CMAJ OPEN

Research

Perceptions and experiences of a gender gap at a Canadian research institute and potential strategies to mitigate this gap: a sequential mixed-methods study

Alekhya Mascarenhas MPH, Julia E. Moore PhD MSc, Andrea C. Tricco PhD MSc, Jemila Hamid PhD MSc, Caitlin Daly MSc, Julie Bain BSc, Sabrina Jassemi BSc, Tara Kiran MD MSc, Nancy Baxter MD PhD, Sharon E. Straus MD MSc

Abstract

Background: The gender gap in academia is long-standing. Failure to ensure that our academic faculty reflect our student pool and national population deprives Canada of talent. We explored the gender distribution and perceptions of the gender gap at a Canadian university-affiliated, hospital-based research institute.

Methods: We completed a sequential mixed-methods study. In phase 1, we used the research institute's registry of scientists (1999–2014) and estimated overall prevalence of a gender gap and the gap with respect to job description (e.g., associate v. full-time) and research discipline. In phase 2, we conducted qualitative interviews to provide context for phase 1 data. Both purposive and snowball sampling were used for recruitment.

Results: The institute included 30.1% (n = 62) women and 69.9% (n = 144) men, indicating a 39.8% gender gap. Most full-time scientists (60.3%, n = 70) were clinicians; there were 54.2% more male than female clinician scientists. Ninety-five percent of basic scientists were men, indicating a 90.5% gap. Seven key themes emerged from 21 interviews, including perceived impact of the gender gap, factors perceived to influence the gap, recruitment trends, presence of institutional support, mentorship and suggestions to mitigate the gap. Several factors were postulated to contribute to the gender gap, including unconscious bias in hiring.

Interpretation: A substantial gender gap exists within this research institute. Participants identified strategies to address this gap, such as establishing transparent search processes, providing opportunities for informal networking and mentorship of female scientists and establishing institutional support for work–life balance.

At undergraduate and graduate student levels, women have outnumbered men in Canadian universities for more than 20 years.[1] However, a similar demographic is not seen in more senior academic levels; the higher the university rank, the lower the proportion of women.[1] Although the pipeline is not the cause for the disparity in biomedical and behavioural sciences, where women have received fewer than 50% of the doctorate degrees for many years,[1] it may be a contributor in fields such as engineering and physics.[2] This disparity is evident in research funding; data from the Canadian Institutes of Health Research showed that women aged less than 45 years were less likely to receive grant funding than their male counterparts.[3] In April 2016, the Canada Research Chair's Steering Committee sent an open letter to presidents of Canadian universities calling on institutions to strengthen efforts to address underrepresentation of women within the program, noting that over the past 15 years, the percentage of female Tier 1 chair holders has remained at 17%.[4] Recently, the Canadian Minister of Science announced rules for the Canada Excellence Research Chairs program to address the gender gap in recipients.[5]

This situation is not unique to Canada, and similar issues have been reported in the United States,[6–8] United King-

Competing interests: None declared.

Disclaimer: Sharon Straus is an associate editor for *CMAJ Open* and was not involved in the editorial decision-making process for this article.

This article has been peer reviewed.

Correspondence to: Sharon Strauss, sharon.straus@utoronto.ca

***CMAJ Open* 2017. DOI:10.9778/cmajo.20160114**

dom[9,10] and Europe.[11,12] The National Institutes of Health in the US funded 14 grants in 2008 to study causal factors that promote and support the careers of women in biomedical sciences.[13] In the UK, the National Institutes of Health Research announced in 2011 that research funding would be contingent on universities receiving at least a Silver Award from the Athena Scientific Women's Academic Network Charter — an award that signifies institutional attempts to advance gender equality.[14]

In 2012, the Canadian Council of Academies conducted a comprehensive review to identify what factors may influence the career trajectory of female researchers and underlie the gender disparity.[1] They outlined that institutional policies influence the career trajectory of female researchers and highlighted the need to know what is happening at Canadian universities to understand the reasons for the disparity and to develop solutions.[1] Failure to ensure that our faculty reflect our student pool and our national population deprives our country of talented individuals who could enhance innovation and advance our competitiveness. To meet this challenge, we explored gender distribution at a university-affiliated, hospital-based research institute and the perceptions and experiences of the gender gap. We are intending to use this information to implement and evaluate strategies to address the gap.

