End-of-career practice patterns of primary care physicians in Ontario

Sarah Simkin

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Telfer School of Management
University of Ottawa

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Summary

Incomplete understanding of attrition from the physician workforce has hampered policy-makers' efforts to achieve optimal alignment of the supply of physicians with population demand for medical services. This longitudinal study of Ontario primary care physicians uses health administrative data to characterize changes in physicians' practice patterns over time. We examined the workload and scopes of practice of 21,240 physicians between 1992 and 2013. We found that physicians reduce their workloads gradually as they age, retiring from clinical practice at an average age of 70.5. Furthermore, we found that 60% of family physicians who stop providing comprehensive primary care continue to provide clinical services for an average of three years, with reduced workloads, before retiring fully. Our findings clarify the process of physician attrition from the workforce and will help to improve estimates of attrition and make physician workforce planning more accurate and effective.

Résumé

Une des choses qui a entravé les efforts déployés par les décideurs politiques pour parvenir à un alignement optimal de l'offre de médecins à la demande de la population pour les services médicaux est une compréhension incomplète de l'attrition de la main-d'œuvre médicale. Cette étude longitudinale de l'Ontario médecins de soins primaires utilise des données administratives sur la santé pour caractériser les changements dans les modes de pratique des médecins au fil du temps. Nous avons examiné la charge de travail et les champs d'activité des 21 240 médecins entre 1992 et 2013. Nous avons constaté que les médecins réduisent leurs charges de travail progressivement à mesure qu'ils vieillissent, se retirant de la pratique clinique à un âge moyen de 70,5. En outre, nous avons constaté que 60% des médecins de famille qui arrêtent la prestation de soins de santé complets continuer à fournir des services cliniques pour une moyenne de trois ans, avec des charges de travail réduites, avant de se retirer complètement. Nos résultats précisent le processus de médecin attrition de la main-d'œuvre et contribueront à améliorer les estimations de l'attrition et faire de la planification des effectifs médicaux plus précis et efficace.

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Legend

AMA – American Medical Association
CAPE – Client Agency Program Enrolment database
CIHI – Canadian Institute for Health Information
CMG – Canadian Medical Graduate
CPDB – Corporate Provider Database
FFS – Fee-for-service
FHT – Family Health Team
FTE – Full-time-equivalent
ICES – Institute for Clinical Evaluative Sciences
IPDB – ICES Provider Database
IMG – International Medical Graduate
MOHLTC – Ministry of Health and Long Term Care (Ontario)
OHIP – Ontario Health Insurance Program
RIO – Rurality Index of Ontario
RRIF – Registered Retirement Income Fund
RRSP – Registered Retirement Savings Plan
SD – Standard Deviation

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Introduction

Although we know a great deal about the medical workforce in Canada, precise alignment of the supply of physicians with the demand from the population for medical services continues to elude policy-makers. Inputs to the physician workforce are well characterized, but egress of physicians from the workforce has been less well studied. While most workforce planning models incorporate estimates of final physician exit from the workforce, these estimates have not been particularly reliable. For example, despite predictions of impending *en masse* retirement (Pong, Lemire, & Tepper, 2007), many physicians from the "baby boom" generation have remained in the workforce with sustained workloads much longer than expected, possibly contributing to physician oversupply in some sectors, as suggested by recent reports of subspecialist unemployment (Fréchette, Hollenberg, Shricand, Jacob, & Datta, 2013).

Estimating physician attrition from the workforce has proven to be difficult for a variety of reasons, including: unreliability of physicians' self-reported retirement intentions (Rittenhouse, Mertz, Keane, & Grumbach, 2004), lack of systematic and consistent collection of end-of-career physician information (Pong, 2011), and a multitude of different definitions of retirement (Denton & Spencer, 2009). The literature focusing on physician retirement suggests that a broader perspective on end-of-career practice patterns is necessary in order to understand physician retirement behaviour.

Accordingly, using a population-based approach and health administrative data from the Institute for Clinical Evaluative Sciences (ICES), this research undertakes to generate a dynamic picture of how Ontario primary care physicians change their practice patterns as they age. In order to learn more about the *process* of retirement, we examine how workloads (*how much* physicians do) and scopes of practice (*what* physicians do) change over time. We also explore how different definitions of attrition from the workforce impact retirement outcomes in an effort to clarify how retirement should be defined and measured in a population of physicians.

Research Objectives

The objectives of this research are twofold:

1 – To characterize the process of physician attrition from the workforce.

2 – To generate knowledge that will facilitate prediction of physician workforce trends and enhance physician workforce planning.

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Research Questions

How do physicians change their practice patterns as they age?

Using 22 years of longitudinal health administrative data (1992-2013), this research characterizes primary care physicians' career trajectories, focusing on their practice patterns in the latter stages of their careers. Physicians' practice patterns are considered with reference to both workload and scope of practice. We are specifically interested in the extent to which primary care physicians continue to provide comprehensive primary care over time, and in the intersection between changes in workload and changes in scope of practice at the ends of physicians' careers.

What factors influence changing physician practice patterns?

This research explores how, and to what degree, physician practice patterns are influenced by various factors, including: age, gender, location of training, and location and model of practice.

Comparisons are made between:

- physicians of different ages
- physicians from different generations (born in or before 1919, in the 1920s, 1930s, 1940s, 1950s, 1960s, 1970s, or in or after 1980)
- male and female physicians
- Canadian Medical Graduates (CMGs) and International Medical Graduates (IMGs)
- physicians with practices in major urban, non-major urban, and rural/remote locations
- physicians remunerated through traditional fee-for-service (FFS), reformed-FFS, capitation, capitation in combination with a Family Health Team and other models

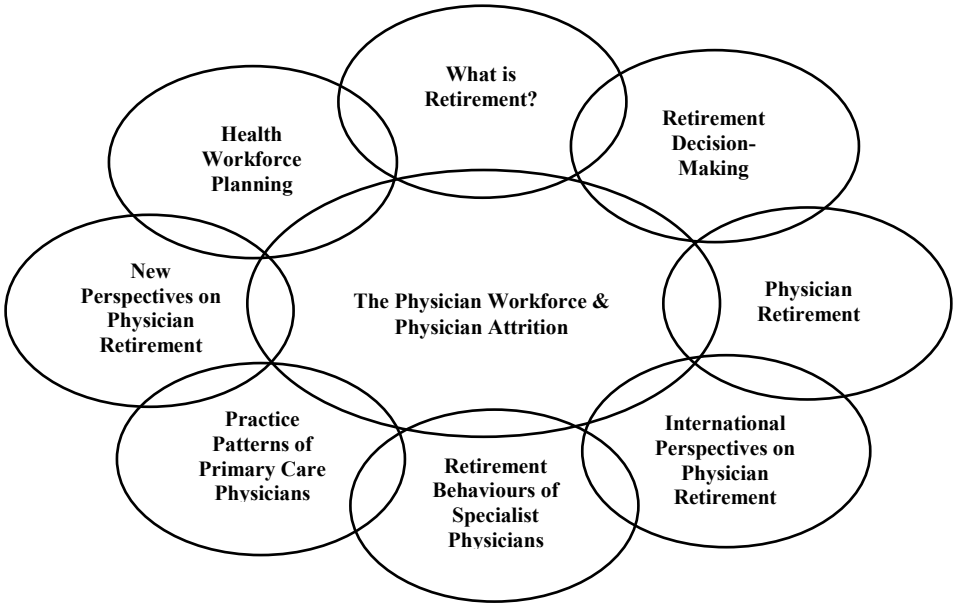
Workload, scope of practice, and physician characteristics are tightly interconnected, and we argue that these three factors cannot – and should not – be examined in isolation. Our research contributes to a more complete and integrated understanding of how physicians' practice patterns change over time. It is our hope that the findings will ultimately help to more accurately predict physicians' retirement behaviours by improving the component of workforce planning models that predicts attrition from the workforce. This, in turn, will be useful in informing health human resource policy decisions and facilitating more effective physician workforce planning.

Background

The physician workforce is a complex adaptive system, with multiple, diverse, and interconnected parts. Each element of the workforce interacts with the others, and they all exist within the context and complexity of the health system itself. A comprehensive understanding of the physician workforce in general, and physician attrition in particular, is necessarily anchored in a range of disciplines. To lay the foundations for this study, we consulted the literature from medicine, sociology, psychology, and economics. We sought international perspectives on physician retirement, from the United States, the United Kingdom and Australia. We considered what is known about practice patterns and retirement behaviours of both specialist and primary care physicians. We also delved into health workforce planning research. The synthesis of all of this information guided the direction of our research.

A schematic of the domains of knowledge and themes emerging from our review of the literature is shown in Figure 1. Given that it is difficult to represent the complexity of these relationships in two dimensions, this is clearly an oversimplification, but it serves to highlight the broad perspective that is required to study the physician workforce and physician attrition.

Figure 1. Schematic representation of the body of knowledge that underpins this research



What is Retirement?

One of the challenges for health workforce planners, policy-makers, and researchers undertaking to understand physician retirement behaviour is that retirement is a complex concept that means different things to different people. Because it is a negative notion, characterizing what one is not doing – working – rather than what one is, retirement is "difficult to observe and measure" (Denton & Spencer, 2009, p. 65).

Statistics Canada has a standard definition of retirement: "Retired refers to a person who is aged 55 and older, is not in the labour force, and receives 50% or more of his or her total income from retirement-like sources" (Bowlby, 2007, p.17). This definition does not help to capture the nuances of late-career medical practice or to separate physicians who are not yet retired from those who are semi-retired or fully retired.

The definition offered by Feldman (1994) may be more useful: "Retirement is the exit from an organizational position or career path of considerable duration, taken by individuals after middle age, and taken with the intention of reduced psychological commitment to work thereafter" (p. 287). This definition allows for more scope in understanding retirement as a distinct career stage associated with an intention to withdraw from work, but it presents challenges of its own: How is *middle age* defined? What constitutes *reduced psychological commitment*?

Denton and Spencer (2009) review retirement concepts and measures that have been used for the purposes of research, grouping them together to reflect non-participation or reduced participation in the workforce, receipt of pension income, end-of-career employment, self-assessed retirement, or combinations of those indicators. The complete absence of labour force participation is a categorical definition that is attractive for its simplicity. However, this definition ignores age-related changes in the intensity of participation – how much a person works – that are of considerable importance for the physician workforce. For example, complete retirement of an actively working physician with a large practice has a greater impact on the health care system than the cessation of practice of a minimally active physician.

Self-assessed retirement is another attractive definition; individuals are considered retired if they consider themselves so, regardless of actual participation in the workforce. While self-assessed retirement status may be a good indicator of state of mind, it is hardly a good indicator of workforce participation (Denton & Spencer, 2009). The subjectivity of the definition – retirement means different things to different people – makes it difficult to compare retirement status between individuals. For example, consider three physicians

working approximately the same amount: one may consider himself retired, the next may think of herself as semi-retired, while the third may not feel retired at all.

