



Global distribution and career outcomes of international fellows trained in Canadian gynecologic oncology programs

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ABSTRACT

Objective: We assessed the global distribution and academic, administrative and research outcomes of international fellows (IFs) trained in Canadian gynecologic oncology (GO) programs.

Methods: A web-based survey was sent to IFs who completed GO training in Canada. Using the Web of science database, we identified the publication list, citation record and H-index of IFs and classified them according to their region of practice: high-income countries (HIC), middle income countries (MIC), and low-income countries (LIC).

Results: From 1996 to 2020, 81 IFs from 23 countries were trained in English-speaking (62,9%) and French-speaking Canadian universities (37,1%). Most IFs came from HIC (87,6%) and none from LIC. Only 12 IFs (14,8%) are now practicing in Canada. Of the 55 IFs who completed the survey (response rate: 67,9%), the majority (58,2%) reported working in an academic hospital and 29,1% were holding an executive position in a national scholar organization. IFs participated in mentoring residents (96,4 %) and medical students (83,6%) and 36,3% initiated a GO fellowship program in their home country. 67,3% of IFs were involved in international research collaboration and 52,7% participated in international clinical trials. The mean number of publications (22,36 vs 7,75, $p = 0.007$), citations (369,15 vs 45,12 $p = 0.0006$) and H-Index (6,88 vs 2,37 $p = 0.0001$) were significantly higher among IFs working in HIC compared to those in MIC. Most IFs (98,2%) recommended their Canadian GO fellowship program to a colleague from their home country.

Conclusion: Most IFs trained in Canadian GO fellowship programs returned to their home countries and achieved important milestones in terms of academic, clinical and research accomplishments.

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1. Introduction

Gynecologic cancers have a major impact on women's lives globally, making them a significant public health concern. (Costa and Lai, 2022) Over recent decades, there have been worldwide efforts to enhance the education and training of residents in obstetrics and gynecology, along with specific initiatives to expand access to subspecialty training. (Pyskir et al., 2022; Rayburn et al., 2012) Structured training aims to impart essential knowledge, develop necessary skills, and guide professional behavior. This is increasingly critical in a specialized field like gynecologic oncology (GO) to ensure the delivery of optimal care. (Hoffman et al., 2020).

In many countries, there are little to no subspecialties in obstetrics and gynecology, and GO is not often recognized as a well-defined specialty. (Mutter et al., 2020; Carvalho et al., 2019; Johnston et al., 2017).

Canada was one of the first countries to establish a gynecologic oncology (GO) fellowship program about three decades ago, and the Royal College of Physicians and Surgeons of Canada (RCPSC) has officially recognized GO as a subspecialty since 1989. (De Petrillo et al., 2019).

One of the core missions of The Society of Gynecologic Oncology of Canada (GOC) is to contribute to the training of international graduates in various GO fellowship programs across Canada.

Canadian GO Fellowship programs have traditionally selected foreign-trained physicians meeting the eligibility criteria to be enrolled as international fellows (IFs) for a period of 2 to 3 years and provided ongoing mentorship after they completed their GO training. Through this path, IFs are given the opportunity to observe and practice in high volume centers in Canada, and to rapidly acquire skills and competencies that can be applied in their home settings with continued distance mentorship. IFs also have the opportunity to be involved in clinical and translational research, from the basics of database management and research methodology to the preparation and submission of scientific publications and conference presentations.

The aim of this study was to describe the global distribution of IFs trained in Canadian GO fellowship programs between 1996 and 2020, and to assess their career achievements in terms of academic, administrative and research productivity.

2. Methods

2.1. International fellows' selection process and training requirements

Canadian GO fellowship programs offer training primarily to Canadian doctors and depending on the province and the number of spots available at training centers, IFs' applications are considered.

