Gender Might Be Factor for Student Admission in Two Brazilian Medical Schools

Gênero Pode Ser um Fator na Seleção do Vestibular de Duas Escolas Médicas Brasileiras

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ABSTRACT

This is a secondary data-based study conducted to investigate whether gender is related to acceptance. Two Brazilian Medical Schools, Universities A and B, were studied. Their entrance exams (EE) were analysed and the number of candidates who took the EE was compared to the number of students admitted to the MS according to gender, in the period between 1995 and 2009. The same data from MS in the United States in 2011 was also evaluated. There was an increase in the percentage of female applicants but it did not correspond to the percentage of admitted students of the same gender. There was a trend of selecting men. At A, 39.3% of the applicants and 47% of the admitted students were men (OR = 1.37; CI95% = 1.24 – 1.51). In B, men represented 39.3% of the applicants and 65.4% of the admitted students (OR = 2.93; CI 95% = 2.76 – 3.11). This was not seen in US MS. The analysis of the EE suggests that the greater selection of men could be a product of EE format.

RESUMO

Este é um estudo de dados secundários para investigar se o gênero é um fator determinante na admissão do vestibular de Medicina. O vestibular de duas escolas médicas (EM) brasileiras, universidades A e B, foi analisado, e o número de candidatos de cada vestibular foi comparado ao número de alunos matriculados em cada EM de acordo com o gênero no período de 1995 a 2009. Os mesmos dados disponíveis dos Estados Unidos (EUA) em 2011 foram avaliados. Notou-se um aumento do número de mulheres prestando vestibular de Medicina, mas este aumento não correspondeu à porcentagem de mulheres matriculadas. Houve uma tendência a selecionar mais homens. Em A, 39,3% dos candidatos e 47% dos estudantes admitidos eram homens (OR = 1,37; IC95% = 1,24 – 1,51). Em B, os homens representavam 39,3% dos candidatos e 65,4% dos estudantes admitidos (OR = 2,93; IC95% = 2,76 – 3,11). Estes resultados não foram confirmados nas EM dos EUA. A análise do EE sugere que a maior seleção de homens poderia ser produto do formato dos vestibulares.

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INTRODUCTION

Scientific and technological advances are leading to changes in how medicine is taught and learned, as are the worldwide shifts in the socio-demographic composition and emerging global health needs[1-2]. Everywhere there have been calls for increases both in number and diversity of health care practitioners in the workforce[2]. It has been suggested that a review of the medical school admission process should be done to turn it more effective and representative of Society's needs[1,3-5], since the future physician workforce is shaped both by the admission process and medical training. Although researchers have accomplished considerable amount of work in medical education, there are relatively few studies about medical school admission process of the early 21st century.

The criteria for the selection of students to medical schools may be divided into two types: cognitive and non-cognitive assessments. The first group includes exams of knowledge regarding mathematics, chemistry, biology, and other subjects. The *United Kingdom Clinical Aptitude Test* in the United Kingdom, the *Medical College Admission Test* (MCAT) and the Scholastic Aptitude Test (SAT) in the United States are examples of cognitive tests. The second group (i.e., non-cognitive) considers interviews, discussions of problems in groups, letters of recommendation, and performance on personality tests, such as the *Multiple Mini Interviews* (MMI), among others[3]. A recent study of medical school admission process in the USA suggests that several aspects of medical school admission process remain unchanged since the mid- 1980s, whereas others went through major modifications[1]. Some of the changes may be explained by differences in the applicant pool and legal and social contexts. Many admission committees are now encouraged to use a holistic admission process to identify applicants who best fit their schools' educational missions and goals[1,5].

The selection process for medical school in Brazil is exclusively conducted using cognitive tests that have been obligatory by law since 1911. The system is not unified in the country allowing each university or medical school to determine the format of its own exam. In general, these exams are comprised of questions on the basic topics learned in high school, such as Portuguese, Mathematics, Physics, Chemistry, Biology, History, Geography, and Foreign Languages. This system was designed to be very objective as an attempt to reduce possible biases or unfairness in the candidate selection process. Nowadays it is widely criticised because it deemphasises the non-cognitive aspects of the candidates and requires exhaustive preparation[6]. Remarkably, few modifications to this system were made since 1911, and thus, it still prioritises academic knowledge.

