How Competitive Is Plastic Surgery? An Analysis of the Canadian and American Residency Match

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La concurrence est-elle forte en chirurgie plastique? Une analyse du jumelage des résidents canadiens et américains

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Abstract

Background: Plastic surgery (PS) is considered to be one of the most competitive specialties. As a result, some students are discouraged from applying, reducing the overall number of PS candidates. Still, much of what we know of the match is based in conjecture. **Objective:** To examine the Canadian PS match data from 1997 to 2016. To our knowledge, this is the first long-term analysis of the Canadian PS residency match. **Method:** We examined the Canadian Residency Matching Service reports from 1997 to 2016, extracting key match statistics, including available positions, number of applicants, positions filled, positions unfilled, and gender-specific match results. To examine competitiveness, the ratio of total applicants per quota per year (CR) and the ratio of applicants who chose PS as their first-choice specialty per quota per year were calculated (FC-CR). The National Residency Matching Program data were used to assess the American integrated PS match over the past decade and served as a comparison. **Results:** The CR of Canadian PS programs declined over the last 20 years ($P < .001$), indicating fewer applicants applied to the program per available position. Similarly, the FC-CR also declined over the last 20 years ($P < .001$). The number of females matching to their first-choice discipline of PS increased from 1997 ($P < .001$). There was no significant change in the number of males matching to their first-choice discipline of PS ($P = .15$). There was no significant change in the competitiveness (CR) of the American integrated PS match over the last decade ($P = 0.087$). **Conclusion:** Encouragingly, today PS has more training positions and more female residents; yet, the overall number of applicants has remained relatively static over the past 20 years. This analysis serves as a valuable reference for PS programs and should assist in developing strategies to encourage the best applicants to apply.

Résumé

Historique : La chirurgie plastique (CP) est considérée comme l'une des spécialités les plus compétitives. Par conséquent, certains étudiants ne postulent pas, ce qui réduit le nombre de candidats. Pourtant, une bonne partie de ce que l'on sait du processus de jumelage repose sur des conjectures. **Objectif :** Examiner les données de jumelage canadiennes en CP de 1997 à 2016. En autant que le sachent les auteurs, c'est la première analyse à long terme du jumelage des résidents canadiens en CP. **Méthodologie :** Les auteurs ont examiné les rapports du Service canadien de jumelage des résidents entre 1997 et 2016, ont extrait les principales statistiques du jumelage, y compris les postes ouverts, le nombre de candidats, le nombre de postes pourvus et les résultats du jumelage selon le sexe. Pour déterminer la compétitivité, les auteurs ont calculé le ratio entre le total des candidats et le quota annuel (QA), de même que le ratio des candidats qui font de la CP leur premier choix et le QA (PC-QA). Les auteurs ont utilisé les données du programme national de jumelage des résidents des États-Unis pour évaluer le jumelage intégré.

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américain en CP depuis dix ans et s'en servir comme point de comparaison. **Résultats :** Le QA des programmes canadiens en CP a diminué depuis 20 ans ($P < 0.001$), ce qui indique que moins de candidats postulent pour chaque poste offert. Le PC-QA a également diminué depuis 20 ans ($P < .001$). Le nombre de femmes jumelées à leur premier choix en CP a augmenté depuis 1997 ($P < .001$). Il n'y avait pas de changement significatif du nombre d'hommes jumelés à leur premier choix en CP ($P = .15$), ni de la concurrence (QA) pour le jumelage intégré américain en CP depuis dix ans ($P = .087$). **Conclusion :** Il est encourageant de voir que plus de postes sont offerts en CP et que plus de résidentes y évoluent. Cependant, le nombre total de candidats est demeuré relativement stable depuis 20 ans. La présente analyse représente une référence précieuse pour les programmes de CP et devrait contribuer à l'élaboration de stratégies pour encourager les meilleurs candidats à postuler.

Keywords

plastic surgery, residency match, competitiveness

Plastic surgery is considered to be one of the most competitive specialties in the Canadian medical residency match. Our own anecdotal experience suggests that some students are discouraged from applying to plastic surgery owing to its perceived competitiveness; however, much of what we know of the match is based on conjecture. To our knowledge, this is the first long-term analysis of the Canadian plastic surgery residency match.