International candidates are usually selected by Canadian GO fellowship programs based on their curriculum vitae, letters of references and interviews. Secondly, the applicants' international diplomas are verified by the Medical Council of Canada. Finally, local provincial medical authority provides a provisional license to IFs who have been selected for GO training, to practice for the duration of the fellowship.

Funding for the training is generally provided by the fellow's home country, international institutions or by the Canadian fellowship program.

In collaboration with The Society of Gynecologic Oncology of Canada (GOC), an annual formal oral examination is administered to IFs to assess their knowledge and certify their training. At the end of the fellowship and after meeting the training requirements, fellows receive a graduation certificate from their training university. Since 2021, the RCPSC has approved a mechanism for IFs trained in Canada to take the Royal College subspecialty examination and join the Royal College as a Subspecialist Affiliate through the Practice Eligibility Route for the Subspecialty Examination Affiliate Program (PER-SEAP). (<https://www.royalcollege.ca/ca/en/membership/membership-royal-college>). This RCPSC's policy change provides greater legitimacy to IFs allowing them

to be better recognized in their home countries.

IFs wishing to practice in Canada, should usually succeed the Licentiate Medical Council of Canada (LMCC) written exams and in some provinces, they should also go through an adaptation/assessment period that must be validated before they can practice in Canada.

2.2. Study design and setting

We conducted a cross-sectional analysis of the career outcomes of IFs trained at various Canadian GO fellowship programs who completed their training program and received a graduation certificate from their training institution in Canada. Nine academic institutions across Canada offer a GO fellowship accredited by the RCPSC. The distribution of these fellowship programs by province and language is as follows: Quebec (3), Ontario (3), Manitoba (1), Alberta, (1) and British Columbia (1), divided into French-Speaking (2) and English-speaking (7) fellowships. (Fig. 1).

2.3. Participants' recruitment and study procedure

Through contacts with fellowship program directors, each GO fellowship program in Canada provided the list of former IFs from the beginning of their fellowship program until 2020, their countries of origin and their e-mail addresses. Web research was conducted between January and June 2022 to identify the current country of practice of these IFs. A citation query was performed through ISI Web of Science. All publications and citations from each IF were considered. H-index was calculated from the Scopus Elsevier platform for each fellow as an indicator of the number and quality of publications.

A web-based survey (in English and French) was developed on the REDcap platform, consisting of different items grouped in the following domains: general background, clinical activity, academic activity, research and education. The survey questions were designed to obtain pertinent demographic information, assess the current position (academic and administrative) of former IFs, their satisfaction with the GO fellowship training in Canada, their current practice and involvement in GO training, clinical and research activities. After the initial invitation, two reminder emails at four-week intervals were sent to complete the survey (Appendix).

The survey was administered between November 2022 and January 2023, and took approximately 10 min to complete. Participation in the survey was voluntary and anonymous, with no financial incentives.

2.4. Statistical analysis

IFs were classified according to their country of origin or practice into high-income countries (HIC), middle-income countries (MIC) and low-income countries (LIC), per the World Bank classification. Values were reported as percentages for categorical variables and median or means for continuous variables. Comparisons between groups were performed using unpaired Student's *t*-test. P-values < 0.05 were considered statistically significant.

3. Results

3.1. Socio-demographic characteristics

From 1996 to 2020, 81 IFs from 23 countries and 4 continents were trained in Canadian GO fellowship programs. Overall, 42 IFs received GO training in Quebec province (51,8%), followed by Ontario (19; 23.4 %), Alberta (14; 17.2 %), Manitoba (3; 3.7 %) and British Columbia (3; 3.7 %). English and French speaking universities respectively trained 62.9 % and 37.1 % of IFs respectively. (Table 1).

