Self-Reported Medical Errors in Seven Countries: Implications for Canada

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Abstract

The purpose of this study was to determine the rate of self-reported errors in Canada compared with other countries, and to identify risk factors for medical error. In 2007, the Commonwealth Fund surveyed a sample of adults in seven industrialized nations, including Canada. Data from this source were used to perform a bivariate analysis comparing those individuals who reported having experienced a medical error with those who did not, followed by a logistic regression model to delineate the relationship between medical error and several explanatory variables.

Overall, 11,910 respondents from seven countries were included in the analysis. The rate of self-reported medical error ranged from 12 to 20% in the seven nations. Approximately one in six Canadians reported having experienced at least one error in the past two years, which translates to 4.2 million adult Canadians. Several variables were found to have a statistically significant relationship to self-reported medical errors in the final regression model, including high prescription drug use, the presence of a chronic condition, a lack of physician time with the patient, age under 65, a lack of patient involvement in care, perceived inadequate nursing staffing and an absence of a regular doctor. Identification of several patient, provider and system characteristics associated with self-reported medical error should aid in the development of strategies to address this problem by healthcare decision-makers and clinicians.

Background/Objective

Canada, like other industrialized countries, aims to provide safe healthcare to its citizens that meets the fiscal responsibilities of delivery in an efficient manner. This is evident from many initiatives across the world aimed at improving patient safety, such as the Institute for Healthcare Improvement's 100,000 Lives Campaign in the United States and the Safer Healthcare Now! initiative in Canada. A key component of improving patient safety is the prevention and management of medical error. Successful management of such errors and changes aimed at reducing the likelihood of their occurrence can have a significant impact on improving patient safety and quality of care, thereby resulting in fiscal benefits to the system.

There is substantial evidence suggesting that medical errors are a leading cause of death and injury (Kohn et al. 1999). According to the Canadian Adverse Events Study, 7.5% of patients admitted to acute care hospitals in Canada during 2000 experienced an adverse event, with 36.9% of those errors being

highly preventable (Baker et al. 2004). Such events ranged from the wrong dose or type of medication to having a foreign object left inside the body following a surgery, with an associated 1.1 million extra days in hospital attributed to these events (Gagnon 2004). This accounts for 5.4% of the total hospital days in Canada (Canadian Institute for Health Information 2004). In their review of the literature, Baker and colleagues (2007) concluded that the situation in Canada is roughly equivalent to that in many other industrialized nations.

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Medical errors can result from issues related to patients, providers or the healthcare system. The main objectives of this study were to determine (1) the self-reported rates of medical, laboratory and medication errors in Canada, Australia, Germany, the Netherlands, New Zealand, the United Kingdom and the United States, and (2) the patient, provider and system-related risk factors for self-reported medical error.

Methods

The Commonwealth Fund's 2007 International Health Policy Survey in Seven Countries, conducted in Australia, Canada, Germany, the Netherlands, New Zealand, the United Kingdom and the United States, was the primary data source for this paper. The data used in this survey were collected by Harris Interactive Inc., and its collection and sample procedures are detailed in full elsewhere (Schoen et al. 2007). In short, surveys were conducted by telephone in 2007 by Harris Surveys and country affiliates, with an average interview time of 17 minutes. We received permission from the Commonwealth Fund to use the raw survey data for the purpose of this paper.

A bivariate analysis of the survey data was performed using a chi-square test of significance with $\alpha = .01$ comparing those respondents who reported having experienced at least one medical error in the past two years with those who did not report having experienced an error. All the variables included in the bivariate analysis were hypothesized to be possible explanatory variables (risk factors) for medical error, based on previous literature. These included factors related to patient demographics, access to care, coordination of care and the patient-provider relationship. In comparing patients experiencing and not experiencing an error, chi-square was used to test for any significant difference in the variables for the purpose of identifying variables to be included in logistic regression models. If the chi-square value for the explanatory variable was significantly associated with an error ($p < .01$), it was then included in the regression model.