In addition to the problems presented by different approaches to defining retirement, research findings can vary depending on the definition of retirement chosen (Wang & Shi, 2014). Hence, the search continues for a more accurate definition of retirement that can be measured more precisely and used to compare retirement patterns over time and across populations and jurisdictions. In the meantime, Denton and Spencer (2009) suggest that one alternative is to place more emphasis on what people *are doing*, whether or not they are classified as retired. This may be a practical approach to studying older physicians' retirement patterns and a more effective way to generate knowledge that can be used for physician workforce planning.

Retirement Decision-Making

Historically, workers continued to work until they were no longer physically able to do their jobs (Shultz & Wang, 2011). Throughout the latter half of the 20th century, however, workforce participation rates among older men declined steadily, likely related to old-age pension benefits, the growing value of leisure, and increased participation in the workforce by women (Gomez & Gunderson, 2011). In the mid-1990s, Canada and most OECD countries observed a reversal of this trend; the expected age of retirement increased from about 59 years to 63 years between 1994 and 2002. Factors postulated to be associated with this shift include: abolishment of mandatory retirement rules, increased uncertainty associated with pension returns, improved health, a shift to less physically demanding work in the knowledge economy, and a desire to amortize the cost of longer periods of education over a longer working life (Gomez & Gunderson, 2011). Observation of these retirement trends has triggered research by economists, sociologists, psychologists, social workers, and demographers, among others, in an effort to characterize and understand the factors that contribute to the retirement decision-making process (Shultz & Wang, 2011).

The many facets of retirement decision-making have been considered from a variety of perspectives. Wang and Shultz (2010) conceptualize the longitudinal progression of the retirement process and enumerate the factors that have the potential to impact this process. They identify the first step as being "Retirement Planning", which leads to any or all of the following subsequent steps: "Early Retirement", "Retirement Decision Making", "Bridge Employment", or "Retirement Transition and Adjustment". They note that the retirement process can be impacted by individual attributes, job and organizational factors, family factors, and socioeconomic factors. Furthermore, they

suggest that the phenomenon of retirement can be understood in terms of factors at individual, group, organizational, and societal levels, and that the issues people face in retirement are closely linked to the psychological aspects of the process (Shultz & Wang, 2011). Beehr, Glazer, Nielson, and Farmer (2000) suggest that decisions to retire can be examined from the perspective of push (generally aversive) and pull (generally pleasant) factors, or from the perspective of work and non-work influences. Feldman and Beehr (2011) postulate three phases of retirement decision-making: imagining the possibility of a future retirement, assessing the past and deciding on the time to let go, and transitioning into retirement by putting plans into action. They see the retirement decision as a balance between the benefits derived from work (status, a way to structure time, a sense of accomplishment, affirmation and social support from colleagues, and satisfaction derived from doing a job well) and the rewards derived from retirement (lower stress, time for satisfying social relationships, more time to spend with family, and greater involvement in hobbies and leisure pursuits).

The retirement decision-making process cannot be isolated from the financial circumstances in which this process takes place. Finances have been found to be an important predictor of retirement (Beehr et al., 2000), and the financial context in which retirement decisions are being made has become more complex (Donner, Sze, & Bluth, 2015; Feldman & Beehr, 2011). Financial issues that can make retirement planning challenging include: macroeconomic conditions – inflation, interest rates, and real estate values – at the time of retirement, difficulty in estimating annual income from defined contribution or self-funded pension plans (as returns are subject to market fluctuations), uncertainty about the financial resources required for increased life expectancy, and anticipation of future health care costs (for workers in the U.S.) (Feldman & Beehr, 2011).

There is a growing consensus among researchers that retirement is not necessarily a single event – the end of work – but rather a process that older workers go through (Feldman & Beehr, 2011; Shultz & Wang, 2011; Wang & Shultz, 2010). The division between work and retirement is not totally distinct, and retirement may be viewed as an additional stage in workers' careers and an opportunity to continue work in a different form (Beehr et al., 2000; Shultz & Wang, 2011).

The concept of "bridge employment" captures the dynamic, non-categorical nature of retirement. Bridge employment is a "longitudinal workforce participation process between one's retirement decision and entering full retirement" (Wang & Shultz, 2010). For physicians, the period of bridge employment may be defined with reference to practice activity as the period between the end of peak practice activity and cessation of practice, and may include changes in scope of practice. Donner and colleagues (2015)

refer to bridge employment as "semi-retirement", while other authors discuss this career stage as "phased retirement" (Cronan, Coleman, Harolds, & Bluth, 2013; Merline, Cull, Mulvey & Katcher, 2010; Onyura et al., 2015). Bridge employment decisions may be undertaken in order to modulate financial uncertainty, or may be motivated by an effort to adjust to life in retirement by providing a gradual transition (Donner et al., 2015; Wang & Shultz, 2010). Equally, bridge employment can be a means to maintaining identity and self esteem, and allowing time for non-work activities while maintaining work-related social contacts (Donner et al., 2015).

Physician Retirement

Despite general observations about the process of retirement decision-making, the financial context in which retirement decisions are made, and bridge employment, retirement norms can vary across countries, regions, industries, and jobs (Feldman & Beehr, 2011). Because of considerations unique to the practice of medicine, it is important to delve more deeply into the specificities of the experience and process of retirement for physicians.

While the literature on physician retirement is not extensive, several important themes have been identified. Academic physicians have been found to value their work very highly, as an intellectual pursuit, a source of identity and self-esteem, and a forum for social connection (Onyura et al., 2015; Silver, Pang, & Williams, 2015). As such, some physicians see retirement as a threat to identity, self-worth, meaning, belonging, and value (Onyura et al., 2015), or "an intermediate step toward the grave" (Harolds, Cronan, Coleman, & Bluth, 2013). However, physicians are also concerned about maintaining competence into older age and express both a desire to retire "at peak skill level" (Onyura et al., 2015) and fears about becoming less competent, innovative, and productive with older age (Silver et al., 2015). Hence, physicians may change what they do at the ends of their careers for fear of complaints or litigation. Both the content of the work of physicians, and the regulated context of that work, make the retirement decisions of physicians unique amongst workers in general and knowledge workers in particular. In keeping with the theoretical frameworks discussed above, physicians tend to see retirement as a transition, reflecting the significant amount of autonomy they have in determining the number of hours to work, the content of their work, and the services they provide during latter phases of their careers (Jeon & Hurley, 2010; Silver et al., 2015).

Researchers have identified multiple factors influencing retirement decision-making in physicians, along with the challenges experienced by physicians during the retirement process. The decision to remain clinically active has been found to be influenced by factors such as

professional satisfaction, sustained good health, financial needs, concern for patient care, enjoyment of the intellectual aspects of practice and interaction with colleagues, mindfulness of increased life expectancy, difficulty finding replacements, feeling compelled to give back to the profession, and the need to maintain health insurance coverage (in the U.S.) (Harolds et al., 2013; Orkin et al., 2012). Factors often cited in the decision to retire include on-call responsibilities, insufficient reimbursement, and lack of professional satisfaction (Brett, Arnold-Reed, Hince, Wood, & Moorhead, 2009; Davidson, Lambert, Parkhouse, Evans, & Goldacre, 2001; Merline et al., 2010; Newton, Luce, Van Zwanenberg, & Firth-Cozens, 2004; Orkin et al., 2012). Challenges in retirement have been found to include loss of the physician role, health and general aging issues, financial security, interactions with the spouse, and lack of activities and interests as a result of longstanding predominant focus on the practice of medicine (Guerriero Austrom, Perkins, Damush, & Hendrie, 2003).

At the group, organizational, and societal levels, there is tension between maintaining the contributions of older physicians while promoting career development and leadership opportunities for younger physicians. On the one hand, delayed retirement of older workers can complicate succession planning by introducing uncertainty and reducing employment and advancement opportunities for younger workers (Gomez & Gunderson, 2011). On the other hand, strict age-based retirement policies (such as are in place in Europe, India, the Phillipines, and South Africa) may result in the loss of the contributions of capable senior physicians (Moss et al., 2013). Calls for academic institutions and specialty professional organizations to "find new mechanisms to engage senior faculty's expertise and experience in meaningful and mutually fulfilling ways" have emerged (Stearns, Everard, Gjerde, Stearns, & Shore, 2013, p. 1932). Bridge employment for physicians – mostly in the form of part-time work – is consistently identified as a strategy that can help to balance the needs of older physicians with those of their younger colleagues, help older physicians to stay in the workforce, and to create a more flexible workforce (Merline et al., 2010). Other institutional strategies for maintaining the contribution of older physicians include part-time or emeritus academic appointments, flexible work arrangements, and continued teaching and mentorship opportunities (Onyura et al., 2015; Silver et al., 2015; Pannor Silver, 2016), as well as job-sharing and medical volunteerism (Silver et al., 2015). In addition, Orkin and colleagues (2012) suggest that a focus on workplace wellness and efforts to enhance professional satisfaction could prevent premature retirement and subsequent shortage of anesthesiologists.

International Perspectives on Physician Retirement

Because of differences in health care systems, physician workforce issues in different countries

manifest slightly differently. We focused on literature addressing physician retirement in developed countries. Specifically, we considered British, Australian, and American studies on physician retirement issues and how the approaches being taken to address them offer insights relevant to the Canadian context.

In the U.K., most research into physician retirement over the past 15 years has been driven by concerns about physician shortage. This concern is as relevant now as it was 15 years ago: a recent survey of more than 15,000 physicians indicated that 34% of general practitioners in the U.K. are considering retirement and 28% of those working full time are thinking about working part time within the next 5 years (Rimmer, 2015). Research most often attempts to identify physicians' retirement intentions (Davidson et al., 2001; French et al., 2006; Taylor, Lambert, & Goldacre, 2008), reasons for retirement (Newton et al., 2004), and the impact of job satisfaction on intention to retire early (Hann, Reeves, & Sibbald, 2011; Sibbald, Bojke, & Gravelle, 2003). A recurring theme coming out of research from the U.K. is that physicians would delay retirement if flexible or part-time work were available (Davidson et al., 2001; French et al., 2006; Sibbald 2003) and that disillusionment with the National Health Service is a factor in physicians' retirement decisions (Davidson et al., 2001; Taylor et al., 2008). Researchers find that retirement is not a categorical transition from work to non-work (Newton et al., 2004) and suggest that retirement policy should shift away from the extremes of either full-time employment or total retirement (Davidson et al., 2001).

In Australia, physician shortages have been a problem as well, particularly in primary care settings. Decreasing early retirement among general practitioners has been suggested as a strategy to bolster primary care service provision in Australia, through improving work-life balance and diminishing the impact of work-related stressors (Pit & Hansen, 2014), and through better remuneration, more flexible working hours, and part-time work (Brett et al., 2009).

In addition to increasing numbers of medical graduates and reduced workforce effort, physician workforce trends in Australia include the nearing of traditional retirement age of a large cohort of physicians (Joyce, 2013). However, despite the fact that retirement trends are a major influence on overall workforce supply levels, Joyce (2013) points out that relatively little information is currently available on actual retirement patterns and that there is an insufficient understanding of the factors that influence physicians' late career workforce participation choices. The Medicine in Australia: Balancing Employment and Life (MABEL) annual survey attempts to remedy this situation by exploring physicians' labour supply decisions, including when to retire (http://mabel.org.au/themes). One recent study using data from MABEL found that only a third of physicians who wanted to reduce working hours were able to do so (Norman & Hall, 2014). Another study, identifying job satisfaction and barriers to reduction of working hours as two key factors in physicians' decisions to retire, is due to be published in full shortly (Joyce, Wang, & McDonald, 2015).

