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27 Years of retention outcomes for a nine-university primary health care nurse practitioner program in Ontario, Canada

Alice Ormiston¹, Guillaume Semblat^{1*}, Robyn Gorham², Sandra Carroll³, Maher El-Masri⁴, Jean Daniel Jacob⁵, Kristen Jones-Bonofiglio⁶, Claire Mallette⁷, Christina McMillan Boyles², Debbie Sheppard-LeMoine⁸, Victoria Smye⁹ and Erna Snelgrove-Clarke¹⁰

Abstract

Background In this article we present 27 years of graduate retention outcomes for a nine-university consortium education program for Primary Health Care Nurse Practitioners (NPs) in Ontario, Canada. We assessed graduate retention in terms of whether graduates are or were practicing: 1) as an NP in Ontario; and 2) as an NP in the geographic region of Ontario where they graduated. It also looks at the geographic distribution of graduates retained as NPs in the province and measures the percentage of graduate NPs who were working in rural and remote areas.

Methods The authors mined the Ontario nursing public registry to identify how many graduates were, or had been, registered as an NP in Ontario at any time between 1996 and December 2022. The authors used registry data to identify the agency where these NP graduates were practising in the province, and then used a google map interface to identify what percentage were still practising in the university region where they graduated. The Rurality Index of Ontario (RIO), a tool used to measure the level of rurality of Ontario communities in terms of health care access, was used to assess the percentage of NPs grads practising in rural and remote areas.

Results 86.7% of NP graduates were registered as practising NPs in Ontario at the time of the study, or had been registered as practising at some time in the past, with a range of 84% to 91% across the universities. 48% to 79% of graduates registered as currently practising NPs in Ontario remained in the region where they had graduated. Geographic maps show a broad distribution of graduates both within university regions and across the province. 8.6% to 38.9% of graduates were working in rural or remote areas. Graduates from universities in northern Ontario had the highest percentage practising in rural and remote areas. Graduate NP rural practice rates in both northern and southern regions reflected the rural demographics of their regions.

Conclusions The findings show that the university consortium model supports NP recruitment and retention across the province, including in rural and remote areas.

Trial registration Not applicable.

Keywords Primary health care nurse practitioners, Nurse practitioner retention, Geographic distribution, Health human resources, Rural health, Remote health, Consortium education program, NP employment, Ontario health care, Workforce distribution

*Correspondence:

Guillaume Semblat
gsemb@np-education.ca

Full list of author information is available at the end of the article



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Background

Inequitable distribution of health care workers and inadequate number and mix of providers in rural and remote areas is a key problem for countries worldwide. Addressing this complex problem requires a multi-pronged strategy. One factor often emphasized by researchers and policymakers, as part of a broader strategy, has been the importance of educating health professions students where they live, through distributed models of education [1–5]. In this study we looked at one example of a geographically distributed health professions education program—the nine-university Ontario Primary Health Care Nurse Practitioner (PHCNP) consortium program in Ontario, Canada—in relation to retention rates, geographic distribution, and rate of practise in rural and remote communities for students who graduated between 1996 and 2022 inclusive.

The Nurse Practitioner role in Ontario

The NP role has expanded in scope and importance in North America and some other countries in the face of primary care shortages, increasingly complex health needs, rising health care costs, and with growing evidence of positive patient outcomes [6–13]. The growth of the NP role in Ontario, Canada, is a case in point. The NP role had existed in Canada since the 1970s, but government did not fund NP services, their expanded role was not legislated, and policymakers and physicians did not provide adequate support for the role [14]. Things changed in the 1990s. The Ontario New Democratic Party, which held a majority government from 1990 to 1995, sought to focus on community-based health care delivery, with an emphasis on health promotion, disease prevention, and reducing health system inequities. At the same time, there were rising pressures on the health care system, increasing health care costs, and a widespread focus on government fiscal restraint in the face of large public deficits. NPs were seen as part of the solution, being less expensive than physicians, able to practise more independently than Registered Nurses (RNs), and able to fill gaps in the system by providing health care in underprivileged and underserved communities, including in rural and remote locations [15]. Hence the government engaged in a broader NP strategy to fund education and formally legislate an extended scope of practise.

Three decades later, NPs in Ontario represent 25% of the primary health care workforce [16]. They are experienced Registered Nurses with advanced education (currently at a master's degree level) and have the authority to independently assess patients, order tests (including computerized tomography [CT] scans, Magnetic Resonance Images (MRIs), Xrays, and ultrasounds), diagnose, prescribe medications including controlled drugs and

substances, refer to specialists, admit and discharge from hospitals, and certify death [17]. The Ontario government, governments in other Canadian provinces, and health care agencies have increasingly seen NPs as a key to addressing the dramatic health professional shortages in the country, particularly the shortages in primary care physicians. This is evidenced by the Ontario expansions in the NP legislated scope of practise noted above, growth in funded NP education spaces, and growing numbers of NP employment positions and funding approaches more generally [18].

As of Jan. 1, 2025, 5,435 Nurse Practitioners were registered in Ontario, most of whom are educated in the primary health care field, and a smaller number in acute care specialties as outlined in the figure below [19] (Fig 1).

A university consortium approach to primary health care nurse practitioner education in Ontario

When the Ontario government sought to expand the NP role in the 1990s, they tasked provincial university nursing education leaders with identifying an education model for Primary Health Care NPs. Given the vast geographic area of Ontario, the significant rural and remote population, the shortage of PhD educated NPs, and the government mandate to provide health care in French for Francophone communities, educators came together and recommended a ten-university consortium model.

The unique geography and character of Ontario can help to shed light on the relevance of this consortium approach. As the second largest province in Canada, after Quebec, Ontario is larger in land mass than France and Spain combined. Most of the over 16 million Ontarians reside in the southern 20% of the province, with approximately 800,000 in the north. At the same time, northern Ontario represents nearly 80% of Ontario's landmass, with a population density of less than one person per square km. In the north and south of Ontario, there are many rural communities often far from major centres. Ontario is also characterized by the second largest Francophone population in Canada outside Quebec (over 600,000), with concentrations in communities in the eastern, northeastern, and central regions, and the government has commitments to providing French language services in these regions under the *French Language Services Act* [20].

