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Cross-sectional analysis of women in neurosurgery: a Canadian perspective

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OBJECTIVE Although the past decades have seen a steady increase of women in medicine in general, women continue to represent a minority of the physician-training staff and workforce in neurosurgery in Canada and worldwide. As such, the aim of this study was to analyze the experiences of women faculty practicing neurosurgery across Canada to better understand and address the factors contributing to this disparity.

METHODS A historical, cross-sectional, and mixed-method analysis of survey responses was performed using survey results obtained from women attending neurosurgeons across Canada. A web-based survey platform was utilized to collect responses. Quantitative analyses were performed on the responses from the study questionnaire, including summary and comparative statistics. Qualitative analyses of free-text responses were performed using axial and open coding.

RESULTS A total of 19 of 31 respondents (61.3%) completed the survey. Positive enabling factors for career success included supportive colleagues and work environment (52.6%); academic accomplishments, including publications and advanced degrees (36.8%); and advanced fellowship training (47.4%). Perceived barriers reported included inequalities with regard to career advancement opportunities (57.8%), conflicting professional and personal interests (57.8%), and lack of mentorship (36.8%). Quantitative analyses demonstrated emerging themes of an increased need for women mentors as well as support and recognition of the contributions to career advancement of personal and family-related factors.

CONCLUSIONS This study represents, to the authors' knowledge, the first analysis of factors influencing career success and satisfaction in women neurosurgeons across Canada. This study highlights several key factors contributing to the low representation of women in neurosurgery and identifies specific actionable items that can be addressed by training programs and institutions. In particular, female mentorship, opportunities for career advancement, and increased recognition and integration of personal and professional roles were highlighted as areas for future intervention. These findings will provide a framework for addressing these factors and improving the recruitment and retention of females in this specialty.

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KEYWORDS women in neurosurgery; workplace culture; recruitment; women in surgery; gender disparity; glass ceiling

The current landscape of women in medicine shows persistent gender-based disparities across the spectrum of specialties in medicine both in Canada and worldwide.[1,2] One of the earliest studies assessing the prevalence of women physicians in the workforce was a national survey of Canadian physicians conducted in 1990. In this study, a questionnaire was sent to respondents from a previous national survey conducted in 1982, as well as to an additional 2000 physicians who were randomly selected within all provinces. At the time, the main observations highlighted that women physicians were working fewer hours and seeing fewer patients relative to their male counterparts and expressed concerns regarding the future of the physician workforce.[3] Subsequent surveys demonstrated an increase in women in the medical workforce. In 2008, 28% of Canada's physicians were women, and in 2018 that figure had increased to 41%.[1] More recent studies have implicated positive outcomes in

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patients treated by women physicians, such as lower readmission and mortality rates and more patient-centered communication.[4]

Turning to surgery in particular, there were 459 women surgeons identified in the Royal College of Physicians and Surgeons in 1990, and subsequently there have been no formal published reports on the numbers of women surgeons.[5] One report from Ontario assessed the composite outcome of death, complications, and readmission in 30 days, comparing the sex of the operating surgeon with linked patient data from several databases to assess differences between surgical outcomes.[4] The authors suggest better outcomes from women surgeons in the matched cohort, with an odds ratio of 0.96 (95% CI 0.92–0.99).[4] Despite better outcomes, women continue to earn less than their male counterparts for the same work.[6] Another study assessed the gender disparity in academic neurosurgery in North America and concluded that women are significantly underrepresented.[2]

Although studies comparing the numbers and the impact of women in medicine and surgery within Canada have been increasing, there has yet to be a thorough analysis of the present landscape of women neurosurgeons in Canada. Accordingly, in the present study we aimed to identify current barriers for women in neurosurgery, as well as to highlight facilitating factors perceived by the present workforce of female neurosurgeons in Canada.

Methods

Study Design and Participant Selection

An online survey using the SurveyMonkey platform (www.surveymonkey.com) was utilized for data collection. The survey content was developed by N.S. and V.B., with a focus on questions pertaining to career success and satisfaction. The format of the questions in the survey included multiple choice, ranking, and short-answer responses. Prospective participants included current female neurosurgeons found on the Royal College of Physicians and Surgeons of Canada website of academic programs and were cross-verified by G.M. Prospective participants were invited to complete the survey via email invitation from August to September 2020. Participation was entirely voluntary and anonymous, and no compensation was implied or provided. This study meets the exclusion criteria of the Canadian Tri-Council Policy Statement for research that requires a review by an institutional research ethics board, since there was no involvement of patients as subjects in this study.