Currently, women represent more than half of the Brazilian medical students as a result of more women applying to medical schools. According to the Federal Council of Medicine (CFM) and National Institute of Educational Studies (Inep), in 2011 women represented 56% of the Brazilian Medical Students. However in few schools, specifically in São Paulo State, men are the majority of the medical students. This study has been conducted to investigate if the college entrance exam could account for these findings.

METHODS

This was a cross-sectional study based on secondary data. The term "applicants" refers to the absolute number of candidates who have taken the entrance exam to attend medical school. "Admitted students" are those who effectively become students of the university. The term "selection process" represents the actual process from application submission to course admission. The number of female and male applicants and the number of female and male admitted students in each medical schools selection process were collected. Data were obtained from the medical schools' websites or from the websites of the institutions that conducted the selection process.

We initially intended to collect information about the demographic profiles of the applicants and admitted students to all medical schools in the state of São Paulo. However, only two universities, which we generically named Universities "A" and "B", had data available for analysis in the time interval between 1995 and 2009. As discussed earlier, all Brazilian entrance exams are cognitive tests and, although each university performs its own exam, they share a similar model. The two analysed tests are representative to those used in other institutions. As a means of comparison, similar data about the United States Medical schools selection process were obtained at the AAMC website for 2011[7].

Applicants of Universities A and B were compared according to age, gender, years of pre-university training (represented by specific courses that prepare students to the entrance exams) before applying to the entrance exam, type of high school (public or private) attended, and family income (in Brazilian minimum wages), using the Chi-square test. Cramer's V post-test was calculated to determine the strength of interdependence among variables after chi-square has determined significance. Cramer's V varies between 0 and 1. Close to 0 it shows little association between variables. Close to 1, it indicates a strong association[8].

The Pearson correlation was used to assess the trend in the number of female and male applicants and admitted students over the studied time period. The odds ratio (OR) and

TABLE 1 Socio-demographical profile of applicants in universities A and B between 1995 and 2009.				
	University A	**University B**	**Significance[1]**	**Cramer's V**
Applicants 1995-2009 (n)	137,752	170,890		
Response rate[2]	92.2%	95.0%		
Mean age			p > 0.05	–
Less than 18 years	43,257 (31.6%)	52,664 (30.5%)		
18 years	39,546 (28.9%)	49,448 (28.7%)		
19 years	24,710 (18.0%)	29,911 (17.3%)		
20 years	13,256 (9.7%)	16,269 (9.4%)		
More than 20 years	16,191 (11.8%)	24,279 (14.1%)		
Gender			p > 0.05	–
Female	83,593 (60.7%)	103,774 (60.7%)		
Male	54,159 (39.3%)	67,116 (39.3%)		
Years of pre-university training			p < 0.05	0,2
1 year or less	53,474 (57.7%)	77,601 (46.9%)		
1 to 2 years	25,626 (27.6%)	71,318 (43.1%)		
More than 2 years	13,580 (14.7%)	16,434 (9.9%)		
Secondary Education Institution			p < 0.05	0,1
Exclusive Private School	106,472 (77.3%)	118,478 (71.5%)		
Exclusive Public School	20,728 (15.0%)	34,662 (20.9%)		
Mix[3]	10,552 (7.7%)	12,647 (7.6%)		
Family Income[4]			p < 0.05	0,2
I (less than 3 bmw[5])	3,781 (5.0%)	10,401 (9.9%)		
II (from 3 to 12 bmw)	21,837 (29.1%)	31,990 (30.5%)		
III (from 12 to 20 bmw)	11,761 (15.7%)	27,830 (26.5%)		
IV (more than 20 bmw)	37,691 (50.2%)	34,737 (33.1%)		

[1] *Chi-square test used to calculate significance.* [2]*Response rate represents the percentage of applicants who completed the socio-demographic questionnaire.* [3]*Mix represents students who attended both private and public high schools.* [4]*Data from 2001 to 2009. Family income between 1995 and 2000 were not available.* [5]*bmw = Brazilian minimum wages.*

the 95% confidence intervals ($CI_{95\%}$) were calculated to estimate the chance of a woman or man being selected during the process at Universities A, B, and at all of the universities in the United States in 2011. The website addresses of the selection processes were not revealed to protect the anonymity of the institutions.