A consortium model provides program access and clinical placements to NP candidates within their geographic region including in rural and remote areas, supports consistency in educational standards and learning outcomes across the province while adapting to regional needs, and through the two French university partners, provides health services in French for Franco-Ontarians. The

NP Specialties	Number of Registrants
Primary Health Care only	4,309
Adult only	810
Paediatrics only	286
Multiple Specialties	30
Total RN Extended (NP) Registrants	5,435

Fig. 1 Number of Nurse Practitioners Registered in Ontario by Specialty. Source: College of Nurses of Ontario

consortium model also enables the harnessing of Master’s and PhD educated NP faculty and resources from across the province to create and support a common curriculum in all locations. In this way the consortium has made the NP education viable in all regions of the province.

The consortium approach was accepted and funded by the provincial government and implemented in 1995 by the universities as a one-year, post-baccalaureate program for clinically experienced practising RNs who also met specified academic standards [21]. Program leaders evolved the model over time so that it includes the following features: a common distance education curriculum developed by provincial faculty; infrastructure and technical management and support from provincial distance education staff; university-specific on-site seminars and labs facilitated by regional faculty; regionally organized clinical placements; university-specific admissions processes that followed provincial admissions standards [21]; and a provincial governance board and curriculum committee supported by provincial staff.

Admissions to the program have also grown, at government’s request and with additional funding, from an initial intake of 70 students to a current annual intake of 330. This growth, and the growth in NP scope of practise, have come in conjunction with a crisis in patient access to primary care in Ontario and across Canada [22]. Expansion has also been supported by proven NP patient outcomes, including patient satisfaction [23–30].

Due to the expansion of NP practise scope and the increased complexity of the NP role, Ontario NP education leaders in the late 2000s, in alignment with the provincial nursing regulator, increased the education level from a one-year, post-baccalaureate certificate to a larger

two-year master’s degree in nursing. Program courses were adapted to reflect the master’s degree level, and universities also offered required master’s courses to help address the additional research and leadership competencies needed by NPs.

As of 2025, the Ontario Primary Health Care NP program (PHCNP) remains a nine-university consortium model, with one university having withdrawn in the early years. PHCNP educational leaders and the Ontario government remain committed to the program’s consortium approach, and Ontario continues to rely on NPs to address primary and acute care needs.

Methods

In 2023, the PHCNP consortium Board of Directors decided to conduct a retention study of graduates since program inception, going back to 1996 when the program had its first cohort of graduates. Given that the nine-university consortium program was designed to help meet primary health care needs across the vast geography of the province, including in rural, remote and Franco-phone regions, we were interested in collecting data on the extent to which PHCNP graduates were recruited and retained in these areas. Retention was defined as NPs who were registered as practising NPs with the Ontario nursing regulatory body, or who had been registered as practising NPs at some point in the past. Based on our aims for the study, we identified four separate research questions:

1. What percentage of PHCNP graduates were registered, or had been registered in the past, as practising NPs in Ontario within the period between 1996

and December 2022, including for graduates of the Francophone version of the program? (This question addresses retention of program graduates as NPs in the province of Ontario)

2. Of graduates who stayed in Ontario and were currently registered as practising NPs as of Dec. 2022, what percentage were practising in the university region where they graduated, including for graduates of the Francophone program? (This question addresses retention in the university region where they graduated)
3. What is the geographic distribution of practicing NP graduates for each region’s graduates, including for graduates of the Francophone program?
4. What percentage of NP graduates were registered as practising NPs in rural or remote communities, including for graduates of the Francophone program?

Method for determining retention of NP graduates in Ontario

From 1996 to the end of 2022, when the data for our NP graduates was accessed, nearly 3000 students had graduated successfully from the PHCNP consortium program. PHCNP Program staff had been tracking NP students and graduates through a central program database. This database contained the name of each of these graduates, the university site where they had studied, whether they were in the French or English version of the program, and which year they had graduated.

To see whether these graduates were practising as an NP in Ontario, we used “Find A Nurse,” [31] the open-access database of the Ontario College of Nurses (CNO), (the provincial nursing regulator). This database is accessible to all members of the public and shows all categories of nurses in the province, including NPs. For members registered as of December 2022, the registry also shows location of practise. We entered all PHCNP graduate names into the “Find A Nurse” Registry in December 2022 to identify, at that moment in time, how many of them were registered as NPs in Ontario or had been registered as NPs in the past. Significant cleanup of the data was done to address name

misspellings, changes of name due to marital status, and French spellings. The data we collected represents the reality of registration status and location as of December 2022, and any subsequent changes to registration status or location are not captured in the study.

Based on this cross referencing of graduate names with the nursing regulator’s open-access database, and the additional information we were able to access from the latter, each NP graduate was categorized into the following:

1. The consortium university from which they had graduated as an NP;
2. Whether they were registered as a practising NP in Ontario, or had been so registered in the past, or whether they had another registration status such as Registered Nurse (RN); and
3. Their location(s) of practise, for those who were registered as currently practising NPs. Each graduate was then sorted into one of the following categories as shown in Figure 2:

Nurse Practitioners have their own registration category with the College of Nurses of Ontario (CNO) as “RN Extended Class.” and thus show up as distinct from Registered Nurses (RNs) in the General class. Furthermore, to show up as an NP, the individual would have to show evidence of recent clinical practise as an NP each year. As will be seen below, most NPs who graduated from the program showed up as currently practicing NPs in Ontario or as having practised as an NP in the past in Ontario. Given the 27-year period of the retention study, we found that many NP graduates had a long career as an NP and then presumably retired or left the profession for another reason. A small percentage never registered as NPs but maintained their registration or had maintained their registration in the RN class. Some had no history of registration in the province and may have left the profession or gone elsewhere. *Each* PHCNP graduate was accounted for in one of the above categories.

This data enabled us to answer our first question—What percentage of PHCNP graduates contributed to the province as practicing NPs at some point within the period 1996 through Dec. 2022?

