Characteristics of first-year students in Canadian medical schools

Irfan A. Dhalla, Jeff C. Kwong, David L. Streiner, Ralph E. Baddour, Andrea E. Waddell, Ian L. Johnson

Abstract

Background: The demographic and socioeconomic profile of medical school classes has implications for where people choose to practise and whether they choose to treat certain disadvantaged groups. We aimed to describe the demographic and socioeconomic characteristics of first-year Canadian medical students and compare them with those of the Canadian population to determine whether there are groups that are over- or underrepresented. Furthermore, we wished to test the hypothesis that medical students often come from privileged socioeconomic backgrounds.

Methods: As part of a larger Internet survey of all students at Canadian medical schools outside Quebec, conducted in January and February 2001, first-year students were asked to give their age, sex, self-described ethnic background using Statistics Canada census descriptions and educational background. Postal code at the time of high school graduation served as a proxy for socioeconomic status. Respondents were also asked for estimates of parental income and education. Responses were compared when possible with Canadian age-group-matched data from the 1996 census.

Results: Responses were obtained from 981 (80.2%) of 1223 first-year medical students. There were similar numbers of male and female students (51.1% female), with 65% aged 20 to 24 years. Although there were more people from visible minorities in medical school than in the Canadian population (32.4% v. 20.0%) ($p < 0.001$), certain minority groups (black and Aboriginal) were underrepresented, and others (Chinese, South Asian) were overrepresented. Medical students were less likely than the Canadian population to come from rural areas (10.8% v. 22.4%) ($p < 0.001$) and were more likely to have higher socioeconomic status, as measured by parents' education (39.0% of fathers and 19.4% of mothers had a master's or doctoral degree, as compared with 6.6% and 3.0% respectively of the Canadian population aged 45 to 64), parents' occupation (69.3% of fathers and 48.7% of mothers were professionals or high-level managers, as compared with 12.0% of Canadians) and household income (15.4% of parents had annual household incomes less than $40 000, as compared with 39.7% of Canadian households; 17.0% of parents had household incomes greater than $160 000, as compared with 2.7% of Canadian households with an income greater than $150 000). Almost half (43.5%) of the medical students came from neighbourhoods with median family incomes in the top quintile ($p < 0.001$). A total of 57.7% of the respondents had completed 4 years or less of postsecondary studies before medical school, and 29.3% had completed 6 or more years. The parents of the medical students tended to have occupations with higher social standing than did working adult Canadians; a total of 15.6% of the respondents had a physician parent.

Interpretation: Canadian medical students differ significantly from the general population, particularly with regard to ethnic background and socioeconomic status.

In contrast with the Canadian situation, medical students in the United States have been well studied in terms of demographic characteristics,[1–4] socioeconomic status[5,6] and indebtedness.[7,8] Similar Canadian data have not been reported since the 1960s.[9]

Research

Recherche

Mr. Dhalla, Mr. Baddour and Ms. Waddell are medical students at the University of Toronto, Toronto, Ont. Mr. Dhalla is Vice-President, Education, Canadian Federation of Medical Students. Dr. Kwong was a medical student at the time of the study and is now a community medicine resident at the University of Toronto. Dr. Streiner is with the Department of Psychiatry, University of Toronto, and the Kunin-Lunenfeld Applied Research Unit, Baycrest Centre for Geriatric Care, Toronto, Ont. Dr. Johnson is with the Department of Public Health Sciences, Faculty of Medicine, University of Toronto.

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Recent commentaries have reiterated the need for medical students to represent the diversity of a country's population adequately.[10,11] Diversity is important not only for reasons of fairness but also as a pragmatic consideration: minority students are more likely than nonminority students to practise in areas of physician shortage and to treat disadvantaged patients, chronically ill patients and patients with more than one illness.[12–16] Similarly, medical students from rural backgrounds are more likely than students from urban backgrounds to practise in rural areas.[17–23] Canada is confronting a looming shortage of doctors, one that is already particularly acute in rural areas.[24] To combat this undersupply of physicians, several medical schools have recently expanded enrolment.[25,26] At the same time, various factors have resulted in many medical schools' dramatically increasing tuition. The most striking example has been at the University of Toronto, where tuition has risen from $3118 in 1995/96 to $14 000 in 2000/01.[27] In light of this rapidly changing environment, a recent essay highlighted the need for a national medical student survey, asking specifically to find out "who is missing from our ranks."[28]

To understand better who Canadian medical students are, we conducted a national survey and compared the characteristics of medical students with those of the Canadian population. We hypothesized that certain visible minorities (e.g., Aboriginal Canadians and black people) would be underrepresented among medical students and that a disproportionate number of students would come from families of high socioeconomic status. We also determined the number of medical students who had physician parents and whether medical students would have more than the requisite 3 to 4 years of postsecondary education. We place our findings in context by comparing them with historical Canadian data and more recent data from the United States.

