Quality of Care of International and Canadian Medical Graduates in Acute Myocardial Infarction

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Background: International medical graduates (IMGs) make up a substantial proportion of the physician workforce and play an important role in the care of patients with acute myocardial infarction (AMI). There are concerns that IMGs may provide inferior medical care compared with locally trained medical graduates, but that has not been established.

Methods: We performed a retrospective cohort study of linked administrative databases containing health care claims of physicians’ service payments, hospital discharge abstracts, and patients’ vital status. We included 127,275 AMI patients admitted between April 1, 1992, and March 31, 2000, to acute care hospitals in Ontario. We then compared the risk-adjusted mortality rates and adjusted use of secondary prevention medications and cardiac invasive procedures in patients treated by IMGs vs Canadian medical graduates.

Results: Of the 127,275 admitted AMI patients, 28,061 (22.0%) were treated by IMGs and 99,214 (78.0%) by Canadian medical graduates. The risk-adjusted mortality rates of IMG- and Canadian medical graduate–treated patients were not significantly different at 30 days (13.3% vs 13.4%, P = .57) and at 1 year (21.8% vs 21.9%, P = .63). Furthermore, AMI patients treated by both groups had similar adjusted likelihood of receiving secondary prevention medications at 90 days and cardiac invasive procedures at 1 year.

Conclusions: The use of secondary prevention medications and cardiac procedures and the mortality of AMI patients were similar, regardless of the origin of medical education of the admitting physician. This information places the care provided by IMGs into perspective and supports the ability of well-selected IMGs in caring for AMI patients.

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INTERNATIONAL MEDICAL GRADUATES (IMGs) in the United States and Canada are usually referred to as physicians who have completed their undergraduate medical education outside of these countries. They may have entered practice directly or after completing a period of postgraduate training in North America. Both countries use licensing requirements to screen the competency of IMGs, and whether these efforts translate into selecting those who can provide high-quality medical care is uncertain. Many suspect that the quality of medical care provided by IMGs may be inferior, but this hypothesis has not been fully evaluated. International medical graduates play a substantial role in the delivery of health care, as they make up approximately one quarter of the physician workforce in both countries. Understanding the potential discrepancies of care provided by IMGs is important in the interests of many health care consumers and policy makers.

The American College of Cardiology and American Heart Association practice guidelines have highlighted the use of evidence-based therapy for secondary prevention in patients with acute myocardial infarction (AMI), and the application of these therapies has been used as quality indicators of care. This well-established performance framework allowed a unique opportunity to compare the quality of medical care provided by IMGs with the care provided by Canadian medical graduates (CMGs). In addition, we compared the risk-adjusted mortality rates of AMI patients treated by IMGs and CMGs.

METHODS

DATA SOURCES

The Ontario Myocardial Infarction Database has previously been described. Briefly, the information in this database is obtained by linking several health care administrative databases in Ontario. All 190,354 patients admitted to Ontario hospitals with an AMI between April 1, 1992, and March 31, 2000, were identified based on a “most responsible diagnosis” of AMI (International Classification of Diseases, Ninth Revision code 410) in the Canadian Institute...
for Health Information hospital discharge database. We excluded patients younger than 20 years or older than 105 years, as well as those who were not Ontario residents, had an invalid Ontario health card number, were admitted as transfers from another acute care institution or to a noncardiac surgical service, had an AMI coded as an in-hospital complication, were discharged alive with a length of stay of less than 3 days, or were admitted with an AMI in the year before the index admission. The rationale for these inclusion and exclusion criteria is detailed elsewhere. A total of 146,382 patients met these criteria, and the coding accuracy of AMI in this cohort is greater than 94%. The Canadian Institute for Health Information database was then linked to the Ontario Registered Persons Database, which contains information on the vital status of all Ontario residents.