To establish hypotheses that justify the results, a brief description of the exams from Universities A and B was done by focusing on the type (discursive or multiple choice), content (Exact Sciences, Humanities, or Biology), and the values of the questions. The exams from 2009 were chosen because they were representative of previous exams, and there have not been significant changes in the content, type, and value of each question along the research time interval. The analysis was based on the percentage that each question represented in

the Maximum Exam Score (MES). The formula *(value of question/MES) x 100%* was used.

All statistical analyses was performed using SPSS® (Statistical Package for Social Sciences) software) for Windows® and Excell® for Windows®.

RESULTS

The populations included in the study consisted of 137,752 individuals in University A and 170,890 in University B. Regarding gender and age, no statistical significant differences between the applicants from both Universities were found. Applicants from University A had less years of pre-university training, attended more private high schools, and had higher family income (Table 1). However, the Cramer's V post-test showed a low interdependence among the variables, meaning

TABLE 2.

Percentages and Odds Ratio (OR) of men and women who applied and were admitted to universities A and B between 1995 and 2009 and in U.S. medical schools in 2011.

	University A	University B	U.S. 2011
Female Applicants (%)	60.7	60.7	46.2
Male Applicants (%)	39.3	39.3	53.8
Admitted Females (%)	53.0	34.6	47.0
Admitted Men (%)	47.0	65.4	53.0
OR (CI 95%)	1.37 (1.24 – 1.51)	2.93 (2.76 – 3.11)	0.97 (0.94 – 1.00)

The percentage of admitted women and men did not correspond to the percentage of applicants for universities A and B. Men were more likely to be selected at universities A and B, with a greater likelihood being observed at university B.

that these differences might have no practical significance and might be due to the size of the sample.

Women represented 60.7% of the total number of applicants at both Universities A (83,593 females and 54,159 males) and B (103,774 females and 67,116 males) between 1995 and 2009 (Table 2). At University A, the number of female and male applicants significantly decreased (r = 0.756; p = 0.001, r = 0.807; p < 0.001; respectively). At University B, the number of female applicants increased (r = 0.746; p = 0.001), while the number of male applicants remained constant (r = 0.193; p = 0.491) (Figure 1).

During the study period, women represented 53% (854) of the total number of admitted students (1,611) at the medical school of University A, and 34.6% (1,419 women out of 4,106 students) at university B (Table 2). At University A, the number of admitted women (854) was 1,12 times greater than the

number of men (757). At University B, the number of admitted men (2,687) was 1,89 greater than the number of female students (1,419).

The number of admitted men at University A remained stable (r = 0.258; p = 0.353), while the number of women rose significantly (r = 0.664; p = 0.007). The trend for this shift can be noted since 1998, and has been increasing ever since. At University B, the number of admitted women increased (r = 0.614; p = 0.015), while the number of admitted men decreased (r = 0.603; p = 0.017), despite the fact that the number of men still represented the majority of the students, for the time period analysed (Figure 1).

At University A, 39.3% (54,419) of the applicants were men, while this gender corresponded to 47% (757) of the admitted students, indicating a slight preference in approving men (OR = 1.37, $CI_{95\%}$ = 1.24 – 1.51). Such phenomenon was

TABLE 3.

Contribution in percentage of each question and the writing composition in the make up of the total points in each phase and in the Maximum Exam Score (MES[1]) of Exam A and B in 2009.