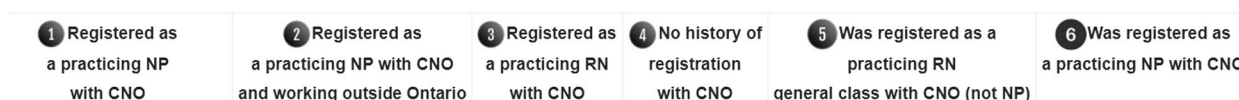


Fig. 2 Categories of PHCNP Program Graduates. Source: CNO, PHCNP database created for this study

Method for determining retention of NP graduates in the region where they studied

To answer our second question, what percentage of PHCNP graduates were retained in the region of the university from which they graduated, we looked at the employment or workplace location of *currently practising NP graduates in Ontario as of Dec. 2022*, and mapped this location in relation to the university region from which they graduated. It should be noted that the nursing registry did not maintain the location of registration for NPs who had practised in the past and who were no longer registered as NPs as of Dec. 2022. Therefore, the data for this second question was limited to NPs who were registered as practising as of Dec. 2022. The boundaries of each university region were determined based on the university’s “catchment area” for NP students’ clinical placements, as shown in Fig. 3. White dots on the figure represent the location of the nine universities. Two universities in the Greater Toronto

Area (GTA) share a regional map, and so there are eight regions in total.

These boundaries were set by PHCNP program leaders historically, and each university works with health agencies in their region to create clinical placement learning opportunities for the NP students. Students complete their placements within their university’s region, with minor exceptions.

Using a google map Application Programming Interface (API), the employment or workplace location of each NP graduate was identified on the map using the latitude and longitude of the workplace. The catchment boundaries were then added to the map to show the workplace location relative to the university region. Locations of graduate practise were identified as either “inside” or “outside” the region. This enabled us to answer our second research question—how many practicing NP graduates in Ontario were working in the region of the university from where they graduated at the end of 2022, and how many were working outside the region but still in Ontario?

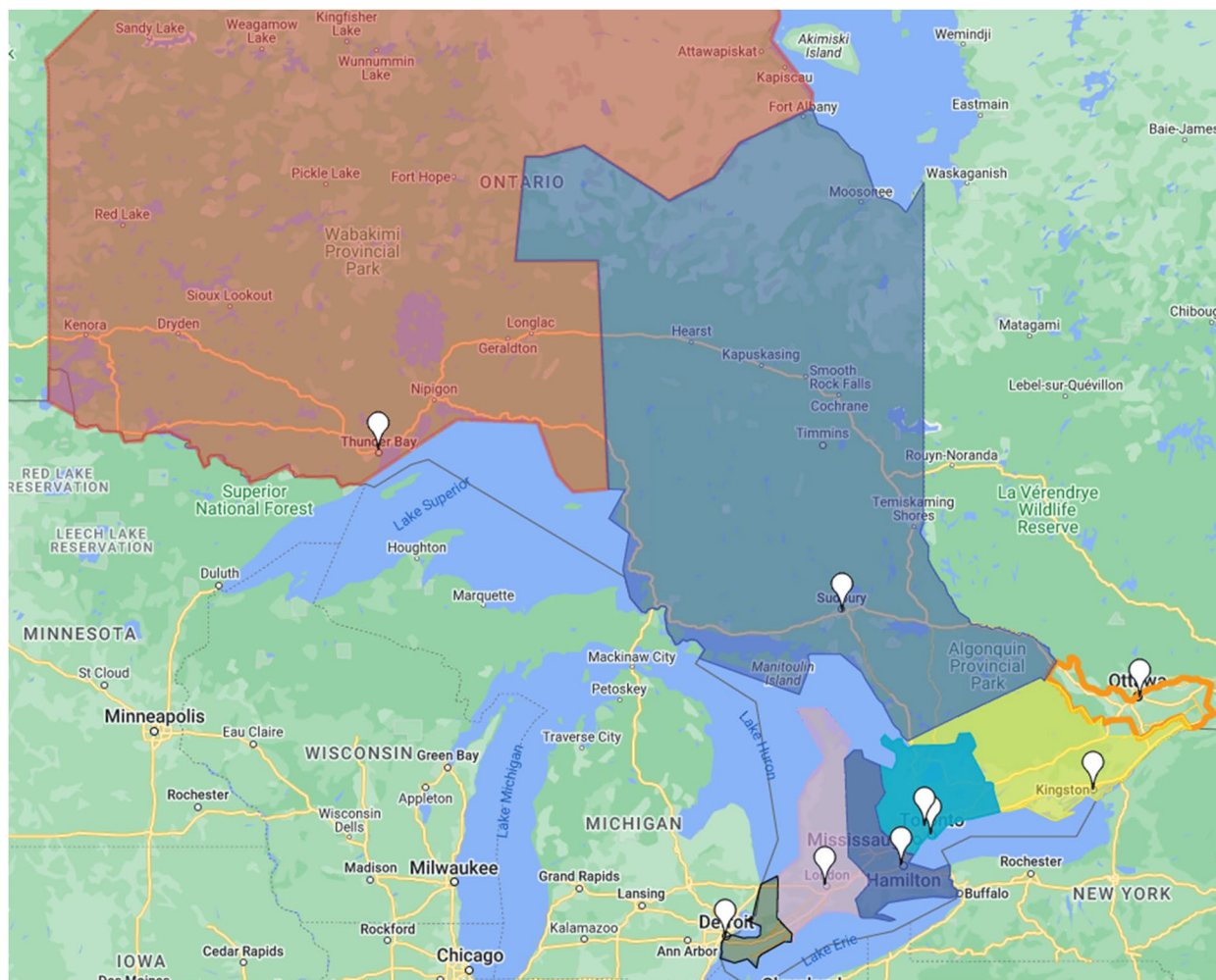


Fig. 3 Consortium University Regions in Ontario. Source: PHCNP Program

Method for determining geographic distribution of NP graduates

The third research question—“what is the geographic distribution of practicing NPs for each region’s graduates?”—was answered visually with an interactive version of the API google map which shows the practise location of graduates from each university and for Ontario as a whole. These maps give a visual representation of the distribution, to see how much spread there is across a region, how clustered the NP graduates may be in particular areas, and the distribution outside the region in an adjacent or further region. The map also indicates where more than one NP is working in an agency.

Method for determining percentage of NP graduates working in rural or remote areas

The fourth research question—what percentage of NP graduates were working in rural or remote areas at the end of 2022—was assessed using the “[Rurality Index of Ontario \(RIO\)](#)” tool developed by the Ontario Medical Association in 2008 to measure the level of rurality for different communities across Ontario in relation to health care access [32]. The RIO is an accepted policy tool used by the Ontario government for various funding incentives for practitioners in northern and “very rural” locations [33]. While the RIO tool was developed for physicians, it has been used by the government for incentive programs for other providers including tuition support for NPs.

The RIO is useful not only because it captures levels of access to health care. It also shows degrees or levels of rurality, from moderately rural to very remote communities, and so provides the opportunity to measure the ranges of rurality where our graduates were practising as of Dec. 2022.

