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Predictors of international medical graduate certification success: A collaborative retrospective review of post-graduate medical education programs in Ontario

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Abstract

Background: The failure rate on college certification exams is significantly higher for international medical graduates (IMGs) than for Canadian medical school graduates.

Methods: In this study, we conducted analyses of retrospective admissions and certification data in order to determine the factors that predict IMG resident success on the College certification exams. IMG residents (n=912) that entered a residency program between 2005 and 2012, and subsequently sat a certification exam were included in the study. Data available at the time of admission for each resident, including demographics, previous experiences, and previous professional experiences, were collected at each of the 6 Ontario medical schools and matched with certification exam results provided by the College of Family Physicians of Canada (CFPC) and the Royal College of Physicians and Surgeons of Canada (RCPSC). Logistic regression models were developed to determine the predictive nature of each factor on resident success on the Colleges' exams.

Results: The models revealed resident age to be a robust predictor of performance across all examinations. English fluency, resident gender, and the human development index associated with the country of medical school training had differential predictive value across the exams.

Interpretation: These findings are informative for Ontario post-graduate medical education programs and will help determine areas for improvement in IMG education. In considering the results, we are reminded that some variables are not amenable to changes in selection criteria.

Keywords: *Medical Education; International Medical Graduates*

Introduction

Postgraduate training in Canada is a critical step on the international medical graduate (IMG) path to medical practice in Canada. Unfortunately, the success rates on the Royal College of Physician and Surgeons of Canada (RCPSC) and/or the College of Family Physicians of Canada (CFPC) licensure exams that follow postgraduate training indicate that IMGs have more difficulty achieving certification than do graduates of Canadian medical schools. For example, in 2007, the pass rate of IMGs that were residency-trained in Canada on their first attempt of the CFPC's certification exam (the CCFP exam) was 66%, while the pass rate for their Canadian Medical Graduate (CMG) counterparts was 90.4%.[1] IMG CFPC certification success rates varied between 51% and 74% in the ensuing three years.[2] More recently, review of data housed at the CFPC reveals that the pass rates for IMG residents on the CCFP exam were 66.7% in 2015 and 88.8% in 2016, as compared to CMG pass rates of 93.3% and 93.5% respectively. Similarly, RCPSC data indicate that between 2007 and 2016, only 78.9% of IMG residents passed RCPSC exams compared with 95.2% for CMG residents.

In October 2010, the Ontario government and the Deans of Ontario medical schools commissioned an independent review of barriers and solutions to fair access for IMGs seeking postgraduate positions with Ontario's Faculties of Medicine. With reference to initial selection criteria for admission to residencies, the resulting Report of Access to Postgraduate Programs in Ontario articulated a need to better understand the predictors of IMG certification success:

> "*[T]he Faculties of Medicine, supported by the Ontario Government, should identify research priorities to increase the evidence base for selection decisions and outcomes, including … predictors for success in residency and beyond, including the best ways to weigh and measure those factors…We recommend that support for research on predictors of success and ways to improve certification exam results, using the Ontario experience, should be a priority.*"[3]

In accordance with the priorities highlighted by this report, we began province-wide research to determine the predictors of IMG success on certification exams. To date, a number of mechanisms have been proposed to explain the lower success rates. Some of these reflect demographic characteristics of the population, such as second language proficiency[4] and older age,[5] while others focus on features of the foreign medical education experience,[6-8] the time elapsed since medical training,[9] and the impact of previous clinical experiences.[10] Furthermore, some have considered the impact that cultural beliefs about gender roles and physician-patient communication may have in explaining the phenomenon[11, 12] (see Walsh et al., 2011, for a review).[2] The current study serves to generate evidence that supports or refutes the validity of these hypotheses. Specifically, we reviewed admissions information concerning 912 IMG residents that entered a residency program at one of the 6 Ontario medical schools (McMaster University, Northern Ontario School of Medicine, Queen's University, University of Ottawa, University of Toronto, Western University) between 2005 and 2012, and subsequently sat a certification exam. These data were then linked to individual certification exam results provided by the CFPC and RCPSC, and regression models were developed to determine the predictive nature of each available factor.

This work replicates and extends a recent study that was conducted by Schabort and colleagues (2014) at McMaster University.[13] The results of their analyses suggested that country of study was a strong predictor of performance on the CCFP and RCPSC certification exams and that there are discipline-specific relationships between previous professional experience and examination success. The

report called for similar analyses to be conducted across Ontario.[13] The current endeavor is thus particularly noteworthy in that it involves a provincial data sharing collaboration between Ontario post-graduate medical education programs and the Colleges. Importantly, this research is hypothesis generating such that any and all conclusions drawn must be considered *ad hoc* interpretations. Furthermore, one must also remember that the *Canadian Human Rights Act*[14] precludes selection decisions that are made on the bases of race or colour, national or ethnic origin, religion, age, family or marital status, sex, pardoned conviction, disability, or sexual orientation. In this regard, it is our strong position that this analysis is best conceptualized as providing evidence that drives the effective improvement of the supports that are made available to IMG residents within their programs of study.