Table 1. Demographics of the survey respondents (*N* = 11,910)

	Total Respondents	Male		Female		≥65 Years of Age	Chronic Illness*
Country	*n*	*n*	%	*n*	%	%	%
Australia	1,009	365	36.2	644	63.8	21.5	60.7
Canada	3,003	1,370	45.6	1,633	54.4	19.5	50.0
Germany	1,407	660	46.9	747	53.1	16.2	44.9
Netherlands	1,557	635	40.8	922	59.2	27.5	68.3
New Zealand	1,000	390	39.0	610	61.0	17.6	53.6
United Kingdom	1,434	557	38.8	877	61.2	28.3	50.4
United States	2,500	942	37.7	1,558	62.3	23.1	60.9
All	11,910	4,919	40.7	6,991	59.3	22.0	55.5

*Defined as one of the following conditions: arthritis, heart disease including heart attack, diabetes, asthma, chronic obstructive pulmonary disease, high blood pressure or hypertension, depression, cancer, chronic pain or a mood disorder other than depression such as bipolar or mania.

Table 2. Medical, medication and laboratory errors in seven countries*

	AUS	CAN	GER	NETH	NZ	UK	USA
Medical, medication errors In past 2 years (percent yes):							
Been given the wrong medication or wrong dose?	8%c	6%	5% g	6%	6%	6%	7%
Had a time when you thought a medical mistake was made in your treatment or care?	11% b,c,d,f	7% d,g	6% g	5% e,f	8% f	5% g	9%
Either medical or medication error	15% b,c,d,f	10% g	9% g	9% g	11%	9% g	13%
Laboratory errors							
Had blood tests, radiographs or other tests in past 2 years (percent yes)	82% b,d,f	79% c,d,f	81% d,f	72% e,f,g	79% f	62% g	79%
Been given incorrect results for diagnostic or laboratory test	5% c,d	4% c,d,f	2% g	2% g	2% g	2% g	5%
Experienced delays in being notified about abnormal results	7% c,g	9% c,e	2% d,e,f,g	7% g	7% g	8%	11%
Either laboratory or diagnostic error	11% c	12% c,d,e	4% d,e,f,g	8% g	9% g	10% g	14%
Combined medical, medication, or laboratory errors							
Any medical, medication or laboratory error (percent yes)	20% c,d,f	17% c,f,g	12% c,g	14% g	16% f,g	13% g	20%
Any error, number of doctors seen in past year							
One	15% h	13% h	7% h	9% h	13% h	9% h	17% h
Three or more	27%	30%	16%	27%	34%	29%	33%
Any error, number of chronic conditions							
One	19% h	17% h	14%	15% h	20%	13% h	21% h
Two or more	26%	28%	16%	25%	22%	24%	32%
Among adults with chronic condition, any error for those with and without a medical home							
Has medical home	18% h	17% h	11% h	17% h	15% h	11% h	21% h
No medical home	30%	29%	19%	22%	30%	26%	34%

AUS = Australia; CAN = Canada; GER = Germany; NETH = The Netherlands; NZ = New Zealand; UK = United Kingdom; USA = United States of America.

* Reading from left to right starting with Australia, the letter indicates significant differences with countries to the right ($p < .05$), as indicated: b = different from Canada; c = different from Germany; d = different from The Netherlands; e = different from New Zealand; f = different from the United Kingdom; g = different from the United States; h = indicates difference within country ($p < .05$).

Source: Commonwealth Fund International Health Policy Survey, 2007. Table and notes reproduced with permission from Schoen et al. (2007).

Logistic regression was carried out to determine if any statistically significant exploratory variables from the bivariate analysis were predictors of medical error. For the risk factors of self-reported medical error in the final regression model, the parameter estimate, standard error and chi-square probability were all calculated. The odds ratios and 95% confidence intervals were also determined for each risk factor to provide an estimate of the relative risk of having a self-reported medical error given the presence of the risk factor. The goodness of fit of the final model was assessed, as was the possible presence of multicollinearity. All data analysis was performed using SPSS Version 16.0 (SPSS Inc., Chicago, Illinois).

Canadians had the third highest self-reported error rate at 17%; this translates to over 4.2 million adult Canadians.