The online survey was sent to all 81 IFs and 55 completed it (response rate: 67.9 %). The median age of responders was 47 years (range 34–62) at the time of survey, and 35 years (range 29–41) at the start of the GO fellowship training in Canada. Two-thirds (66.6 %) of

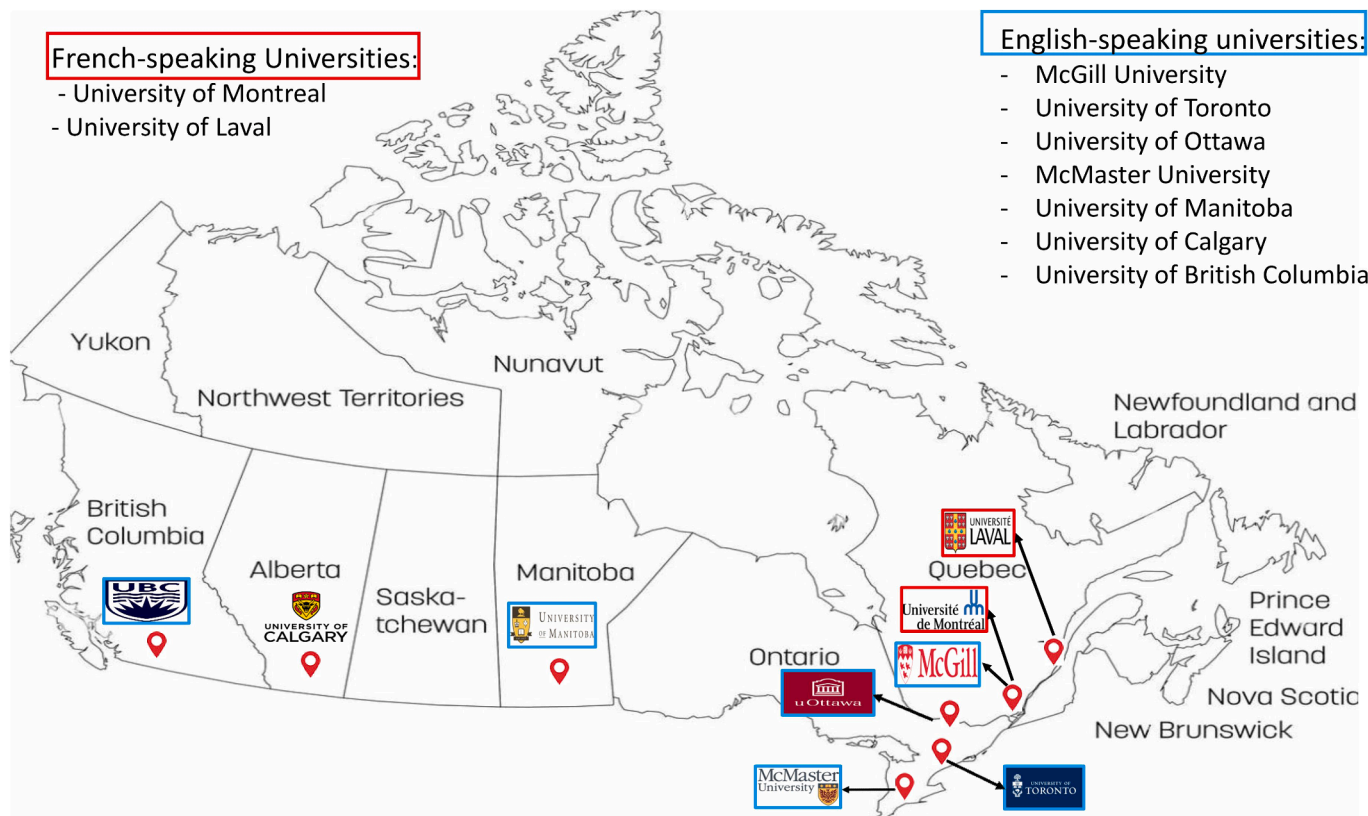


Fig. 1.

Table 1

Characteristics of international fellows enrolled in various GO Fellowship programs in Canada between 1996 and 2020.

