Medication Errors and Response Bias: The Tip of the Iceberg

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Abstract

Background: Medication errors are a common cause of morbidity and mortality.

Objectives: To evaluate the rate of acknowledgment of medication errors as reported by physicians working in the community and in hospitals.

Methods: An anonymous questionnaire was sent to 9320 active physicians (about 48% community physicians, 17% hospital physicians and 35% working in both places), with questions on the rate and type of medication errors that they had encountered during their professional career. The questions specified errors in dosage, type of medicine (wrong indication), route of administration and drug interactions.

Results: Only 627 physicians (6.7%) responded. Of these, nearly 79% admitted having made an error in prescribing medication; the majority admitted to more than one error. Physicians with fewer years of experience admitted having made a mistake more than did physicians with more experience (P = 0.019). Pediatricians and geriatricians made more dosage mistakes (P = 0.02), while family physicians and psychiatrists made more mistakes in drug interactions (P = 0.001).

Conclusions: It is possible that indifference, fear of identification, or lack of awareness may have contributed to the low response rate despite the fact that the questionnaire was anonymous. Educational programs should be implemented in medical schools to encourage physicians to report errors before the onset of adverse reactions.

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It has been estimated that 770,000 patients are injured or die yearly from medication errors and adverse drug events in the United States. Studies have estimated that 2 to 7 of every 100 admissions are affected by adverse drug events. It has further been estimated that approximately half of these events have their source at the drug-ordering stage. The principal types of errors involve missing medication dose[s], incorrect dose or frequency, or incorrect route of administration [1-4]. The consequences of medication errors may include prolonged hospitalization, unnecessary treatment, and death [5]. Although most medication errors do not result in adverse events, the importance of early diagnosis and reporting medication errors is well documented. Several studies discuss the extent of medication errors, why they happen, and methods for prevention [1-7]. There are sparse data on the rate of physicians who admit to having made a mistake [8]. The purpose of this study was to evaluate the rate of acknowledging medical errors among physicians working in the community and in hospitals.

Subjects and Methods

An anonymous structured questionnaire was sent to 9320 of the approximately 15,000 member physicians of the Israeli Medical Association. The 9320 recipients are subscribers to *Abstract Medical Review*, a medical newsletter. *Abstract Medical Review*® was launched in 1994 by Teva Pharmaceutical Industries Ltd., an Israeli company. The newsletter is sent by mail to some 18,000 physicians, pharmacists, nurses and other health care workers. It includes summaries of the latest and most important referenced papers from a worldwide selection of relevant journals in the fields of medicine, pharmaceuticals, management and marketing. *Abstract Medical Review* subscribers receive questionnaires two to three times a year on other topics. The usual response rate for such questionnaires is 60–70% (Ami Blay, Editor, *Abstract Medical Review*®, Teva Pharmaceutical Industries Ltd.). The distribution of specialties and subspecialties among the recipients of the questionnaire was similar to that of the approximately 15,000 members of the Israeli Medical Association.

Two weeks before the questionnaire was sent, the physicians received a postcard announcing that the questionnaire was on its way as part of a survey on medication errors being conducted by *Abstract Medical Review* and the clinical pharmacology and toxicology unit of Assaf Harofeh Medical Center. The questionnaire asked a series of general questions about physician use of various forms of information regarding prescribing, the types of errors the physician may have made during his or her professional career, and specific questions about use of a drug consultation center. An "error" was defined as dosage miscalculation, drug-drug interaction, mistaken type of medication, and wrong route of administration. The questionnaire did not address drug-disease interactions or drug-food interactions. The physicians were not asked about the result of their error or how the errors were discovered. The respondents were requested to send the completed questionnaire anonymously by mail or fax to the *Abstract Medical Review* editorial office. The estimated time for filling the questionnaire was about 5 minutes. No reminders were sent.

Statistical analysis

Univariate categorical analysis was used for most statistical analysis, performed by using the chi-square test. Stepwise logistic regression was employed for the multivariate analysis. The analysis was performed using SPSS© software. All the *P* values stated are two-tailed. For determining the significance of proportion of interaction mistakes committed by psychiatrists, the mean proportion of mistakes was compared to the interaction proportion of mistakes. This was done by using the normal standard approximation of proportions.