The Canadian surgical match has seen an overall decline in applicants in recent years. In 2002, 20.8% of applicants' first-choice residency specialty was surgical. This figure declined to 13% by 2014.¹ Similar outcomes have also been reported in the United States.² The potential consequences of this decline include a less competitive applicant pool, as well as a deficit of surgeons.³

Although our current understanding of the plastic surgery match is that it may be immune to this trend of declining applicants, recently the largest plastic surgery training institution in the country reported a decline in the interest in their program.¹ These authors reported a 15.3% decline in the number of first-choice applicants to plastic surgery programs from 2002 to 2007 to 2008 to 2013, a figure that was on par with a falling number of applications to otolaryngology and urology, other seemingly competitive surgical specialties.¹ One of the theories behind these declining trends is the desire among medical students for a career with greater work-life balance.⁴ Working against this theory is the finding that lifestyle was deemed only a moderately important factor in the decision process of potential applicants to plastic surgery.⁵ We speculate that plastic surgery has maintained a high volume of applicants over the last number of decades as a result of career satisfaction. Practicing plastic surgeons frequently report high levels of career satisfaction, often higher than physicians in other surgical specialties.⁶ Mentorship, which is likely to be directly influenced by surgeon satisfaction, plays a key role in fostering an interest in plastic surgery and thus may also positively influence the number of applicants.⁷

Besides numbers alone, the gender mix within plastic surgery is a topic of frequent discussion. In 1999, Plastic Surgery Foundation president Dr William Morain coined the term "plastic ceiling" to describe the obstacles faced by women in plastic surgery.⁸ In the United States, only 14% of plastic surgeons are female, while females account for 34% of residents.⁹ Furthermore, only 7% of chief or chair in their respective

departments are female.¹⁰ These inequalities are also evident in scholarly awards. For example, the Plastic Surgery Academic Scholar Award has only once been awarded to a woman.¹¹ Similarly, a female nominee has never received the Godina Fellowship awarded by the American Society of Reconstructive Microsurgery to a promising young microsurgeon.¹² Not surprisingly, these inequalities are now at the forefront of a new and ongoing series in *Plastic and Reconstructive Surgery* aimed at addressing the social and professional challenges experienced by women in the field of plastic surgery.⁹ In Canada, these numbers are not significantly different from the United States, with 79% of the 2015 Canadian plastic surgery workforce being male.¹³ As we face the same inequalities as our American colleagues, Canadian plastic surgery leadership must also do its part to investigate the fundamental factors contributing to these issues, naturally starting with the residency match.

The primary objective of this study was to evaluate Canadian plastic surgery residency match data from 1997 to 2016, including the gender distribution of the match. The secondary objective was to assess the American integrated plastic surgery match over the past decade to serve as a comparison.

Materials and Methods

Canadian Plastic Surgery Match

The publically available Canadian Residency Matching Service reports for the years 1997 to 2016 were examined. Only data on Canadian medical graduate applicants were extracted, as the international medical graduate applicant pool is heterogeneous and confounded by a number of external factors.¹⁴

The following data were extracted: number of available positions (quota), total applicants, applicants only applying to plastic surgery, applicants who chose plastic surgery as their first-choice specialty, plastic surgery spots filled, and plastic surgery spots unfilled. Gender-specific data included females and males who ranked plastic surgery as their first choice, as well as females and males who matched to their first-choice specialty of plastic surgery. Gender-distributed data were not available until 1998.

To examine competitiveness of plastic surgery as a specialty, the ratio of total applicants per quota per year and the ratio

Figure 1. Quota and the number of Canadian plastic surgery applicants between 1997 and 2016.

of applicants who chose plastic surgery as their first-choice specialty per quota per year were calculated. These operational values were labeled the competitiveness ratio (CR) and the first-choice competitiveness ratio (FC-CR), respectively.

US Plastic Surgery Match

The publically available National Resident Matching Program data were examined for the years 2007 to 2016. Both the number of US senior medical students and the total number of applicants (US senior medical students, returning US medical students, and international medical students) applying to the American integrated plastic surgery match were extracted.