Characteristics	N (%)
Fellowship language	
English	51(62,9)
French	30(37,1)
Fellowship province	
Quebec	42(51,8)
Ontario	19(23,4)
Alberta	14(17,2)
Manitoba	3(3,7)
British Columbia	3(3,7)
Fellowship University	
Université de Montréal	21(25,9)
University of Toronto	15(18,5)
University of Calgary	14(17,2)
McGill University	12(14,8)
Université Laval	9(11,1)
University of Ottawa	4(4,9)
University of Manitoba	3(3,7)
University of British Columbia	3(3,7)

responders identified as male and 33.3 % as female. Among the responders, 54,5% completed their GO fellowship in 2 years, while 45,5% completed it in 3 years. Most IFs (61.8 %) had no formal GO fellowship program available in their home countries and GO was not recognised as a sub-specialty in 16.4 % of IF's countries. Before they started the GO fellowship training in Canada, most IFs (76.4 %) were offered a position as a gynecologist oncologist in their home country conditional on the success of their GO fellowship training.

3.2. Geographic distribution

Most IFs trained in Canadian GO programs were from Middle East

(49; 60.5 %) and Europe (17; 21 %). A few came from North America (7; 8.6 %), South America (3; 3.7 %), Africa (3; 3.7 %), and Asia (2; 2.5 %). (Fig. 2). The majority of IFs (87.6 %) originated from HICs, 12.4 % from MICs and none from LICs.

In terms of region of practice, most IFs were working in the Middle East (55 %), North America (22.2 %) and Europe (14.8 %) with few in Africa (2), South America (2) and Asia (2). None of them was practicing in LIC, while 9.9 % were working in MIC and 90.1 % in HIC. Only 12 international fellows (14.8 %) were practicing in Canada, of whom 10 came from a HIC. (Table 2).

3.3. Funding

In our survey, 40,0 % of IFs received funding from their Canadian fellowship program, the second source of funding was international organisations in 36,4 % of cases. Only 13 (23,6 %) IFs received funding from their home country.

3.4. Career outcomes

3.4.1. Clinical activity

At the time of survey, about half (58.2 %) of IFs reported working in an academic setting, while 29.1 % were practicing in a non-academic public hospital and 12.7 % in private practice. In terms of clinical or academic position, 61.8 % reported being attending physicians, 18.2 % were program directors and 14.5 % were professors. Overall, 30.9 % reported prescribing chemotherapy as part of their practice and 8.7 % responded that specialists other than gynecologic oncologists were performing surgeries on patients with gynecologic malignancies in their countries.