Results

The final data set for this paper consisted of adults aged 18 and older in seven different countries: Australia, Canada, Germany, the Netherlands, New Zealand, the United Kingdom and the United States, totalling 11,910 survey respondents. Demographic characteristics of this group are listed in Table 1.

Table 2 displays the self-reported medical, medication and laboratory errors in each of the seven countries. Overall, the percentage of respondents who reported having experienced at least one error ranged from a low of 12% in Germany to high of 20% in Australia and the United States. Canadians had the third highest self-reported error rate at 17%. This translates to over 4.2 million adult Canadians (17% of 24.7 million adult Canadians in the 2006 census [Statistics Canada 2006]) who experienced at least one error during this time frame.

In the bivariate analysis (Table 3), a majority of the hypothesized risk factors for error occurred more frequently in those who experienced an error ($p < .01$). This included variables related to patient demographics, access to care, coordination of care and the patient-provider relationship. In fact, only one of our hypothesized risk factors (patients reported not receiving written medical information) did not occur more frequently in the patients who experienced an error, although it neared statistical significance ($p = .069$). It should be noted that for one variable (age), the relationship to medical error was opposite what we initially hypothesized, as we observed that younger (under 65) respondents were more likely to report having experienced an error.

Through the use of logistic regression with self-reported medical error as the dependent variable and nine hypothesized risk factors from the bivariate analysis as independent variables, a seven-variable risk model was produced. Table 4 contains the final overall model with the seven risk factors for self-reported medical error: presence of a chronic condition, a lack of physician time with the patient, age under 65, use of four or more medications, a lack of personal involvement in care, perceived inadequate nursing staffing and the absence of a regular physician. All of these variables were our initial hypothesized risk factors for error, except age less than 65.

Discussion

This study confirms that self-reported medical error is a common problem in Canada and other comparable industrialized nations. While the rate of self-reported error ranged from 12 to 20%, Australia, the United States and Canada ranked the worst among the seven countries, which closely follows a 2005 survey of patient perceptions of safety in which these same three countries were the worst of six compared countries (Davis et al. 2006).

Our final prediction model for self-reported medical error appears to be rigorous. Several indices were used to assess model fit. A test of the full model versus a model with intercept only was statistically significant (chi-square = 161.04, $p < .001$), and the model was able to correctly classify 79% of cases. Also, the Hosmer-Lemeshow Goodness-of-Fit test was not significant, indicating the data fit the model well (chi-square = 4.7, $p = 0.699$). Overall, the correlations (pairwise relationships) between the predictor variables are quite low, ranging from 0.05 to 0.23. The very low risk of multicollinearity among predictors was also confirmed by visual examination of predictor scatterplots.

The risk factors in our final prediction model include system, patient and provider characteristics. All of these were hypothesized risk factors with one exception – age under 65 (see Table 4). Our findings may be explained, in part, by the cultural differences between the two cohorts, whereby those in the older cohort are more familiar with a paternalistic style of medicine and, as such, are less likely to question outcomes from their healthcare experiences. Another variable to consider is education of the two groups. There has been a trend toward increased education over the years; we may conclude that formal education, which is also reflected by socioeconomic status, is less for the majority of the older cohort, which may influence their propensity not to report errors, perhaps from not recognizing that an error occurred or from being intimidated by a system that appears more paternalistic to such groups.

Based on the results of our study, we have two primary recommendations for clinicians and healthcare policy makers. First, we suggest the creation of a proactive risk identification system for medical error based on the model generated in this study. When patients present at a physician office, physicians could assess risk according to the three types of characteristics