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In the United States, the study of physician retirement also takes place in the context of a shortage of primary care physicians. A recent study of primary care physicians focused on identifying the age at which these physicians retired (Petterson, 2016). (In the U.S., primary care physicians include family physicians, general internists, and general pediatricians.) The authors used American Medical Association Masterfile data to determine the age at which physicians retired from clinical practice. Physicians between the ages of 55 and 80 were included in the calculation, and the median retirement age of family physicians was found to be 65.1, with female physicians retiring about one year earlier than their male colleagues. This study defined retirement as the point at which physicians retired from direct patient care, but no consideration was given to the intensity of participation in patient care activities prior to retirement. Similarly, this study examined physicians' participation in administrative, teaching, and research near the ends of their careers, but not physicians' scopes of practice in the clinical sphere. The authors discuss strategies to lengthen physicians' careers in an effort to alleviate shortages, including working part-time, pursuing non-clinical work, or working as a locum physician.

Retirement Behaviours of Specialist Physicians

Over the past decade, the research conducted on workforce issues among specialist physicians has been driven by uncertainty regarding the appropriate size of the physician workforce, physician shortages (such as of psychiatrists in Australia (Fletcher & Schofield, 2007)) and shortages in positions for new graduates. In Canada, concerns about specialist unemployment and underemployment have intensified over the last five years (Fréchette et al., 2013). Often, research into workforce issues affecting specialist physicians is instigated and supported by specialty medical associations, and usually involves surveying their members. For example, a survey of current, incoming, and recently graduated Canadian gastroenterology trainees was expressly undertaken to identify factors that contribute to the burden of unemployment and underemployment in this specialty (Razik, Cino, Canadian Gastroenterology Program Directors, & Nguyen, 2013). Respondents to this survey perceived the dearth of positions as being related to two major factors: lack of funding, and senior physicians who continue to work beyond retirement years.

Perhaps as a result of a tighter job market for recent graduates in the U.S., radiology has been the focus of a number of workforce-related studies. Moriarty, Brown, and Schultz (2014) describe workforce needs based on self-reported work and retirement preferences of currently practising radiologists. The American College of Radiology has been particularly active in investigating physician workforce issues, given that between 2000 and 2012, the growth rate for imaging has

slowed, health care benefits have begun to limit highly reimbursed examinations (such as MRI and CT), many radiologists are practising longer, and younger radiologists are having difficulty finding employment (Cronan et al., 2013). Cronan and colleagues identify retirement issues as being central to broader radiology workforce issues, and state: "a rethinking of retirement is essential" (2013, p. 101). Harolds and colleagues (2013) found that a wide range of ages in a radiology practice and cultural differences between generations can result in tense group dynamics and they make suggestions intended to assist radiology practices with discussing retirement and pre-retirement planning. Cronan and colleagues (2013) suggest that providing flexible or phased retirement will result in a workforce able to respond to fluctuations in imaging volume. They enumerate options for retirement specific to radiology, including: part-time positions, job-sharing, reduction in night call for older radiologists, off-site branches in different time zones, night-call services, and formal phased retirement.

Other specialties have been the subject of research as well: surveys of Canadian neurologists (Bailey, Warren, & Buske, 2005; Kirby, Weston, Barton, Buske, & Chauhan, 2016) and pediatric surgeons (Emil et al., 2014), and American pediatricians (Merline et al., 2010) and anesthesiologists (Orkin et al., 2012), have established an understanding of the age structure, self-reported work patterns, and intentions and preferences with regards to retirement of these workforces. Some modeling and projections have been done for ophthalmologists in Canada (Bellan, Buske, Wang, & Buys, 2013), describing the current and projected workforce using the number of ophthalmologists per population and age- and sex-based FTEs (full-time equivalents), with significant regional variation being documented across Canada. Shipman and colleagues (2004) projected a 64% increase in the number of pediatricians in the United States from 2000 to 2020, whereas the child population is expected to expand by only 9%, and they discuss the implications of these projections for the pediatric physician workforce.

Practice Patterns of Primary Care Physicians

Family medicine is a specialty that has represented approximately half of Canada's physician workforce since the late 1970s (CIHI, 2016). Since primary care physicians deliver different kinds of care in a wide variety of settings, family physicians have more work options at the ends of their careers and so they may demonstrate retirement patterns that are different from specialists in other disciplines. As large numbers of primary care physicians from the "baby boom" generation approach retirement, questions have been raised about how succeeding generations of physicians, who tend to work differently, will replace them. Studying practice patterns of primary care physicians in order to understand how the care they provide changes over time – with a focus on the end-of-career period – presents an opportunity to enhance both the breadth and depth of our understanding of the physician workforce.

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Differences in the practice patterns of Canadian family physicians related to generation and gender have been well documented: In a study examining workloads of family physicians over a ten-year period, Watson and colleagues (2005) found that younger physicians – both male and female – provided fewer services than their older colleagues, and that workloads of female physicians were approximately 80% of their male counterparts. A subsequent study (Watson, Slade, Buske, & Tepper, 2006) also documented generational differences in workloads, demonstrating that younger and middle-aged family physicians carried smaller workloads in 2003 than their same-age peers did 10 years earlier and that female family physicians' workloads decreased from 74% to 68% of their male counterparts over the ten-year study period. Similar trends have been observed in Australia (Schofield & Beard, 2005). These studies raise concerns that, because older physicians carry workload volumes significantly larger than younger ones, retirement of older physicians could result in significant shrinkage of overall family physician service volumes. As the physician population ages, understanding how primary care physicians withdraw from the workforce and how younger physicians take their places becomes increasingly important. Also, because the feminization of the primary care physician workforce has continued since the studies by Watson and colleagues (these differences were identified by analyzing the practice patterns of physicians between 1991 and 2003), additional research is necessary to explore career trajectories and retirement patterns of female physicians (Hedden et al., 2014).

Primary care practice profiles are also changing over time. Chan (2002b) documented declining comprehensiveness of primary care by examining participation rates of Ontario primary care physicians in the provision of emergency, inpatient, nursing home, house call, anaesthesia, and obstetrical services. The proportion of "office-only" primary care physicians (those who did not provide services in any non-office setting) rose from 14% to 24% over a ten-year period (between 1989/90 and 1999/2000). Chan (2002b) postulated that declining comprehensiveness may be driven by physician aging or by the lifestyle preferences of younger physicians. While some older physicians may choose to limit their professional activity to office-only practice, it is possible that other older family physicians may choose instead to stop providing care in the office in favour of work in other settings. The choice of primary care physicians to pursue bridge employment or phased retirement in non-office settings – for example, by providing care to hospital inpatients or by assisting at surgery – merits further study.

New Perspectives on Physician Retirement

In 2011, the Canadian Institute for Health Information report entitled "Putting Away the Stethoscope for Good? Toward a New Perspective on Physician Retirement" presented the results of a comprehensive analysis of physician retirement issues in Canada at the time (Pong, 2011). The author synthesizes information from a variety of sources, including the 2007

National Physician Survey, Scott's Medical Database, the National Physician Database, and the Canadian Medical Association (CMA) Master File, to create a holistic picture of the state of understanding of physician retirement in Canada.

In answer to the introductory question "What is known about physician retirement?" Pong (2011) asserts: "The short answer to this question is that we do not know very much" (p. 8). One reason for this is that none of the data sources in Canada – or indeed, in other parts of the world – are specifically designed to capture information on the complexities of retirement reviewed above. As such, estimates of retirement rates have to be inferred or derived before they are included in workforce planning models. And, since different data sources define retirement differently, comparison of the estimates yielded by different data sources and planning models can be difficult. For example, the Scott's Medical Database and the CMA Master File yield different estimates of annual retirement rates (0.54% and 0.79%, respectively), both of which are substantially lower than overall rates of *intended* retirement within 2 years obtained from the 2007 National Physician Survey (3.2%). The differences in these estimates can be explained by underlying differences in the data sources used to generate them.

The report identifies many reasons why physicians limit clinical practice: to raise a family, to focus on administration or pursue further training, poor health, or in order to transition to retirement. A large number of minimally active physicians may bias medical workforce statistics and skew projections. As such, being able to identify such physicians is important. Pong (2011) examined changes in physicians' activity levels – as reflected by the number of clinical services provided (which measures volume of work) and FTE status (which measures the monetary value of that work as reflected by fee-for-service payments). Varying the threshold can result in different estimates of minimally active physicians. For example, if the minimally active threshold is set at 33% or less of previous workload, the proportion of physicians still in practice and considered minimally active would be 7.3% of physicians aged 55 and older and 11.9% of physicians aged 65 and older. In the setting of health care, where patient access to service and wait times are perennial concerns, the services provided by a minimally active physician may be critical to certain populations of patients and the health care system as a whole.

In order to illustrate how an alternate perspective on retirement could work, Pong (2011) presents a series of case studies. In one case study, six age-specialty cohorts are tracked over an 18-year period from 1989 to 2006 to see how many individuals remained in fee-for-service clinical practice and how the FTE values of cohort members who remained in active practice changed over time. In general, the number of physicians in active practice declines over time, as does their average FTE value. In a second case study, two cohorts of family physicians (aged 50-54 and 55-59 in 1989) are isolated, and the percentages of physicians involved in eight types of clinical service over time are examined in order to test the hypothesis that physicians are likely to limit their scopes of practice as they age. Fee-for-service billing trends indicate that the

percentage of family physicians providing office assessment services, hospital inpatient services, basic procedural skills services, advanced procedural skills services, obstetrical services, mental health services, surgical assistance services, and anaesthesia services declines by varying degrees with increasing physician age.

This is a comprehensive analysis that attempts to go beyond the traditional conception of retirement as a categorical end-point and to understand the complexity of the medical practice patterns of older physicians. The report argues that retirement should be seen as the "end point of a continuum of changes in medical practice as a physician gets older" (Pong, 2011, p. 55). It concludes by suggesting that a clarified definition of retirement be adopted, that databases be as consistent as possible in defining retirement and counting retired physicians, and that strategies should be employed to take into consideration changing practice patterns of physicians as they age rather than relying on traditional head count methods.

Health Workforce Planning

The physician workforce is a complex adaptive system and developing a model to describe and predict it is challenging. No workforce planning approach has been fully successful, as evidenced by alternating physician shortages and surpluses over the past several decades in most developed countries. Many countries use at least one health workforce planning model (Ono, Lafortune, & Schoenstein, 2013), and ongoing efforts to understand and manage the health workforce continue in Canada (Birch & Bourgeault 2007) and around the world (Gorman 2013).