Methods

We completed a sequential mixed-methods study to explore the presence of a gender gap at a Canadian university-affiliated research institute, the perceptions and experiences of scientists related to this gap and potential strategies to address this gap. This study was completed at St. Michael's Hospital, which is fully affiliated with the University of Toronto. The hospital's research institute was established in 1999 and includes basic, clinical and health services research.

Phase 1

Data source

We accessed the registry of scientists appointed to the research institute. It is maintained by the hospital's Office of Research Administration and included all scientists appointed from 1999 to December 2014, including those who left the institution. Data were available on the year of the scientist's initial appointment, their academic appointment, gender (male/female/other), job description and research discipline. Scientists at the hospital have an academic appointment (as lecturer through to full professor) with the University of Toronto. Job descriptions include clinician scientist (the person also has a clinical appointment), employee scientist (a person with a PhD who is not a clinician), and associate scientist (a person who may be appointed elsewhere or a part-time researcher). Research discipline was categorized as basic research, clinical research (includes health services research) or both.

Analysis

We estimated the prevalence of a gender gap among scientists at the research institute and investigated the gap with respect to associate versus full-time scientists, clinician versus employee scientists and to research discipline (basic v. clinical or both). We examined gender distribution in academic rankings (lecturer, assistant professor, associate professor and professor) and investigated the trend from 1999 to 2014 to determine if there was any change in hiring or retention of women. Comparisons in gender gap among the different categories were made using exact binomial distributions.

Phase 2

We conducted a qualitative study with individual interviews using thematic analysis to provide context for phase 1 data and identify strategies to promote gender equity.

Participants and recruitment

A purposive sampling strategy in addition to snowball sampling was used to recruit current or past scientists, respectively. We recruited participants from various career stages. Career stages were defined as early (< 5 yr since initial appointment), mid (5–10 yr) and senior (> 10 yr) career. We targeted 4–6 participants from each career stage and from both clinician and employee scientists. These categories were based on differences noted in phase 1 data. We anticipated that 4–6 participants in each category (Appendix 1 available at www.cmajopen.ca/content/5/1/E144/suppl/DC1) would be sufficient to reach saturation among relatively homogenous groups of participants.[15]

Scientists were identified from the registry and sent a personalized recruitment letter. Snowball sampling was used to identify people who had left the institution. Sampling continued until saturation of themes was achieved.

Data collection

Semistructured telephone interviews were conducted between November 2015 and January 2016. Interviews were conducted by 1 of 3 experienced interviewers (AM, SJ or JB) using an interview guide. The guide was developed by the research team after reviewing phase 1 results and with a focus on exploring the research institute context, reasons for the gender gap and strategies to mitigate disparity. At the onset of the interview, participants were shown phase 1 data to outline the gender gap. The interview guide (Appendix 2 available at www.cmajopen.ca/content/5/1/E144/suppl/DC1) was tested for clarity with 2 people (excluded from analysis) and revised. Interviews were audio recorded, transcribed and deidentified to ensure anonymity. Interviewers took field notes during interviews as a secondary data source.

Analysis

Thematic analysis was used for the interview transcripts.[16,17] Three qualitative experts conducted the interviews and participated in ongoing memoing during data collection. The codes generated during memoing comprised the initial coding framework. A modified coding consensus approach was used. The coding framework was then reviewed by the

research team and applied to a portion (n = 4, 19.0%) of transcripts by 2 analysts using NVivo 11.[18] Interrater reliability for the coding was calculated, and discrepancies were resolved through discussion. Conceptual changes to the coding framework were then made as necessary. The analysts engaged in a second round of coding on an additional portion (n = 5; 23.8%) of transcripts, and interrater reliability was calculated. After the second round of coding, agreement was found to be good (Kappa coefficients ≥ 0.6) and the remaining transcripts (n = 12, 57.1%) were coded by a single analyst. After each interview, the interviewers took field notes and made memos of new and recurring themes in a password-protected database. We used this database to determine when we had reached saturation, namely the point at which few or no new themes were found in consecutive interviews.[19] The results were shared with participants to invite feedback and ensure accuracy; permission was obtained to include relevant quotes. None of the scientists who developed this study participated in interviews or analysis. One author (SES) reviewed the transcripts and provided input into coding of deidentified transcripts. The remaining authors only provided input on aggregate summaries and manuscript development.

Ethics

The qualitative study was approved by the St. Michael's Hospital Research Ethics Board.

