hospital admissions in Canada are associated with an AE, and close to 2.8% may be preventable (Baker et al. 2004). These data are consistent with the results obtained by many of the international studies that used the same methodology: retrospective chart review using a trigger tool (Brennan et al. 1991; Leape et al. 1991; Wilson et al. 1995; Thomas et al. 2000; Davis et al. 2001; Vincent et al. 2001; Davis et al. 2002; Davis et al. 2003). The CAES focused on patients 19 years of age and older. The rate of AEs in Canadian children remains unknown.

The Canadian Association of Paediatric Health Centres (CAPHC) is a national, not-for-profit, organization whose members are multidisciplinary health professionals who provide care for children, youth and families within community, regional and tertiary/quaternary healthcare facilities, rehabilitation centres and community home care services. At the 2004 Canadian Association of Paediatric Hospitals (CAPHC) annual conference, patient safety priorities and recommendations for CAPHC's Patient Safety Collaborative were identified and developed by a multi-stakeholder National Patient Safety Group. A key recommendation of the workshop was for CAPHC to take the lead in developing a paediatric trigger tool to assess the incidence of AE in paediatric populations.

In this article, we will provide background information on the use of trigger tools to detect AEs, and then describe the process used for developing a Canadian paediatric trigger tool and testing its feasibility and validity. Development of this trigger tool is one component of a long-term initiative that will contain several phases and responses to the issue of paediatric patient safety. We believe this project will lead to specific recommendations for improved data collection and event monitoring and will provide a baseline for further intervention studies to reduce AEs in Canadian paediatric acute care hospitals.

What Are Trigger Tools?

The term trigger tool was first coined by Classen et al. (1991) to describe a method used to detect potential adverse drug events (ADEs). The impetus for developing this computer-based system was the desire to establish a methodology that would be less labour intensive and more effective than the traditional chart review. In Classen's system, customized software linked to the patient's electronic medical record, which already had an interface with the hospital pharmacy system, was used to identify sentinel signals or triggers (e.g., certain drugs, antidotes, abnormal laboratory values and abrupt stop orders) suggestive of medication-related medical error and ADEs. These triggers

were able to prompt a more detailed review of the chart, possibly in real-time, thereby allowing the possibility of intervention. Chart reviewers (e.g., nurses, MDs and pharmacists) with knowledge and understanding of the medical milieu were trained to distinguish use of the drug in response to an ADE from its use for another reason, and thus could more accurately estimate the number of ADEs.

The concept of using triggers or clues to detect AEs has not been restricted to detection of ADEs alone. Using retrospective chart review, numerous studies have applied screening criteria to identify potential AEs. Such methodology forms the basis for studies published in the United States, United Kingdom, Australia, New Zealand and Canada on the incidence of AEs in hospitalized adults (Brennan et al. 1991; Leape et al. 1991; Wilson et al. 1995; Thomas et al. 2000; Davis et al. 2001; Vincent et al. 2001; Davis et al. 2002; Davis et al. 2003). More recently, the Institute for Healthcare Improvement (IHI) has developed a Global Trigger Tool for measuring AEs, which they define as "injury or harm related to (or from) the delivery of care" (Rozich et al. 2003). There remains no published report, however, on the use of a trigger tool to detect AEs in hospitalized children.

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Why a Trigger Tool for Paediatrics?

Research conducted in the US has shown that children experience a substantial number of potentially preventable patient safety problems. Using an administrative database, Miller et al. (2003) reported incidence rates of patient safety events from 0.2 (foreign body left during procedure) to 154 (birth trauma) per 10,000 discharge records, and noted that children who experienced patient safety problems whilst in hospital were 2 to 18 times at greater risk of death than children who did not experience patient safety problems. In another study, Slonim et al. (2003) reported the rate of US hospital-related medical errors to range from 1.81 to 2.96 per 100 discharges. Unique paediatric in-patient issues, such as strangulation by IV tubing, have been described (Garros et al. 2003), and AEs arising during the course of paediatric emergency care have been reported (Kozer et al. 2002; Goldmann and Kavshal 2002).

Patient factors such as developmental change, dependency on adults, different disease epidemiology and demographic characteristics (the four Ds) and healthcare provider factors can each contribute, alone or in combination to vulnerabilities in paediatric care (Miller et al. 2004). Therefore, it is reasonable to expect that unique triggers may be required to detect AEs in paediatrics, since wellness and disease may manifest differently across the spectrum from infancy through adolescence, and differ again from presentation in adults.