Results

Of the 9320 anonymous questionnaires sent out, only 627 (6.7%) were completed and returned. The distribution of the medical specialties and subspecialties of the responding physicians did not differ significantly from those who did not respond ($P = 0.99$). Between 89% and 96% of the physicians in the various specialties and subspecialties did not respond. The distribution between places of work was also comparable (about 48% community physicians, 17% hospital physicians and 35% worked in both places). It was also observed that hospital-employed physicians among the respondents reported more years of employment than did their community clinic counterparts ($P < 0.03$). However, information was not available to allow comparison of the number of years of employment among responders vs. non-responders.

Of the respondents, 470 physicians (78.9%) admitted having made a medication error; 376 (63.1% of all respondents) made more than one error, and 94 (15.8% of all respondents) made one error only. Evaluation of physicians' use of information sources regarding prescribing errors showed that the most-used information source is medical literature (67%), followed by drug information services (44%). Other information sources were the internet (38%) and pharmacists (7%).

Through univariate analysis we found that physicians with fewer years of medical experience admitted more often to having made a mistake than did physicians with more experience ($P = 0.019$) [Table 1]. However, no significant difference was found with regard to specialty, place of work (community or hospital), or country of medical school graduation (Israel, Eastern Europe, or other) between those who did and did not admit to having made an error. Multivariate analysis was performed through logistic regression using specialty, place of work, country of medical school graduation, and years of practice as covariates. Number of years of practice was the only significant variable found ($P = 0.016$). In accordance with univariate analysis, the multivariate analysis showed that the fewer years a physician has practiced, the more likely she or he will admit to making an error ($P = 0.016$). Dosage errors (40.8%) lagged slightly behind errors related to drug interactions (41.7%). Pediatricians (54.2%) and geriatric physicians (58.3%) admitted making more mistakes in dose of medication ($P = 0.02$), while family physicians (57.1%) and psychiatrists (59.4%) tended to make mistakes in drug interactions ($P < 0.001$).

Table 1. Distribution of specialties according to admission of a medication error

	Made no mistake	Admit making at least one mistake	Total cases	*P**
Total	126 (21.1%)	470 (78.9%)	596	
Specialty				
Internal Medicine	15 (22.1%)	53 (77.9%)	68	
General physician	12 (26.7%)	33 (73.3%)	45	
Family physician	22 (19%)	94 (81%)	116	
Geriatrics	0	11 (100%)	11	
Pediatrics	18 (20%)	72 (80%)	90	
Cardiology	1 (8.3%)	11 (91.7%)	12	
Gynecology	16 (30.8%)	36 (69.2%)	52	
Surgery	4 (30.8%)	9 (69.2%)	13	
Ophthalmology	5 (41.7%)	7 (58.3%)	12	
Neurology	2 (16.7%)	10 (83.9%)	12	
Psychiatry	5 (16.1%)	26 (83.9%)	31	
Other	13 (20.3%)	51 (79.7%)	64	0.328*
Place of work				
Community	51 (20.1%)	203 (79.9%)	254	
Hospital	15 (16.7%)	75 (83.3%)	90	
Both	41 (23.4%)	134 (76.6%)	175	0.417*
Country of medical school graduation				
Eastern Europe	12 (16%)	63 (84%)	75	
Israel	50 (18.9%)	214 (81.1%)	264	
Other	40 (26.1%)	113 (73.9%)	153	0.119*
Years of practice				
> 10	10 (10.6%)	84 (89.4%)	94	
10–20	42 (24.6)	129 (75.4%)	171	
< 20	59 (23%)	198 (77%)	257	0.019*

* The *P* value is for chi-square test for independence and refers to the entire category.

Discussion

Of 9320 physicians who received the questionnaire, only 6.7% responded. Distribution of specialties and subspecialties among the responders did not differ from the study group. Of the responding physicians 78.9% admitted having made a medication error.

Previous studies have indicated that incorrect dosage is the most common type of medication error. In this study, we found that dosage errors (40.8%) lagged slightly behind errors related to drug interactions (41.7%). We also found that pediatricians (54.2%) and geriatric physicians (58.3%) tended to make dosage mistakes. These data are compatible with other studies [2,3,5,6,8-11].