Sample Size and Data Analysis

A total of 31 prospective participants were invited to take part in the study by email and 19 individuals completed the survey. Survey responses and aggregate data were exported from SurveyMonkey to Microsoft Excel for analysis. Qualitative analyses were performed by modified thematic analyses, employing open and axial coding. Open coding involves analysis of patient response and generating common groupings based on shared ideas. Axial coding describes the stratification of responses according to overarching themes.

Results

Study Participation and Demographics

A total of 31 women neurosurgeons were found to be currently practicing in Canada. Approximately half (51.7%) are currently practicing in the province of Quebec, compared to 22.6% in Ontario, 12.9% in Alberta, and 6.4% in Nova Scotia and Saskatchewan. There were no women neurosurgeons in the provinces of British Columbia, Manitoba, New Brunswick, and Newfoundland.

The response rate was 61.3% overall (n = 19), with 57.9% of respondents from the province of Quebec. Other provinces of practice among our responders included Ontario (21.1%), Saskatchewan (10.5%), and Alberta (10.5%). Among our responders, 52.6% had trained in Quebec, 21% in Ontario, 10.5% in Nova Scotia, and 5.2% in Saskatchewan, Alberta, or out of the country, respectively.

Perceived Barriers to Career Success

The term "success" was presumed by participants. It was cumulatively noted that the perceived most important barriers women face in neurosurgery are inequalities with regard to advancement opportunities relative to male counterparts, as well as conflicts between personal and professional life, specifically pertaining to having a family (Fig. 1). Indeed, 57.9% of participants found that men were provided with more opportunities in regard to career advancement. The same proportion of respondents felt that maintaining a balance between their professional and personal lives was a barrier to success for women in neurosurgery. Lack of mentorship by senior staff was also reported as a perceived barrier by 36.8% of our participants. The least important barrier was the lack of availability or consistency of constructive feedback by senior staff and colleagues. Approximately 58% of participants found that these factors were more specific or more prominent in neurosurgery than in other surgical specialties.

One-third of responders also felt that there have been no positive changes in Canadian institutions to support women in neurosurgical training. One-third emphasized that having women mentors early in training was an important factor to attract and retain trainees in neurosurgery. More flexibility to allow for a work-life balance, as well as being part of a supportive group of neurosurgeons, was also mentioned by 28% of responders to be a way of attracting and retaining women in the field. Approximately 20% of participants also felt that having more women in leadership and mentorship roles would help retain more women trainees.

Over one-quarter of respondents also stressed the inequality of job opportunities in Canada, noting that women graduates faced fewer job opportunities than their male counterparts, leaving them underemployed and oftentimes forced to leave their careers as neurosurgeons.

Factors Identified as Positively Enabling

More than half of participants (52.6%) reported that among the enabling factors presented to them, having supportive colleagues and a positive work environment were the most important to facilitate success in neurosurgery (Fig. 2). Academic accomplishments, including publica-