	Exam A			Exam B		
	1st Phase	2nd Phase	% of MES[2]	1st Phase	2nd Phase	% of MES[2]
Type of Question						
Discursive Questions	100%	100%	100%	0	100%	64%
Multiple Choice Questions	0	0	0	100%	0	36%
Questions' Content						
Writing Composition	50%	0	14.3%	0	12.5%	8%
Mathematics, History, Geography, Portuguese and English	25%[3]	50%	42.8%	56.2%	12.5%	30.5%
Chemistry, Physics, and Biology	25%	50%	42.9%	33.8%	75%	61.5%

[1]MES represents the maximum grade of the test. [2]The formula (value of the question or composition/MES)x100% was used. [3]Does not include English because it is not a part of the first phase of Exam A.

FIGURE 1.

Number of applicants and admitted students according to gender at universities A and B between 1995 and 2009,
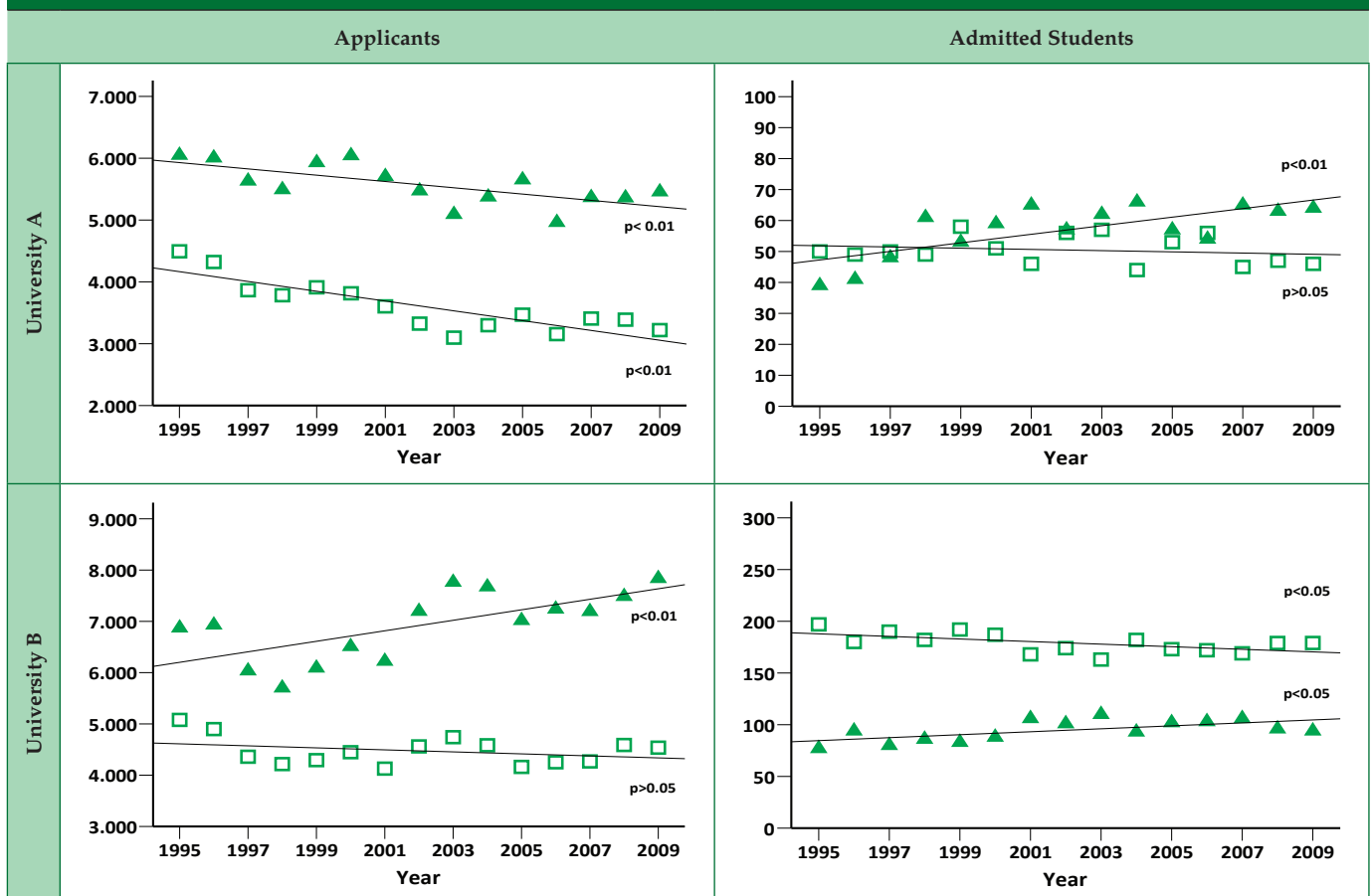
The graphs represent the number of applicants or admitted students (axis Y) by year (axis X) at universities A (top panel) and B (bottom panel) between 1995 and 2009. The lines correspond to the linear trend of each group. Along the side of each line is represented the significance of linear correlation. ▲ = women; □ = men.