Table 3. Bivariate analysis of respondents with, and without, any medical error

Variable	Patients with Error (*n* = 1,938)*		Patients without Error (*n* = 7,652)*		*p* Value (asymp. sig. [2-sided])
	n	%	*n*	%	
Gender					
Male	735	37.9	3,092	40.4	
Female	1,203	62.1	4,560	59.6	.046 c
Chronic illness					
No	567	29.3	3,072	40.1	
Yes (at least one)	1,371	70.7	4,580	59.9	.000 b
Poor physician explanation *Rarely* or *never* to, "When you need care or treatment, how often does your general practitioner/regular doctor/the doctor– explain things in a way you can understand?"	87	4.7	104	1.4	.000 b
Poor physician knowledge of medical history *Rarely* or *never* to, "When you need care or treatment, how often does your general practitioner/regular doctor/the doctor– know important information about your medical history?"	102	5.6	164	2.3	.000 b
Lack of time with physician *Rarely* or *never* to, "When you need care or treatment, how often does your general practitioner/regular doctor/the doctor– spend enough time with you?"	174	9.5	248	3.4	.000 b
Age					
18–64	1,534	79.2	5,772	75.4	
65+	404	20.8	1,880	24.6	.001 a
Medication use					
0 medications	514	26.6	2,625	34.5	
4+ medications	639	33.1	1,776	23.4	.000 b
Patient involvement in care *Yes, definitely* to, "Were you involved as much as you wanted to be in decisions about your care and treatment?"	377	50.9	1,151	67.8	.000 b
Enough hospital nurses *Yes* to, "In your opinion, were there always or nearly always enough nurses to care for you during your hospital stay?"	497	66.7	1,405	82.5	.000 b
Written medical information *Yes* to, "Did you receive written information on what to do when you returned home and what symptoms to watch for?"	483	64.9	1,168	68.7	.069 c
Regular physician? *Yes* to, "Regular doctor?"	1,736	89.6	7,083	92.6	.000 b

a = significant difference in variable between respondents with, and without, any error, $p < .01$ (two sided); b = significant difference in variable between respondents with, and without, any error, $p < .001$ (two sided); c = no significant difference.

* Of the total number of survey respondents, 9,590 qualified to report on error survey questions. Qualification for these questions was a hospital admission within the past 2 years at the time the survey was administered. A chi-square test of significance with $\alpha = .01$ was used.

Table 4. Logistic regression model results with risk factors for medical error

Variable	Parameter Estimate (b)	SE	χ^2 Probability	OR	95% CI	
Lack of patient involvement in care	0.753	0.138	0.000	2.124	1.620–2.784	
Perceived inadequate nursing staffing	0.560	0.119	0.000	1.751	1.388–2.210	
Absence of a regular doctor	0.679	0.233	0.004	1.972	1.248–3.312	
Use of 4+ medications	0.264	0.118	0.026	1.302	1.033–1.642	
Age 65+	–0.493	0.130	0.000	0.611	0.474–0.788	
Lack of physician time with patient	0.508	0.154	0.001	1.662	1.228–2.249	
Presence of a chronic condition	0.504	0.142	0.000	1.655	1.252–2.187	
Equation constant	–3.864	0.416	0.000	–	–	–

CI = confidence interval; OR = odds ratio; SE = standard error.

in our model: risk related to patient characteristics, physician characteristics and the system. Moreover, a similar process could be carried out during patients' admission to hospital, in that their chart could be tagged with an error risk level of high, moderate or low depending on the circumstances. Second, both healthcare organizations such a regional health authorities and individual clinicians should strive to encourage patient involvement in care. In our model, a lack of perceived involvement in decision-making was the risk factor with the highest odds ratio associated with self-reported medical error.

The primary limitation of this study is the self-reported nature of the survey data. This may produce variations in results due to differences in interpreting the definition of *error* by the survey respondents, especially across multiple countries. An attempt to draw generalizations and make comparisons from system-wide data at the country level can also lead to ecological fallacy due to variations at each level. However, there is consistency of self-reported error rates across the seven countries (see Table 2), which suggests that the self-reported data are valid.

A lack of perceived involvement in decision-making was the risk factor with the highest odds ratio associated with self-reported medical error.

Conclusion

This study has demonstrated that medical error is a commonly occurring problem from the perspective of patients in seven industrialized countries. The risk factors for self-reported medical error that have been identified in this study should aid clinicians and healthcare policy makers in the design and implementation of targeted strategies to address this issue. By proactively identifying patient-, provider- and system-related risk factors for medical error, the opportunity for improving the safety of Canada's healthcare system could be greatly enhanced. HQ

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