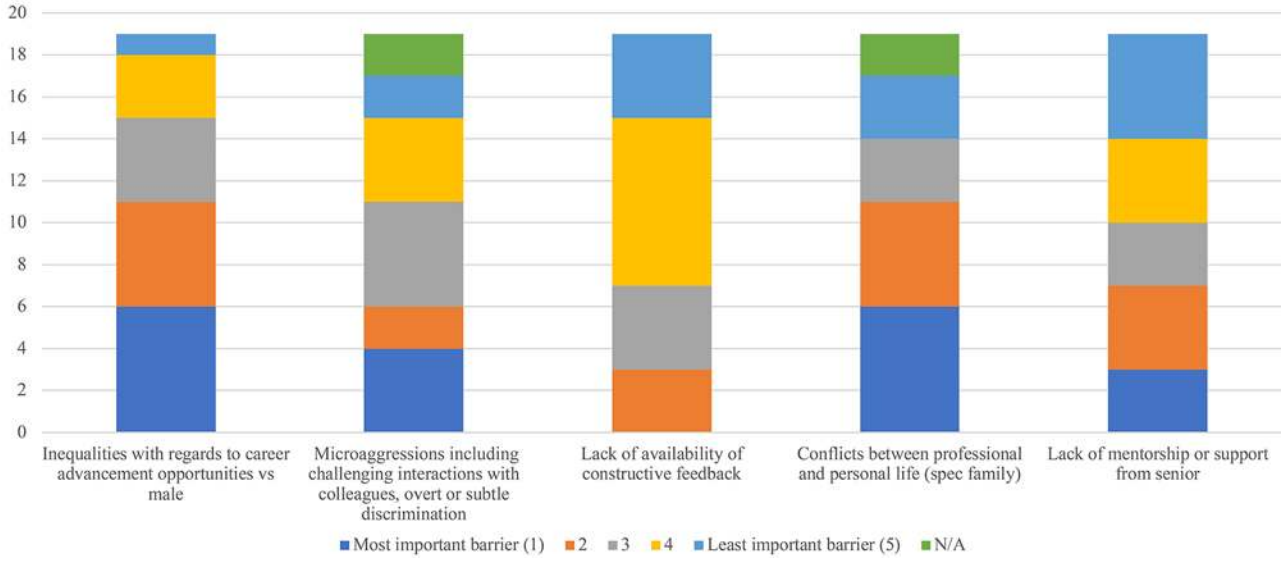

FIG. 1. Likert scale presenting perceived barriers to success among women in neurosurgery. The most important barriers are graded 1, and the least important barriers are graded 5. N/A = not applicable; spec = specifically.

tions and advanced degrees, as well as advanced fellowship training were also perceived as positive facilitating factors. Indeed, 36.8% found academic accomplishments to be facilitators for career advancement, and fellowship training, although never rated as "most positive," was found to be important for success for 47.4% of participants. Over half of the respondents (52.6%) found that mentorship from men had a disproportionately lower positive impact on their career growth.

Among the positive changes that were noted by our respondents as part of the qualitative component of our study, 57.1% felt that having more women coworkers, as well as women appointed as program directors and chairs of neurosurgical programs, has made it easier to support and train more women in neurosurgery. Furthermore, 10.5% found that greater social awareness of gender disparities in general has facilitated positive changes in the workplace for women in neurosurgery.

Discussion

The findings from the present study identify several key factors that may be contributing to the mismatch between women in medicine and recruitment of women to neurosurgery in Canada. While nearly half of medical trainees are women, they only make up approximately 11% of the neurosurgical workforce in Canada.[7,8] Similarly, American data suggest that women are more likely to leave neu-