The theoretical basis and practical application of workforce planning models in Canada have evolved over time, moving from the use of health provider head counts and demographics toward population health needs-based planning. In an examination of shifts in the Canadian physician workforce, Chan (2002a) focused on flows into and out of the workforce, while Denton, Gafni and Spencer (2009) subsequently generated predictions of physician supply based on the age structure of the physician population, and Birch and colleagues (2009) developed a model that could be used in a variety of situations, using population need as a starting point for provider requirements. The difficulty of these models in accurately predicting physician supply is in part related to a focus on physician head counts and the volume of service provided by physicians; simplistic and unrealistic assumptions about physician attrition also hinder accurate estimates of outflow from the workforce. In addition, inconsistencies in the estimates of workforce metrics produced by different data sources add uncertainty (Pong, 2011; Staiger, Auerbach, & Buerhaus, 2009), which has led to widespread calls for more systematic collection of data related to physician retirement (Jeon & Hurley, 2010; Kletke, 2004; Pong, 2011).

Using data to understand the *process* of retirement – how physicians change what they do over

time – may be the key to understanding physicians' retirement behaviour and being able to incorporate more accurate estimates of physician supply into workforce models.

Next Steps in Physician Retirement Research

In summary, the literature features numerous calls for further research into physician retirement. Prior research urges a broader approach to physicians' end-of-career practice patterns (Davidson et al., 2001; Jeon & Hurley, 2010; Newton et al., 2004; Pong, 2011), and a conspicuous gap exists in our understanding of the intersection between physicians' workloads and their scopes of practice at the ends of their careers. Given the changing demographics of the profession, there is a clear need to investigate generational and gender differences in retirement decisions (Feldman & Beehr, 2011; Degen, Li, & Angerer, 2015) and the impact of the feminization of the primary care workforce on attrition patterns of family physicians (Hedden et al., 2014). It is important that further research generate evidence that can be used to inform physician workforce policy and form the basis for better health workforce planning (Jeon & Hurley, 2010; Joyce, 2013). Finally, any further study must recognize the complex and multifaceted nature of the issue of physician retirement (Silver et al., 2015).

The synthesis of the literature in this section presents a unique and comprehensive overview of how the body of knowledge around the physician workforce and physician attrition informs the study of physician retirement in general and this study in particular. The research we reviewed informed the design and execution of our study, and influenced our decisions on issues including but not limited to: investigating patterns of transition to retirement, exploring the outcomes of different definitions of retirement, and examining generational differences in practice patterns.

Methodology

This is a longitudinal, population-based, open cohort study using health administrative data from the Institute for Clinical Evaluative Sciences (ICES). Demographic and practice-related data for family physicians were extracted from six linked databases – the ICES Physician Database (IPDB), the Corporate Provider Database (CPDB), the Ontario Health Insurance Plan (OHIP) Claims Database, the Client Agency Program Enrolment (CAPE) database, the AVGPRICE database, and the CONTACT database – for the period 1992 to 2013 (see Appendix 1). These datasets were linked using unique, encoded identifiers and analyzed at the Institute for Clinical Evaluative Sciences (ICES). Analyses were conducted using SAS® Enterprise Guide® 6.1. This study received approval from the University of Ottawa Research Ethics Board (see Appendix 2) and through the ICES Privacy Impact Assessment process.

The Population

The cohort is composed of all family physicians having provided OHIP-funded comprehensive primary care services at any time between 1992 and 2013 (the years for which all relevant data were available).

We initially identified all family physicians licensed to practise in 1992. In each subsequent year, we added family physicians not yet identified to the cohort, capturing new graduates who started practices and physicians who migrated to Ontario. Once included, physicians remained in the cohort until the end of the study period (see Appendix 3).

Physicians who did not provide comprehensive primary care at any time during the study period were excluded from the analyses.

Demographic and Practice-Related Data

For each physician, we captured year of birth, sex, and location of training (the country in which the physician's medical school was located).

In each year, we characterized the rurality of the location of the physician's practice using the 2008 Rurality Index of Ontario (RIO). The RIO score is a measure of relative rurality used by the Ontario Medical Association and the Ontario Ministry of Health and Long Term Care, primarily for allocating incentive funding. The score ranges from 0 to 100,

with higher scores reflecting increased rurality. Community population, population density, and travel times to the nearest basic and advanced referral centres factor into the score. (See Appendix 4 for examples of RIO scores and classifications.) In keeping with previous research using RIO scores, practice locations where characterized as Major Urban, Non-Major Urban, or Rural on the basis of their RIO scores. (Note that any community with a RIO score ≥ 40 is designated as "Rural". Remote communities – with RIO scores approaching 100 – are included in the "Rural" designation and so we use Rural to denote rural *or* remote.) Using RIO scores, we were able to identify physicians who maintained their practices in major urban, non-major urban, or rural locations throughout their careers, as well as physicians who changed rurality during the study period. (Note that physicians who moved their offices from one place to another in a given city, or from one rural community to another, are not included in this statistic, since their RIO score remains unchanged.)

We also recorded each physician's remuneration model in each year of the study. Physicians were classified as being remunerated via traditional Fee-For-Service (FFS), Reformed-FFS, Capitation, Capitation and Family Health Team (FHT), or Other (this category includes 10 separate and relatively uncommon remuneration models) (see Appendix 5). The majority of alternate remuneration models (reflecting all models other than traditional FFS payment that is based solely on FFS) were introduced subsequent to the primary care reform processes that started in Ontario in 2002.

In each year of the study period, physicians in the cohort were characterized as providing comprehensive care or not using an algorithm developed at ICES. Physicians were deemed to have provided comprehensive care if they worked at least 44 days and billed at least once in at least 7 of 22 activity areas associated with primary care provision in that year (see Appendix 6). These areas include: mini/minor assessments, general assessments or reassessments, intermediate assessments, periodic health exams, geriatric care, mental health or addiction services, hospital care, home visits, chronic care or long term care, emergency department or equivalent services, vision care, palliative care, flu shots, other immunizations, office lab procedures, allergy shots, other injections, pap smears, anticoagulant therapy, pre-operative assessments, diabetes management, and smoking cessation.

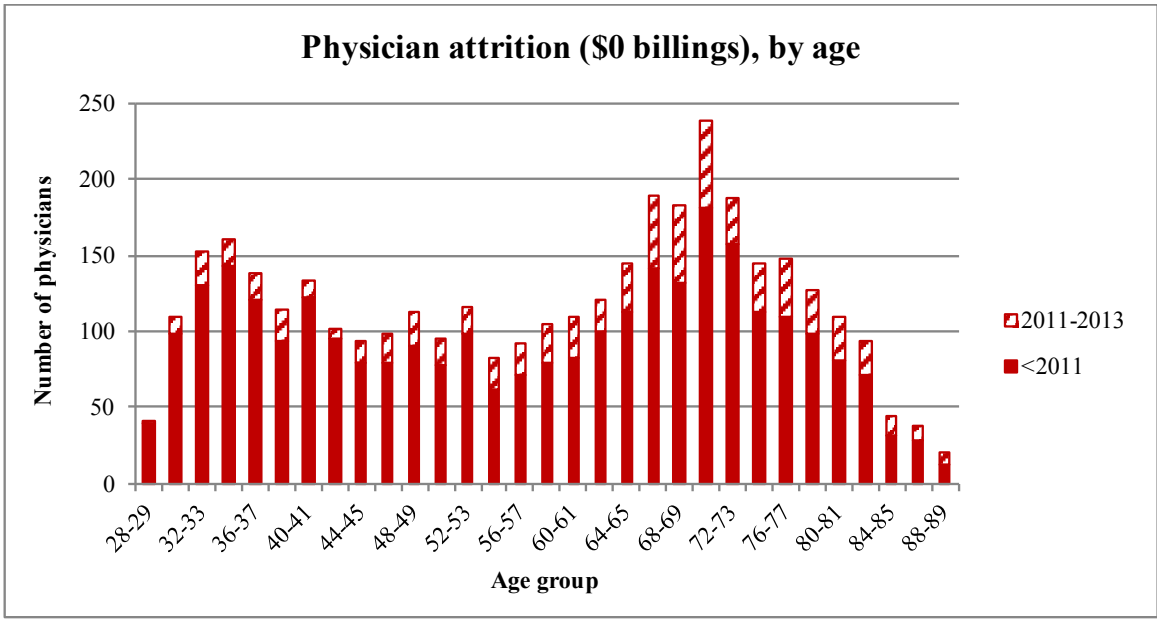
Definitions and Measures of Retirement

We considered physicians to be retired in the year after they were last active, when **current and future billings were equal to zero**.

By applying a definition based on non-participation in the workforce ($0 billed) to our data, we identified attrition from clinical practice. Because attrition may occur for reasons other than retirement (for example, migration or illness) and it is not possible to tell from our data exactly why these physicians have stopped practising in the province, our definition of retirement is more accurately one of attrition that is being used as a proxy for retirement.

Our initial analyses using the $0 billing threshold showed that attrition from practice occurs across the age spectrum, and that the frequency distribution of attrition is bimodal, with a peak in the early years of practice, the nadir around age 55, and another peak in later years (Figure 2). Separating physicians for whom retirement may not be a certainty (those who retire near the end of the sample period, between 2011-2013 (striped bars)) did not change this pattern. An aging physician workforce lends urgency to the effort to understand attrition patterns of older physicians, and so we chose to focus on physicians in the older age group (aged ≥ 55).

Figure 2. Attrition from practice ($0 billing threshold)



In order to assess the influence of the definition of retirement on our findings, we conducted sensitivity analyses using three alternate definitions of retirement (based on billings, workload, or licensure), some with multiple measures, yielding a total of eight separate thresholds for comparison. These thresholds were chosen to correspond with those used in other physician workforce studies, in order to maintain consistency and maximize comparability. We conducted analyses in which, in turn, each of the eight thresholds was applied. For each, physicians 55 years and older must have dropped

below the threshold in the year under consideration and in all future years to be considered retired.

Table 1. Different thresholds to measure retirement

Definition	Measure
Billings	≤$20,000
	≤$10,000
	$0 (Primary definition)
Workload	≤0.33 FTE
	≤0.25 FTE
	≤0.15 FTE
	≤0.10 FTE
Licensure	License to practise relinquished

Retirement thresholds based on billings ($10,000 and $20,000) were adjusted to account for inflation in each fiscal year using the Consumer Price Index (base year 2002).

Because the definition of retirement in our study requires that physicians meet a given threshold in *current* and all *future* years, there is a degree of uncertainty associated with the estimates nearing the end of the sampling period. In the most recent years of the sample, the numbers of retired physicians may be overestimated because of the small number of subsequent years available to us for analysis. Therefore, physicians who meet the retirement threshold in a given year may be inappropriately considered retired if there is insufficient follow-up to ascertain that they continued to meet the threshold in subsequent years. The estimates in the final year of the sample – with no follow-up at all – are essentially cross-sectional and are the least accurate; as the follow-up period increases, the accuracy of the estimates increases.