The following data were extracted: number of available positions (quota), total applicants, and number of US senior applicants. No gender-specific specialty match data were available. A CR was calculated.

Data from 2007 did not include the total number of applicants, and thus, this figure was calculated using the total number of positions and ratio of positions per applicant type.

Statistical Analysis and Graphing

Graphs and statistical models were developed using Prism version 7 (GraphPad Inc, La Jolla, California). Findings were considered statistically significant with a $P < .05$.

Results

Canadian Match Statistics

The quota (number of available positions) and the number of applicants to Canadian plastic surgery programs from 1997 to 2016 are displayed in Figure 1. The CR declined over the last 20 years ($P < .001$), indicating fewer applicants applied to the program per available position (Figure 2). Similarly, the FC-CR also declined over the last 20 years ($P < .001$; Figure 2). Table 1 summarizes these values. There was 1 unfilled residency spot after the first iteration match in 2008. This spot was subsequently filled in the second iteration match.

Figure 2. A, Number of Canadian plastic surgery applicants per available position between 1997 and 2016 (Canadian CR). B, Number of Canadian applicants who chose plastic surgery as their first-choice discipline per available position between 1997 and 2016 (Canadian first-choice competitiveness ratio [FC-CR]).

The number of males and females ranking plastic surgery as their first-choice specialty increased over the last 20 years ($P < .05$ and $P < .001$, respectively). The number of females matching to their first-choice discipline of plastic surgery increased from 1997 ($P < .001$; Figure 3), which corresponded to the increase in females selecting plastic surgery as their first-choice specialty (see paragraph above). There was no significant change in the number of males matching to their first-choice discipline of plastic surgery ($P = .15$; Figure 3), despite the increase in males ranking plastic surgery as their first-choice specialty (see paragraph above).

American Match Statistics

The American integrated plastic surgery quota and the number of US senior and total applicants (US senior medical students, US returning medical students, international medical students) from 2007 to 2016 are displayed in Figure 4. There was an increase in the number of integrated plastic surgery positions offered over time ($P < .01$). There was no significant increase in the number of applicants over time ($P = .07$). There was no significant change in the competitiveness of the integrated plastic surgery match over the last decade ($P = .087$; Figure 5).

Table 1. Canadian Plastic Surgery Residency Quota, Total Number of Applicants, CR, and FC-CR, Per Year.

Year	Quota	Applicants	CR	FC-CR
1997	11	63	5.73	NA
1998	8	66	8.25	3.5
1999	11	63	5.73	2.91
2000	10	54	5.40	3.30
2001	10	45	4.50	2.60
2002	11	53	4.82	2.45
2003	12	51	4.25	2.50
2004	11	35	3.18	3.18
2005	14	51	3.64	1.86
2006	21	56	2.67	1.90
2007	24	76	3.17	1.96
2008	23	70	3.04	1.96
2009	26	61	2.35	1.73
2010	28	77	2.75	1.89
2011	28	65	2.32	1.64
2012	26	70	2.69	1.73
2013	26	57	2.19	1.85
2014	26	73	2.81	2.11
2015	25	56	2.24	1.80
2016	23	70	3.04	2.17

Abbreviations: CR, competitiveness ratio; FC-CR, first-choice competitiveness ratio; NA, not available.

Discussion

Twenty years of Canadian plastic surgery residency match outcomes, and the most recent 10 years of the American integrated plastic surgery residency match, were analyzed. Despite studies that rank plastic surgery among the most competitive residency specialties, our analysis suggests that its competitiveness is declining.¹⁴ This is made evident by a significant decline in both the CR and FC-CR. This trend is the result of an increasing quota without a compensatory increase in the number of applicants as illustrated in Figure 1.