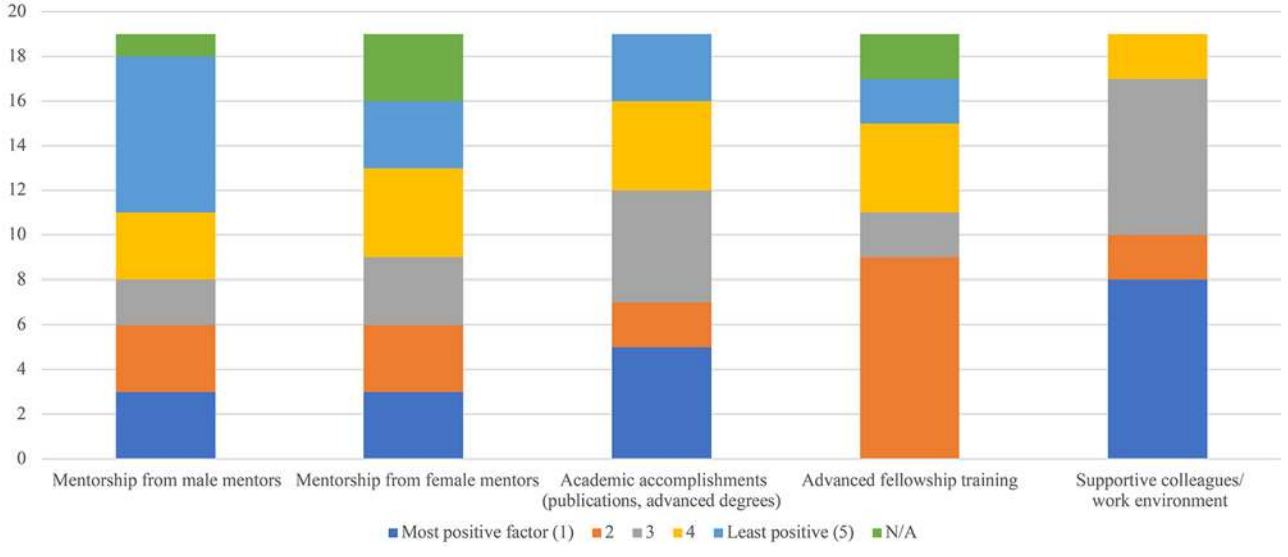

FIG. 2. Likert scale of perceived facilitating factors for success by women neurosurgeons in Canada. The most enabling factors were graded 1, and the least enabling factors for success were graded 5.

rosurgical residency training, with an attrition rate of 17% among women compared to 5% for men.[9] There are multiple gender-specific obstacles that women must overcome to become and remain neurosurgeons. Because women will soon make up most of the medical workforce,[10] it is imperative for the field to identify both facilitating factors and obstacles preventing women from entering or working in neurosurgery to continue to attract the best and brightest candidates to this specialty, regardless of their gender.[11]

Current Canadian Landscape in Neurosurgery

The findings from this study provide the first systematic insights into challenges women neurosurgeons have faced in Canada and can aid in mitigating these factors for the future. The two key emerging features on the basis of both the quantitative and qualitative analyses include an increased need for women mentorship for trainees and junior staff and increased recognition of the influence of balancing family obligations with neurosurgical practice.

Rates of women leadership within neurosurgery are improving in Canada. In September 2020, Dr. Gelareh Zadeh became the Division Chair of Neurosurgery at the University of Toronto, while at the time of this report Dr. Geneviève Milot was finishing her 6-year mandate as Chief Medical Examiner of the Royal College Boards of Neurosurgery. Half of the neurosurgeons currently practicing at the Centre Hospitalier Universitaire Hôpital Enfant-Jésus in Quebec City are women. Furthermore, there are currently three women occupying the role of Residency Program Director in Canada. We stress that there will be many firsts in the coming years and that every time there is a "first," a "second" becomes more attainable.

We came to recognize through this study that half of practicing female neurosurgeons are located within the province of Quebec. This finding is in keeping with the current proportion of women practicing neurosurgery in Canada. We hypothesize that the large number of women practicing neurosurgery in Quebec may partly be due to the different education system, which allows young women to enter medical school as early as the age of 18 years. Women who train in Quebec can enter neurosurgical residency programs in their early twenties, when a balance between professional and personal lives may be more easily achieved. Medical faculties at the Université de Montréal and Université Laval have consistently been accepting a larger proportion of women in medicine during the past decade. Thus, there may be a greater proportion of women graduates, which leads to a greater probability of them training in surgical specialties.[12] Another potential factor is that working schedules during residency are more suitable for a balance between personal and professional life, as 26-hour calls have been abolished since 2012 in the province of Quebec. Other contributing factors include more social awareness of gender inequalities in Quebec, and better childcare, which demonstrates commitment to equality in gender roles, and thereby more actions taken toward the reduction of gender inequality in the workplace.

Perceived Barriers

Barriers to success for women in neurosurgery that emerged from our study included inequalities with regard to opportunities for career advancement, such as fewer positions in academic centers or title promotions compared to male colleagues, as well as difficulty balancing personal and professional lives for women in neurosurgery. These findings are in accordance with the findings of a European group surveying women neurosurgeons, who found that disparities in career advancement opportunities and promotions to leadership positions compared to those available to their male counterparts were the greatest obstacles for women in neurosurgery.[13] Inequality with regard to career opportunities is thought to start as early as the time of first promotion,[14] and disparities between men and women continue to increase at higher levels of leadership. In one report, Venes and Parent suggested that women tend to be held to different standards than their male counterparts, thus possibly limiting their access to higher career achievement.[15] However, the details of such disparate standards are not clearly defined. This investigation also revealed that women continue to be paid less than men for the same type of work, a finding that highlights the continued disparities between men and women in the field of neurosurgery, and that such inequities undoubtedly contribute to the hardships women face as they try to build their careers.