more prominent at university B, where men represented 39.3% (67,116) of the applicants and 65.4% (2,687) of the enrolled students (OR = 2.93, $CI_{95\%}$ = 2.76 – 3.11).

In contrast, at medical schools in the United States (U.S.) in 2011, the percentage of admitted women and men was proportional to the number of female and male applicants (Table 3). Thus, gender was not a factor related to the selection processes in the U.S., i.e. women and men have equal chances of being selected (OR = 0.97, $CI_{95\%}$ = 0.94 – 1.00).

The characteristics of each university entrance exam were compared. Both were conducted in two phases (Table 4). The entrance exam from University A (Exam A) was only composed of discursive questions. The first phase consisted of 28.6% of the MES and included a writing composition and questions about the following disciplines: Chemistry, Biology, History, and Geography. The writing composition represents 50% of

the points in the First Phase and 14.3% of MES. The Second Phase represents 71.4% of the MES and was divided into specific exams about the following disciplines: Portuguese, English, History, Geography, Chemistry, Physics, Mathematics, and Biology. Chemistry and Biology exams had twice the weight and together with the Physics exam represented 42.9% of the MES.

At University B, the first phase of the entrance exam (Exam B) represented 36% of the MES and consisted exclusively of multiple-choice questions concerning all disciplines. The Second Phase contributed to 64% of the MES and was composed of a writing composition and discursive questions about Portuguese, Physics, Chemistry, and Biology. Questions on Chemistry, Physics, and Biology accounted for 61.5% of the MES, while the writing composition represented 8% of the MES.

DISCUSSION

According to the Brazilian Medical Council, in 2011, the number of female physicians (149,981) in Brazil has not yet surpassed the number of men (226,801)[9]. However, the growth of women practicing medicine is increasing. At the same year, there were 1.5 men for every woman while this ratio was 2.3 in the 90's, indicating that Brazil will have more female physicians in the coming years. One possible explanation for this trend might be attributed to a greater desire among women for a medical carrier. This study supports this hypothesis, since the number of female applicants was greater at the two studied Universities.

The authors of this paper have arbitrarily created the term "pressure to be admitted" to designate the correspondence in the percentage of applicants and admitted students of the same gender. In other words, if a larger number of a specific gender applies to medical school, it is expected that a proportionally greater number of this gender will be admitted.

In the selection processes at both studied Universities, women exercised greater pressure to be admitted. However, the data obtained in this study demonstrates that the entrance exams at Universities A and B preferentially selected men, mitigating or even surpassing the pressure to be admitted effect. It is important to observe that these results did not contradict the trend of the feminisation of medicine, which is observed worldwide[10-11].

Despite preferential selection for men at both Universities, at University A, more women were enrolled. At University B, the number of admitted men was greater even though there were less male applicants. These observations could indicate that the specific characteristics of each school's selection process could accentuate gender as a determining factor.