Results

Phase 1

As of Dec. 30, 2014, there were 206 scientists appointed to the research institute. Among them, 30.1% (n = 62) were women and 69.9% (n = 144) were men, indicating a 39.8% gender gap. This gap was seen across appointment statuses (clinician v. nonclinician, associate v. full-time), research disciplines and academic rankings. Looking at recruitment since the research institute was launched (Figure 1), there was a significant gender gap in appointments, where more men than women were hired each year, with the exceptions of 2004 and 2014. The gender gap varied from year to year, and the median gender gap was 40% (interquartile range [IQR] 25.5%–56.3%). The smallest gap was 14.3% (2005), and the largest was 81.8% (2006). Although the gap was consistently seen from 1999 to 2014, there was no trend seen for differences in hiring over time across job descriptions.

Job description

Gender gaps existed across all job descriptions (Table 1). Most full-time scientists (60.3%, n = 70) were clinician scientists, and the gap was largest in this group. Specifically, there were 54.2% more male than female clinician scientists. The smallest gender gap was among employee scientists, with 21.8% more men than women.

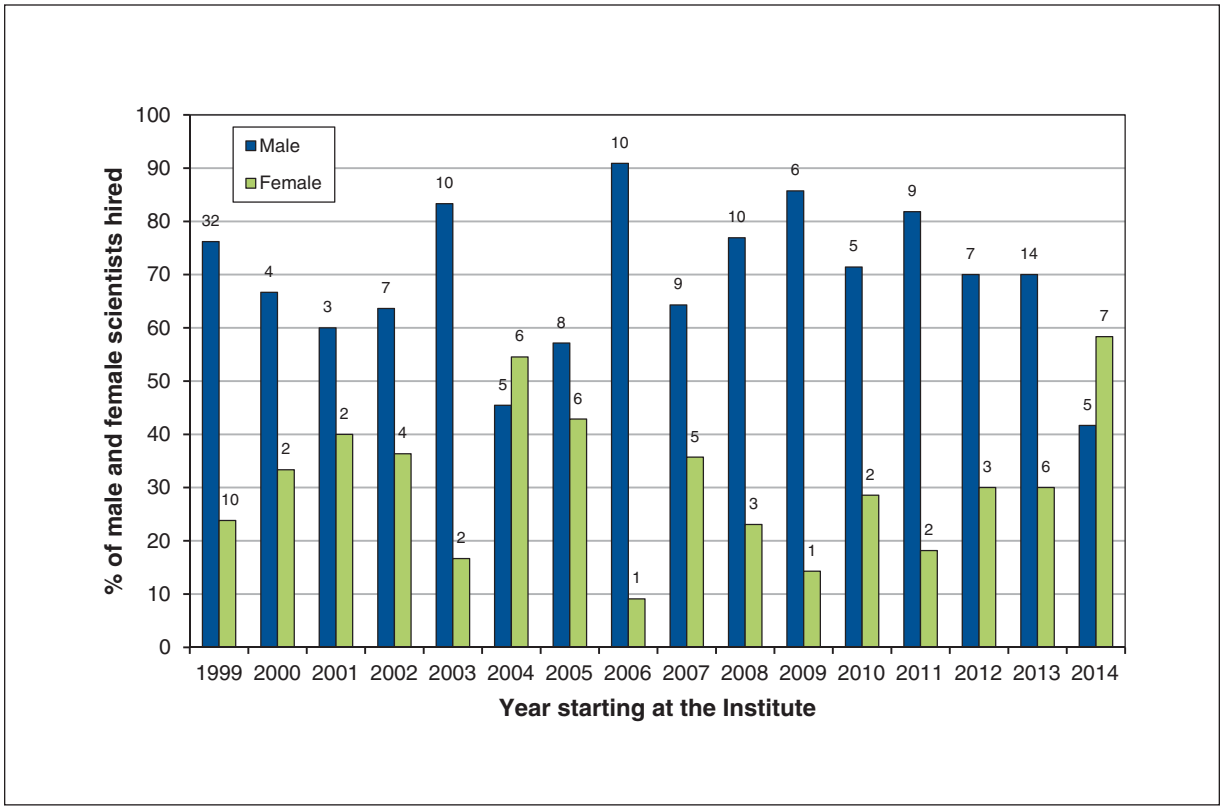

Figure 1: The gender gap as a proportion of appointments from 1999 to 2014. Numbers over bars represent the numbers of hires in that year.