Among the approaches to attempt to close this gap, greater representation of women on influential, policy-making boards, such as the Canadian Neurosurgical Society, American Association of Neurological Surgeons, and Congress of Neurological Surgeons, would be beneficial. Such societies are all currently largely, if not solely, led by men. Subsections or committees such as the Women in Neurosurgery organization founded in 1989 in the United States do not exist in Canada or in Europe, but have been found to play a large role in fostering recruitment and career advancement opportunities for women in neurosurgery.[16,17] Their implementation in Canada may thus be important to increase recruitment to the field and foster fruitful careers for current residents.

Role strain, defined as the difficulty in balancing personal and professional interests,[18] is more common among women than men.[19,20] We stress that although this concern is often cited, very few question why men do not have this similar strain regarding the balance between their familial and professional obligations. We hypothesize that because of traditional gender role attribution, men are not expected to be the primary caretaker or parent. Although not all women choose to have a family, role strain is oftentimes cited as a barrier to career advancement,[21] and is likely reinforced in inflexible environments such as surgical services. As an example, in a study surveying Canadian women surgeons, only 22% of participants had a formal maternity leave policy at their institution.[22] Interestingly, it is possible that role strain may be a perceived barrier rather than a real one, as Carr et al. suggested that there is no difference in productivity between women with families and women without children.[19] Furthermore, analysis of productivity among women in internal medicine showed that while productivity may diminish during childbearing age, women tend to be more productive than men in their later years.[23,24] We hypothesize that having more women

with successful careers, as well as fulfilling personal lives, will help dismantle this perception among young women who aspire to become neurosurgeons. Furthermore, we would suggest that Canadian institutions and medical associations implement strategies such as formalized parental leave (maternity and paternity) to improve work-life balance, which would help in attracting and retaining the brightest graduates regardless of their gender and family plans. The culture around parental leave must also shift, as it has been shown that parents typically take less leave than they are entitled to.[25] Federal law in Canada ensures maintenance of benefits for maternal and parental leave, and employers must accept parents into their job or in a comparable job with equal pay. By federal law, one cannot be penalized or lose his or her job if he or she takes parental leave.[26] However, a Canadian study surveying plastic surgery residents who parented a child during residency or early on in their careers showed that there continues to be confusion around parental leave, and that support for parental leave and childbearing is oftentimes lacking or negatively perceived.[27]

Facilitating Factors for Career Success

Several studies have shown that mentoring and role models play an immense part when it comes to making a career choice in medicine.[11,28–30] Although many women will benefit from mentorship from male neurosurgeons, studies have suggested that women may benefit differently from female mentorship.[31,32] Academic women surgeons surveyed in a Canadian study wished they could have benefited from women mentorship despite most of them having at least one male mentor.[22] Although our data suggest that female mentorship was rather neutral in enabling success in neurosurgery for women, lack of mentorship was a perceived barrier to success, highlighting, as have many previous studies, its importance in attracting and retaining women to the field.[16,17] A possible explanation for our results is that women possibly lack mentorship and sponsorship opportunities in male-dominant surgical specialties, as evidenced in a recent study looking at mentorship experience in orthopedic surgeons.[33] Mentorship and, more specifically, sponsorship experiences may also differ for women practicing medicine in academic settings. Indeed, women were less likely than their male counterparts to have their mentors facilitate invitations as chair at a conference or authorship in a manuscript, both of which were shown in our study to be facilitating factors for success in neurosurgery. Women also more commonly felt that their work was used by their mentors to advance their own careers rather than those of their mentees, and that they were not likely to be prospectively advised about criteria for promotion compared to their male counterparts.[34] We hypothesize that these negative experiences may decrease as women find mentorship from more senior women members, as a recent study showed that female first authors in the neurosurgery literature had a tendency to have a female senior coauthor.[35] Furthermore, as publications were found to be an enabling factor for success in our study, women-to-women mentoring may also facilitate publication and research proficiency, which we hope may provide for more career advancement opportunities.