An adjustment to account for the number of years of follow-up was calculated by iteratively estimating the number of physicians considered retired, while varying the cut-off year. Because calculated adjustments for estimates generated with at least five years of follow-up were less than the average year-to-year variability, these estimates (the years prior to 2008 with a cut-off year of 2013, using all available data) were considered to be the most accurate and were used as reference years. Estimates generated using cut-off years of 1999 to 2008 and assuming no follow-up were compared to the reference estimates and the average differences between estimates were used to determine the adjustment to be applied in the final year of the sample to correct the overestimation resulting from insufficient follow-up. A similar methodology was used to calculate adjustments for estimates generated with 1, 2, 3, or 4 years of follow-up. For example, for physicians meeting the $0 billing threshold, estimates generated with no follow-up were found to be on average 33% higher than estimates with follow-up data. An adjusted estimate was therefore produced by reducing the number of physicians considered retired

according to the $0 billing threshold in 2013 by 33%. Estimates generated with one year of follow-up were found to be 18% higher than estimates with follow-up data, and so the estimated number of physicians considered retired according to the $0 billing threshold in 2012 was adjusted by 18%. These adjustments were applied uniformly to overall estimates of retired physicians.

We examined how the definition of retirement impacts the estimate of the number of retired physicians in each year of the study period. We also examined how long it took physicians to transition from each of the seven different retirement thresholds based on workload and billings to relinquishment of their licenses. We calculated the average age at which physicians reach retirement thresholds. (Minimally active physicians – physicians who fell below a given threshold throughout the study period – were excluded from this analysis.)

Practice Pattern Measures

Workload

Recognizing that a single measure may not provide an adequate description of physician workload over time, we chose to examine workload from five perspectives:

- Payments – We collected information from the IPDB about the total amount paid to physicians annually. This amount includes fee-for-service and capitation payments, but does not include all sources of remuneration (for example, on-call stipends are not captured in this variable). An adjustment to account for inflation was applied to this amount in each fiscal year using the Consumer Price Index (base year 2002).
- Full-Time-Equivalent (FTE) Status – We used the IPDB measure of annual FTE status for each physician, which is derived using the total amount paid to physicians annually. FTE is used as a measure of relative workload, and is generated by comparing total annual payments of individual physicians with defined FTE payment benchmarks. If an individual physician's payments are between the 40^{th} and 60^{th} percentile of payments made to physicians of the same specialty, the physician is assigned a value of 1.0 FTE. If a physician's payments are below the 40^{th} percentile, the physician is assigned an FTE value proportionately less than 1.0. If a physician's payments are above the 60^{th} percentile, the physician is assigned an FTE value equal to 1.0 + the logarithm of the ratio of the physician's payments to payments at the 60^{th} percentile (ICES, 1999).
- Service Volumes – We collected the total number of visits provided by each physician annually from the IPDB.

- Days Worked – We queried the OHIP claims database to determine the number of days worked annually by each physician. In order to be classified as having worked on a given day, the physician must demonstrate at least one billing for at least five individual patients on that day.
- Panel Size - We collected information on the number of patients cared for by each physician in each year. Between 1992 and 1997, panel sizes were derived from the OHIP claims database using a virtual attribution process. This process attributes patients to physicians' panels based on the amount of care they receive in a given year; the physician who provides the greatest amount of service to a given patient (as measured by the cost of that service) is deemed to be that patient's primary physician, and the patient is attributed to that physician's panel in that year. Patients who do not visit a physician in a given year are not attributed. Between 1998 and 2013, physician panel sizes were defined as the sum of OHIP-derived panel sizes and panel sizes of enrolled patients explicitly recorded in the CAPE database (Amy Mark Fraser, personal communication, March 30th, 2016).

Scope of Practice

Our analysis of physician scope of practice focused on the extent to which primary care physicians continued to provide comprehensive primary care over time, particularly as they near the ends of their careers. We focused our analyses on physicians aged 55 years or older who stopped providing comprehensive care. We examined the temporal relationship between stopping comprehensive care and retirement, identifying one group of physicians who stopped providing comprehensive care because they retired, and another who continued to practise after they stopped providing comprehensive care. We then looked forward in time to see which clinical activities the latter group of physicians engaged in instead of providing comprehensive care.

We examined the following clinical activities: Anaesthesia, ER, Inpatient, Home Visits, Mental Health Services, Nursing Home, Obstetrics, On-Call Anaesthesia or Assisting, Palliative Care, and Surgical Assisting. For each practice activity, we identified 1 to 6 billing codes that, if present in a physician's billings, would confirm their participation in the activity. These codes also had to be present in sufficient number to support characterizing the physicians as providing the service (Table 2). Previous research into physician scope of practice informed the choice of both the activities and the thresholds (Pong 2011; Chan, 2002b).

By querying the OHIP claims database for codes related to each practice activity, we characterized physicians as participating in each practice activity or not, in each year of

the study period. For example, physicians participating in obstetrical deliveries are expected to bill P006 (Vaginal Delivery); this code should never be present in the billings of physicians who do not do obstetrics. In order to be characterized as providing intrapartum obstetrical care in a given year, physicians must have billed P006 at least twice that year.

Table 2. Annual service thresholds (billings ($) or service counts) necessary for being characterized as participating in a given activity

Anaesthesia	> $1000
ER	> 50
Inpatient	> 50
Home Visits	> 10
Mental Health Services	> 50
Nursing Home	> 50
Obstetrics	> 2
On-Call Anaesthesia or Assisting	≥ 1
Palliative Care	> 10
Surgical Assisting	> 12

Analyses

We examined physicians' average workloads, by age, in order to see how workload changed over the course of physicians' careers. We also conducted stratified analyses to look for differences in workloads that may have been linked to demographic or practice-related factors such as gender, location of training, or location of practice. We also examined differences in workload between physicians working in fee-for-service (FFS) settings before and after primary care reform and in non-FFS settings after primary care reform. (Non-FFS settings were grouped together and included Reformed-FFS (Family Health Groups), Capitation (Family Health Networks and Family Health Organizations), and Family Health Teams (FHT).) Finally, we explored whether the generation to which physicians belong influenced their workload by grouping physicians according to the decade of their birth and stratifying each workload measure by these groups.

Average retirement ages, amongst physicians aged 55 years and older, were compared for statistically significant differences related to gender and location of training using Student's t-tests, and related to location of practice using ANOVA.

In order to learn more about the patterns of practice leading to retirement, we aligned physicians' retirement years and looked back in time at their practice patterns prior to retirement. We conducted these analyses with a view to identifying changes in workload or scope of practice that could presage retirement. We examined both workloads and

scopes of practice in each of the ten years before physicians met the $0 billing threshold. We also compared the workloads of physicians who retired with those who continued practising, before and after these physicians stopped providing comprehensive care.

Results

The Population

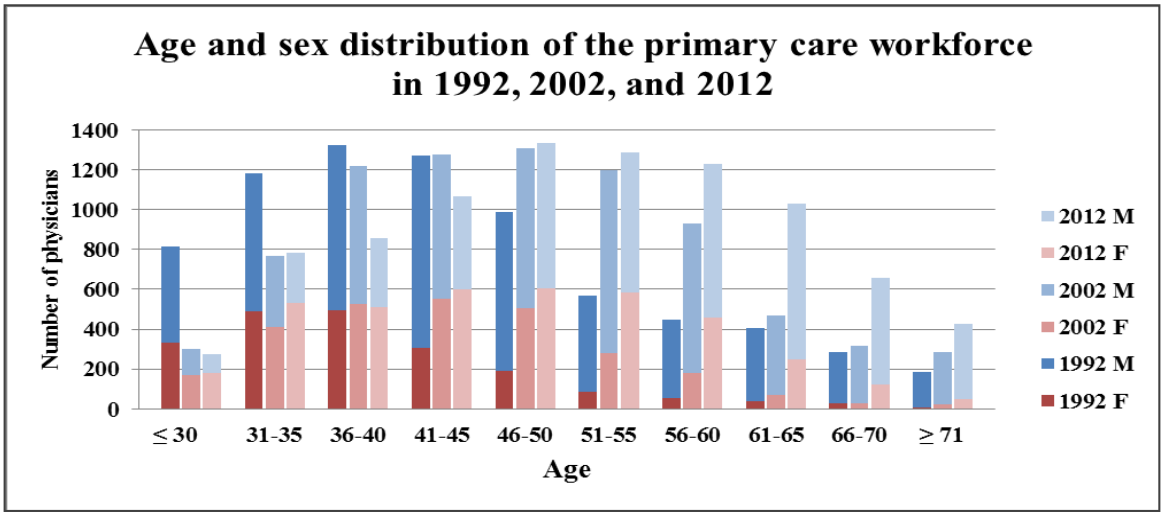
The cohort is composed of 21,240 family physicians. Of these, 5,688 family physicians did not provide comprehensive primary care at any time during the study period. The remaining 15,552 physicians compose what we define as the primary care workforce.

The physicians who did not provide comprehensive care may have been engaged in focused practices – in Emergency Medicine, for example – or may have been minimally active, consistently working less than 44 days per year. These physicians were excluded from our analyses primarily because this study focused on providers of primary care. However, this group of physicians is an important part of the physician workforce in general, and efforts to understand their retirement patterns should be considered in future.

The Primary Care Workforce

The demographic profile of the primary care workforce at three points in time, in 10-year intervals, is shown in Figure 3.

Figure 3. Age and sex distribution of the primary care workforce



Over time, there has been an aging and feminization of the workforce. The workforce in 1992 was relatively young, as demonstrated by the tall dark bars in younger age groups, while the workforce in 2002 has grown older, as demonstrated by the tall light bars in older age groups. The proportion of women in the workforce increased over time, as

evidenced by red bars that get taller from left to right in each grouping.

After remaining quite stable around 22% between 1995 and 2005, the proportion of international medical graduates (IMGs) in the workforce increased steadily, to 30% in 2013. Internationally trained physicians working in Ontario come from 118 different countries, although the majority of IMGs were educated in the United Kingdom, Ireland, or India. The share of physicians educated in these three countries changed over time: in 1992, physicians from these three countries made up 54% of the internationally educated workforce in Ontario, compared to 31% in 2013.

Between 1992 and 2013, the practice locations of primary care physicians in Ontario were relatively stable. The majority of physicians (77%) had practices in major urban locations while 16% of physician practised in non-major urban locations, and 7% of physician practised in rural locations. Over the course of the study period, 2200 physicians changed rurality. Physicians moved in all directions and at different times in their careers. Physicians who moved did so on average 1.67 times overall, and neither physician gender nor location of training influenced the propensity of physicians to move.

Retirement

The estimated number of physicians considered retired in each year of the study period, according to different retirement thresholds, is shown in Figures 4A and 4B. Dashed lines are estimates that have been adjusted to account for uncertainty in the measure at the end of the sample period.