Table 1: Response rate among students entering medical school in Canada in 2000 by school

Medical school	No. of students	No. (and %) who responded
University of Ottawa	102	96 (94.1)
Memorial University	62	54 (87.1)
McMaster University	112	96 (85.7)
Dalhousie University	90	77 (85.6)
University of Saskatchewan	55	47 (85.5)
Queen's University	80	68 (85.0)
University of Toronto	189	155 (82.0)
University of British Columbia	120	94 (78.3)
University of Calgary	101	78 (77.2)
University of Western Ontario	110	80 (72.7)
University of Alberta	127	90 (70.9)
University of Manitoba	75	46 (61.3)
All	1223	981 (80.2)

Methods

Questionnaire design

We developed a survey to investigate, among other topics, the demographic characteristics, socioeconomic status and educational background of medical students. We pretested the survey among about 30 medical students from across Canada. The pretest resulted in minor modifications to the questionnaire. The pretest responses were discarded, and the pretest participants were resurveyed with the rest of the medical student population. To promote content validity and allow for direct comparison to the Canadian population, several questions (e.g., visible minority status and education) were virtually identical to those asked in the 1996 Canadian census.[29]

We ascertained the students' age and sex as well as the first 3 digits of their postal code at the time of high school graduation. We used Canada Post's classification system to classify postal codes as rural or nonrural (a 0 as the first numerical digit indicates a rural postal code) and Statistics Canada data to determine the proportion of the Canadian population living in areas with rural postal codes. Similar to the 1996 census, we asked respondents to choose which of the following terms best described them: white, Aboriginal (e.g., status, nonstatus, Métis, Inuit), Chinese, South Asian (e.g., Indian, Pakistani, Sri Lankan), black, Filipino, Latin American, Southeast Asian (e.g., Cambodian, Indonesian, Laotian, Vietnamese), Arab, West Asian (e.g., Afghan, Iranian), Japanese, Korean or "other." As in the census, respondents were allowed to select as many responses as applicable and could write in a response that differed from the choices provided.

Parental occupation, education and income were used as direct indicators of socioeconomic status. We used a modified version of the Pineo–Porter occupational scale[30] to classify parental occupation. We also asked respondents whether their parents were doctors.

We used the median family income of the respondent's neighbourhood (the region defined by the first 3 digits of their postal code) at the time of high school graduation as an indirect indicator of socioeconomic status. Neighbourhood income data were derived from responses to the 1996 census.[29]

We asked students what degrees they had completed before entering medical school and how many years they had studied at university.

Survey procedure

We received approval for the study from the Ethics Review Office at the University of Toronto. In the fall of 2000 we collected the email addresses of all students enrolled in Canada's 16 medical schools. On the basis of enrolment data,[27] we estimated that we had valid email addresses for over 95% of the students at the schools under study.

Table 2: Age distribution of the respondents at Dec. 31, 2000

Age, yr	No. (and %) of students*
≤ 19	11 (1.2)
20–24	617 (65.0)
25–29	259 (27.3)
≥ 30	62 (6.5)

*Six respondents did not answer this question.

The students were sent an email message that contained a personal identification code and invited them to visit a specific Internet site to complete the questionnaire. Up to 2 reminders were sent to nonrespondents. To encourage participation, student representatives at each school promoted the survey using draw prizes (e.g., a handheld computer was offered to a randomly chosen respondent from each school). The survey was conducted over 7 weeks in January and February 2001, a period chosen to avoid examinations and vacations.

Foreign students were excluded from the analysis. As well, students at the 4 medical schools in the province of Quebec were excluded, mainly because the quality of our email address databases for the Quebec schools was poor. The databases were incomplete (e.g., we had valid email addresses for less than two-thirds of the students enrolled at the Université de Sherbrooke) and included a large number of premedical students. We discovered these problems after administering the survey but before analyzing the results. Also, the response rates at the Quebec schools were poor (38% to 53%). Before analyzing the data, we decided to exclude Quebec students' responses because we could not be confident that the data were representative.