The most important driver for success in our study was having a positive and collegial working environment. To our knowledge, this finding has not been reported in previous studies as the main driver for success for women in surgical specialties. Neurosurgery has a reputation for inflexible work environments, and we hypothesize that collegial and positive working environments may help overcome this barrier,[14] thus becoming an enabling factor for success in the field. It remains unclear, however, what makes an environment positive and collegial, and whether colleagues in other specialties, as well as accommodations made by the hospital in general and not specifically for neurosurgeons, play a role in making environments more favorable for success. Peer advocacy and environments in which women feel their work is being recognized are both factors that may attract and, most importantly, retain women in neurosurgery. These factors have been described as relational facilitators among women in other surgical specialties.[36]

Other important drivers for a successful career included academic accomplishments such as publications and advanced degrees, as well as advanced fellowship training. These factors likely drive success for men in neurosurgery as well, but raise the question as to whether women neurosurgeons receive similar rewards or opportunities for equal achievements. Indeed, one study looking at the glass ceiling among women in academic medicine found that 59% of women compared to 83% of men were promoted to associate or full professor after 11 years of faculty experience, despite controlling for productivity.[37] As women in leadership positions continue to be lacking,[16,17] we hypothesize that women may require higher achievements than men to advance their careers. A way to counteract this phenomenon would be for institutions to promote and encourage female residents and junior staff to participate in seminars that aim to foster management and leadership skills.

Finally, it should be noted that in the domain of mentorship and advocacy, there is an important role for male neurosurgeons and trainees to serve as allies in supporting traditionally underrepresented minorities, including female neurosurgeons. Allyship of male physicians has a strong positive potential to improve the current culture and landscape of the neurosurgical workforce and has been shown in other disciplines.[38]

Study Limitations

Some study limitations should be noted. First, the study was limited in the overall representation across all provinces and territories in Canada; however, we estimate that the responses were representative of the respective workforce in these regions. Second, current women residents may provide a different perspective than attendings surveyed in the present study who trained during a different era. Future studies aimed at surveying the resident experience may be valuable to better inform the current training perspectives in this domain.

Conclusions

Taken together, this study provides the first systematic analysis of the current landscape of experiences and per-

spectives of female neurosurgeons in Canada and provides a basis for addressing disparities and challenges that women have traditionally faced in this specialty. Several actions can be undertaken to minimize the perceived barriers and retain young women in neurosurgery. First, institutions must study their data in a gender-based fashion to determine whether there has been or continues to be gender-based discrimination at several levels, including promotion in academic positions and ranking in residency positions. Better childcare options provided on-site or near the hospital should also be considered to promote a healthier balance between personal and professional lives, and surgical departments need to be first-line advocates for such changes. Formal parental leave policies for both mothers and fathers should be mandatory among institutions to establish positive expectations regarding parenthood that coincides with career development. Furthermore, mentorship and sponsorship programs should be instituted among women in neurosurgery to foster the development of women neurosurgeons at several levels, including medical students, residents, and young attendings, given the relatively small group this represents in Canada. Promotion committees should be implemented and structured reviews of resident and attending curriculum vitae should be performed regularly to identify eligibility of faculty for promotion and to provide equal opportunity for residents and staff to receive support and advisement regarding their career paths. This structured environment is likely to decrease unequal opportunities for career advancement. Finally, there is no doubt that having more women in leadership positions will help attract more young women to the field. Greater social awareness of gender disparities in the workplace and dismantling of traditional gender roles will also play a role in promoting more women to enter traditionally male-dominated fields. We anticipate that these results will not only lead to progress in the dialogue on this topic but also serve as a framework for directly addressing these issues across neurosurgical training programs in institutions.

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Disclosures

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Author Contributions

Conception and design: Veilleux, Samuel, Yan, Bass, Al-Shahrani, Mansur. Acquisition of data: Veilleux, Samuel. Analysis and interpretation of data: Veilleux. Drafting the article: Veilleux, Samuel, Yan, Bass. Critically revising the article: all authors. Reviewed submitted version of manuscript: all authors. Approved the final version of the manuscript on behalf of all authors: Milot. Statistical analysis: Veilleux, Samuel. Study supervision: Milot.

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