3.4.2. Academic and scholarly activity

Membership in national and international cancer societies was

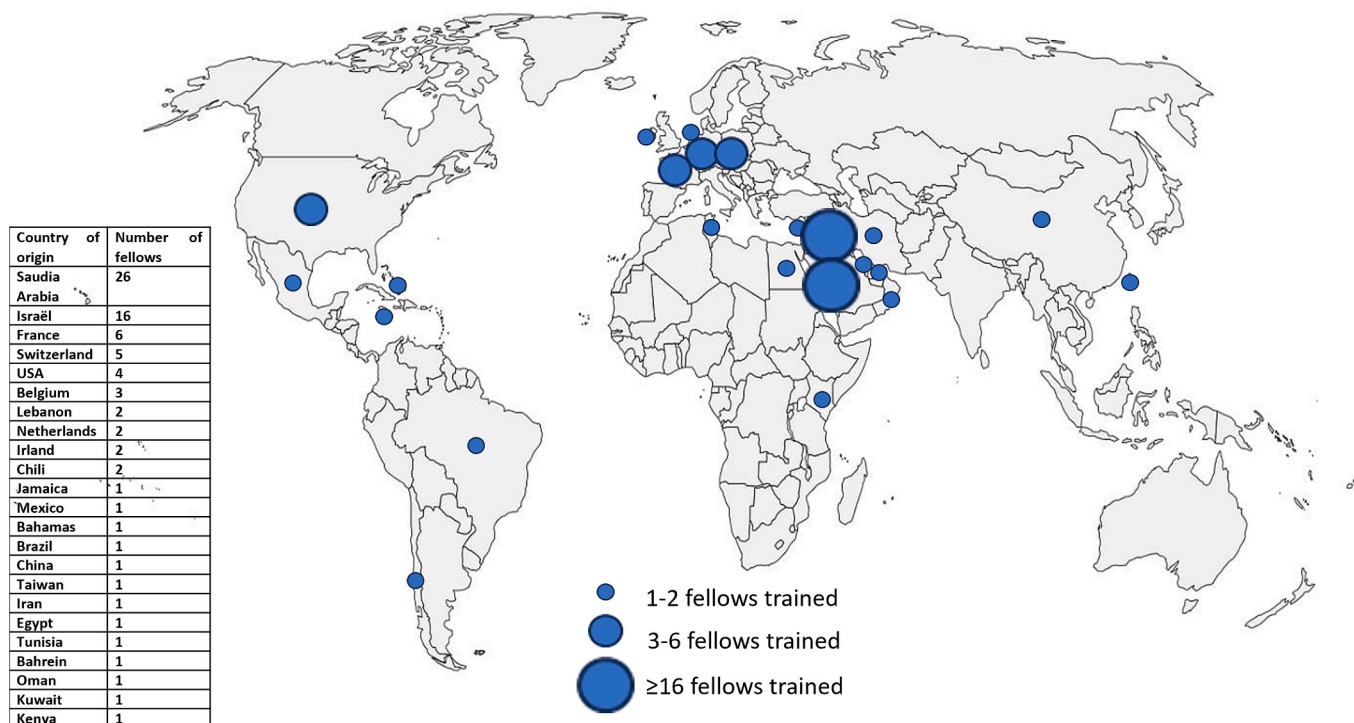


Fig. 2.

Table 2

Geographic Distribution of International Fellows trained in GO fellowship programs in Canada between 1996 and 2020, according to the country/region of practice, and the country/region of origin.

Characteristic	N (%)
Country of Origin, according to the GNI	
LIC	0 (0)
Low-MIC	4 (4,9)
High-MIC	6 (7,4)
HIC	71 (87,6)
Current country of practice, according to the GNI *	
LIC	0(0)
Lower-MIC	3(3,8)
Higher-MIC	5(6,2)
HIC	73(90)
Region of origin	
Middle East	49(60,5)
Europe	17(21)
North America	7(8,6)
South America	3(3,7)
Africa	3(3,7)
Asia	2(2,5)
Current region of practice	
Middle East	45(55,5)
Europe	12(14,8)
North America	18(22,2)
South America	2(2,5)
Africa	2(2,5)
Asia	2(2,5)
Currently working in Canada	
Yes	12(14,8)
No	69(85,2)

LIC: Low Income Country; MIC: Middle Income Country; HIC: High Income Country.

* World Bank country classifications by income level (GNI: Gross national income).

reported by 83.6 % and 85.5 % of IFs, respectively. Overall, 29.1 % of responders reported holding an executive position in a national medical society, 36.4 % served as reviewers in a scientific journal and one IF

reported being a journal editor.

3.4.3. Educational involvement and mentorship

The majority of IFs reported participating actively in mentoring residents (96.4 %), medical students (83.6 %), PhD students (9.1 %) and master research students (20 %). In terms of academic responsibility, 10 % of responders were residency program directors and 10 % were fellowship program directors. Up to 20 former IFs initiated or led a GO fellowship program in their own country.

3.4.4. Research training, collaboration, and productivity

In some Canadian GO fellowship programs, a third additional year of training focusing on research activities was mandatory (University of Toronto), and in other programs it was optional (University of British Columbia, McGill University, McMaster University, University of Montreal).

