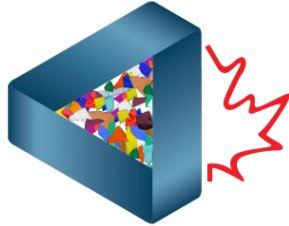


Habiba Kadiri (University of Lethbridge)



MOSAIC, *Mathematics, Outreach, Society, Accessibility, and Inclusiveness Column* is directed by the CMS EDI committee and touches upon issues concerning equity, diversity, and inclusion in mathematics. Comments, suggestions and submissions are welcome.

Habiba Kadiri (she/her), University of Lethbridge (habiba.kadiri@uleth.ca)

In this article we hope to explain why the CMS needs to collect data about the status of diversity across the mathematical community at large.

What is the role of the CMS-EDI committee?

One of the first duties for the Executive Committee is “to take appropriate action to ensure diversity throughout the Society”. The CMS EDI committee was created in Summer 2020 to support the Executive Committee in this effort. Since then, it has organized discussions and scientific sessions during each semi-annual meeting, and it has also created a new column, MOSAIC, in the CMS Notes. These initiatives open long awaited spaces for mathematicians to express themselves and share their experiences as members of underrepresented groups. They also provide a space for EDI champions to share their wisdom in building a more inclusive community.

The specific mandate of the CMS-EDI committee includes “to ensure that conferences are accessible and welcoming to all groups”, “to monitor the position and interests of women in mathematics, those with disabilities, LGBTQ+ communities as well as other underrepresented groups in Canada and in the Society”, and “to recommend actions to the Board of Directors which will assure equitable treatment of these groups in the mathematical community.” [1]

Some initiatives have already been undertaken using the experiences of other research communities; for instance, to help session organizers of the CMS meetings select a more diverse panel of speakers, the committee has advised replacing the invitation system with an open call one. We hope this system will be in place by Summer 2022. To determine if this initiative is effective would require some quantitative measures.

Collecting data to take appropriate action to ensure diversity throughout the CMS

As of today, the CMS does not collect or at least share any aggregated data about its meeting participants. More generally, there is a lack of data at all levels of CMS activities. Understanding if and where problems exist and identifying practical solutions require data about the circumstances of the mathematical community. In this article, we would like to highlight various reasons why collecting data is essential to fulfill the CMS mandate and to support the mathematical community:

1. We can measure our position relative to the national (funding agency) mandate;
2. We can measure the extent to which the CMS meets its own mandate;
3. We can identify biases in how the CMS characterizes excellence, and specifically how it recognizes the outstanding contributions of its membership and community;
4. We can start to assess whether the mathematical spaces we support are welcoming and safe for all participants.

One of the first tools that the EDI-Committee is building to start understanding some of these questions is a **nation-wide survey**.

1. **We need data to measure our position relative to that of the national (funding agency) mandate.**

During the November 2017 Gender Summit in Montreal, Dr. Mona Nemer, Chief Science Advisor of Canada, stated that “increasing the number and impact of women and other members of underrepresented groups in STEM requires the concerted efforts of our entire society—including governments, scientific organizations, research granting agencies, and educational institutions”.

Dr. Nemer also added that “using the same thinking and approaches—including criteria, metrics, policies and procedures for hiring and recognition at all levels—will not lead to change.” [2]

NSERC’s need to initiate change arose, in part, from a 2006 Settlement Agreement with the Canadian Human Rights Commission. The settlement ad-

ressed a complaint concerning the underrepresentation of individuals from four designated protected groups in the Canada Research Chairs (CRC) Program. The four groups were comprised of (women, Indigenous peoples, persons with disabilities and members of visible minorities). With successive addendums until 2019[3], the Federal Court has required the government to implement targets and to use data to set and enforce said targets. The CRC program is required to achieve the following representation rates by 2029[4]:

Women	Visible Minorities	People with Disabilities	Indigenous
50.9%	22%	7.5%	4.9%

The program now has public accountability and transparency requirements as well as penalties in the event of non-compliance[5]. As of October 2021, the Representation of members of the above four designated groups among the NSERC's CRC[6] was:

Women	Visible Minorities	People with Disabilities	Indigenous
30.2%	26.2%	5.3%	0.8%