CLASSIFICATION OF ADMITTING PHYSICIANS

The admitting physician for each AMI patient was determined by linking the Ontario Myocardial Infarction Database cohort to the Ontario Health Insurance Plan database, which contains information on physician claims for all fee-for-service billings in Ontario. The billing codes for each patient were analyzed, and the admitting physician was identified as the first physician who submitted a claim rendered on or after the admission date. Billing codes for emergency department physicians were not included in determining the admitting physician. In the event that 2 or more physicians submitted claims on the admission date, the admitting physician was defined as the physician who submitted the most claims for follow-up care during that hospitalization. A unique admitting physician was identified for 127,275 patients, representing the final study cohort. Additional characteristics of the admitting physician were identified by linkage to the Corporate Provider Database of the Ontario Ministry of Health and verified against information in the Ontario Physician Human Resource Data Centre database. These data sources provided information on the age, sex, self-reported medical specialty, and medical school education of the physicians. All patient identifiers and physician billing numbers were encrypted to maintain patient and physician confidentiality.

USE OF SECONDARY PREVENTION MEDICATIONS AND CARDIAC INVASIVE PROCEDURES

Data on the use of secondary prevention medications in 63,301 older survivors of AMI were obtained by linkage to the Ontario Drug Benefit database. This database is a government-funded drug benefit program that covers outpatient drug costs for all Ontario residents 65 years or older. Our aspirin use rates are likely underestimates, as patients may have elected to purchase aspirin over the counter.

As part of the Ontario Myocardial Infarction Database initiative, information on medical therapy provided during the AMI hospitalizations was abstracted for a random sample of 4383 patients of all ages, drawn from 44 hospitals in Ontario between 1994 and 1996. These supplemental data allowed us to measure the use of secondary prevention medications offered during the inpatient stay. Information on the use of cardiac invasive procedures (cardiac catheterization, percutaneous coronary intervention, and coronary artery bypass surgery) within 1 year of the index AMI was obtained by linkage to the Ontario Health Insurance Plan physician services and the Canadian Institute for Health Information hospital discharge database.

STATISTICAL ANALYSIS

We first compared the physician characteristics of IMGs and CMGs. Then, we compared the demographic and clinical characteristics of patients treated by IMGs with those of patients treated by CMGs. Categorical variables were compared between the 2 groups using chi-square tests, while continuous variables were compared using t tests or nonparametric tests. Chi-square tests compared the use of medical therapy, cardiac procedure use, and mortality between IMG- and CMG-treated patients. This was repeated comparing IMGs from English-speaking developed countries (England, Ireland, Australia, New Zealand, and South Africa) with IMGs originating from all other countries where English was not the predominant language. We excluded US medical graduates in all our analyses because of their similarities with CMGs, which was consistent with previous studies.

We used the Ontario AMI mortality prediction rules to calculate risk-adjusted mortality rates. These rules are based on logistic regression models that predict 30-day and 1-year mortality after an AMI. International Classification of Diseases, Ninth Revision codes were used to identify the prevalence of 9 clinical risk factors in the 13 secondary diagnostic fields of the Canadian Institute for Health Information database and the age and sex of the patients. These variables included severity of cardiac disease (shock, congestive heart failure, pulmonary edema, and arrhythmia) and comorbid conditions (cerebrovascular disease, cancer, diabetes mellitus, and acute and chronic renal failure). This model has good predictive power, with areas under the receiver operating characteristic curve of 0.78 for 30-day mortality and 0.79 for 1-year mortality. These rules were validated in 2 separate independent data sets in California and Manitoba, with receiver operating characteristic curves of 0.77 and 0.78 for 30-day and 1-year mortality, respectively. The model development and validation are described in detail elsewhere.

Multivariate analyses of the use of secondary prevention medications and cardiac procedures provided by IMGs were also conducted using random-effects hierarchical logistic regression models. A multilevel analysis allows one to correctly incorporate variables measured at different levels of the hierarchy and to take into account the fact that the outcomes of patients under the care of a single physician or within the same hospital may be correlated. For use of medical therapy, we adjusted for patient characteristics, including all the clinical variables that were used to construct the Ontario AMI prediction rules, and other physician characteristics (age, sex, specialty, and physician volume of AMI patients treated). In a similar manner, for use of cardiac invasive procedures, we adjusted for patient and physician characteristics and other hospital factors (hospital volume, teaching status, and availability of revascularization facilities) that may influence procedure use.

Multilevel models were fitted using the software package HLM (Scientific Software International, Lincolnwood, Ill). All traditional statistical analyses were conducted using SAS version 8 software (SAS Institute, Cary, NC).