Most locations in Ontario have been assessed in terms of the Rurality Index of Ontario and assigned a numeric score from 0 to 100 (with 100 being the most remote and ‘0’ being the most urban). A community is assigned a rurality number based on three factors:

- Population (count and density)
- Travel time to a basic referral centre
- Travel time to an advanced referral centre

We used the Ontario Medical Association RIO Lookup tool [34] to identify the RIO number for the communities where our graduates were working as of Dec. 2022. We then calculated the percentage of those graduates who were practicing in a community with an RIO code of 20 or above and broke this down further to show the percentage of NP graduates according to differing levels of rurality.

The RIO cutoff of 20 excluded urban areas across Ontario except Sault Ste. Marie (RIO of 24) and Timmins (RIO of 29), both smaller cities in the northeastern region with populations of well under 100,000, and both approximately 3.5 hours’ drive from Laurentian University in Sudbury. PHCNP program administrators have used an RIO cutoff of 20 to determine which students qualify for clinical placement travel subsidies to rural areas, as part of their mandate to promote distributed health care within the regions. As well, we deemed the Ontario government use of an RIO code of 40 for many of their incentive programs for health providers in rural and remote areas as too restrictive for our purpose. Our research question was broader in wanting to capture the percentage of NP graduates practising in rural areas more generally, not just in communities that qualify for government incentive programs. For these reasons we set a cutoff of 20 to define rural.

We also compared the percentages of NP graduates practising in rural areas in our study against Statistics Canada percentages of Ontarians living in rural areas in the north and south of Ontario, to see if the percentage of NPs in rural practise reflected the population percentage. While Statistics Canada uses a different definition of rural, based on population size and proximity to a “population centre,” their data offered some basis for comparison.

Results

This section presents the findings of the study, including: 1) the retention rates of PHCNP graduates in Ontario as of Dec. 2022; 2) other pathways PHCNP graduates had taken; 3) retention rates for PHCNP graduates within the region where they studied as of Dec. 2022; 4) geographic visuals of the distribution of PHCNP graduates from each university and for the province as a whole who were practising as of Dec. 2022; and 5) percentage of PHCNP graduates practising in rural or remote communities as of Dec. 2022.

PHCNP graduate retention in Ontario

The table below shows the retention of PHCNP graduates in Ontario as practising NPs from 1996 through 2022 inclusive, broken down by university and for the province as a whole. Retention is defined as having been registered as a practising NP at the time of the study or having been registered as a practising NP at some time in the past. The aim of this section is to show what percentage of graduates from the consortium program have gone on to contribute to the Ontario health workforce by practising as NPs, versus taking other potential pathways such as leaving the province to work elsewhere or remaining practising as an RN versus an NP Table 1.

Table 1 PHCNP graduate retention in Ontario (as of Dec. 2022)

University	# Reg'd as Practising Ontario NP	% Reg'd as Practising Ontario NP	# Previously Registered as a Practising Ontario NP	% Previously Registered as a Practising Ontario NP	% of All Graduates Contributing/Having Contributed to the Ontario NP Workforce
Lakehead	168	71.8%	38	15.2%	88%
Laurentian (French and English graduates combined)	275	76.4%	39	10.8%	87.2%
Laurentian (French program graduates only)	45	69.2%	6	9.2%	78.4%
McMaster	288	77.8%	46	12.4%	90.2%
Ottawa (French and English program graduates combined)	274	68.2%	64	15.9%	84.1%
Ottawa (French program graduates only)	78	61.4%	21	16.5%	77.9%
Queen's	189	70%	38	14.1%	84.1%
Toronto Metropolitan	370	79%	55	11.8%	90.8%
Western	260	75.8%	31	9%	84.8%
Windsor	213	74%	33	11.5%	85.5%
York	239	77.9%	35	11.4%	89.3%
Average	2276	78.1%	251	8.6%	86.7%

College of Nurses of Ontario

Overall, the PHCNP Consortium universities had a consistently high percentage of graduates remaining within the province and practicing as NPs, with a range of 78% to 90.8% for all regions. French program graduates had slightly lower retention rates than English program graduates.

Other pathways for PHCNP graduates

Those who had not practised as an NP in Ontario were identified in one of the following categories: 1. Practised exclusively as a Registered Nurse after graduation; 2. No History of NP or RN Registration in Ontario; and 3. Registered as a Practising NP in Ontario but Working Outside Ontario. These numbers were quite small and are reported in detail in the [Appendix](#) section of this article.

Graduate retention within region

There was variation across the province in terms of the percentage of those PHCNP graduates who stayed in the region where they graduated. Figure 4 reflects the percentages of those who continued to practise inside their university region and those who practised in Ontario but outside their home university region. As mentioned above, the regulatory body does not maintain employment locations for graduates who had practised as an NP in the past but were no longer registered as a practising NP. Consequently, we could only track employment or practise locations for NP graduates who were registered as practising NPs as of Dec. 2022.

The green parts of the graph represent the percentage of practicing NP graduates who were working as an NP within the region of their home university as of Dec. 2022. The blue represents those who were working outside their home university region as an NP but still in Ontario. Northern regions, where Lakehead and Laurentian universities are situated, have much smaller populations than in the south and a vaster land mass. They also had higher retention rates within their regions (72% and 66% respectively) compared to most of the southern regions. This shows the importance of the distributed consortium model in educating providers from the North, for the North. The Greater Toronto Area (GTA) has by far the highest number of NP positions and growth in NP positions year over year. The retention rates within region for the GTA universities—York and Toronto Metropolitan—were correspondingly high, at 79% and 78% respectively. As we will see in the next section, the GTA also attracts many graduates from other regions in the province, likely due to the availability of jobs there, highlighting the importance of employment opportunity as a factor in recruitment and retention. University of Windsor, Ontario, in the furthest southwest corner of the province, also had higher in-region retention at 71%. Further study is needed to understand the variability in the retention rates across regions, and the lower in-region retention rates for graduates of McMaster, Queen's, and Western in particular. The proximity of these regions to the Greater Toronto Area (GTA) and the greater number of NP positions in the GTA are likely factors.