These trends differ from those seen in the American plastic surgery match, which demonstrates no significant decrease in the overall program CR (Figure 5). As plastic surgery is historically viewed as a competitive specialty, it is conceivable that in Canada more applicants are discouraged from applying due to its perceived competitiveness; however, we suspect prospective applicants who are discouraged from applying are not aware that the number of available spaces has increased over time. This report may find use as a recruitment tool and a helpful resource for students who find themselves discouraged by the perceived competitiveness of plastic surgery. We further speculate that plastic surgery experiences a significant degree of self-selection in the applicant pool, with a large proportion of students being aware of its competitiveness and applying regardless of fluctuations in CR. By the same token, certain students, some who may be excellent candidates, self-select out of plastic surgery due to perceived barriers, such as competitiveness and the requirement to pursue research. These students may not consider plastic surgery as a career due to the fear of disappointment of not matching into their first-choice

Figure 3. Number of female (A) and male (B) Canadian medical applicants matching to their first choice of plastic surgery residency between 1998 and 2016.

Figure 4. Total number of applications, number of US senior medical student only applications, and quota of the American integrated plastic surgery match from 2007 to 2016.

Figure 5. The number of total applicants per available position in the American integrated plastic surgery programs between 2007 and 2016 (American CR).

specialty. As a result, there are undoubtedly more potential applicants who may be suited for plastic surgery but who never apply.

The decline in the plastic surgery CR in Canada may in part be the result of changing patterns in candidate selection. Although it has been suggested that academic excellence is the most important factor when matching to a competitive specialty, recent changes in the undergraduate medical education system in Canada have deemphasized, and in certain instances, eliminated academic metrics.¹⁵ As described by Krauss et al, this leads residency programs to place greater emphasis on other factors such as letters of reference, elective experiences, and research productivity, when determining a candidate's suitability.¹⁶ This is in contrast to the American residency match, which historically emphasizes academic excellence and United States Medical Licensing Examination step 1 scores.¹⁷ These results suggest that Canadian applicants may be increasingly hesitant to apply to plastic surgery if they have not pursued research or other academic activities related to their first-choice specialty.

The number of medical students entering primary care in Canada has increased by 5% from 38% in 2003 to 43% in 2016.¹⁸ In addition, more than 50% of the Canadian workforce is now composed of family physicians.¹⁹ This increase in the number of students training to become generalists is in part due to an institutional and legislative drive to train more generalists.²⁰ As a result, fewer applicants are applying to specialist training programs, such as plastic surgery. Although it has been speculated that specialist employment concerns are in part to blame, the literature concerning this matter is inconclusive.¹ From anecdotal accounts, trainees of certain surgical specialties have difficulty finding employment, often requiring multiple fellowships to improve their marketability. The desire and need for more generalists, the potential employment hardships faced by specialists even after residency,²¹ and the increased desire for more lifestyle-focused specialties²² all likely play a role in the failure of a concomitant rise in plastic surgery applicants despite the increase in quota.

The gender-specific match statistics reveal that in plastic surgery, Canadian females ranking the specialty as their first-choice discipline has increased over the last 20 years. This trend is consistent with reports of an increased number of female applicants to all surgical specialties.²³ The same cannot be said of male applicants, who did not demonstrate a significant increase in the number of matches to their first-choice specialty of plastic surgery. We suspect these changes in application characteristics may be due to an increased number of female plastic surgeons in lead academic roles. We anticipate this figure to climb over the next decade as the next cohort of female plastic surgeons graduate. It will be important to monitor the academic and leadership success of this upcoming group of surgeons as a measure of gender congruity in Canadian plastic surgery. Unfortunately, no gender-specific data from the American integrated plastic surgery match were available for comparison.

Our study has a number of limitations. The first limitation is that it only samples from historical data and is not a predictive model per se. The data do not take into account fluctuations in the number of medical students graduating, the number of unmatched students applying to plastic surgery, or changes in the overall plastic surgery quota. Further studies attempting to predict future annual competitiveness may wish to address these concerns. Finally, our study does not account for the relative competitiveness of plastic surgery compared to other specialties.

Encouragingly, today plastic surgery has more training positions and more female residents; yet, the overall number of applicants has remained relatively static over the past 20 years. This is reflected in the decreasing CR and should raise concern. Medical students are being directed toward more "generalist" careers, and self-selection limits the applicant pool further. Together, these observations raise concerns regarding the quality of residents and surgeon supply in the future. This analysis serves as a valuable reference for plastic surgery programs and should assist in developing strategies to encourage the best applicants to apply to the specialty.

Declaration of Conflicting Interests

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