Completing the self-identification questionnaire is mandatory; however, all questions provide an option to select "I prefer not to answer". Understanding why collecting this data is important and how it informs EDI initiatives is clearly communicated by NSERC[7][8]. In 2018, a relatively low rate of 5.7% "I prefer not to answer" shows that applicants understand and are willing to provide self-identification information[9]. Since then, the CRCC self-identification questionnaire was revised in 2020 as the 2019 Addendum required revisions to collect data regarding LGBTQ2+ communities. Considering the fundamental partnership between granting agencies and mathematicians, one expects the CMS to have a vested interest in upholding these commitments. While it is in a privileged position to monitor the status of underrepresented groups in mathematics, the CMS does not yet appear to collect any data. Thus, it is difficult to have an accurate picture of the situation. In the meantime, with information readily available, such as participant lists, one can make estimates concerning women as it is a category one can identify with a marginal error.

2. We need data to measure the extent to which the CMS meets its own mandate.

Over the last thirty years, the majority of the Canadian population has been female[10]. Over 40% of graduates in mathematics and related studies are women at both the Bachelor and Master level. This rate drops to about 30% at the PhD level (2019 Stats Canada[11] and 2021 NSF[12] reports). We are giving here a first account of the participation of women in the various CMS activities during the past year. These numbers are not official ones and should not be referred to as they have been compiled based only on the information found on the CMS websites.

CMS Boards	Women
Board of governors [13]	37%
Editorial boards [14]	24%
Canadian Journal of Mathematics	25%
Canadian Mathematical Bulletin	47%
Crux Mathematicorum	
CMS Winter meeting 2021 [15]	
Participants	32%
Speakers	35%
Organizers of a scientific session	49%

While these participation numbers align with the rate of PhD's in mathematics, a closer study of the participation numbers at the last CMS meeting reveals some discrepancies in the representation of women depending on the scientific sessions. For example, none of the 8 education, EDI, and Indigenization themed sessions had less than a 20% female speaker rate, and only one had below 30%. On the other hand, among the other 24 scientific sessions, there were 2 below 10%, 8 below 20%, and 12 below 30%. In the context of an online conference, these numbers can be considered disappointing as the pool of potential speakers is less restricted by geography, financial means, or logistics, such as parental duties. More systematic data collection would allow us to clarify the situation and better assess the need for specific policies in the organizer handbook.

3. We require data to identify biases in how the CMS characterizes excellence.

The following table summarizes data collected from the CRCC report[16].

	Women	Visible Minorities	People with Disabilities	Indigenous
Canada Graduate Scholarships–Master's	62%	20.1%	4.4%	2.3%
NSERC Postgraduate Scholarships	41.6%	27.8%	3.4%	1.8%
NSERC Postdoctoral Fellowships	42.4%	41.6%	-	-
NSERC Discovery Grants	23.9%	23.0%	1.4%	0.6%
Canada Research Chairs	38.6%	21.4%	5.5%	3.2%

Note that the CGSM and the CRC's numbers are for the Tri-Agencies.

In addition, a rapid assessment of the Chairholders database^[17] indicates that roughly 21% of CRC's in mathematics are held by women.

The following table presents the frequency of some Canadian awards for women in mathematics since their inception, and its evolution over the past 10 years. The numbers below are not official ones and should not be referred to as they have been compiled based only on the information found on the CMS Awards website^[18].

Awards	Women (since beginning)	Women (since 2012)
Fellowship of the CMS ^[19] (since 2018)	11.8%	11.8%
David Borwein Distinguished Career Award ^[20] (since 2006)	0%	0%
Graham Wright Award for Distinguished Service ^[21] (since 1995)	10.3%	20%
Adrien Pouliot Award ^[22] (since 1995)	14.3%	20%
Excellence in Teaching Award ^[23] (since 2004)	16.7%	20%
Coxeter James Prize ^[24] (since 1978)	4.5%	0%
Jeffery-Williams Prize ^[25] (since 1968)	1.9%	0%
CMS Blair Spearman Doctoral Prize ^[26] (since 1997)	7.7%	0%
G. de B. Robinson Award ^[27] (since 1995)	15.4%	27.3%
CRM-Fields/CRM-Fields-PIMS Prize ^[28] (since 1995)	7.4%	10%

The CMS fellowship was created in 2018 to acknowledge "contributions to the profession and to the Canadian mathematical community" and "to support the advancement of mathematicians to leadership positions within their own organisations and the broader society". We note a significant discrepancy between the rate of women recognized via this fellowship and the rate of women contributing to the CMS board of governors or to the organization of sessions at the CMS meetings.