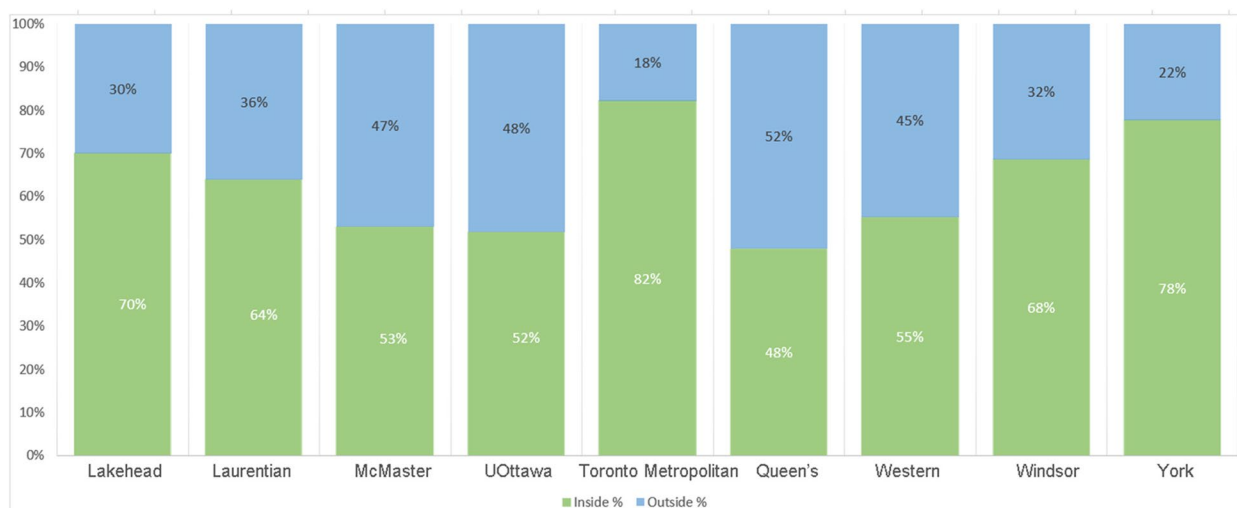


Fig. 4 Percentages of NP Graduates Practicing Inside and Outside Their Home University Region. Source: College of Nurses of Ontario, Google API maps

Graduate retention within region—francophone program

The below figure shows the retention within the region of graduation for NPs who took the Francophone version of the PHCNP program offered at Ottawa and Laurentian universities. The green section of the bar shows those who were practicing as NPs within the region where they graduated as of Dec. 2022, and the blue shows the percentage that are practicing elsewhere in Ontario (Fig. 5).

Further insight into these results can be gleaned from the geographic distribution maps and the rurality of the communities where the graduates are practicing, as outlined below.

Geographic distribution of PHCNP graduates

The geographic distribution of practising NP graduates is shown through the interactive google map interface at the link below, which shows the clinical placement

boundaries of the university regions, and where the graduates of each region were practising as NPs at the end of 2022. Readers may click on the hyperlink and then click on a particular region on the left side of the map to see where the graduates of that region were practising as of Dec. 2022. Blue dots on the map may represent multiple PHCNP grads, as some agencies employ multiple NPs. Agencies that employ more than one NP are highlighted with yellow circles, showing where there is a higher density of NPs. The maps overall show the range of locations across the province where graduates from each region were practising in Dec. 2022, including the reach of graduates into northern, rural and remote regions (Fig. 6).

Percentage of NPs practicing in rural communities

Using the Rurality Index of Ontario tool described above in the Methods section, we calculated percentages

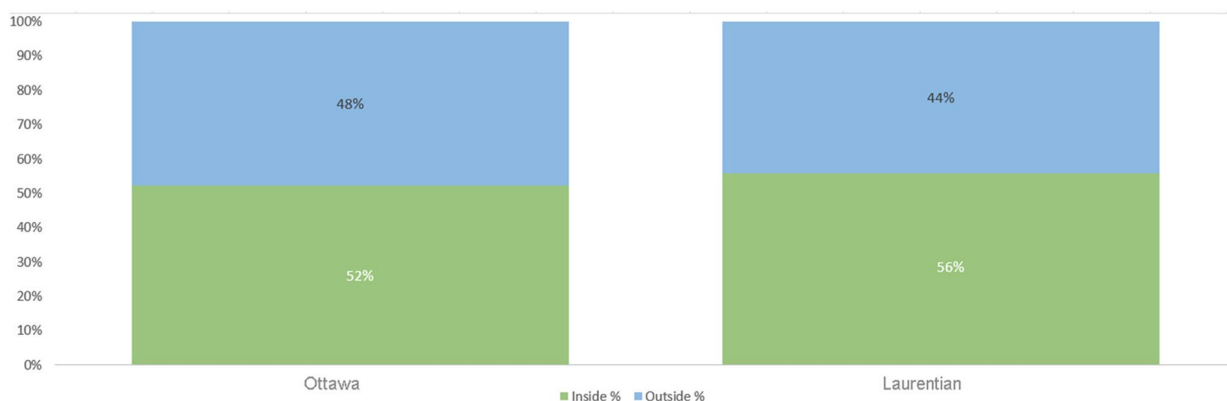


Fig. 5 Retention of NP Graduates Within Region from the Francophone PHCNP Program in Ottawa and Laurentian. Source: College of Nurses of Ontario, Google map API