Research discipline

Almost 69% (n = 142) of scientists were clinical researchers, 20.9% (n = 43) conducted basic research, and 10.2% (n = 21) conducted both basic and clinical research (Table 1). Ninety-five percent of basic scientists were men, indicating a 90.5% gender gap. Among scientists conducting clinical research, there were 21.2% more men than women. Among employee scientists, there were 14.2% more women than men conducting clinical research.

Academic appointment

Of the 206 scientists, 201 had a university appointment, and a gender gap persisted across all university appointments. This gap increased with increasing academic rank; specifically,

Table 1: Gender distribution among scientists

Category	Total, no. (%)	Female, no. (%)	Male, no. (%)
Job description			
Full-time scientists	116 (56.3)	34 (29.3)	82 (70.7)
Clinician	70 (60.3)	16 (22.9)	54 (77.1)
Employee	46 (39.7)	18 (39.1)	28 (60.9)
Associate scientists	90 (43.7)	28 (31.1)	62 (68.9)
Research discipline			
Basic	43 (20.9)	2 (4.7)	41 (95.3)
Full-time scientists	32 (74.4)	2 (6.3)	30 (93.8)
Clinician	15 (46.9)	0 (0.0)	15 (100.0)
Employee	17 (53.1)	2 (11.8)	15 (88.2)
Associate scientists	11 (25.6)	0 (0.0)	11 (100.0)
Clinical	142 (68.9)	56 (39.4)	86 (60.6)
Full-time scientists	67 (47.2)	29 (43.3)	38 (56.7)
Clinician	39 (58.2)	13 (33.3)	26 (66.7)
Employee	28 (41.8)	16 (57.1)	12 (42.9)
Associate scientists	75 (52.8)	27 (36.0)	48 (64.0)
Both	21 (10.2)	4 (19.0)	17 (81.0)
Full-time scientists	17 (81.0)	3 (17.6)	14 (82.4)
Clinician	16 (94.1)	3 (18.8)	13 (81.3)
Employee	1 (5.9)	0 (0.0)	1 (100.0)
Associate scientists	4 (19.0)	1 (25.0)	3 (75.0)
Academic appointment			
Lecturer	8 (4.0)	3 (37.5)	5 (62.5)
Full-time scientists	4 (50.0)	1 (25.0)	3 (75.0)
Clinician	4 (100.0)	1 (25.0)	3 (75.0)
Employee	0 (0.0)	NA	NA
Associate Scientists	4 (50.0)	2 (50.0)	2 (50.0)
Assistant professor	94 (46.8)	37 (39.4)	57 (60.6)
Full-time scientists	39 (41.5)	19 (48.7)	20 (51.3)
Clinician	21 (53.8)	8 (38.1)	13 (61.9)
Employee	18 (46.2)	11 (61.1)	7 (38.9)
Associate scientists	55 (58.5)	18 (32.7)	37 (67.3)
Associate professor	43 (21.4)	11 (25.6)	32 (74.4)
Full-time scientists	32 (74.4)	8 (25.0)	24 (75.0)
Clinician	17 (53.1)	4 (23.5)	13 (76.5)
Employee	15 (46.9)	4 (26.7)	11 (73.3)
Associate scientists	11 (25.6)	3 (27.3)	8 (72.7)
Full professor	56 (27.9)	8 (14.3)	48 (85.7)
Full-time scientists	39 (69.6)	4 (10.3)	35 (89.7)
Clinician	28 (61.4)	3 (10.7)	25 (89.3)
Employee	11 (28.2)	1 (9.1)	10 (90.9)
Associate scientists	17 (30.4)	13 (76.5)	4 (23.5)

Note: NA = not available.

85.7% of professors were men and 14.3% were women, indicating a gender gap of 71.4%.

Phase 2

Twenty-one scientists were interviewed. The interviews lasted 45–60 minutes. Participant demographics are outlined in Table 2; detailed demographics cannot be provided to maintain confidentiality. Four participants were former scientists with the hospital. Most of the participants were clinician scientists, reflecting phase 1 results. We had nearly equal representation of male (48%, $n = 10$) and female (52%, $n = 11$) participants, and equal representation of participants (33%, $n = 7$) from each career stage.

There were 7 key themes identified from the interviews; these are illustrated with participant quotes.

Perceived impact of the gender gap

Personal impact: Male participants said that they were unaffected by the gender gap. Several women reported feeling negatively affected by the gender gap; some described a feeling of social isolation and a perception that they are not a priority for the research administration. Examples were given, such as feeling unheard in meetings and being excluded from meetings outside regular business hours because of presumptions about family responsibilities.

