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Your Health Care May Kill You: Medical Errors

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Abstract. Recent studies of medical errors have estimated errors may account for as many as 251,000 deaths annually in the United States (U.S)., making medical errors the third leading cause of death. Error rates are significantly higher in the U.S. than in other developed countries such as Canada, Australia, New Zealand, Germany and the United Kingdom (U.K). At the same time less than 10 percent of medical errors are reported. This study describes the results of an investigation of the effectiveness of the implementation of the MEDMARX Medication Error Reporting system in 25 hospitals in Pennsylvania. Data were collected on 17,000 errors reported by participating hospitals over a 12-month period. Latent growth curve analysis revealed that reporting of errors by health care providers increased significantly over the four quarters. At the same time, the proportion of corrective actions taken by the hospitals remained relatively constant over the 12 months. A simulation model was constructed to examine the effect of potential organizational changes resulting from error reporting. Four interventions were simulated. The results suggest that improving patient safety requires more than voluntary reporting. Organizational changes need to be implemented and institutionalized as well

Keywords. Medical errors, adverse drug reactions, error reporting systems

1. Introduction

A 1999 Institute of Medicine report estimated that in the U.S. 45,000-98,000 deaths occurred annually due to medical errors [1]. A more recent study found that medical errors may claim as many as 251,000 lives each year in the U.S. [2]. Medical errors now account for 9.5 percent of all deaths in the U.S. making errors the third leading cause of death after heart disease and cancer.

A Commonwealth Fund survey [3] found error rates in the U.S. to be higher than in six other countries. The study surveyed 700-750 patients in Australia, Canada and New Zealand and 1,000 adults in the U.S., U.K. and Germany. Thirty-five percent of U.S. patients reported medical, medication and/or laboratory mistakes. Patients surveyed in the U.K. were least likely to report errors (22%). The likelihood of errors increased with the number of physicians involved in the patient care. Medical mistakes, medication errors or laboratory errors increased in the U.S. from 22% to 48% if four or more doctors were involved in patient care. Moreover, 75% of these patients were not told about the mistake by their doctor.

A number of Information Technology (IT) systems have been developed to detect and prevent medication errors, the most common type of medical errors [4]. These systems screen data

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such as ICD-9 codes, pharmacy and laboratory data. Rules are used to look for changes in medication orders, and abnormal laboratory results that may be indicative of medication errors and/or adverse drug events.

An important first step in preventing medical errors is a standard reporting system combined with information sharing among providers. Error reporting is a major strategy in an attempt to reduce medical errors. In the U.S. 24 states have mandated some form of error reporting. Reporting systems include the Veterans Administration Patient Safety Reporting System (PSRS) [5], Data Watch developed by the FDA [6], and a system developed by the Institute for Safe Medical practice [7]. Other Countries are developing and implementing reporting systems such as Korea, Japan and France. These systems are predicated on the assumption that the identification and reporting of conditions that lead to medical errors will lead to analyses of underlying causes and process improvement. However, there are financial, cultural and legal barriers to the successful implementation of reporting systems. It has been estimated that only 5-10% of medical errors are reported [8].

We evaluated one major medication error reporting system. The Pittsburgh Regional Healthcare Initiative (PRHI) was formed by providers to improve health care delivery. Members adopted the U.S. Pharmacopeia MEDMARX error reporting system. The sys- tem is internet accessible and anonymous. It has a taxonomy of errors and a database for describing errors, their causes and corrective actions taken by participating organizations. Error reporting was voluntary and each quarter participating hospitals were provided a summary of their reported errors, corrective actions taken, and regional averages. The purpose of the study was to determine whether implementation of the system led to increased error reporting and secondly, whether data sharing among providers led to organizational efforts to prevent the errors from reoccurring.

2. Methods

Data for the study were collected from 25 hospitals that had submitted 17,000 reports of medical errors during four successive quarters after the reporting system was implemented. The two outcome variables for this study were the number of medication errors reported and the ratio of corrective actions taken to the number of errors reported. Hospital characteristics controlled for included whether the hospital was a teaching hospital, number of beds and the hospital's JCAHO score.

Latent growth curve analysis was employed to analyze whether the changes in error reporting and corrective actions by the hospitals were statistically significant. This methodology estimates a regression curve for each hospital's data and produces a summary curve based on data from all of the hospitals in the sample.