In the literature, dosage errors by pediatricians are attributed

to incorrect calculations, underestimations of the body weight of children, and the use of unlicensed and off-label medications [2,5,6,8-11]. Several studies report that most serious errors occur at the drug-ordering stage. Wrong dosage and prescribing errors are most common in pediatric and emergency departments [11]. Fahrenkopf and colleagues [12] reported in a recently published study that depressed residents made significantly more medical errors than their non-depressed peers [12]. Dosage errors by geriatric physicians are described in other studies as errors caused by dosage adjustment that should be made in patients with renal insufficiency [13]. We also found that psychiatrists (59.4%) and family physicians (57.1%) admitted to making mistakes in drug interactions. Such psychiatric interaction errors are well known in the literature [14,15]. These interaction errors are commonly the result of the characteristics of these medicines. Most of these drugs are metabolized through the cytochrome P450 system, and the metabolic reagents are highly interactive.

Members of the target population are accustomed to receiving two to three questionnaires a year from the *Abstract Medical Review* on various topics, and the usual response rate is 60–70% (Ami Blay, Editor, *Abstract Medical Review*®, Teva Pharmaceutical Industries Ltd.). Our survey stated specifically that it was anonymous and that there was no interest in the reporters' identity; the questionnaires were sent to the physicians' home address. We speculate that several factors may have contributed to the low response to the questionnaires: possible fear of identification and repercussion for the reporters despite promised anonymity, lack of interest in the problem of medication errors, or lack of recognition of the magnitude and importance of medication errors.

To err is human [16], and while physicians are only human there is frequently an expectation that they should be infallible, particularly in this era of technological advances in diagnosis and treatment. Admitting an error is an ethical issue [17,18], especially in life-or-death cases. A physician who realizes that he or she has made a medication error may or may not admit to that error since the personal consequences for the patient and/or the physician can be serious. Physicians may find themselves subject to malpractice charges in cases of patient death, or toxic consequences where a case for "gross negligence" can be made. In medicine, human errors can have significant, sometimes adverse consequences. While the stated goal of risk management teams is to identify and learn from medical errors, physicians who make a medical error that results in patient harm often fear malpractice litigation and may respond with deception, defensive self-protective behavior, anger, and projection of blame onto others. Such responses by physicians impede the much-needed processes of confession and grieving, and discourage fulfilling the ethical responsibility to advise patients of errors [19-22]. A punitive reaction from hospital administrations and risk management teams frustrates efforts to identify and attempt to correct the underlying sources of error.

In recent years various methods to improve the reporting of medication error incidents have been introduced. The most common method continues to be voluntary reporting by physicians who err. Studies have shown that voluntary reporting identifies only a small fraction (5–6%) of medication errors [14,15]. In our study, although the response rate was only 6.7% we found a high rate of physicians who admitted to making a medication error (78.9%). The basic principle behind error self-reporting systems is that they be designed as "no fault" enterprises [16]. Physicians reporting their mistakes are assumed to act for the prevention of medical errors. The database of mistakes can be studied to discover possible systematic modifications that may help reduce the probability of error, rather than rooting out the "bad physicians" in order to punish them.

The literature suggests several methods for preventing or reducing rates of adverse drug events resulting from medication error, including use of several types of information technology [23-29]. In many instances, though, it is recommended that the responsible physician confess before a mistake is revealed by its consequences.

Since to err is human, there is a need for a human solution. The low response rate in this study may indicate the extent to which the problem calls for creative solutions. Technological support methods aimed at physicians and other care providers can impact on the rate of medication errors [23-29]; in addition, human support from clinical pharmacists, clinical pharmacologists, and other drug specialists should be readily available. An additional "human" aspect relates to the physician-patient relationship. Patients should be treated as partners, and all relevant information about medications should be conveyed to the patient including errors in order to recognize as soon as possible side effects and signs of toxicity.

The low response rate limits the study's generalizability to the physician community as a whole. The consequences of the errors and the way that most of the errors were discovered were unknown to us. These limitations did not allow us to draw firmer conclusions regarding the process of admitting to medication errors. Because of the limited questionnaire we could not specify whether there was a tendency to report non-significant errors or severe ones.

Conclusions

Physicians should approach their colleagues with empathy when a medical error has occurred, encouraging discussion of the event and focusing on solving problems. Furthermore, medical schools should implement specific educational programs on medication errors and their prevention. The welfare of both patients and physicians can be improved by the medical community adopting an open attitude to medication errors.

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