Methods

Design: This is a retrospective study that involves the use of information available at the time of resident selection to develop, via regression analyses, prediction models for certification examination results.

Study Population: The study aimed to include data from all IMGs enrolled in post graduate medical training programs in Ontario between 2005 and 2012. IMGs that had not written either the CCFP or RCPSC certification examinations were excluded from this study. An IMG was defined as a Canadian citizen or permanent resident that received a medical degree at an institution outside of Canada. Data concerning residents were de-identified at the level of the resident and institution of post graduate medical training prior to analysis. Accordingly, findings for all participating universities are aggregated.

Study Administration and Data Collection: Data were collected from application information that was submitted to post-graduate residency programs in Ontario through the Canadian Residency Matching Service (CaRMS) or that was held in the Ontario Physician Human Resource Data Centre (OPHRDC) between 2005 and 2012. These data include demographics and details about the resident's medical school experiences, country of medical training, professional activities, and in many cases the Medical Council of Canada Evaluating Exam (MCCEE), as well as the Clinical Exam 1 (CE1) or National Assessment Collaborative Objective Structured Clinical Exam (NAC-OSCE). To accomplish this a process for the collation and analysis of resident data that was amendable to the ethical use and security concerns of the partner institutions was developed. This included the drafting of a comprehensive data sharing agreement, which described considerations for governance, provisions for ensuring confidentiality, and secure operational support for data management through the OPHRDC.

Collation of these data from the 6 post-graduate residency programs yielded the following factors as sufficiently represented to be included in the proposed predictive models: age (years), gender (male, female), previous internship (yes, no), previous residency (yes, no), previous professional experience (yes, no), research experience (yes, no), conference attendance (yes, no), publications (yes, no), and teaching dossier (yes, no). English fluency (yes, no) and country of medical school training (Human Development Index (HDI) value) were also included as factors. English fluency was defined by appropriate attestation of primary and secondary, or medical school education conducted in English as according to the CaRMS provincial eligibility criteria.[15] The HDI is a composite statistic of life expectancy, education, and per capita income indicators, and is used to rank countries along a scale of human development. HDI values increase with greater lifespan, education, and GDP, and with lower fertility and

inflation rates. By transforming the country of medical education factor to an HDI value, we were able to treat it as a continuous variable. The HDI assigned to each country was based on the 2011 rating.[16]

These data were then merged with certification examination data provided by the CFPC and the RCPSC with support from the OPHRDC. In particular, performance on the first attempt of the CCFP and RCPSC certification examinations - specifically, the score on the Simulated Office Orals (SOOs; dichotomous), score on the Short Answer Medical Problems (SAMPs; dichotomous), a pass/fail on the combined SOOs and SAMPs (dichotomous), and pass/fail on the RCPSC certification examination (dichotomous) - were used as the dependent variables in regression models.

Analyses: Multivariable logistic regression models were employed to determine which variables were associated with success on the CCFP and RCSPC examinations. The methods of analysis included the construct of univariate logistic regressions for each independent variable as it pertained to each relevant dependent variable. Any independent variable that was significant at an alpha value set at $p \leq 0.1$ was included in a multivariable logistic regression for each relevant dependent variable. Through a stepwise approach, non-significant variables ($p > .05$) were removed until the model yielded only significant variables at an alpha value set to $p < .05$

Results

In total 912 IMG residents (431 RCPSC; 481 CFPC) were included. Records indicate that 1077 IMGs wrote the RCPSC certification examinations and 575 IMGs wrote the CCFP certification exam for the first time over the same period. Thus the analyzed cases represent 40.0% and 83.7% of the total potential populations, respectively. Participants' pass rate on the RCPSC exam was 84.5% and for the CCFP exam it was 78.6%. The stepwise multivariable regression analyses of family medicine residents reflect a sample size of 469 residents. This discrepancy was due to missing age data on 12 residents.

The univariate analyses of CCFP exam SOOs component success yielded age (OR = 0.95; p = .007) and previous medical professional experience (OR = 0.51, p = .052) as predictive of resident success at $p < .1$. However, the multivariable regression analyses for this dependent variable demonstrated only age to be a predictor of success. Specifically, as age increases, the residents' odds of passing this portion of the CCFP exam decreases (Table 1).