A simulation model was constructed to model the error reporting system. The model generates medication doses and errors based on a normal distribution. Errors may harm or not harm the patient. Error reporting rates are assumed to increase over time. The model also generates actions taken by the hospital in response to reported errors. Interventions can be of two types: individual actions or system changes. Individual interventions include education, training and enhanced communication. System changes involve technology implementation and policy changes. The simulation model was validated with data reported by the participating hospitals. The effectiveness of four potential interventions was simulated. Intervention 1 was the implementation of a computerized physician order entry system (CPOE). Intervention 2 was the use of CPOE with decision support. Intervention 3 was participation of a clinical pharmacist on rounds

who reviewed medication orders. Intervention 4 was the undertaking of root-cause-analysis to prevent future errors

3. Results

The analysis indicated that 52% of the errors reported potentially could have harmed the patient. The other errors reported caused patient harm. In two cases the errors may have caused the patient's death.

Figure 1 shows the average number of errors reported by the hospitals and the average proportion of errors that lead to corrective actions by the hospitals over the four quarters [9]. Where the reporting system was implemented, participating hospitals re- ported an average of 45 medication errors each quarter. Within a year's time the number of errors reported almost doubled. The increase in reporting rates was similar among the hospitals. At the same time the proportion of errors that resulted in corrective actions by the hospitals remained almost constant over the four quarters.

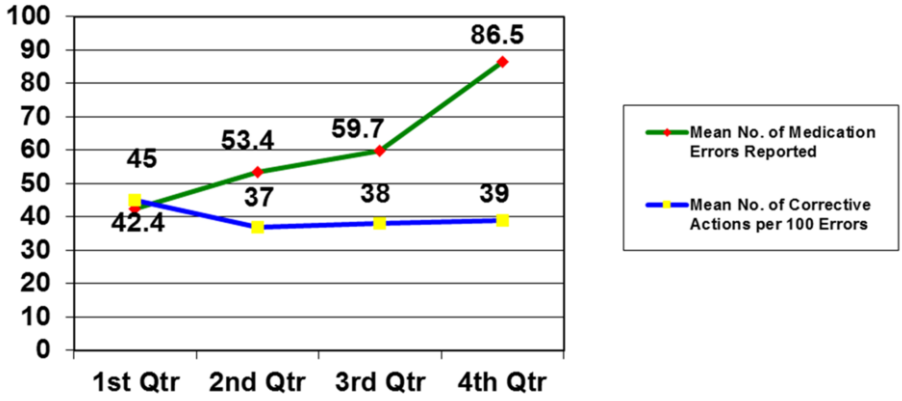

Figure 1. Medication Errors and Organizational Changes Reported over Four Quarters

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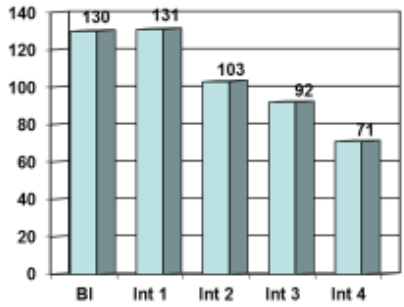
Results of the simulations are shown in Figure 2 [10]. The model predicts that implementation of computerized physician order entry by itself will have a very small effect on the number of medication errors. When decision support is added to the CPOE system, the model predicts errors will be decreased by about 20 percent. Inclusion of a clinical pharmacist on

hospital rounds will result in additional error reduction. It is only when the hospital commits to root-cause-analysis and system changes to prevent future errors that the model predicts that medication errors can be reduced by 70 percent.



- [BL] Existing information system
- [Int 1] Computer-based physician order entry system
- [Int 2] Computer-based physician order entry system that provides dosing information about drugs at the time orders are written
- [Int 3] Pharmacists participation on physician rounds
- [Int 4] Pharmacists participation and organizational commitment to identify causes of errors and make system changes to improve patient safety

Figure 2. Estimated Average Number of Medication Errors that Could Have Resulted in ADEs by Quarter

4. Conclusion

Over more than two decades' medical errors have continued to be a major cause of death in the U.S. as well as in other countries. Despite the mandated implementation of error reporting systems in many states, less than 10 percent of errors are reported. Even when errors are reported, hospitals fail to take effective actions to prevent their reoccurrence. The current study found that only 15 percent of the actions that hospitals took in response to reported errors involved system changes. Major barriers need to be overcome in order to improve patient safety [11].

Information technology can reduce errors. Electronic medical records, electronic prescribing, bar coding of medications, and decision support systems have been shown to be effective. However, many hospitals have been slow to invest in these technologies. Research is needed in order to make a better business case for investing in these systems in order to improve patient safety.

A second barrier to improving patient safety has been the reimbursement system. The current system does not provide sufficient incentives to hospitals and physicians to invest in patient safety. Too often medical errors result in increased revenue. At the same time there is too much reliance on the medical malpractice system to prevent future errors. New models that promote patient safety are needed.

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