Analysis

Responses to the Internet questionnaire were transferred automatically into a computer database. Duplicate responses and those with an invalid identification number were removed. We analyzed the data and examined the frequency distribution of responses to find evidence of irregularities in the data, which were either manually recoded (e.g., \$50K was recoded as \$50 000) or discarded. We used descriptive statistics to summarize the responses to all questions. Where possible, we performed χ^2 tests to detect differences in the characteristics of medical students versus the Canadian population.

Table 3: Ethnic background of the respondents and of Canadians aged 15 to 24 years*

Self-identified ethnic background	No. (and %) of students†	% of Canadians aged 15 to 24 yr
Aboriginal	7 (0.7)	4.5
Black	12 (1.2)	2.5
Chinese or South Asian	193 (20.2)	7.8
Other visible minority	56 (5.9)	4.8
White	644 (67.6)	80.0
More than 1 background	41 (4.3)	0.4

*According to 1996 Canadian census data.
†Two respondents did not answer this question.

Using 1996 census data,[29,31–34] we compared medical students to the Canadian population with regard to self-identified ethnic background, rural versus urban residence, socioeconomic status and education. To be consistent, we excluded Quebec residents from the Canadian population data, except in the comparison of occupations, where this was not feasible. We compared medical students and their parents with Canadians of the same age range whenever possible.

Results

A total of 1223 students entered the 12 Canadian medical schools outside Quebec in 2000.[35] We received responses from 981 of these students, for a minimum response rate of 80.2%. Because we did not have email addresses for all 1223 students, the true response rate was actually slightly higher. The response rate differed between schools (Table 1). We excluded 26 respondents because they were not Canadian citizens, permanent residents or refugees; this left 955 responses for further analysis.

Demographic characteristics

There were slightly more female (51.1%) than male respondents. Most of the respondents (65.0%) were 20 to 24 years old (Table 2).

Only 10.8% of the medical students lived in a rural area at high school graduation, as compared with 22.4% of the Canadian population in 1996 ($p < 0.001$). There was a higher proportion of people from visible minorities among the respondents than among the Canadian population ($p < 0.001$) (Table 3). Certain minority groups, most notably Aboriginal Canadians ($p < 0.001$) and black people ($p = 0.015$), were underrepresented. Chinese and South Asian people were overrepresented ($p < 0.001$ in each case).

Socioeconomic status

The fathers and mothers of the medical students had attained a much higher level of education than did Canadian men and women aged 45 to 64 ($p < 0.001$ for both comparisons) (Table 4). The parents of the medical students also tended to have occupations with higher social standing than did working adult Canadians (Table 5). A total of 15.6% of the respondents had a physician parent.

Table 4: Education of the students' parents and of the Canadian population aged 45 to 64 years*

Highest education level attained	No. (and %) of students' fathers†	% of Canadian men aged 45–64	No. (and %) of students' mothers†	% of Canadian women aged 45–64
High school graduate or less	146 (15.5)	50.2	188 (19.8)	58.8
Diploma below bachelor level	170 (18.1)	32.0	255 (26.9)	29.2
Bachelor's degree	257 (27.4)	11.2	321 (33.9)	9.0
Master's or doctoral degree	366 (39.0)	6.6	184 (19.4)	3.0

*According to 1996 Canadian census data.
†Sixteen respondents did not give their father's education level, and 7 did not give their mother's education level.

Consistent with the differences in education and occupational status, the household income of the respondents' parents exceeded that of the average Canadian household (Table 6). Medical students also tended to come from higher-income neighbourhoods ($p < 0.001$) (Table 7).

Educational background

Only 6.7% of the respondents had not completed a bachelor's degree. A total of 20.4% of the respondents had completed a graduate degree, including 3.5% who had completed a doctoral degree. Overall, 178 (18.6%) had 3 years or less of postsecondary education before medical school, 373 (39.0%) had 4 years, 124 (13.0%) had 5 years, 136 (14.2%) had 6 years, and 144 (15.1%) had 7 years or more.

Interpretation

We found that Canadian medical students are not representative of the Canadian population. Medical students are much more likely than the general Canadian population to come from urban areas, come from neighbourhoods with high median family incomes and be children of well-educated, professional parents. Medical students are also far less likely the general Canadian population to be black or Aboriginal.