RESULTS

CHARACTERISTICS OF AMI PATIENTS

The median age was 69 years and 36% were female among 127,275 patients admitted to the hospital with an AMI between April 1, 1992, and March 31, 2000, in Ontario (Table 1). The IMG- and CMG-treated patients had similar clinical characteristics, comorbidities, and expected mortality rates. The IMG-treated patients were less likely
CHARACTERISTICS OF IMGs

Of the 5574 physicians who treated at least 1 AMI patient between April 1, 1992, and March 31, 2000, in Ontario, 1036 (18.6%) were IMGs and 4538 (81.4%) were CMGs (Table 2). The IMGs were significantly older, less likely to be female, and less likely to be a family physician, and they had a slightly higher volume of AMI patients treated per year compared with the CMGs.

More than half of all IMGs in Ontario obtained their medical degrees from England and Ireland. Other regions of origin, in order of frequency, included the Indian subcontinent, former Soviet Union, Asia, Western Europe, and South Africa (Table 3).

SECONdary PREVENTION MEDICATIONS, Cardiac PROCedURES, and Mortality

Table 4 details the use rates of secondary prevention medications and cardiac procedures. The IMG-treated patients had lower crude use rates of statins at discharge and of β-blockers at discharge and by 90 days. These differences, however, were not observed after multivariate adjustment. The adjusted use of secondary prevention medications was not significantly different between the 2 groups, except for angiotensin-converting enzyme inhibitors and statins at 90 days, whereas IMG-treated patients were slightly more likely to receive therapy after adjusting for patient and other physician characteristics. Similarly, patients treated by IMGs had slightly lower crude use rates of cardiac catheterization, percutaneous coronary intervention, and coronary artery bypass surgery within 1 year of their AMIs, but these trends were not observed after adjustment for other patient, physician, and hospital characteristics.

The AMI mortality rates were similar between patients treated by IMGs and CMGs. For IMG- and CMG-
treated patients, the 30-day risk-adjusted mortality rates were 13.3% and 13.4%, respectively (P = .57) (Table 5).

The 1-year risk-adjusted mortality rates were 21.8% and 21.9%, respectively (P = .63).

**IMGs FROM ENGLISH-SPEAKING AND NON–ENGLISH-SPEAKING COUNTRIES**

Among the 1036 IMGs, 437 (42.2%) originated from non–English-speaking countries. Compared with IMGs from English-speaking countries, their median age was younger (49 vs 53 years) and they were more likely to be female (15.6% vs 6.7%) (data not shown). Their countries of origin (in order of frequency) were India (23.4%), Poland (6.9%), China (including Hong Kong) (4.6%), Taiwan (3.2%), former Czechoslovakia (3.7%), Pakistan (3.2%), and the Philippines (2.8%). The adjusted use of aspirin in the hospital was higher in patients treated by IMGs from English-speaking countries (odds ratio, 1.85; 95% confidence interval, 1.12-3.06). However, the adjusted use of other medical therapies and cardiac procedures was not significantly different between the 2 groups. The risk-adjusted mortality rates of AMI patients were not significantly different at 30 days (13.1% vs 13.6%, P = .11) but were slightly lower in patients treated by IMGs from non–English-speaking countries at 1 year (21.3% vs 22.3%, P = .02).

**COMMENT**

Despite concerns that IMGs may provide inferior care, this study suggests that little difference existed between patients managed by IMGs and CMGs. The IMGs in our study came from all over the world, with more than 60 countries of origin. We found similar use of secondary prevention medications and cardiac invasive procedures. Furthermore, the mortality rates of AMI patients after discharge were essentially identical. This information places the care provided by IMGs in perspective and should reassure patients and policy makers about their ability to deliver AMI care.

There is considerable suspicion that IMGs in North America are not as well trained or as qualified as graduates of domestic medical schools. This perception is based on the fact that IMGs face cultural and language barriers, may have had exposure to different disease epidemics, or did not receive adequate medical education to practice medicine at a technologically advanced level. To date, however, there has been little evidence to support or refute this hypothesis. Previous evaluations of medical knowledge of IMGs using test scores have yielded conflicting results. Although IMGs consistently scored lower on the US Medical Licensing Examination, IMGs enrolled in training programs scored higher on the In-Training Examination in Internal Medicine compared with their US counterparts. Other attempts to evaluate the quality of IMGs have been limited by the lack of recommended practice guidelines and the lack of correlation between medical practices and outcomes.