We note that during the past 10 years, the rate of awards recognizing excellence in mathematics has not increased in half the awards or prizes, namely the David Borwein Distinguished Career Award, the Coxeter James Prize, the Jeffery-Williams Prize, and the CMS Blair Spearman Doctoral Prize. In addition, none of them has been awarded to a woman in the past 10 years.

Even though 30% of math PhD graduates and 42.4% of NSERC PDF recipients are women (among whom a positive proportion of mathematicians), none of them was recognized with a Blair Spearman Doctoral Prize.

In the end, all the numbers are below 21% which is roughly the proportion of women CRCs in mathematics.

The table does not show the Krieger-Nelson prize which has specifically targeted female mathematicians since 1995. We note that this award does not seem to have leveraged the profile of its recipients the way other CMS prizes do have: many recipients have received several awards while only one Krieger-Nelson prize recipient received another Canadian award.

Finally, we note that the CMS does not have any other form of celebration for the contributions to mathematics from other underrepresented groups in the discipline.^[29] There is also no explicit mention of contributions to EDI taken into consideration in the selection of the recipients.

As universities and NSERC have made commitments to rectify biases against underrepresented groups, we are left wondering how they reconcile

with using the CMS accolades in the evaluation or promotion process.

The following table looks at the representation of women among the ICM speakers^[30] affiliated with Canada, in comparison to those affiliated with France and the United States of America. The choice of these two countries is justified by being Fields Medalist leaders together with Canada's main research partner countries.

Country	Women (from beginning)	Women (since 2010)
Canada (since 1912)	1/46 = 2.18%	1/12 = 8.32%
France (since 1897)	33/387 = 9.04%	14/55 = 25.45%
United States (since 1900)	50/727 = 6.88%	17/106 = 16.04%

Canadian representation at the ICM has been subject to gender imbalance, far more than have France and the USA. We note one Canadian female speaker at the ICM since 1912. This number can grow to 3 by allowing consideration of dual citizenships.

The next International Congress of Mathematicians will take place this summer in Saint Petersburg, Russia. Because of Russia's list of human rights abuses (political prisoners include a student mathematician, repression of opponents, including students and faculty, discrimination of LGBT people, etc), mathematicians around the world have called for a boycott^[31] of the event. At the very least, the CMS will need to publicly acknowledge these valid concerns raised by the mathematical community about the situation in Russia in relation to ICM 2022.

4. We need data to assess whether mathematical spaces are welcoming, and safe for all participants.

According to a 2019 Statistics Canada survey on students' experiences of discrimination based on gender, gender identity or sexual orientation at post-secondary schools^[32], 20% of women students experienced discrimination, versus 13% of their male colleagues. Discrimination was also more common for LGBTQ+ students who reported twice the rate of heterosexual students, at 31% versus 15%.

There is testimonial evidence that math students and math conference participants have upsetting or distressing experiences. However, there is limited quantitative data available in the context of the CMS formalized. In November 2018, the CMS officialised its Code of Conduct^[33] and included it in the registration process for its meetings as of December 2021. It is however not clear whether the code has any real substance, as the number of incidents is not recorded. Data about STEM more generally indicates a need for action. To understand if any initiative to make math spaces more welcoming and more safe can be effective, we will need to collect data specific to our community.

Conclusion

There is limited information regarding the status of underrepresented groups in the Canadian mathematical community. The current information gathered shows clear disparity between the rate of participation and the rate of recognition for women in mathematics. We can only assume a similar phenomenon is happening for other equity seeking groups. Only the regular collection of self-identification data will allow us to monitor the diversity of participants and to design new measures that achieve greater equity, diversity, and inclusion. Currently, our Society seems behind common practices that our funding agencies, our universities, and our international partners have already put in place to partially compensate biases against underrepresented groups.

This year, the CMS is launching an inaugural EDI survey to get an overview of the diversity of Canadian mathematicians and to understand the experience of underrepresented groups in mathematical spaces. The relevance of this survey depends on a large buy-in, so we hope you will participate and will encourage all of your mathematical contacts to do so as well.