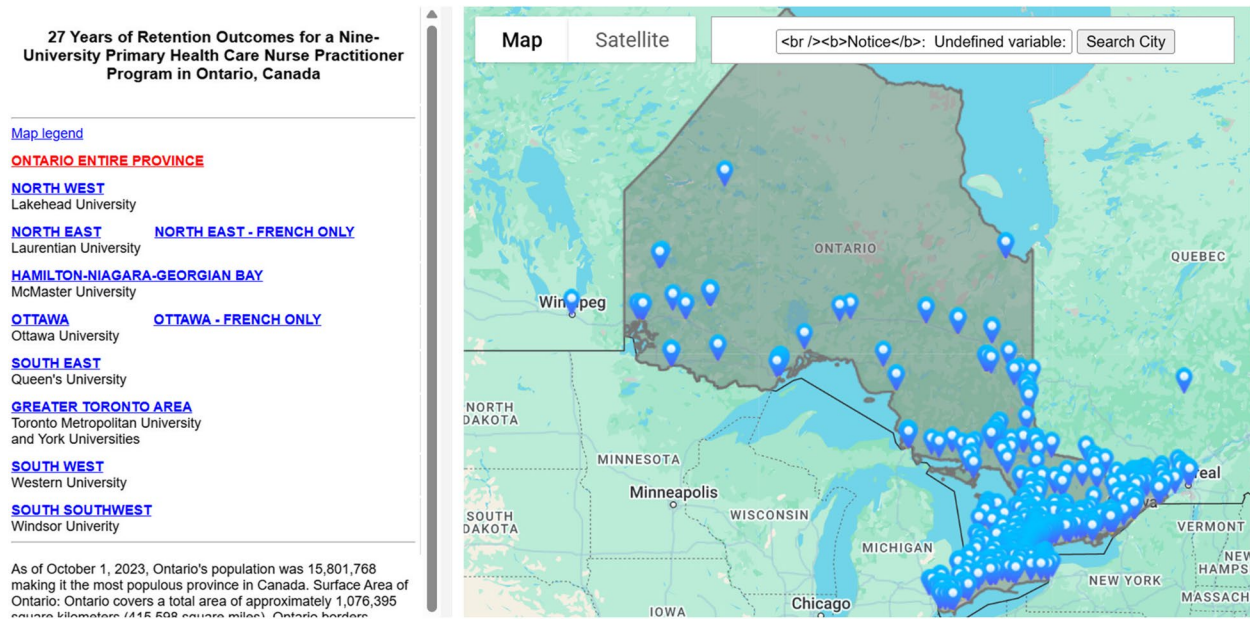


Fig. 6 Interactive map showing distribution of practising NP grads for each region. Source: College of Nurses of Ontario and Google map API. <https://np-education.ca/documents/retentionsmap/indexgrad.php?univ=help>

of PHCNP graduates who were practicing in rural or remote communities as of Dec. 2022. An RIO of 20 to 30 indicates a moderately rural community in terms of population and health care access. The Ontario government uses an RIO of 40 as the minimum for their incentive programs designed to attract more providers to these locations, indicating significant unmet health care demand in these communities. Characteristics of communities with higher RIOs can be illustrated with the following examples:

- Alberton Township in northwestern Ontario has the highest possible RIO score of 100. It had a population of 954 people in 2021 and is a four-hour drive from both nearest major centres of Thunder Bay and Winnipeg.
- Kenora, Ontario, also in the northwest of the province, has an RIO of 80. It had a population of 14,967 people as of 2021 and is a two-and-a-half-hour drive from the nearest major urban centre of Winnipeg, Manitoba.

Below in Table 2 we see the percentages of NP graduates by university who were practising in rural communities with an RIO of at least 20, with further breakdowns into percentages working in communities with higher degrees of rurality.

We can see that in the Northwest and Northeast, where Lakehead and Laurentian Universities are respectively

located, the percentages of graduates working in rural or remote communities is the highest at 28.3% and 39.4% respectively, and with larger percentages practising in communities with the highest levels of rurality. This reflects the broader demographics of northern Ontario, with 34.2% of the population in the Northwest living in a rural area (defined as an area having less than 1,000 people), and 30.2% of people in the northeast living in a rural area [35]. These regions are the most sparsely populated areas of Ontario with the biggest land mass. According to an Ontario government report, the Northwest region of Ontario measures an area of about 460,000 square kilometres (slightly smaller than Spain), with a total population of 236,000 people and a population density of 0.6 people per square kilometre. The Northeast region measures about 400,000 square kilometres, with a total population of 565,000 people and a population density of 1.4 people per square kilometre. Combined, the two northern regions represent 80% of the land mass of Ontario [35].

French graduates from the northeast of Ontario had an extremely high rurality rate at 55.6%, with the majority of these in communities categorized in the highest levels of rurality. This reflects the clustering of Franco-Ontarian communities in the rural northeast, such as Hearst with an RIO of 95. These results show the importance of the consortium bilingual education model in developing health services for the Francophone population. As the google maps for the Francophone program graduates demonstrate, some University of Ottawa francophone

Table 2 Percentage of PHCNP graduates practicing in rural or remote communities in Dec. 2022

University	% in Communities with RIO of 20 or higher	% in communities with RIO of 20–30	% in communities with RIO of 31–45	% in communities with RIO of 46–55	% in communities with RIO of 56 to 75	% in communities with RIO of 76 to 100
Lakehead	28.3%	3.6%	1.2%	0	1.8%	21.7%
Laurentian (all graduates)	39.4%	15%	3%	3%	12.8%	5.6%
Laurentian French program graduates only	45.4%	4.5%	2.3%	6.8%	15.9%	15.9%
McMaster	9.7%	5%	1.8%	2.5%	0	0.4%
Ottawa (all graduates)	13.5%	1.9%	7.5%	1.5%	1.5%	1.1%
Ottawa French program graduates only	10.5%	0%	5.3%	1.3%	0%	3.9%
Queen’s	21.2%	9%	6.9%	2.6%	1.6%	1.1%
Toronto Metropolitan	8.4%	4.2%	3.1%	0%	0.8%	0.3%
Western	22.5%	8.7%	2.4%	3.6%	0.8%	2%
Windsor	15.8%	13.9%	1.9%	0	0	0
York	9.6%	4.6	3.8	0.4	0.8	0

College of Nurses of Ontario, Ontario Medical Association

graduates migrated to the northeast for employment, while some Laurentian graduates located in the Ottawa region. Hence the two Francophone university sites benefit Franco-Ontario communities in providing spillover of graduates into each other’s regions.

In southern Ontario, those universities that had larger rural catchment areas, particularly Ottawa, Queen’s, Western, and Windsor, also had higher numbers of graduates practicing rurally, at 13.5%, 21.2%, 22.5%, and 15.8% respectively. Statistics Canada has identified 13.3% of Ontarians as living in a rural area, albeit with a somewhat different definition of rural than the RIO [36]. The comparison nevertheless provides some context to suggest that PHCNP graduate practise in rural areas bears some reflection of rural demographics in the south. The fact that PHCNP program leaders dedicate some of their government program funding to reimburse students for part of their travel costs to rural clinical placements no doubt supports rural recruitment after graduation.

Limitations

The study is quantitative and descriptive and shows snapshots of NPs who graduated between 1996 and 2022 inclusive, with data current in December 2022. Changes in NP graduate locations or registration status since December 2022 are not captured here. Further, while we were able to identify NPs who had practised in the province but had retired or left practise by the end of 2022 in our statistics about retention of graduates in the

province, the provincial nursing registry does not show the employment history of these NPs once they retire or give up their registration. Therefore, it was not possible to map the location(s) where these NPs had practised within Ontario, or how many had practised in rural or remote areas. That mapping data is restricted to NPs who were currently practicing as NPs as of December 2022.