Development of the Trigger Tool: Establishing Objectives

In January 2005, CAPHC's "Trigger Tool Design Group" (TTDG) was formed, consisting of a team of paediatric clinicians and administrators, human factors scientists, health information professionals, stakeholders and two members of the CAES study team, all authors on this report. The TTDG was challenged with the task of developing a Canadian paediatric trigger tool for potential AEs. The objectives in developing the tool were to:

1. Develop a valid and reliable tool that could be used to identify and quantify the number of AEs in paediatric acute care;
2. Compare the incidence of AEs in hospitalized children to that previously reported in adults;
3. Act as a launching pad for quality improvement activities toward the prevention of AEs in paediatrics.

Establishing a Framework for the Trigger Tool Project

With funding from the Health Care Strategies and Policy Contribution Programs, Health Canada, the TTDG began its work. Following a number of preliminary teleconferences, a face-to-face meeting was convened in February 2005 in order to propose a framework for the initiative. Given the broad content expertise and experience with trigger tool methodology within the TTDG, the following road map was developed:

- Evaluate existing trigger tools and customize one to meet our paediatric needs.
- Model the CAPHC Paediatric Trigger Tool Project on the CAES to enable comparison of AE rates.
- Develop a procedure manual and toolkit for use with the trigger tool.
- Pilot the newly developed paediatric tool at several facilities in Canada in order to
  (1) establish the feasibility of using the newly formed tool, and
  (2) validate the customized tool.
- Establish and train physician/pharmacist/nurse teams from several Canadian paediatric health sciences centres to determine whether a "trigger" was indeed evidence of an AE.

- And, ultimately, implement a pan-Canadian project designed to determine the rate of AEs in the paediatric acute care setting.

Developing the Tool

Five trigger tools were identified through a detailed literature review and personal communication with international groups [Child Healthcare Accountability Initiative (CHAI) and the Vermont Oxford Neonatal Network (VONN)] investigating the role of trigger tools in paediatrics. Tools identified as appropriate for further consideration included:

- The Canadian Adverse Events Study screening criteria
- The CHAI medication trigger tool
- The Global Trigger Tool: Institute for Healthcare Improvement (IHI)
- The VONN neonatal trigger tool (personal communication Dr. Paul Sharek)
- The Calgary Trigger tool

The IHI Global Trigger Tool was selected as the foundation upon which to build the CAPHC trigger tool because it was comprehensive and modular. In order to focus on in-patient paediatric care, four of the original six modules (care, medication, surgical and intensive care) were included, and a new one, laboratory tests, was created. A key consideration was to ensure that all triggers would be collapsible into the CAES framework to enable us to fulfil our objective of comparing the incidence of AEs in hospitalized Canadian children to that reported by Baker et al. (2004) in the CAES. Therefore, an EXCEL spreadsheet was created wherein each of the other four trigger tools (CAES, CHAI, Calgary, VONN) were lined up against the modified Global Trigger Tool, and individual triggers from the four tools were cross-referenced to those of the Global Trigger Tool. Common triggers were identified, and through this process of reconciliation and consolidation, a preliminary new tool containing 94 triggers was established.

On review of this preliminary tool, specialists in human factors science determined that a 94-trigger tool substantially exceeded an acceptable and manageable size for application in a clinical chart audit. As a result, representatives from the Canadian and US paediatric patient safety community have been invited to join the TTDG to evaluate and reduce the preliminary trigger tool with a goal of achieving a more workable 40 triggers. The revised trigger tool will be finalized in Fall 2005.

Feasibility Testing and Validation of the Tool

Two further steps are proposed prior to actual implementation of the new Pediatric trigger Tool. Initially, the feasibility of using the new tool will be tested in each of three types of paediatric hospitals – stand-alone, hospital-within-a-hospital and a general hospital providing paediatric in-patient services to ensure that our study plan is practical. Subsequently, we will validate the new tool by a two-phase process: having a physician review the charts (Phase 2), triggered by a nurse review (Phase 1) to ensure that triggers are indeed identifying AEs in the paediatric population.

Future Application

Once established and validated, the Paediatric Trigger Tool will have several applications. First and foremost, it will enable delineation of the incidence of AEs in paediatric acute care across Canada. The cross-referencing of the Paediatric Trigger Tool to other tools, specifically the CEAS tool, will make it possible to compare the incidence of AEs in Canadian children to that in adults, and to track the incidence of AEs over time. From a logistics point of view, the tool will be compatible with portable electronic devices, facilitating real time audit and database updates where applied.

A key objective of this initiative is to create a tool that will generate data that can be viewed both from a national and a local hospital perspective, and to launch quality improvement activities to prevent AEs in paediatric care. As part of the ultimate implementation and analysis of results, it is envisioned that each individual hospital would be given access both to their own breakdown of AEs, and to that of the nation-wide survey, both stratified anonymously by site and aggregated. Not only would these data identify issues and quantify rates, they would also identify target rates that could subsequently be used for benchmarking and identification of best practices. Through subsequent quality improvement initiatives, safer paediatric care would be generated.