Some women felt that they have fewer opportunities for career advancement and received less financial compensation than men. They felt "passed over" for promotions in comparison to male colleagues who had similar or less accomplished curricula vitae. Some worried about their job security at the institute. Participants who left the institute did not leave because of the gender gap, but suggested that others may have left for that reason.

Some female participants did not feel negatively affected by the gender gap. They felt fortunate to receive excellent mentorship and support within the institute. Their perception was that women were not undervalued and that strong female role models existed. Some wondered whether a gender imbalance, skewed in either direction, could be advantageous; the individual who is different may get noticed and offered opportunities.

Impact on culture at the research institute: Participants perceived that the gender gap existed because of the research culture and maintained the culture. First, female perspectives may be less apparent in any discussion on work–life balance. Participants perceived that men are more likely than women to have a partner who is primarily responsible for work at home. As a result, male-dominated organizations may produce a work culture that does not favour people who have home responsibilities. Female participants said they developed solutions for child care and meeting work demands (e.g., hiring volunteers, flexible work hours).

Second, since there were fewer female scientists, the same women may get asked to participate in various committees. Participants raised concerns that this may make work–life balance more challenging for women and take time away from their research.

Factors perceived to influence the gender gap

Informal recruitment process: Participants perceived that the recruitment process was unclear and not transparent. They questioned whether there may be an unconscious gender bias in recruitment, which has persisted through informal hiring strategies. Participants said they were unaware of information on how candidate searches were performed, how positions were advertised or how many candidates applied. Participants explained that they were hired through informal processes such as having positions created by mentors or colleagues, being invited to join after acquiring grants or research awards and being sought to run a specific program in their research specialty.

Participants differentiated between the hiring of clinician and nonclinician scientists. Clinician scientists were recruited through their clinical division head, who presents candidates to the research institute. Participants highlighted that the gender gap among clinician scientists may reflect a gap in the recruitment of clinicians. Nonclinician scientists were described as being hired directly through the research institute. Participants perceived an informal component to both recruitment channels. Participants speculated that women may not have the same access to informal social networks that exist between men (Box 1). Because institute leadership is predominantly male, they may instinctively network with, and recruit, people who are similar to them.

Table 2: Demographic characteristic of 21 interview participants

Characteristic	No. of participants
Sex	
Female	11
Male	10
Appointment	
Clinician scientist	13
Employee scientist	8
Career stage	
Early career (< 5 yr)	7
Mid-career (5–10 yr)	7
Late career (> 10 yr)	7
Former St. Michael's hospital scientist	4

Box 1: Informal social networks

"Like this person … if I was female would never have invited me out for a beer. It's that level of informal advancement that, thankfully these kind of things are pointed out by my partner who educates me on them, because it's not really something that I've been thinking about. But that is seriously problematic. It's nobody's fault, right? But it's … I mean … No one is trying to exclude based on gender but doesn't necessarily feel like you're excluding based on gender if you're extending invitations to meet informally with people." — Male scientist, early career

Historical trends in hiring and retention and proportion of women in pool of eligible candidates: Participants speculated that the existing gender gap might dissipate as men in senior positions retire and more women in junior positions advance. Participants wondered if gender gaps existed in recent hires because there are fewer female candidates. Some participants suggested that women may be less interested in the scientist role owing to its lengthy education requirements and impact on work–life balance. The navigation of trade-offs between career and family for women aged 25–35 years was described as challenging (Box 2).

Research disciplines and gender: Participants noted that the gender gap varied by research discipline and was most pronounced in basic research. Within clinical research, participants perceived variability across research fields; for example, some participants perceived more women in social science research. Some participants raised the issue that certain research disciplines (that may be more male-dominated) might be more valued within the research institute than others, thereby contributing to the gender gap.

A similar issue was raised for clinical disciplines. It was mentioned that certain clinical divisions tended to have fewer women than others. As a result, clinician scientists from these divisions tended to be male. There was a perception that clinical divisions with more women were divisions that seemed to be understaffed. Female clinicians in these divisions may have less time or resources to engage in research.