Because the data was based on a snapshot of where all graduates were practising as of Dec. 2022, we do not have a good sense of how graduates may have moved around over time. No differentiation was made between the practice locations of new graduates and those who graduated much earlier and had been in the workforce for many years.

A further limitation is the lack of qualitative studies to capture reasons why graduates may have located where they did. This data would have helped us to better interpret some of the quantitative results.

Additionally, the study does not present a clear cause and effect between the consortium model and retention in region or in province, although it clearly seems associated with such retention. Interpretive data from graduates is needed to have more insight into this and would also enable us to identify other factors affecting where graduates locate and why, and the extent to which they stay in a location. This also highlights how the distributed models of education need to be looked at in relation to other factors affecting recruitment and retention of NPs, such as availability of jobs in each region; workplace climate; compensation that reflects the expanded scope of

practise and level of responsibility of NPs; health care agencies that facilitate NPs to practise to their full scope; funding models that enable NPs to set up new practices in needed areas and spend adequate time with their patients to provide holistic care; as well as incentives to practise with rural, remote and underserved populations [37–39]. Distributed education cannot by itself address the multiplicity of factors that impact recruitment and retention. From a policy-making perspective, distributed education must be seen as one part of a broader health human resources strategy rather than a solution unto itself.

Lastly, the highly contextual nature of retention rates means that attempts to make comparisons across regions and health science disciplines are fraught. We undertook a comparison with retention statistics from The Northern Ontario School of Medicine University (NOSM) [40], which has campuses in both the northwest and the northeast and a social accountability mandate to educate physicians in the north for the north. Despite the regional alignment of NOSM and PHCNP northern university sites, and the fact that many NOSM graduates specialize as Family Physicians and have a similar scope of practise to NPs, our metric did not align with theirs, as showed in Table 3 below.

We did not have data for our PHCNP graduates on where they had done their undergraduate degrees. We thus created a separate row for the NP graduates in the table above to reflect this. In addition, NOSM was measuring retention of their graduates across the *entire* north, whereas we measured retention of Laurentian and Lakehead graduates in the more limited regions of the northeast and northwest respectively. In fact, there is some spillover of graduates from one region to the other within the north, which would make NP retention in the north even higher than the 70% and 64% indicated.

Further differences in context of practise compound the challenges in comparing retention rates. For example, physicians have the capacity to set up their own practises in the north, based on their ability to bill the government on a fee for service basis, while NPs tend to be salaried employees and rely on health care agencies and targeted government funding to create positions to which they

would apply [41]. This latter can make it more difficult for NPs to take up practise or expand practise opportunities in the north. In addition, the great majority of PHCNP program graduates end up practising in their specialty of primary health care (since the program does not educate them for acute care specialties), while some NOSM medical graduates specialize in other areas that could require location in an urban area [42]. We experienced similar challenges in comparing metrics and context in relation to a 2024 Canadian study of in region retention for graduates of medical schools across Canada [43].

These differences in retention metrics and data availability, on top of differences in working conditions, job availability, payment models, and policy contexts, suggest that attempts to set a broader benchmark for regional health professional retention may be unwise. If education leaders and policymakers wish to increase retention rates in particular regions, they need to take a more focused, contextual approach.

Future areas of study

Qualitative follow-up interviews or focus groups with PHCNP graduates would be an important additional study to identify more clearly the reasons why they located where they did and why they may have stayed or left. This interpretive data would be important to gather for each of the categories of NP grads we identified in the study: 1) those who remained within their home university region and were practising as NPs; 2) those who were registered as a practising NP in Ontario but moved to a different region of the province to work; 3) those who were practising as NPs in rural or remote areas; 4) those who registered as NPs in Ontario but were practising outside Ontario at the time of the study; and 5) those small numbers of graduates who stayed registered and practising as RNs rather than as NPs. Such qualitative analysis is also important to interpret the results of this study for graduates of the French version of the PHCNP program, who had slightly lower retention rates in some respects than for program graduates as a whole.

Qualitative data could also help us gain insight into the variability of in-region retention rates across the different university regions, and differences between French and

Table 3 Retention of graduates in region in the north: comparison of NP program and NOSM

Degrees taken in the north	Lakehead PHCNP Master's program	Laurentian PHCNP Master's program	NOSM
Undergraduate only	Not applicable	Not applicable	51%
UG and postgraduate	Data not available	Data not available	88%
Postgraduate only	Data not available	Data not available	57%
Postgraduate with UG location unknown	70%	64%	Not applicable

NOSM and PHCNP Program

English program graduates. As outlined above in the limitations section, this interpretive data is needed to help identify which other factors, besides education, need to be targeted by policymakers.

To track the movement of graduates over the course of their career, a cohort study that looks at where graduates practised five years out from graduation, ten years, and so on, combined with interpretive information, could deepen our understanding of graduate trajectories and the factors important in retention.

A further area of study would be to assess how many PHCNP graduates are working with Indigenous communities and vulnerable urban populations. We know anecdotally that NPs in Ontario are important in providing services to these populations; a focused study to track this would be useful to better understand the contributions of NPs and the recruitment and retention factors related to serving these populations.

Conclusions

This study shows the success of the nine-university consortium program in supporting recruitment and retention of primary health care NPs across the large and diverse geography of Ontario, including in northern, rural and remote communities.

Appendix—details of PHCNP graduates who did not practice as NPs in Ontario

The following three tables outline the number and percentage of PHCNP graduates who did not end up practising as NPs in Ontario. All PHCNP graduates are captured in either of this article or in one of the three categories below.

1. Practised exclusively as a Registered Nurse after graduation—all graduates

4.7% of PHCNP graduates had not registered as practising NPs after graduation with the provincial registration body but had remained registered as Registered Nurses (RNs).

Some graduates who remained as RNs could be in transition, still looking for an NP role after graduation. Limited employment opportunities and concerns with working conditions may also be an issue. French program graduates had a higher number in this category and more investigation is needed to understand why (Table 4).

2. No History of NP or RN Registration in Ontario

7.4% of PHCNP graduates overall did not have any history of registration in Ontario, either as an RN or an NP. They may have gone on to practise in another jurisdiction in Canada or internationally. The reality of labour mobility is likely a factor here, including for Francophone program graduates who may opt to practise in Quebec, which is adjacent to Ontario geographically (Table 5).