Similar data have not been reported since the mid 1960s.[9] Many of the findings reported then are similar to our findings. For example, in the 1965/66 academic year, 8.4% of medical students spent their high school years in a rural community, as compared to 30.4% of the Canadian population. Rural students are only slightly better represented in our study. In 1965/66, 38.0% of medical students' fathers had attended university, as compared with 7.5% of the age-matched Canadian male population. Direct comparison with our data is difficult because educational attainment has increased, but we found that 39.0% of medical students' fathers had a graduate or doctoral degree, as compared with 6.6% of the age-matched Canadian male population.

That the magnitude of the socioeconomic difference between medical students and the general Canadian population has changed so little must be viewed as disappointing. For example, the widely held belief that children of doctors are overrepresented among medical students is truer today than 35 years ago: 15.6% of today's medical students have a physician parent, as compared with 11.8% in 1965/66. However, significant progress has been made over the last 35 years. Slightly over half of our respondents were women, as compared with 11.4% of those starting medical school in 1965/66.[36] Ethnic diversity among Canadian medical students is also undoubtedly more pronounced than in past decades.

Table 5: Occupational status of the students' parents and of the working adult Canadian population*

Occupational status†	No. (and %) of students' fathers‡	No. (and %) of students' mothers‡	% of working adult Canadians§
Professional, high-level manager	652 (69.3)	461 (48.7)	12.0
Semiprofessional, technician, middle manager	47 (5.0)	52 (5.5)	22.4
Supervisor, foreperson	49 (5.2)	29 (3.1)	4.4
Skilled, semiskilled or unskilled labourer	166 (17.6)	258 (27.3)	59.4
Not applicable	27 (2.9)	146 (15.4)	1.8

*According to 1996 Canadian census data.
†Classified using a modified version of the Pineo–Porter scale.[30]
‡Fourteen respondents did not give their father's occupation, and 9 did not give their mother's occupation.
§Includes Canadians living in Quebec.

Table 6: Household income of the students' parents and of Canadian households*

Income, $	No. (and %) of parent households†	Income, $	% of Canadian households
< 40 000	143 (15.4)	< 40 000	39.7
40 000–80 000	287 (30.9)	40 000–80 000	40.4
80 000–120 000	228 (24.6)	80 000–125 000	15.0
120 000–160 000	112 (12.1)	125 000–150 000	2.2
> 160 000	158 (17.0)	> 150 000	2.7

*According to 1996 Canadian census data. Income ranges differ between parents' households and Canadian households because available census summaries used slightly different income ranges than those used in our survey.
†Twenty-seven respondents did not answer this question.

In contrast to the United States, all of Canada's medical schools are public institutions. As well, Canada's tax regimen and social programs are generally thought to produce a more equitable distribution of wealth in Canada than in the United States. Nevertheless, Canadian medical students are, at least on superficial examination of the data, no more representative of the Canadian population than US medical students are representative of the US population. Of the students who entered medical school in the United States in 1999, 35% were from visible minorities (as compared with 25% of the US population), and 12% were from underrepresented minorities (as compared to 20% of the US population).[2,37,38] Research into the socioeconomic status of medical students in the United States needs updating,[39] but older data indicate that the students came predominantly from higher-income families: among students who entered medical school in 1976, 54% of students' families had annual incomes greater than US$20 000, as compared with 22% of the US population.[5] A contemporaneous study showed that 17% of US medical students came from rural backgrounds, as compared with 26% of the US population.[4] We found a similar pattern of underrepresentation among Canadian medical students.

The data we present are relevant for policy discussions in at least 3 areas. First, there is a shortage of doctors in rural Canadian communities.[24,40] Both US and Canadian studies have shown that growing up in a rural community is the factor most strongly associated with choosing rural practice.[17,19–22] We found that there are less than half as many students from rural backgrounds as one would expect from the Canadian population. This indicates that the shortage of rural doctors is likely to worsen in the near future.

Second, Aboriginal Canadians suffer from a disproportionate burden of illness[41] and have a life expectancy that is 7 years shorter than that of the average Canadian.[42] As well, Aboriginal Canadians are less likely than non-Aboriginal Canadians to seek the care of a physician.[43] We found that the number of Aboriginal medical students is only one-sixth of what one would expect from the Canadian population. Given that up to 50% of Aboriginal physicians in Canada are involved in Aboriginal health,[44] increasing the number of Aboriginal medical students would probably lead to improved access to physician services within Aboriginal communities.