[Insert Table 1 about here]

The univariate analyses of CCFP exam SAMPs component success showed age (OR = 0.95, p = .001), female gender (OR = 2.1; p = .004), English fluency (OR = 1.7; p = .044), country of medical school training (OR = 8.5; p = .032), previous internship (OR = 0.54, p = .031), and previous publications (OR = 2.3; p = .033) as predictive of resident success at $p < .1$. Age, female gender, and English fluency were retained as significant predictors in the multivariable model. Specifically, as age increases, the residents' odds of passing this portion of the CFPC exam decreases. Moreover, the analysis indicates that residents that are female and/or fluent in English are more likely to succeed on this portion of the exam (Table 2).

[Insert Table 2 about here]

The univariate analyses of success at the composite CCFP exam (SOOs and SAMPs) yielded age (OR = 0.95, p < .001), female gender (OR = 1.6; p = .039), English fluency (OR = 1.6; p = .053), country of medical school training (OR = 7.2; p = .025), previous medical professional experience (OR = 0.63, p = .059), and previous publications (OR = 2.1; p = .031) as predictive of resident success at p < .1. Age and English fluency were retained as significant predictors in the multivariable model. In particular, as age increases, the odds of passing the CCFP exam decreases, and residents fluent in English have greater odds of passing the CCFP exam (Table 3).

[Insert Table 3 about here]

The univariate analyses of success at the RCSPC exams yielded age (OR = 0.94, p = .001), English fluency (OR = 1.7; p = .05), country of medical school training (OR = 102.7; p < .001), previous residency (OR = 0.44, p = .01), and previous medical professional experience (OR = 0.38; p = .002) as predictive of resident success at p < .1. Age, English fluency, and country of medical school training were retained as significant predictors in the multivariable model. Specifically, the odds of passing the specialty certification examination decrease as age increases; increase with English fluency; and increase as the HDI rating of the country of medical school training increases (Table 4). Importantly, the seemingly high odds ratio associated with the HDI factor is a function of the scoring occurring on scale that spans between 0 and 1.

[Insert Table 4 about here]

Discussion

Lower IMG certification performance as compared to CMGs served as an impetus for the provincial medical education community to identify the predictors of IMG success on these exams. To accomplish this, the current project engaged the 6 post-graduate medical education programs in Ontario and the two Colleges in a data sharing endeavour that allowed for modeling of certification success as a function of the information available to residency programs at the time of resident selection. The resultant statistical models indicate resident age to be a robust predictor of performance across all examinations. Specifically, the odds of success on the certification examination were lower for older residents. There are a number of ways that this finding may be interpreted. Age may be a surrogate measure for time elapsed since medical education and/or a residents' most recent professional experiences. However, age may also reflect professional approaches that are more fully developed in the older IMG resident population, which may in turn have more difficulty adapting work habits to meet the unique demands of the Canadian medical system.[5] English fluency registered as a significant positive predictor of success on the SAMPS and overall on the CCFP and RCSPC examinations.

The written nature of these tests offer a likely explanation for the significant effect associated with this predictor. The HDI score of the country of medical school training was also a positive predictor of success on RCSPC examinations. The HDI score reflects development at the level of the country and does not account for the quality of specific medical training institutions within each country. Interestingly, HDI was not predictive of CCFP exam performance. This finding is opposite to the work of Schabort and colleagues (2014) study, which revealed the country of medical school training to have a predictive value for CCFP exam performances but not RCPSC exam performance.[13] Thus, the current work refutes their idea that cultural aspects of family practice affect the way IMGs residents perform in the family medicine certification examination context. The only other relationship that emerged as a significant predictor in the collected data was a positive relationship between female residents and performance on the SAMPs portion of the CCFP examination. Given that the SAMPs is a written examination, and also that gender did not register as significantly predictive of the oral exam (i.e., SOOs), it is difficult to interpret this finding as a function of inherent gender-based rater bias. However, it does raise a number of possibilities that warrant further investigation. For instance, the short answer management problems from this period may cover content or be worded in a fashion that favours female performance. However, it is also possible that the imbalance of global opportunities for women in health care means that foreign-trained women seeking admission into Canadian post-graduate training programs are from an inherently more-qualified applicant pool.

In weighing each of the identified predictors, one must remember that the *Canadian Human Rights Act* precludes some uses of the presented results.[17] In particular, applicant characteristics such as age, gender, and nationality, are not amendable to changes in selection criteria. However, these findings may ultimately serve the improvement of in-program supports that are designed to assist IMG residents. For instance, post-graduate medical education training programs may further investigate the challenges that face older IMG residents in their learning and use that information to adjust the organization of curricula, the nature of assessment and performance review, and/or remediation approaches in order to offer educational activities that more appropriately address the needs of these learners.