Figure 4A. Number of physicians (aged ≥ 55) considered retired using measures of retirement based on workload (FTE)

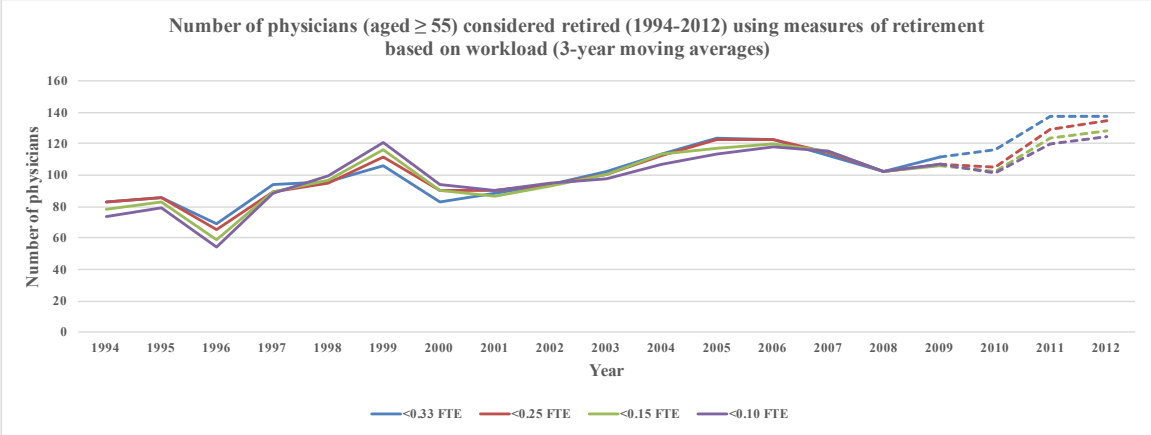
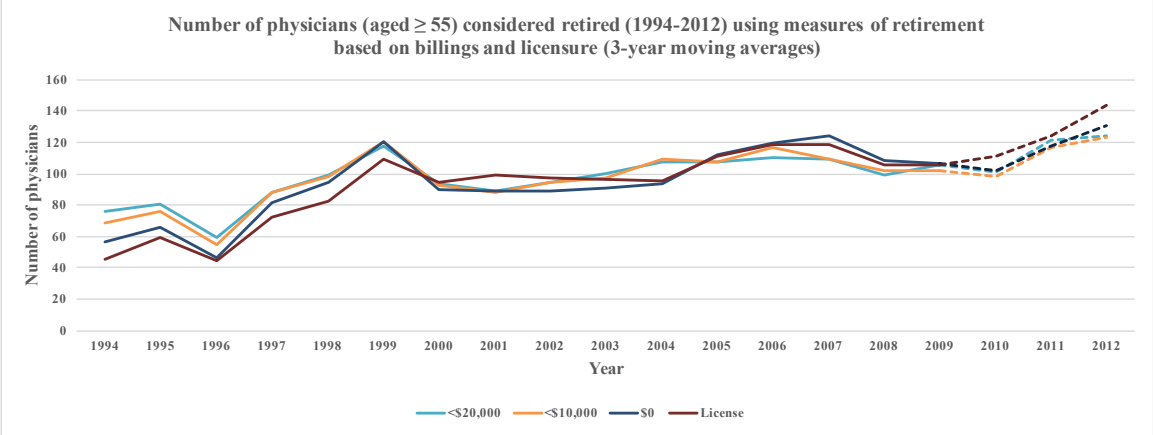


Figure 4B. Number of physicians (aged ≥ 55) considered retired using measures of retirement based on billings and licensure



Estimates of retirement are relatively stable between 2000 and 2010, while some volatility in the number of retired physicians is noted in the late 1990s, and a trend toward increased retirements in the most recent years of the sample period may be evident. When annual retirements are standardized for the size of the workforce, very similar patterns are evident.

The estimate of how many physicians are retired depends on the definition of retirement. In general, our primary definition of retirement – $0 billed in current and future years – produces estimates of retired physicians that are lower than all the other thresholds except the threshold based on licensure, which, for the most part, yields the most conservative estimates. Thresholds of < 0.10 FTE and < $20,000 produce almost identical estimates. There is good concordance over time between estimates of retirement using different measures; estimates of retirees are, on average within 12% of one another.

Using data from 2000 to 2013, we examined how long it took physicians to transition from each retirement threshold to relinquishing their licenses.

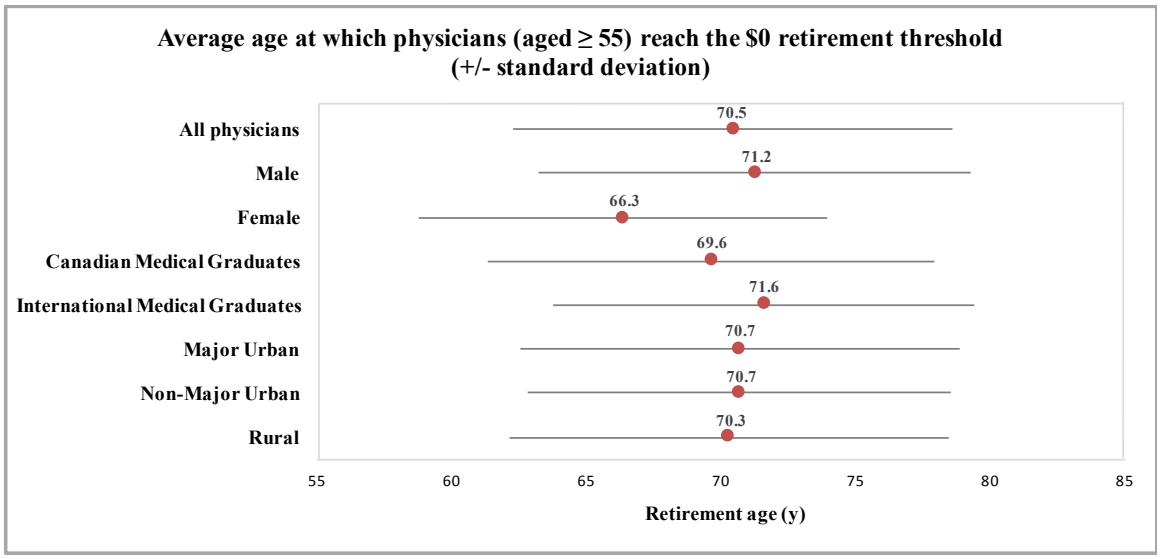
Table 3. Average proportion of physicians (aged ≥ 55) transitioning from a given retirement threshold to relinquishing license within a given time frame, 2000-2013

	Same Time	% within 1 year	% within 2 years	% within 3 years	% within 5 years	% within 10 years
<0.33 FTE	26%	56%	64%	70%	78%	93%
<0.25 FTE	32%	61%	68%	75%	82%	94%
<0.15 FTE	42%	69%	77%	83%	88%	97%
<0.10 FTE	50%	76%	84%	89%	91%	97%
<$20,000	46%	73%	81%	86%	90%	97%
<$10,000	56%	79%	87%	90%	94%	97%
<$0	86%	92%	94%	96%	97%	99%
License	100%	100%	100%	100%	100%	100%

Eighty-six percent of physicians aged ≥ 55 who reached the $0 billing threshold also gave up their licenses at the same time. Within five years, 97% of these physicians had relinquished their licenses. In comparison, only 26% of physicians who fell below the 0.33 FTE threshold gave up their licenses at the same time, and only 78% relinquished their licenses within five years. The more strict a retirement threshold physicians meet (the less they work), the closer they are to retirement.

We calculated the average age at which physicians aged ≥ 55 reach the $0 billing threshold for retirement (Figure 5). The average retirement age is 70.5 across the entire cohort (95% confidence interval (CI) 70.1 to 70.8). Our stratified analyses show that on average, male physicians retired at age 71.2 (95% CI 70.8 to 71.6) and female physicians retired at age 66.3 (95% CI 65.5 to 67.1). On average, international medical graduates retired at age 71.6 (95% CI 71.1 to 72.1) and Canadian-trained physicians retired at age 69.6 (95% CI 69.2 to 70.1). The differences between the ages at which male and female physicians and international and Canadian medical graduates retired were found to be statistically significant ($p < 0.05$). Physicians with practices in major urban locations retired, on average, at age 70.7 (95% CI 70.2 to 71.1), as did physicians with practices in non-major urban locations (95% CI 69.8 to 71.5). Physicians practising in rural locations retired, on average, at age 70.3 (95% CI 69.0 to 71.6). The location of practice – major urban, non-major urban, or rural – does not significantly influence retirement age ($p > 0.05$).

Figure 5. Average retirement age (± SD)



The estimated retirement age varies based on the definition of retirement used. A difference of 2 years is seen between the most conservative estimate (produced by

relinquishment of license) and the most generous estimate (produced by < 0.33 FTE). Thresholds of < 0.10 FTE and < $20,000 produce very similar estimates of average retirement age.

Table 4. Average age at which physicians (aged ≥ 55) meet the $0 billing threshold

	All	Sex		Location of training		Location of practice		
		M	F	CMG	IMG	Major Urban	Non-Major Urban	Rural
<0.33 FTE	68.8	69.5	64.7	67.8	70.1	69.2	68.8	68.1
<0.25 FTE	69.1	69.9	64.9	68.1	70.5	69.5	69.3	68.7
<0.15 FTE	69.6	70.4	65.3	68.7	70.9	69.9	69.8	69.6
<0.10 FTE	69.8	70.6	65.6	69.0	71.0	70.1	70.1	70.1
<$20,000	69.7	70.5	65.5	68.8	70.9	70.0	69.9	69.8
<$10,000	70.0	70.8	65.8	69.2	71.1	70.3	70.2	70.0
<$0	70.5	71.2	66.3	69.6	71.6	70.7	70.7	70.3
License	70.9	71.6	66.9	70.1	71.9	71.0	71.1	70.6

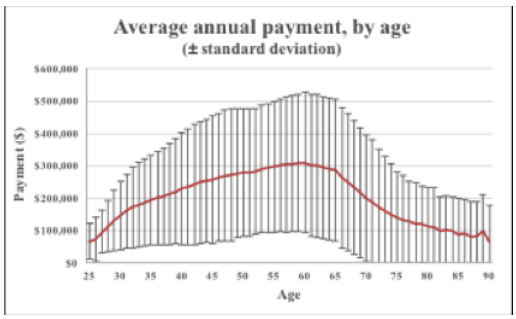
Average retirement ages were stable over time, with no trend toward retirement at older or younger ages between 1992 and 2013.

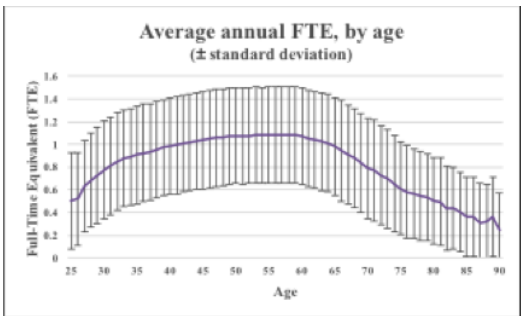
Workload

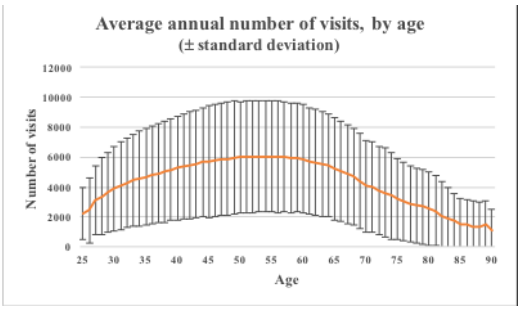
The preceding analyses have examined the presence or absence of workforce participation amongst aging physicians. However, the *extent* of participation – how much physicians work at the ends of their careers – is also important to understand.