Table 7: Quintile of neighbourhood median family income among the respondents

Neighbourhood income quintile (range, $)	No. (and %) of respondents*
Highest (56 664–138 590)	381 (43.5)
Second (49 575–56 627)	189 (21.6)
Middle (43 724–49 455)	132 (15.1)
Fourth (38 690–43 709)	120 (13.7)
Lowest (18 324–38 686)	54 (6.2)

*Thirty respondents did not provide the first 3 digits of their postal code, and 49 respondents came from neighbourhoods that were too small to be linked to income data accurately.

Third, those who are economically disadvantaged also have worse health outcomes.[45] Although the evidence is not as robust for socioeconomic status as it is for rural origin or minority status, medical students from economically disadvantaged backgrounds are more likely to end up treating low-income patients.[12] We found that students from the poorest neighbourhoods (lowest quintile) were 7 times less likely to enter medical school than were students from the richest neighbourhoods.

As the applicant pool itself is not representative of the population,[46,47] increasing the number of medical students from underrepresented groups will undoubtedly prove to be a difficult task. Medical schools obviously cannot address all the factors involved in underrepresentation, but it has been recognized that they can play some role.[9] Three ways in which representation might be improved are increasing knowledge of the medical profession among rural and disadvantaged young people, removing financial barriers to access, and modifying the admissions process to accommodate students with unconventional backgrounds (e.g., accounting for the need to work each summer on farms or in other family businesses). It has also been speculated that increasing the minority representation on admissions committees may lead to increased physician diversity.[48] Interventions before medical school can also play a role: Bediako and colleagues[49] found that an academically rigorous high school program for minority and economically disadvantaged students led to higher rates of application and admission to medical school. Although it could be hypothesized that increasing the number of students from underrepresented segments of the population will lead to a lowering of standards, several studies have shown that people from disadvantaged backgrounds perform as well in medical school as their more advantaged peers.[50–52]

Several limitations to our study should be considered. First, the results are derived from a survey that relied on self-report, and independent verification of the data was not possible. Second, students from an underrepresented minority or socioeconomic class may have been more likely to respond to our survey. Our response rate of 80% limits the effect of a skewed response. Third, because in many cases we sought sensitive information, some respondents chose not to answer certain questions. However, we believe that this effect is negligible; the question about parental income was the least likely to be answered, and only 3% of students did not respond to that question. A final, major limitation is the exclusion of Quebec students from our study. To keep comparisons with national data consistent, we removed Quebec residents from national data sets. Particularly because most medical students in Quebec do not have a prior undergraduate education, they may be very different from their counterparts outside Quebec. As for occupational status, caution should be used in interpreting the data. Our respondents chose their parents' occupational

status themselves, whereas trained administrators assigned the occupational status for the Canadian population. As well, the Canadian population data included only working adults, whereas our survey included working and nonworking parents of medical students.

Future work should address the question of why certain groups are underrepresented in medical school. Comparisons are needed between medical students and applicants (to see whether the medical school admissions process favours certain groups) and between medical students and undergraduate students (to see whether the barriers to medical school are distinct from the barriers to university in general). It is well known that undergraduates are not representative of the general population.[53–55] Although we were able to compare various characteristics between the entering classes of 1965 and 2000, the 35 intervening years are a long and unfortunate gap. In real terms, medical school tuition in Canada was lowest around 1980,[28] and it would be of considerable interest to know whether the underrepresentation of rural, black and Aboriginal students and students of low socioeconomic status was as marked then as it is now.

Competing interests: None declared.

Contributors: Dr. Kwong and Mr. Dhalla were equally responsible for conceiving and coordinating the project, analyzing the data and drafting the manuscript. Dr. Johnson provided mentorship and guidance throughout the project and also participated in data analysis and manuscript preparation. Ms. Waddell helped design the questionnaire and methods. Dr. Streiner provided statistical expertise during questionnaire design and data analysis. Mr. Baddour was responsible for data collection. All of the authors contributed to revising the manuscript and approved the final draft.

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Correspondence to: *Dr. Ian L. Johnson, Rm. 4017, McMurrich Building, 12 Queen's Park Cres. W, University of Toronto, Toronto ON M5S 1A8; ian.johnson@utoronto.ca*