Our ability to engage collaborators to enact this study suggests great promise for the development of a functional approach to conducting large scale integration and analyses of educationally-relevant trainee data that is concurrently acceptable to a number of stakeholders. As a consequence, the wider medical education research community is now well-situated to scale up this process of inter-institutional data sharing to include other studies of student performance at a provincial or even a pan-Canadian level. This is not to say that the data collection and management process was not without its challenges. Indeed, our experiences with this particular research project provided some important lessons that will be informative to future medical education research of this variety. Of particular note, our original research plan aimed to include resident performance on the Medical Council of Canada Evaluating Exam (MCC-EE) as an independent variable in the regression models. However, the standard that defines an acceptable level of performance is re-established approximately every five years. Given this, that the residents in our sample had graduated medical school across a range dating back to the early 1990's, and that the year in which the MCC-EE was written was not indicated in the datasets, we came to understand that these scores could not be reliably included in the analytical models. However, it is our position that these scores are likely powerful predictors of resident success. Thus we encourage Canadian medical education institutions to adjust their data recording practices so that information about the year of testing and the relevant standard for passing the test is

recorded. Access to the overall variability in MCC-EE scoring for any one particular year would also be valuable to the use of this data. In addition to the MCC-EE, our research group was also interested in including the Clinical Exam 1 (CE1) or the newer National Assessment Collaborative Objective Structured Clinical Exam (NAC-OSCE) in our analyses. These scores, while also subject to the same issues of standard as the MCC-EE, were not present in all of the applicant files because they have not always been a standard requirement in the residency selection process for IMGs. Accordingly, we also advocate post-graduate medical education programs to engage in the consistent updating of resident information as it becomes available.

This work represents a critical initiative in developing an evidence-based platform for determining the factors that have the most substance in explaining IMG certification exam performance. In doing so, this work results in a large data set that is reflective of the IMG population province-wide and that sets the table for the rigorous hypothesis testing of proposed depressed exam performance mechanisms. Ultimately, this work will culminate in an improved understanding of the IMG certification success phenomenon, help residency programs identify at-risk residents, and underpin the development of specific educational and remedial interventions. Furthermore, this work serves as an important first step in developing an infrastructure by which the determinants of certification examination performance among all medical graduates may be examined. One may consider the lack of data integration across institutions and with the Colleges before this work as a major gap that has been addressed by this collaborative project.

Contributions: MM managed the collation of the various data sets, designed the statistical models, conducted the statistical analysis, and facilitated the interpretation of results. CB, GC, CA, DA, GB, SPP, GS, EW, JMW, and IS managed the collation, submission, and integration of data from each of their respective collaborating institutions, facilitated the data transfer processes with the OPHRDC, and contributed to the interpretation of results. LEMG designed the study, led the writing of the manuscript, and supervised all aspects of the project. All authors contributed to the critical revision of the paper, approved the final manuscript for publication, and have agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work were appropriately investigated and resolved.

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Table 1. Predictors of success on CCFP SOOs via multivariable logistic regression

Factor	Odds Ratio	Std. Err.	z	p-value	95% CI low	95% CI high
Age	0.950	0.018	-2.69	0.007	0.915	0.986
_cons	71.918	57.916	5.31	<.001	14.837	348.588

*429 residents out of 469 residents pass this portion of the exam (failure rate of 8.5%)

Table 2. Predictors of Success on CCFP SAMPs via multivariable logistic regression

Factor	Odds Ratio	Std. Err.	z	p-value	95% CI low	95% CI high
Age	0.940	0.0159	-3.66	<.001	0.909	0.972
Female	1.957	0.531	2.47	0.013	1.150	3.332
English	2.136	0.584	2.78	0.006	1.250	3.652
_cons	31.164	21.839	4.91	<.001	7.892	123.067

*401 residents out of 469 residents pass this portion of the exam (failure rate of 14.5%)

Table 3. Predictors of Success on the composite CCFP exam (SOOS and SAMPs) via multivariable logistic regression

Factor	Odds Ratio	Std. Err.	z	p-value	95% CI low	95% CI high
Age	0.945	0.014	-3.86	< 0.001	0.918	0.972
English	1.884	0.448	2.67	0.008	1.182	3.002
_cons	25.409	15.440	5.32	<0.001	7.723	83.605

*372 residents of 469 residents pass both portions of the CFPC exam (failure rate of 20.7%)

Table 4. Predictors of Success on the RCPSC exams via multivariable logistic regression

Factor	Odds Ratio	Std. Err.	z	p-value	95% CI low	95% CI high
Age	0.958	0.017	-2.39	0.017	0.925	0.992
English	1.873	0.563	2.09	0.037	1.039	3.377
HDI	41.753	48.458	3.22	0.001	4.293	406.048
_cons	1.268	1.553	0.19	0.846	0.115	13.988

*364 resident out of 431 residents passed this exam (failure rate of 15.5%)