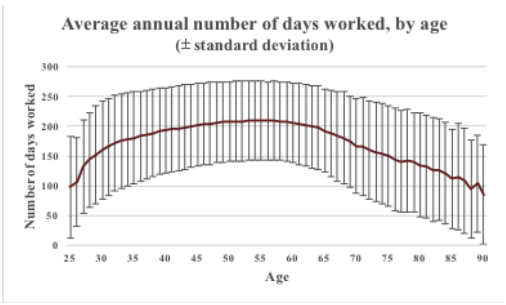
Age-activity curves (Figure 6) show that workloads generally increase throughout physicians' careers, sharply at first and then more gently, before declining. The slopes of the workload curves shift from positive to negative between ages 55 and 61. This is when physicians, on average, begin to reduce their workloads.

Figure 6. Average annual workload, by age (± SD)









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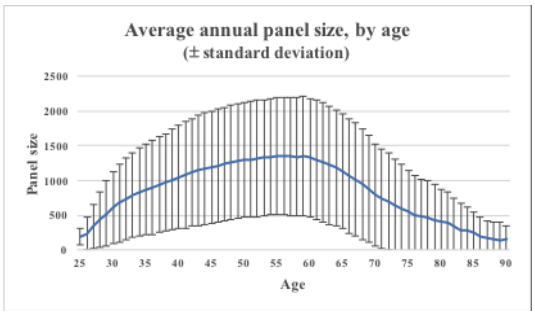
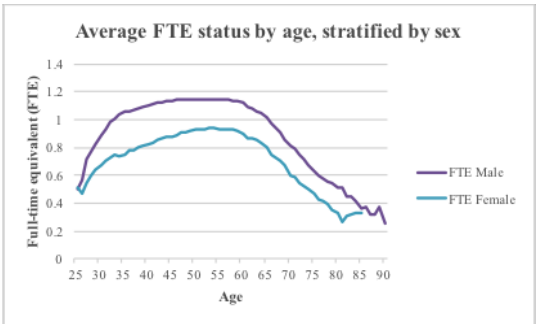
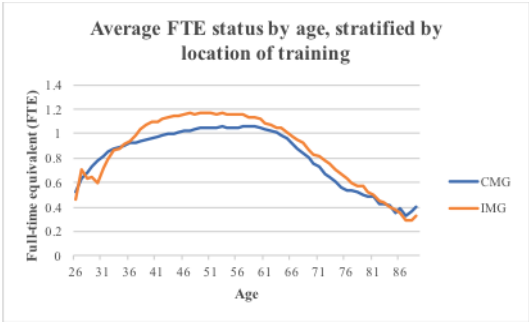


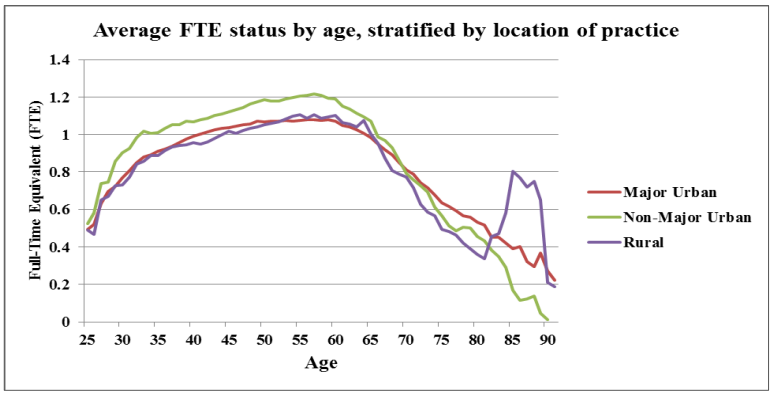
These figures should be interpreted with caution: they do not represent the work pattern of any given physician. They show only the average workload of physicians who are still in the workforce at any given age. The number of physicians contributing to each point on the curve is variable, with large numbers of physicians in the intermediate age groups and small numbers of very young and very old physicians.

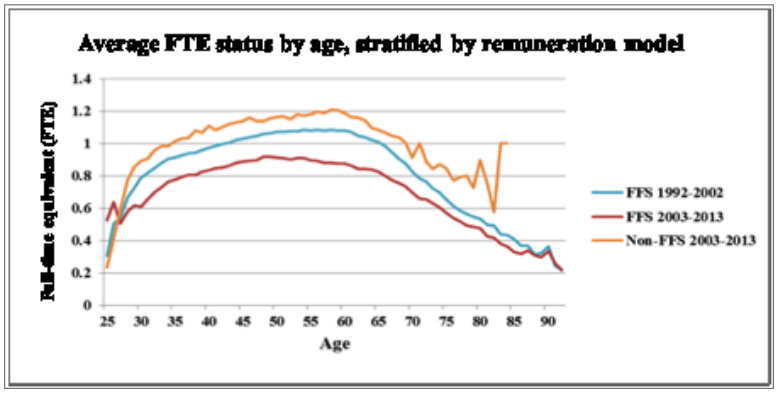
We conducted stratified analyses of workload data to look for differences in workload across gender, location of training, and location of practice over the course of physicians' careers. We also examined differences in workload between physicians working in fee-for-service (FFS) settings before and after primary care reform and in non-FFS settings after primary care reform.

Figure 7. Average FTE status, by age, stratified









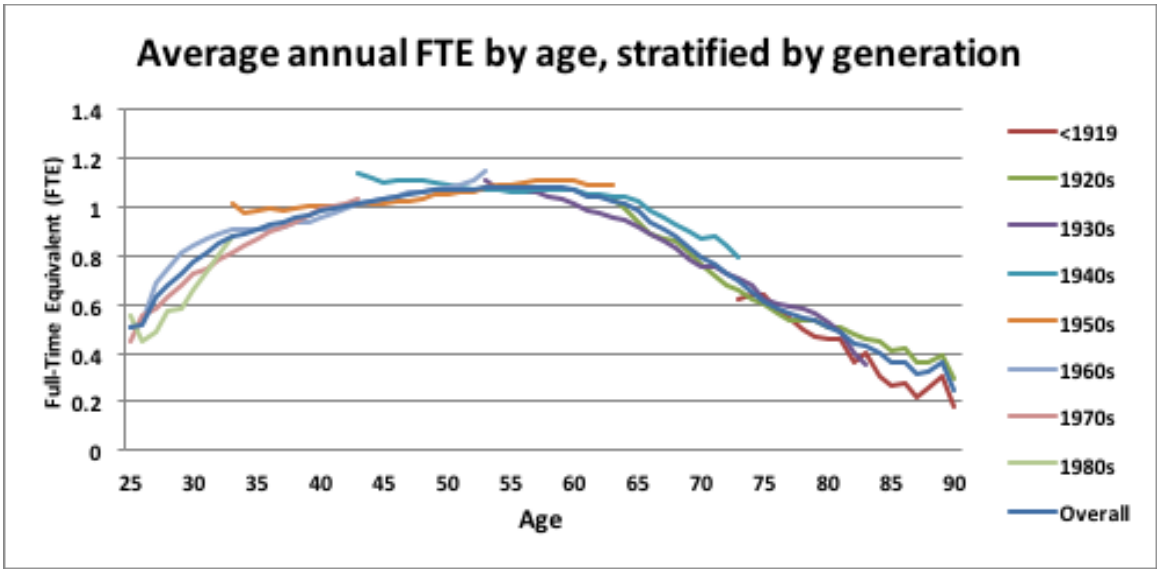
Stratified analyses revealed that female physicians have smaller workloads than male physicians throughout their careers. Likewise, international medical graduates work more than Canadian medical graduates for most of their careers. Physicians with practices in non-major urban locations work more than their colleagues until they are in their late 60s, at which point the differences in workload become less pronounced. Physicians working in practices with non-fee-for-service (FFS) remuneration (Reformed-FFS, Capitation, and FHT settings) have larger workloads than their fee-for-service colleagues. These patterns are consistent across the five measures of workload that we examined (payments, FTE, visits, number of days worked, and panel size).

Note that while the age-activity curves are very smooth in the intermediate age ranges, some increased variability is seen at the extremities of physician age (both old and young). For example, it appears that rural physicians in their 80s work much more than their colleagues with practices in major urban or non-major urban locations. However, this finding is actually an artifact related to the small number of physicians in this category and the disproportionate impact of several physicians with very high workloads on the average workload of the group.

End-of-career practice patterns of primary care physicians in Ontario

In an effort to identify secular trends in physician practice patterns, we stratified each of the workload measures by physician generation, with physicians grouped according to the decade of their birth (≤1919, 1920s, 1930s, 1940s, 1950s, 1960s, 1970s, and ≥1980).

Figure 8. Average FTE status, by age, stratified by generation



Average physician workload, measured by FTE status and stratified by generation, is shown in Figure 8. Curves representing each physician generation closely approximate the curve representing physicians overall, suggesting that the effect of physician generation on workload is minimal. When average workload, measured by days worked and panel size, is stratified by generation, very similar patterns are evident. Some separation between younger generations (physicians born after 1950) is evident when workload, as measured by the number of visits, is stratified by generation, and efforts to uncover the underlying reason for the observed separations are ongoing.

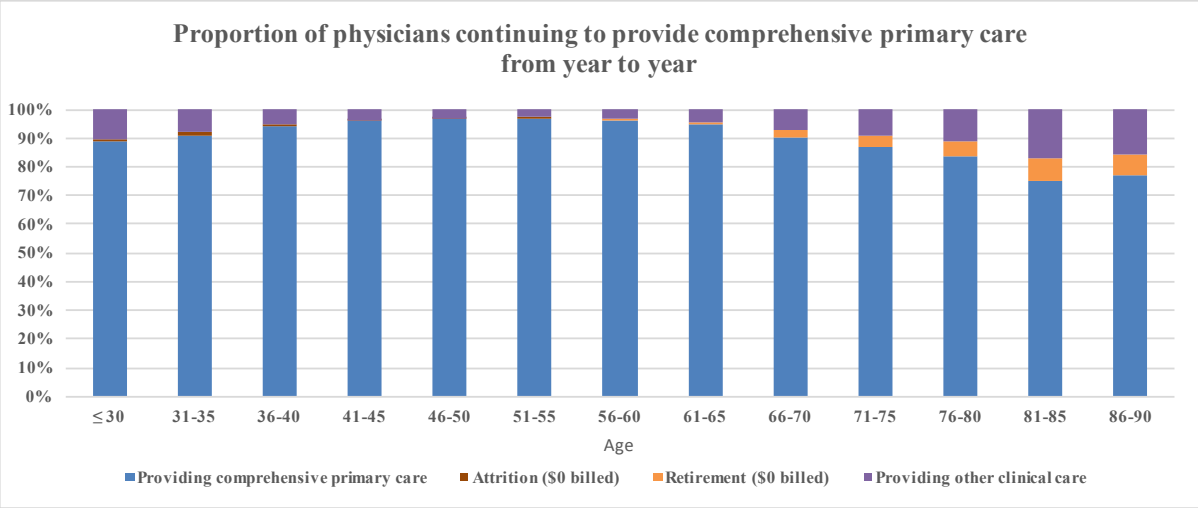
Scope of Practice

Having examined whether or not physicians continue to participate in the workforce as they age, and the extent of their workforce participation, we also sought to understand how physicians' scopes of practice – *what they do* – change over time. We were specifically interested in the extent to which primary care physicians continue to provide comprehensive care as they age and the temporal relationship between stopping the provision of comprehensive primary care and retirement.