3. PHCNP Graduates Registered in Ontario as NPs but Working Outside Ontario

1.2% of all graduates were registered as practising NPs in Ontario but had no evidence of having practised in Ontario as an NP. Because they were registered, we were able to find their location of work as of Dec. 2022 in the Ontario registry, and to categorize them as working outside the province. Under Ontario regulations, they could maintain their Ontario NP status if they were practicing as an NP in the United States or other Canadian province. These individuals would have some motivation to remain registered in Ontario, indicating some ongoing tie to the province (Table 6).

Table 4 PHCNP graduates practising/having practised exclusively as RNs

University	Registered as a Practising RN as of Dec. 2022	Previously Registered as a Practising RN	Total
Lakehead	5 (2.2%)	6 (2.6%)	4.8%
Laurentian (all grads)	12 (3.5%)	6 (1.7%)	5.2%
Laurentian French program grads only	5 (7.7%)	4 (6.2)	13.9%
McMaster	7 (2.0%)	4 (1.1%)	3.1%
Ottawa (all grads)	7 (2.7%)	4 (1.5%)	4.2%
Ottawa French program grads only	3 (2.4)	10 (7.9%)	10.3%
Queen’s	10 (2.3%)	5 (1.1%)	3.4%
Toronto Metropolitan	11 (3.3%)	2 (0.6%)	3.9%
Western	11 (4.0%)	4 (1.4%)	5.4%
Windsor	7 (2.3%)	4 (1.3%)	3.6%
York	5 (1.6%)	8 (2.6%)	4.2%
Average	77 (2.8%)	52 (1.9%)	4.7%

Table 5 PHCNP graduates with no history of registration in Ontario

University	No History of Registration in Ontario
Lakehead	15 (6.6%)
Laurentian (all grads)	23 (6.6%)
Laurentian (French program grads only)	4 (6.2%)
McMaster	22 (6.2%)
Ottawa (all grads)	30 (7.8%)
Ottawa (French program grads only)	10 (7.9%)
Queen’s	26 (9.9%)
Toronto Metropolitan	23 (5.2%)
Western	34 (10.2%)
Windsor	16 (5.8%)
York	17 (5.6%)
All	206 (7.4%)

College of Nurses of Ontario

Table 6 PHCNP graduates registered as a practicing NP in Ontario in Dec. 2022 but working exclusively outside Ontario

University	Registered as a Practicing NP in Ontario but Working Outside Ontario
Lakehead	1 (0.6%)
Laurentian (all grads)	3 (1.1%)
Laurentian (French program grads only)	1 (2.3%)
McMaster	1 (0.4%)
Ottawa (all grads)	8 (3.0%)
Ottawa (French program grads only)	5 (6.6%)
Queen’s	2 (1.1%)
Toronto Metropolitan	0 (0.0%)
Western	4 (1.6%)
Windsor	7 (3.3%)
York	1 (0.4%)
All	27 (1.2%)

College of Nurses of Ontario

The numbers overall here are very small. Ottawa, which borders with the province of Quebec, and Windsor, which borders with Detroit, both had slightly higher numbers of NP graduates who were registered in Ontario but practising outside Ontario. We know that many nurses in Windsor live in the city but commute to Detroit, so this may explain the slightly higher numbers. Similarly, PHCNP graduates of the Ottawa French program may be practising in Quebec but maintaining their Ontario registration status.

Abbreviations

- CNO College of Nurses of Ontario, the provincial regulatory body for Nurses which maintains the registry for all categories of nurses
- NP Nurse Practitioner, Master’s prepared, advanced practise Registered Nurses who have the authority to perform controlled acts beyond what is available to Registered Nurses, such as ordering tests, communicating a diagnosis, referring to specialists, prescribing medications, and admitting and discharging from hospital. NPs in Ontario can work independently and are recognized by the Ontario government as an alternative to a Family Physician for provision of primary care
- PHCNP Primary Health Care Nurse Practitioner, an NP that specializes in primary health care. Primary care providers in Canada act as an individual’s first point of contact with the health care system and can refer patients to specialists as needed. In this paper, PHCNP also refers to the Ontario Primary Health Care Nurse Practitioner Program, the consortium program that is the subject of this study.
- RIO Rurality Index of Ontario
- RNs Registered Nurses. Registered Nurses in Ontario complete the equivalent of a four year baccalaureate degree in nursing and have a narrower scope of practise than an NP.
- GTA Greater Toronto Area, which includes the City of Toronto and immediately surrounding regions, and has a population of approximately seven million people.

Supplementary Information

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Supplementary Material 1
 Supplementary Material 2
 Supplementary Material 3

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Authors’contributions

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Data availability

Data is provided within the supplementary information files.

Declarations

Ethics approval and consent to participate

Not applicable. This manuscript does not report on or involve the use of any animal or human data or tissue. The data regarding where the PHCNP graduates are working is part of a public registry by the College of Nurses of Ontario and does not require consent to access.

Consent for publication

Not applicable. This manuscript does not contain data from any individual person, including individual details, images, or videos.

Competing interests

The authors declare no competing interests.

Author details

¹Council of Ontario Universities, 180 Dundas St. W., Suite 1800, Toronto, ON M5G 1Z8, Canada. ²Laurentian University, 935 Ramsey Lake Road, Sudbury, ON P3E 2C6, Canada. ³McMaster University, 1280 Main Street, Hamilton, ON L8S 4K1, Canada. ⁴Toronto Metropolitan University, 350 Victoria St, Toronto, ON M5B 2K3, Canada. ⁵University of Ottawa, 200 Lees Ave, Ottawa, ON K1 N 6 N5, Canada. ⁶School of Nursing and Centre for Health Care Ethics, Lakehead University, 955 Oliver Road, Thunder Bay, ON P7B 5E1, Canada. ⁷York University, 4700 Keele Street, M3 J1P3, Toronto, ON N6 A5B9, Canada. ⁸University of Windsor, 401 Sunset Ave, Windsor, ON N9B 3P4, Canada. ⁹Western University, FIMS & Nursing Building Rm. 3301 A, 1151 Richmond Street North, London, ON N6 A5B9, Canada. ¹⁰Queen's University, 99 University Ave, Kingston, ON K7L 3 N6, Canada.

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