A fundamental vision of CAPHC is to improve the safety of healthcare for all infants, children and youth across the continuum of care. By making the finalized Paediatric Trigger Tool readily available to all paediatric facilities across the country, we feel that we will be able to generate meaningful qualitative and quantitative data that can be applied to achieve safer paediatric healthcare.

References

Baker, G.R., P.G. Norton, V. Flintoft, R. Blais, A. Brown, J. Cox, E. Etchells, W.A. Ghali, P. Hébert, S.P. Majumdar, M. O'Beirne, L. Palacios-Derflingher, S. Reid, R.J. Sheps and R. Tamblyn. 2004. "The Canadian Adverse Events Study: The Incidence of Adverse Events Among Hospital Patients in Canada." *CMAJ* 170 (11): 1678–86.

Brennan, T.A., L.L. Leape, N.M. Laird, L. Hebert, A.R. Localio, A.G. Lawthers et al. 1991. "Incidence of Adverse Events and Negligence in Hospitalized Patients. Results of the Harvard Medical Practice Study I." *N Engl J Med* 324(6): 370–77.

Classen, D.C., S.L. Pestotnik, R.S. Evans and J.P. Burke. 1991. "Computerized Surveillance of Adverse Drug Events in Hospitalized Patients." *JAMA* 266(20): 2847–51.

Davis, P., R. Lay-Yee, R. Briant, S. Schug, A. Scott and S. Johnson et al. 2001. "Adverse Events in New Zealand Public Hospitals: Principal Findings from a National Survey." Wellington, NZ: Ministry of Health.

Davis, P., R. Lay-Yee, R. Briant, W. Ali, A. Scott and S. Schug. 2002. "Adverse Events in New Zealand Public Hospitals I: Occurrence and Impact." *N Z Med J* 115(1167): U271.

Davis, P., R. Lay-Yee, R. Briant, W. Ali, A. Scott, S. Schug. 2003. "Adverse Events in New Zealand Public Hospitals II: Preventability and Clinical Context." N Z Med J 116(1183): U624.

Garros, D., J. King, B. Brady-Fryer and T.P. Klassen. 2003. "Strangulation with Intravenous Tubing: A Previously Undescribed Adverse Advent in Children." *Pediatrics* 111: e732–e734.

Goldmann, D. and R. Kaushal. 2002, Oct. "Time to Tackle the Tough Issues in Patient Safety." *Pediatrics* 110(4): 823–26.

Kozer, E., D. Scolnik, A. Macpherson, T. Keays, K. Shi, T. Luk and G. Koren. 2002, Oct. "Variables Associated with Medication Errors in Paediatric Emergency Medicine." *Pediatrics* 110(4): 737–42.

Leape, L.L., T.A. Brennan, N. Laird, A.G. Lawthers, A.R. Localio and B.A. Barnes et al. 1991. "The Nature of Adverse Events in Hospitalized Patients. Results of the Harvard Medical Practice Study II." *N Engl J Med* 324(6): 377–84.

Miller, M.R., A. Elixhauser and C. Zhan. 2003. "Patient Safety Event During Pediatric Hospitalizations." *Pediatrics* 111(6): 1358–66.

Miller, M.R., P.J. Pronovost and H.R. Burstin. 2004. "Pediatric Patient Safety in the Ambulatory Setting." *Ambulatory Pediatrics* 4: 47–54.

Rozich, J.D., C.R. Haraden and R.K. Resar. 2003. "Adverse Drug Event Trigger Tool: A Practical Methodology for Measuring Medication Harm." *Qual Saf Health Care* 12: 194–200.

Slonim, A.D., B.J. LaFleur, W. Ahmed and J.G. Joseph. 2003. "Hospital-Reported Medical Errors in Children." *Pediatrics* 111(3): 617–21.

Thomas, E.J., D.M. Studdert, H.R. Burstin, E.J. Orav, T. Zeena, E.J. Williams et al. 2000. "Incidence and Types of Adverse Events and Negligent Care in Utah and Colorado." *Med Care* 38(3): 261–71.

Vincent, C., G. Neale and M. Woloshynowych. 2001. "Adverse Events in British Hospitals: Preliminary Retrospective Record Review." [published erratum in BMJ 322: 1395]. *BMJ* 322(7285): 517–19.

Wilson, R.M., W.B. Runciman, R.W. Gibberd, B.T. Harrison, L. Newby and J.D. Hamilton. 1995. "The Quality in Australian Health Care Study." *Med J Aust 163* (9): 458–76.

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