Perceptions of support at the institution

Support from research administration: Some participants felt strongly supported, and others felt they had either no support or no relationship with research leadership. Those who felt supported described receiving training and administrative resources for grant writing, patience and understanding with regards to the challenges of grant acquisition, support for family leaves, independence with running research activities and positive feedback on research ideas. Those who did not receive support said they were made to feel like they were not a priority. In an environment where funding is hard to acquire, some participants perceived that scientists who are able to acquire larger grants were more valued. Some participants wondered if research leadership knew who they were or what research they were conducting. Some described experiences of contacting the administration, but either receiving no response or not a favourable response.

Support from peers: Overall, participants described having collegial relationships with peers. They described the research institute as being a positive and collaborative environment. Participants described occasional incidents of unprofessional behaviour. Most often, the people behaving unprofessionally were in more senior positions and more likely to be male. Examples included stealing grant ideas, interrupting established collaborations and excluding others from group brainstorming meetings. All participants who experienced these behaviours were female, although not all female participants mentioned unprofessional behaviour. Participants were unable to say whether these issues were related to gender, but believed these behaviours were the product of the competitive nature of research.

Access to mentorship: Participants with mentors perceived them to be valuable for providing insight on how to succeed as a scientist, making them feel valued, giving them feedback and providing them with opportunities. Participants who did not have mentorship described the desire for a mentor, especially early in their career.

Suggestions to address the gender gap

Establish transparent and explicit search processes: Participants suggested that a systematic and transparent search process be used for recruitment, including creating gender-balanced search committees, fair and wide advertising of scientist job postings (e.g., including minority websites) and thorough screening of local and international applicants. Participants said that scientists and leaders at the research institute should make efforts to ensure that eligible women are sought and included in informal networks, which are currently used for recruitment. For hiring clinician scientists, participants felt that the research institute should take a more active role in encouraging clinical division directors to consider whether there is any unconscious gender bias in recruitment. Finally, it was suggested that the search process be documented to ensure transparency (Box 3).

Provide career mentorship across career stages: Participants suggested that the mentorship of junior female researchers and trainees could help narrow the gender gap by empowering interested women to become scientists (Box 4). For early female mentorship to be implemented, participants suggested that the onus should be on research leadership and senior scientists to identify future scientists, particularly among women, and create opportunities for support and mentorship.

Box 2: Trade-offs between career and family

"Everything (related to) whether you are going to be an academic scientist or not is decided during your training, and if you have family and your training is delayed, If you can't work that much, then your publication list is not that good. To be that excellent, you are right away in a disadvantage. And that can happen more often to women than to men" — Female scientist, mid-career

Box 3: Transparent recruitment process

"I don't think that this can be addressed until we are going to (have) recruitment which is more open with candidates applying for these jobs from all over, and then we can see whether this gender gap is still there, whether there is a gap among the applicants and whether there is a gap after the selection process" — Female scientist, mid-career

Box 4: Mentorship

"There is quite a bit of evidence now that the best predictor of success for scientists is a successful mentor. For very tangible reasons, from tangible reasons as mentors they know how to do research and you can get caught up or you can fall into holes and so on, and a good mentor is quite good at seeing those holes." — Male scientist, mid-career

Establish institutional support for work–life balance: Participants described areas where work–life balance strategies can be encouraged; for example, allowing women and men who have young children to remain engaged in research. Ideas included having meetings at times that are more conducive to picking up or dropping off children at school, having private rooms with storage for breast milk, encouraging recruitment of part-time staff or volunteers for support and providing human resources when scientists are on family leave. Some female scientists described that a full-term maternity leave was challenging because they feared that they would fall behind in research productivity in comparison with colleagues. Clinician scientists mentioned that in smaller clinical divisions if one person goes on maternity leave, the remaining faculty cover the clinical work, which makes work–life balance and research more challenging.

Interpretation

A substantial gender gap exists at this research institute, across job descriptions and research disciplines. Several factors were postulated to contribute to it, including the potential for unconscious bias in hiring. Participants did not mention that they believe there is intentional bias against women within the institution. Participants identified strategies to consider implementing to overcome the gender gap, such as establishing transparent and explicit search processes, providing opportunities for informal networking of female scientists, providing career mentorship and establishing institutional support for activities that promote work–life balance.