Notes

[1] CMS Terms of Reference Standing Committees and Editorial Boards.
<https://www2.cms.math.ca/Docs/Terms/terms2020-07.pdf>

[2] Speech of Dr. Mona Nemer, Chief Science Advisor of Canada, at the Gender Summit, Montréal, Québec (November 7, 2017).
https://www.ic.gc.ca/eic/site/063.nsf/eng/h_97755.html

[3] 2019 Addendum to the 2006 Canadian Human Rights Settlement Agreement.
https://www.chairs-chaire.gc.ca/program-programme/equity-equite/2019_addendum-eng.aspx

[4] Table 10, Canada Research Chairs Program Statistics.
https://www.chairs-chaire.gc.ca/about_us-a_notre_sujet/statistics-statistiques-eng.aspx

[5] Canada Research Chairs Administration Guide
https://www.chairs-chaire.gc.ca/program-programme/admin_guide-eng.aspx#consequences

- [6] Table 4, Canada Research Chairs Program Statistics:
https://www.chairs-chaire.gc.ca/about_us-a_notre_sujet/statistics-statistiques-eng.aspx
- [7] Self-identification data collection in support of EDI.
https://www.ic.gc.ca/eic/site/063.nsf/eng/h_97615.html
- [8] NSERC Framework on Equity, Diversity and Inclusion.
https://www.nserc-crsng.gc.ca/NSERC-CRSNG/EDI-EDI/framework_cadre-de-reference_eng.asp
- [9] Canada Research Coordinating Committee 2018-19 Progress Report: Strengthening Canadian Research.
<https://www.canada.ca/en/research-coordinating-committee/services/publications/progress-reports/2018-2019/annex-1-self-identification-data-collection.html>
- [10] Female population – Stats Canada.
<https://www150.statcan.gc.ca/n1/pub/89-503-x/2010001/article/11475-eng.htm#a2>
- [11] Persistence and Representation of Women in STEM programs – Stats Canada.
<https://www150.statcan.gc.ca/n1/pub/75-006-x/2019001/article/00006-eng.html>
- [12] Women, Minorities, and Persons with Disabilities in Science and Engineering – NSF report:
<https://nces.nsf.gov/pubs/nf21321/report/field-of-degree-women#mathematics-and-statistics>
- [13] <https://cms.math.ca/about-the-cms/governance/>
- [14] <https://cms.math.ca/publications/>
- [15] <https://winter21.cms.math.ca/>
- [16] Canada Research Coordinating Committee 2020-2021 progress report.
<https://www.canada.ca/en/research-coordinating-committee/services/publications/progress-reports/2020-2021.html>
- [17] NSERC's Awards Database
https://www.nserc-crsng.gc.ca/ase-oro/index_eng.asp
- [18] <https://cms.math.ca/awards/>
- [19] "For excellent contributions to mathematical research, teaching, or exposition; as well as having distinguished themselves in service to Canada's mathematical community."
- [20] "To recognize individuals who have made exceptional, broad, and continued contributions to Canadian mathematics."
- [21] "To recognize individuals who have made sustained and significant contributions to the Canadian mathematical community and, in particular, to the Canadian Mathematical Society."
- [22] "To recognize individuals or teams of individuals who have made significant and sustained contributions to mathematics education in Canada."
- [23] "To recognize sustained and distinguished contributions in teaching at the post-secondary undergraduate level at a Canadian institution."
- [24] "To recognize young mathematicians who have made outstanding contributions to mathematical research."
- [25] "To recognize mathematicians who have made outstanding contributions to mathematical research."
- [26] "To recognize outstanding performance by a doctoral student who graduated from a Canadian university in the preceding year."
- [27] "To recognize the publication of excellent papers in the CJM and CMB and to encourage the submission of the highest quality papers to these journals."
We count the number of articles (co)-authored.
- [28] <http://www.fields.utoronto.ca/honours-and-fellowships/crm-fields-pims-prize>
- [29] Elbert Frank Cox was the first African American to receive a PhD in mathematics co-supervised by Lloyd Williams, co-founder of the CMS.
<https://cms.math.ca/about-the-cms/inclusive-mathematics/>
- [30] Plenary and Invited Speakers of the International Congress of Mathematicians (ICM)
<https://zenodo.org/record/1976747#YdlyfyxIBpQ>
Speakers with multiple known citizenships are not counted.
- [31] Boycott ICM 2022 in Russia.

<http://www.icm2022boycott.org/>

[32] Students' experiences of discrimination based on gender, gender identity or sexual orientation at postsecondary schools in the Canadian provinces, 2019:

<https://www150.statcan.gc.ca/n1/pub/85-005-x/2020001/article/00001-eng.htm>

[33] CMS Code of Conduct:

<https://cms.math.ca/wp-content/uploads/2020/02/CMS-Code-of-Conduct-Jan-2019.pdf>