While the conduct of research projects and their completion was encouraged in all programs, this was not a formal requirement to receive the GO fellowship certificate.

However, most IFs were involved in a scientific research activity during their training, with 90.9 % reporting being co-author of a scientific publication, 65.5 % being selected for an oral presentation and 60 % for a poster presentation at a Canadian meeting. More so, 34.5 % and 50.9% of IFs reported having given an oral and a poster presentation, respectively, at an international scientific conference during their training in Canada. After completing their GO fellowship, most of IFs (67.3 %) were involved in an international research collaboration and 52.7 % participated in an international clinical trial. Nearly half of the responders (49.1 %) were involved in a research program or a scientific publication with their former fellowship program team and 32.7 % with a former co-fellow.

As of June 30, 2022, the mean number of publications for all IFs was 20.84 (range 0–230), with a mean number of citations of 341.4 (range 0–4415) and a mean H-index of 6.18 (range 0–31). No difference in research outcomes was found between IFs trained in English versus French speaking GO programs nor between IFs who were practicing abroad or in Canada. (Table 3) However, the mean number of

Table 3

Scientific productivity of the international fellows trained in GO fellowship programs in Canada between 1996 and 2020.

	Number of publications	p-value	number of citations	p-value	H-index	p-value
Language of the fellowship						
English	21,03	0.96	324,49	0.85	6,62	0.74
French	20,65		358,31		6,10	
Current country of practice						
Canada	18,41	0.66	193,91	0.23	6,25	0.88
Outside Canada	21,33		361,95		6,47	
Current country of practice						
HIC	22,36	0.007	369,15	0.0006	6,88	0.0001
MIC	7,75		45,12		2,37	

Data are presented as mean. Significance at $p < 0.05$.

MIC: Middle Income Country; HIC: High Income Country.

publications (22.36 vs 7.75, $p = 0.007$), the mean number of citations (369.15 vs 45.12, $p = 0.0006$) and the mean H-Index (6.88 vs 2.37, $p = 0.0001$) was significantly higher for IFs working in HICs, compared to those practicing in MICs. (Table 3).

3.4.5. Satisfaction with the training

The vast majority of IFs (98.2 %) recommended their Canadian GO fellowship program to a colleague in their home country and 54.5 % reported having a colleague working in the same country who completed a GO fellowship in Canada upon their recommendation.

4. Discussion

According to recent projections, global cancer incidence is expected to increase by 75 % over the next 20 years, (Bray et al., 2012) and WHO anticipates that the number of deaths from cancer worldwide will rise to over 13.1 million by 2030. (World Health Organization (WHO) Cancer, 2012) A key contribution to curb this alarming burden of cancer globally is the provision of a workforce adequately trained in oncology. (Dunham, 1945) Many studies have also shown that women with gynecologic cancers who are treated by certified gynecologic oncologists tend to live significantly longer with a better quality of life. (Vernooij et al., 2007).

To our knowledge, this is the first study describing the career outcomes of IFs trained in Gynecologic Oncology in North America.

Over the past decades, Canada has played a key role in the formal training of international medical graduates in GO as a sub-specialty. The first IF was enrolled in a GO fellowship training in Canada in 1996, and at total of 81 IFs have been trained in this country between 1996 and 2020.

At the time of the survey, most Canadian trained IFs were holding academic positions, thereby contributing to the training of residents, medical students, graduate and postgraduate students in their home country or country of practice. Twenty IFs started or led a GO fellowship program in their own country, highlighting the role played by Canadian fellowship GO programs in transmitting evidence-based knowledge and in spreading standard-of-care practice and medical education globally. A major advantage of GO training in Canadian institutions is the high-volume of surgical cases, allowing IFs to rapidly develop surgical skills. Accordingly, adequate exposure to surgical mentors during fellowship training has been found to encourage young trainees toward an academic surgical career. (Debas et al., 2005).