Our findings address some of the lack of information identified in the Canadian Council of Academies assessment,[1] providing data on the gender gap at a university-affiliated research institute and context around why the gender gap may exist. Our study indicates that informal search and recruitment processes are likely a contributing factor to the gender gap. The gender gap in academics is long-standing, and it is highly unlikely that the tincture of time will resolve it, given that women have outnumbered men at student and junior faculty levels for more than 25 years,[1] and research shows that there are no significant differences in baseline career aspirations between women and men.[20] The pathway to a research career is also affected by socialization and stereotypes that define roles and expectations before university.[1,21] Although gender stereotypes begin early in life, academic success is achievable when opportunities are available.[1,22] Our study results reflect this challenge and highlight potential strategies to mitigate the gender gap.

Funding agencies and academic institutions worldwide have noted similar gender gaps, and informal or nontransparent recruitment processes were identified as a potential contributor.[23,24] The Canadian Council of Academies assessment identified that American and European efforts are more advanced than those in Canada and that we should look to them for potential strategies.[1] Many universities have implemented guides for search committees to use when recruiting academics.[14,25,26] Similarly, the Athena Scientific Women's Academic Network advocates that universities consider gender in progression from students into academia.[14] There is little data available to determine the effect of these guides. However, a recent UK evaluation of Athena Scientific Women's Academic Network found that although some benefits were seen and people had positive perceptions of its impact, it can unintentionally reproduce and reinforce gender inequity through its enactment.[14] Specifically, the work required to monitor the gender equity programs typically fell to women; moreover, impact can be limited because of wider institutional and national polices and norms on issues such as hiring.[27]

Our results also align with findings from a systematic review of interventions that mitigate gender bias in employment, which found bias against women being evaluated for positions that are traditionally or predominantly held by men.[28] This review identified strategies to mitigate this bias, including aiming for an applicant pool with at least 25% women, committing to the value of credentials before applicants are reviewed and training panel members in unconscious bias and the role that it can play in discussions and decisions.[28] A recent study found that a 20-minute workshop on implicit biases and strategies for overcoming them changed participants' perceptions of bias.[29] Furthermore, a randomized trial involving faculty from 92 departments at 1 university showed an increase in self efficacy to engage in gender-equity-promoting behaviours after a 2.5-hour workshop[30].

Limitations

Our study was conducted at a single institution, but it represents a large and diverse group of scientists who conduct basic and clinical research. The interview findings may not be generalizable to other departments or institutions. However, saturation of themes was achieved, and the sample included representation from all career stages and job descriptions. Moreover, qualitative research is used to generate rich descriptions and explanatory data; it is not used to obtain population-based estimates.[19]

We only recruited 4 scientists who left the institution, and scientists who did not participate might have different perspectives.

Because there are no formal hiring processes in place at the research institute, we were unable to report data on the number of people who applied for positions. Based on study findings, it was recommended that formal, transparent recruitment processes be developed and implemented, thereby ensuring these data will be available.

Conclusion

We found a significant gender gap at a research institute, existing over 15 years. Active strategies are needed to address the

gap and ensure that the creativity and innovation offered by our diverse population is not lost. To achieve this, programmatic efforts across institutions are required. It has been suggested that we need to provide equitable access to opportunities and resources, manage unconscious bias, support work–life balance and engage leadership. Future studies should explore the training pipeline to determine where and why we are losing women from potential academic careers. Furthermore, we need to develop and test interventions to mitigate gender bias and not expect this to change without explicit intervention — time alone will not bridge this gap.

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Affiliation: Li Ka Shing Knowledge Institute, St. Michael's Hospital; University of Toronto, Toronto, Ont.

Contributors: Sharon Straus conceived the study. Sharon Straus, Julia Moore and Alekhya Mascarenhas made substantial contributions to its conception and design. All of the authors had input into the conception of the study and the interpretation of the results. Sabrina Jassemi, Julia Moore and Alekhya Mascarenhas collected the data. Alekhya Mascarenhas was the primary qualitative analyst for the interview data, and Jemila Hamid was the primary statistician for the registry data. Sharon Straus drafted the manuscript and all authors commented on it. All of the authors read and approved the final manuscript to be published and agreed to act as guarantors of the results.

Funding: This study was funded by the St. Michael's Hospital Office of Research Administration.

Acknowledgements: Andrea Tricco is funded by a Tier 2 Canada Research Chair; Sharon Straus is funded by a Tier 1 Canada Research Chair. The authors thank Lianne Jeffs for input into the discussion that led to the conceptualization of this project, the scientists who participated in this project and the research leadership at St. Michael's Hospital who supported the conduct of this study.

Supplemental information: For reviewer comments and the original submission of this manuscript, please see www.cmajopen.ca/content/5/1/E144/suppl/DC1