Explanations for gender differences in test performance are still very inconclusive, being attributed to both biological and socio-cultural factors. One general hypothesis suggests that underlying biological substrate associated with socialization experiences encourage males to pursue math-related activities with greater frequency and intensity than females, while girls prefer verbal-related activities[12-14].

Studies examining the math test performance of males and females lead to the conclusions that there are few differences between typical elementary and middle school boys and girls, and any differences that do exist are likely to favor girls. In high school and college, however, boys perform better in math tests than girl[12-14]. Nevertheless, females were generally faster than males on word meaning and sentence comprehension tasks, performing better on reading and writing tests than males.[14]

Research on test bias indicates that college entrance exams such as the SAT may under predict college grades[13,15].

Math achievement tests underestimate classroom performance because the tests are measuring a somewhat different kind of competence than is required in classroom learning. The argument is that even if females have somewhat poorer math-fact retrieval skills than males, they can perform equally as well or even better in situations where time is not an issue and the content to be learned and tested is well defined[12-14]. It is not surprising that high school boys scored significantly higher than girls SAT math test every year since 1972, even though female high school students are generally better students overall[15].

Another possible explanation is that women may be less effective than men in competitive environments, albeit they perform similarly in non-competitive environments. In a laboratory experiment, Gneezy et al. observed that when the competitiveness of the environment was raised, there was a significant increase in performance for men, but not for women[16].

Finally, several studies have investigated the relation between format of the question, multiple choice questions (MCQs) or written response, and difference in gender test performance. Answers requiring written responses favoured females while males performed better in MCQ[17,18].

The greater selection of men found in the present study could be a product of the format of the admission process, which prioritises content in the areas of the Exact Sciences; is very competitive; and, in the case of University B, has 36% of MES based on MCQs.

These results might indicate the existence of pre-application factors that favor male performance in tests. As this is an ecological study based on secondary information, there were no individual data available to compare gender and other social-demographical variables. Still, it was possible to identify differences between both Universities. Women actually performed better on Exam A, what could lead to conclude that years of pre-university training, attending to private high schools, and a higher family income might mitigate the differences in test performance between genders. All of these factors are linked to the social context of the applicants, which could show that gender differences in test performance could be associated with social status. Students with higher social status might have less gender differences in performance. These findings have to be taken with caution, since Cramer's V post-test showed a low interdependence among these variables. Nevertheless, another study compared the scores at the MCAT among black, Latino and white examinees and showed that gender, racial and ethnic group differences did not account for the mean scores differences found. These were linked to social determinants as parent's education and income[19].

Although the admission process in Brazilian medical schools is subjected to many problems and critics, no alternative methods have been proposed yet. Cognitive tests are mandatory by law since 1911 and non-cognitive exam requires more time, money and trained professionals to be implemented. These factors hinder the introduction of new selection process.

In the U.S., the majority of candidates in the selection processes at medical schools in 2011 were men (53.8% men, 46.2% women). In the same year, the percentage of men selected for medical schools was 53%[7]. These data reveal the proportionality in the number of male and female applicants and admitted students, thereby preserving the pressure to be admitted effect at the U.S., in contrast to what was observed in the two Brazilian schools. Thus, gender was not a determining factor in the selection process in the U.S., which could be in part attributed to its non-cognitive stage. Reiter et al., demonstrated this hypothesis by showing no relationship between gender and scores on the MMI, GPA, or MCAT non-cognitive tests[20].

The primary limitation of this research is being a cross-section study, which does not allow determining the cause-consequence effects between the format of the exams and the observed trend of men selection. However, these are remarkable results and future studies should seek to evaluate if the format and content of the selection process could represent a gender bias in selection of medical schools' admission processes.

Another limitation was the scarcity of available data in Brazilian medical schools regarding their selection processes. The small number of schools included in the study (only two Universities) inhibits generalising the results for all Brazilian schools. Further researches are necessary to confirm this hypothesis and better clarify the influence of socio-demographic features in the admission process of medical schools.

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ETHNICAL APPROVAL

The Ethics Committee of Clinical Hospital of School of Medicine of University of São Paulo approved the study.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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