Most IFs were involved in scientific research activities during their GO training in Canada, which is critical to establish a culture of research that contributes to IF's career growth. Indeed, participation in research and publication during medical school and residency is associated with pursuing an academic career. (Straus et al., 2006) Furthermore, a survey of GO professors and fellows found that having an established research mentor and protected research time was associated with higher academic productivity. (Cohen et al., 2012) Interestingly, most Canadian-trained IFs were involved in international research collaborations and participated in international clinical trials. This is an important

consideration because scientific research and international collaboration in the field of oncology contributes to the improvement of multi-modality cancer treatment globally. (Bakker et al., 2013).

Scholar activity, in the form of publications in peer-reviewed journals, is a quantitative measure of academic productivity and can be used to assess academic progress. (Jou et al., 2021) A significant difference was found in terms of scientific productivity between IFs working in HICs versus MICs. HICs are home to the majority of cancer-related scientific publications. (Bakker et al., 2013) including in the field of GO, with the United States (41.2 %) and Europe (29.7 %) making up a striking 70.9 % of the world's research production. (Klar et al., 2009) Thus, training more IFs from other regions of the world in GO may contribute to boost scientific productivity in these medically underserved regions.

Cancer incidence and mortality are increasing more rapidly in LMIC compared to HIC. (Bray et al., 2012) It was predicted that 70 % of all new cancers by 2020 would occur in LMIC. (Farmer et al., 2010) The WHO identified that there is a severe shortage of a well-trained workforce in sub-Saharan Africa, which has 24 % of the world's health burden and only 3 % of the World's Health Care workers. (The World Health Report, 2006) Unfortunately, none of IFs trained in Canada originated from LICs and only 12,4% came from MICs. The stringent eligibility criteria and lack of funding mechanisms or scholarships to support the training of IFs from LICs limit their ability to participate in GO training in Canada.

Given the financial and cultural barriers, training specialists from LMICs in HIC settings like Canada might not be the most effective way to adequately develop and maintain an oncology workforce in resource-limited settings. Conversely, training specialists in low-resource settings face multiple challenges, including the need for protected time for other clinical activities, the limited access to best practice guidelines, the lack of a training curriculum tailored to the trainee's work environment, the isolation from trained professionals, and the need to secure support services. (Randall et al., 2021) To overcome these challenges, innovative approaches have been developed. For example, the Central America Gynecologic Oncology Education Program (CONEP) and Health Volunteers Overseas supported by Society of Gynecologic Oncology (SGO) and American Society of Clinical Oncology provide outside mentorship, telemedicine-facilitated tumor boards and on-site surgical training in Central America's countries. (Johnston et al., 2017) Another illustration comes from a group of Canadian gynecologic oncologists who created a teaching module to intensively train locally identified gynecologists to perform radical hysterectomy and pelvic lymphadenectomy in Africa. The curriculum includes didactic modules of preoperative and post-operative care, surgical anatomy and complications. (Elit et al., 2010) Finally, the International Gynecologic Cancer Society (IGCS) Global Curriculum program pairs academic gynecologic oncologists from HIC with experienced clinicians in LMIC to create structured GO fellowships. Launched in 2017, this program included as of 2021, 32 fellows across 12 sites supported by 29 local mentors and 26 international mentors. To date, IGCS Global Curriculum trainees have published 19 articles in

peer-reviewed journals and presented 47 abstracts, including 31 abstracts at international meetings.(Randall et al., 2021).

The GO Canadian fellowships programs achieved their global education goal, as 85 % of trainees returned to their home country to practice. Among those who remained in Canada, some were recruited to help fill Canadian gynecologic oncological positions in academic centers, while others filled new GO positions in uncovered Canadian regions. The fact that most of international fellows IFs (76.4 %) obtained a position in their home country at the end of the training in Canada, with 87.6 % of them coming from HICs, could explain the low rate of IFs settling in Canada to work. Also, IFs who trained in Canadian GO fellowship programs were generally required to show proof of a job offer in their home country before being admitted to the GO training program in Canada. Although this did not guarantee that IFs would return to their home countries, it suggests that Canadian training programs are committed to train IFs so that they can return to their home country to fill the training gaps in their country and address the local needs.