Our study demonstrates that, in the setting of AMI, IMGs performed as well as CMGs in all aspects of quality of care. On outcome measures, patients treated by IMGs and CMGs had identical risk-adjusted mortality rates at 30 days and 1 year after AMI. On process measures, both groups prescribed aspirin, β-blockers, angiotensin-converting enzyme inhibitors, and statins at the same frequency, after adjusting for other physician characteristics. Furthermore, there was no substantial difference
between the care provided by IMGs from English-speaking countries and non–English-speaking countries. Interestingly, only half of the patients were prescribed β-blockers after AMI, despite practice guidelines strongly advocating their use.9,10 This finding represents an opportunity to improve care and outcomes of AMI patients, regardless of the background origin and medical training of the physician.

Recent studies have demonstrated the benefits of cardiac invasive procedures in AMI patients over conventional medical therapy,19-21 and new indications have been incorporated into practice guidelines.19 Although the optimal use rates and methods to evaluate quality in the use of cardiac invasive procedures are not known,22 we examined their application in our study not to measure quality of care but to evaluate potential differences in treatment patterns. In IMG-treated patients, we found lower crude use rates of cardiac catheterization, percutaneous coronary intervention, and coronary artery bypass grafting. However, these differences disappeared after adjusting for hospital characteristics, such as cardiac procedural capacities. This is not surprising, as the use of cardiac procedures is influenced by the availability of resources.23-24 Therefore, the lower unadjusted rates likely do not represent inferior care but suggest that IMGs have less access to invasive procedures, as they more frequently practice in hospitals without revascularization facilities.

One of the reasons to explain a lack of difference in care between IMGs and CMGs may relate to the careful screening and training process before licensure is granted to all physicians in Ontario. Ontario has a high proportion of IMGs (40% of all IMGs in Canada), while only accounting for one third of the Canadian population. The requirements for obtaining licensure have varied over time, with the number of IMGs licensed highest in the 1960s to the early 1980s, followed by more restrictive licensing policies beginning in the mid 1980s, when policymakers believed that there was an impending surplus of physicians in Canada. Consequently, the mean age of the IMGs was 10 years older than that of the CMGs in our study. Most of the IMGs in our study had already been in practice for several years (and may have taken some additional residency training in Canada) and thus had time to become familiar with Canadian standards regarding the treatment and management of AMI patients. Furthermore, before a license is granted, IMGs in Ontario are required to pass the same national certifying examinations in a specialty or in family practice as CMGs. All physicians in Canada must be the equivalent of “board certified” in the United States before receiving a general practice license, which acts as an important filter for ensuring that physicians in Canada are of high quality.

Several limitations of the present study merit consideration. First, we determined the level of care based on a single admitting physician at the initial AMI hospitalization. Although other medical providers may have influenced the care of these patients, we did not find substantial difference between the treatment provided by IMGs or CMGs in the hospital setting and after hospital discharge. Furthermore, using the same methods to determine the admitting physician, a strong relationship was previously demonstrated between the experience of the admitting physician with the use of evidence-based therapy and the outcome of AMI patients.23 Second, the generalizability of our findings to other jurisdictions such as the United States remains to be established. The IMGs in the United States tend to proportionately come from non–English-speaking countries that represent approximately 40% of all the physicians in our cohort. The large sample of IMGs from England and Ireland in our cohort represents an older generation of physicians who immigrated between the 1960s and the early 1980s, while newer generations of IMGs are drawn predominantly from non–English-speaking countries,20 as they are in the United States. Finally, our findings may not be generalizable to other areas of medicine, as we only evaluated the quality of care of AMI patients.

In summary, we found no difference in the prescribed therapies and the mortality rates of AMI patients admitted to Ontario hospitals treated by IMGs and CMGs. This evidence supports the notion that carefully selected IMGs can provide quality health care to AMI patients, after passing national certification examinations and having time to assimilate into practice in Canada. Further studies are needed to confirm our findings in different areas of medicine and to evaluate the ability of IMGs working in other jurisdictions.

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