

Chapter 9

Improving Patient Safety with Information Technology

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ABSTRACT

Over three-quarters of a million people are injured or die in hospitals annually from adverse drug events. The majority of medication errors result from poorly designed health care systems rather than from negligence on the part of health care providers. Health care systems, in general, rely on voluntary reporting which seriously underestimates the number of medication errors and adverse drug events (ADEs) by as much as 90%. This chapter reviews the literature on (1) the incidence and costs of medication errors and ADEs; (2) detecting and reporting medication errors and related ADEs; (3) and the use of information technology to reduce the number of medication errors and ADEs in health care settings. Results from an analysis of data on medication errors from a regional data sharing consortium and from computer simulation models designed to analyze the effectiveness of information technology (IT) in preventing medication errors are summarized.

INTRODUCTION

Adverse drug events resulting from medication errors are a significant problem in the U.S. (Bates, 1996; Classen, Pestotnik, Evans, Lloyd, & Burke, 1997). Traditionally hospitals have relied on voluntary reporting of errors. As a result it is estimated that only 5-10% of medication errors that result in harm to patients are reported (Cullen, Bates,

Small, et al., 1995). Most of these errors result from deficiencies in system design (Leape, Bates, Cullen, et al., 1995; Gwande, Thomas, Zinner, et al., 1999; Anderson, 2003). Based on these studies, the Institute of Medicine recommended that confidential voluntary reporting systems be adopted in all health care organizations and that information technology be implemented to reduce medication errors (Kohn, Corrigan & Donaldson, 2000). However, little progress has been made since the IOM report (Leape & Berwick, 2005).

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This chapter reviews the literature on: (1) the incidence and costs of medication errors and ADEs; (2) detecting and reporting medication errors and related ADEs; (3) and the use of information technology (IT) to reduce the number of medication errors and ADEs in health care settings. The methodology includes: (1) a review of the literature on the incidence of medication errors and the use of IT to detect and reduce medication errors; (2) analysis of data from a regional data sharing system; and (3) the results of computer simulation models designed to analyze the effectiveness of IT in preventing medication errors.

BACKGROUND

It is estimated that three quarters of a million people are injured or die each year from adverse drug events (ADEs) (Bates, 1996; Classen, Pestotnik, Evans, Lloyd, & Burke, 1997; Lazarou, Pomeranz & Corey, 1998). One study of medication errors in 36 hospitals and skilled nursing facilities in Georgia and Colorado found that 19% of the doses were in error; seven percent of the errors could have resulted in adverse drug events (ADEs) (Barker, Flynn, Pepper, Bates, & Mikeal, 2002). Overall it has been estimated that adverse drug events (ADEs) occur in from two to seven out of every 100 patients admitted to a hospital in the USA (Bates, Cullen, Laird, et al., 1995; Classen, Pestotnik, Evans, Lloyd, & Burke, 1997). Medication errors and associated ADEs increase the cost of hospitalization by about \$4,700 per incident (Bates, Spell, Cullen, et al., 1997). The increased costs for a 700-bed hospital due to ADEs were estimated to be \$2.8 million annually. Johnson and Bootman (1995) estimated the annual cost of morbidity and mortality due to drug therapy in 1995 for the U.S. to be \$76.6 billion.

ADEs also occur among outpatients at an estimated rate of 5.5 per 100 patients (Honigman, Lee, Rothschild, et al., 2001). A recent analysis of hospital emergency departments in the U.S.

estimated that ADEs account for 2.4 out of every 1,000 visits (Budnitz, Pollock, Weidenbach, Mendelsohn, Schroeder, & Annest, 2006).

Most errors are not reported making it difficult to ascertain the true rate of medication errors. Hospitals generally rely on voluntary reporting, which may result in the detection and reporting of as little as 10% of ADEs (Cullen, Bates, Small et al., 1995). One study of hospital units found that only 36 errors were reported on incident reports and 84 errors were reported on anonymous questionnaires over a period of 59,470 patient days (Barker & Allan, 1995). It was estimated that as many as 51,200 errors may have occurred in dispensing and administering medications over this period of time.

Over 24 states have mandated some form of medical error reporting (Comden & Rosenthal, 2002). Many of these reporting systems are internet-based and differ in the data that is shared (from specific processes/outcomes such as medication errors and/or nosocomial infections or infections resulting from treatment to a broad range of incidents); the participants (individual clinicians to entire healthcare organizations); geography (regional, state, and national); technology (paper-based to online); and regulatory expectations about participation (voluntary or mandatory) (Rosenthal & Booth., 2004; Flowers & Riley, 2001). To date there is little evidence of the effectiveness of these error reporting systems in reducing medication errors and ADEs.

A study analyzed data from 25 hospitals in Pennsylvania that agreed to share data on medication errors and organizational actions taken to prevent a reoccurrence of these errors (Anderson, 2008; Anderson, Ramanujam, Hensel and Siro, 2008). The Pittsburgh Regional Healthcare Initiative was predicated on a learning chain model where reporting and sharing information on errors will lead to organizational program solving. Identifying system failures and unsafe practices and procedures will then result in improved patient safety (Siro, 2003, 2005). Over a 12 month period

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