Medical ‘brain drain’, or ‘human capital flight’, in which highly educated and talented individuals from low-resource countries emigrate in search of personal or professional advancement, is a public health challenge in various regions of the world.(Anderson et al., 2007).

Although GO was recognised as a sub-specialty in 84.6 % of IF’s home countries, a national GO fellowship program was only available in 38.2 % of IF’s countries of origin. For instance, GO is an officially recognized subspecialty in 35.2 % (12/34) of European countries with only 60 % of them offering an official accreditation in GO including a formal fellowship program.(Gultekin et al., 2011) In Brazil, one of the largest and most populated country in the world, there is no certified training in GO. Consequently, GO surgeries are performed by surgical oncologists or general gynecologists and systemic therapies are managed by medical oncologists.(Johnston et al., 2017) In our survey, only 37 % of responders reported prescribing chemotherapy as part of their practice. In a survey of European-based clinicians involved in GO practice, 56 % of responders indicated that gynecologic oncologists were allowed to prescribe chemotherapy in their countries (Chiva et al., 2017) and chemotherapy administration was part of the GO training program in 70.5 % of European countries.(Gultekin et al., 2011) While these variations in GO competencies and practices across settings could have an impact on the satisfaction of IFs with their training experience, 98.2 % of responders in our study reported having recommended their Canadian GO fellowship program to a colleague in their home country. Moreover, most IFs valued exposure to all aspects of GO from radical surgeries to chemotherapy administration and supportive care. Accordingly, previous studies have reported high level of fellows’ satisfaction with their training in a variety of programs.(Nousiainen et al., 2012).

5. Conclusion

Most IFs trained in Canadian GO fellowship programs reported a high rate of satisfaction with their training and returned home to act as local leaders in the field of GO as evidenced by their contribution to clinical, education, and research activities. A minority of IFs came from LMIC, questioning the suitability of current traditional fellowship models in HIC in reducing global disparities in GO education and care. The establishment of “in-country training programs” as proposed by the SGO or the IGCS, complemented by distant learning and telementoring programs could be more culturally adapted to LMIC.

CRedit authorship contribution statement

Omar Touhami: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Lara De Guerke:** . **Ly-Ann Teo Fortin:** Writing – review & editing, Writing – original draft, Methodology, Data

curation, Conceptualization. **Justin Foo:** Writing – review & editing, Writing – original draft, Formal analysis, Data curation. **Diane Provencher:** Writing – review & editing, Writing – original draft. **Vanessa Samouelian:** Writing – review & editing, Writing – original draft. **Beatrice Cormier:** Writing – review & editing, Writing – original draft. **Susie Lau:** Writing – review & editing, Writing – original draft. **Shannon Salvador:** Writing – review & editing, Writing – original draft. **Walter Gotlieb:** Writing – review & editing, Writing – original draft. **Lucy Gilbert:** Writing – review & editing, Writing – original draft. **Stephane Laframboise:** Writing – review & editing, Writing – original draft. **Alon D Altman:** Writing – review & editing, Writing – original draft. **Prafull Ghatage:** Writing – review & editing, Writing – original draft. **Harinder Brar:** Writing – review & editing, Writing – original draft. **Janice Kwon:** Writing – review & editing, Writing – original draft. **Tien Le:** Writing – review & editing, Writing – original draft. **Alexandra Sebastianelli:** Writing – review & editing, Writing – original draft. **Joel Fokom Dongue:** Methodology, Data curation, Writing – review & editing, Writing – original draft, Formal analysis. **Marie Plante:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization, Supervision, Project administration.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.gore.2024.101512>.

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