We examined the likelihood of physicians of a given age continuing to provide comprehensive care from year to year. We found that the vast majority of physicians

continue to provide comprehensive care over time (Figure 9). When physicians at any age stop providing comprehensive care, they are more likely to continue practising in another setting than to stop practising completely. Note that Figure 9 displays proportions and that the actual numbers of physicians in younger and older age groups are smaller than those in intermediate age groups.

Figure 9. Proportion of physicians continuing to provide comprehensive primary care from year to year



Next, we selected physicians who stopped providing comprehensive primary care and looked forward in time at their practice patterns. Of the 2786 physicians aged ≥ 55 who stopped providing comprehensive care, 73% percent retired ($0 billing threshold) at some point during the study. Of these physicians, 824 (40%) stopped providing comprehensive care because they had retired, while the remaining 1211 (60%) stopped providing comprehensive primary care and continued providing other clinical care before they retired. These physicians worked, on average, for 3 more years before retiring.

Neither gender nor location of training nor location of practice appear to influence how long physicians continue to work after they stop providing comprehensive care and before they retire; physicians in each group retired, on average, within six months of one another.

In general, most physicians who continued to practise after they stopped providing comprehensive care continued with activities that were previously part of their practices.

Table 5. Practice patterns of physicians (aged ≥ 55) who continue to practise after they stop providing comprehensive primary care

Clinical Activity	N	Previously part of practice (%)
Anaesthesia	12	*

ER	96	≥ 95%
Inpatient	252	≥ 95%
Home Visits	185	≥ 90%
Mental Health Services	311	≥ 95%
Nursing Home	266	100%
Obstetrics	23	100%
On-Call Anaesthesia or Assisting	239	≥ 95%
Palliative Care	84	≥ 90%
Surgical Assisting	291	≥ 90%

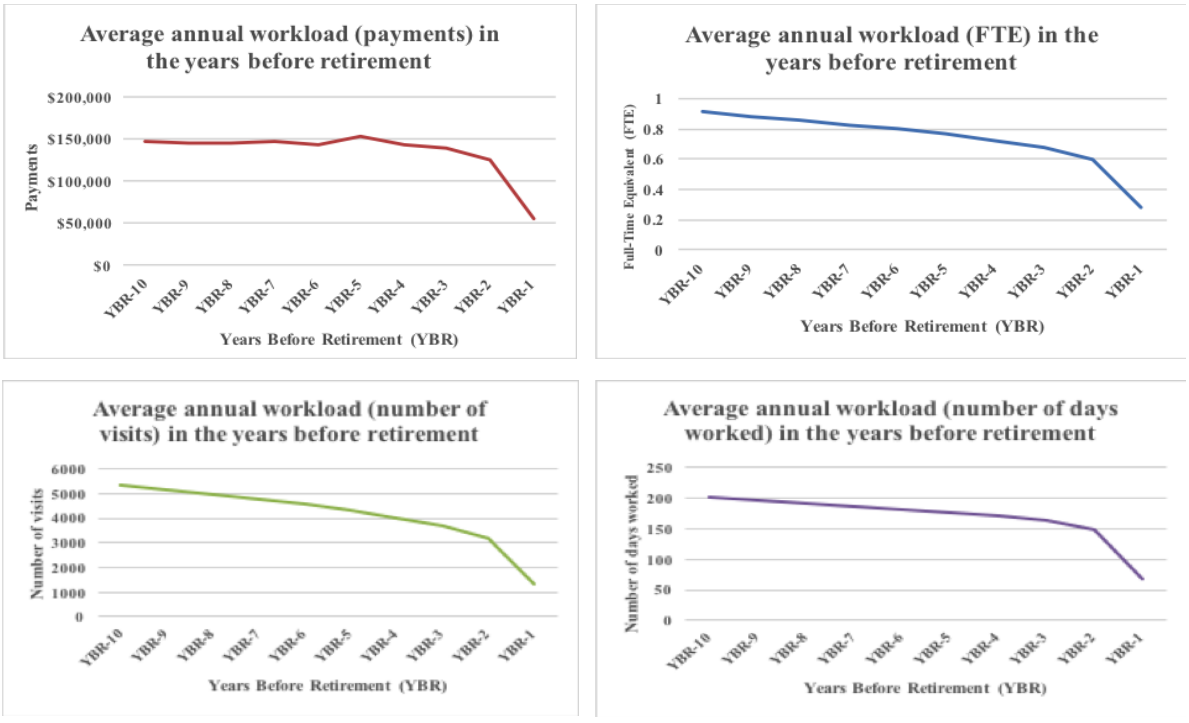
*The number of physicians participating in this activity is very small. The vast majority of physicians who continue providing anaesthesia services were doing so before.

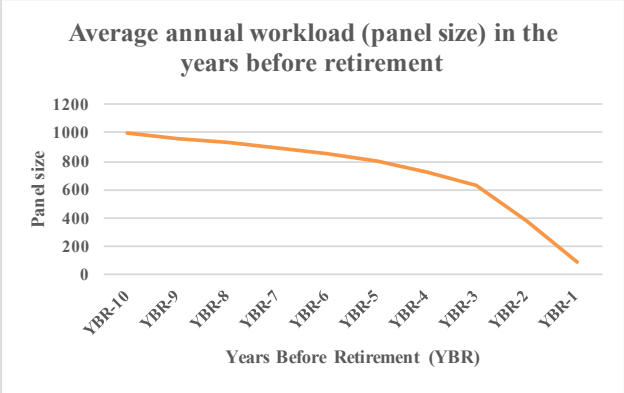
Integrated Practice Analysis

We identified 2142 physicians (aged ≥ 55) who met the $0 billing threshold for retirement and we examined their practice patterns – both workload and scope of practice – in the years before they retired (Figure 10).

Physicians gradually reduce workloads, by all measures except payments, in the years prior to retirement. A sudden reduction in workload is evident in the year immediately preceding retirement.

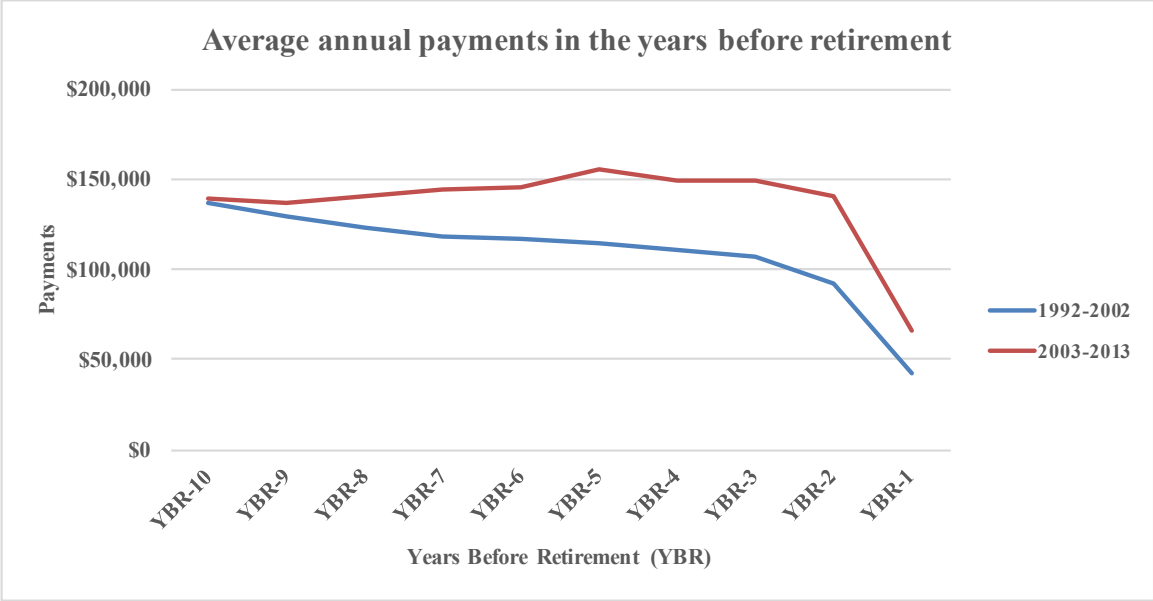
Figure 10. Average annual workload of physicians aged ≥ 55 in the years before retirement





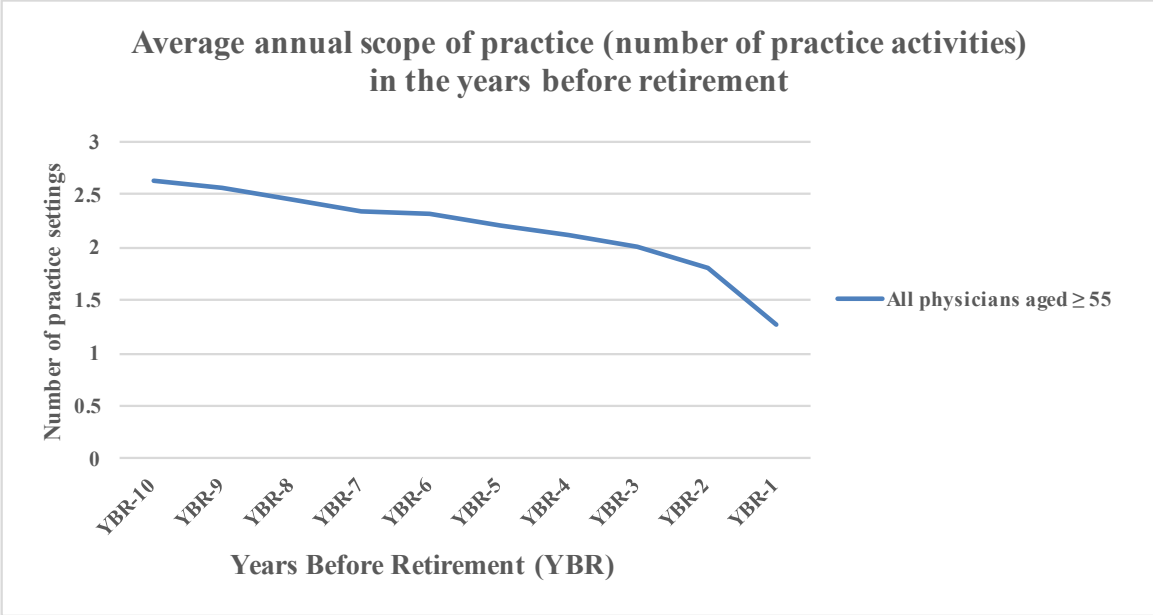
Compared to other workload measures, physician payments remain very stable in the years before retirement. We compared the average annual workload – measured by payments in the years before retirement – of physicians who retired between 1992 and 2002 with that of physicians who retired between 2003 and 2013 (Figure 11). We found that prior to 2002 (when the process of primary care reform began), average annual payments in the years before retirement decline over time in a manner similar to the other workload measures. After 2002, payments in the years before retirement actually increase slightly. This supports the hypothesis that sustained payments in the face of other declining workload measures may be accounted for by increases in remuneration related to primary care reform.

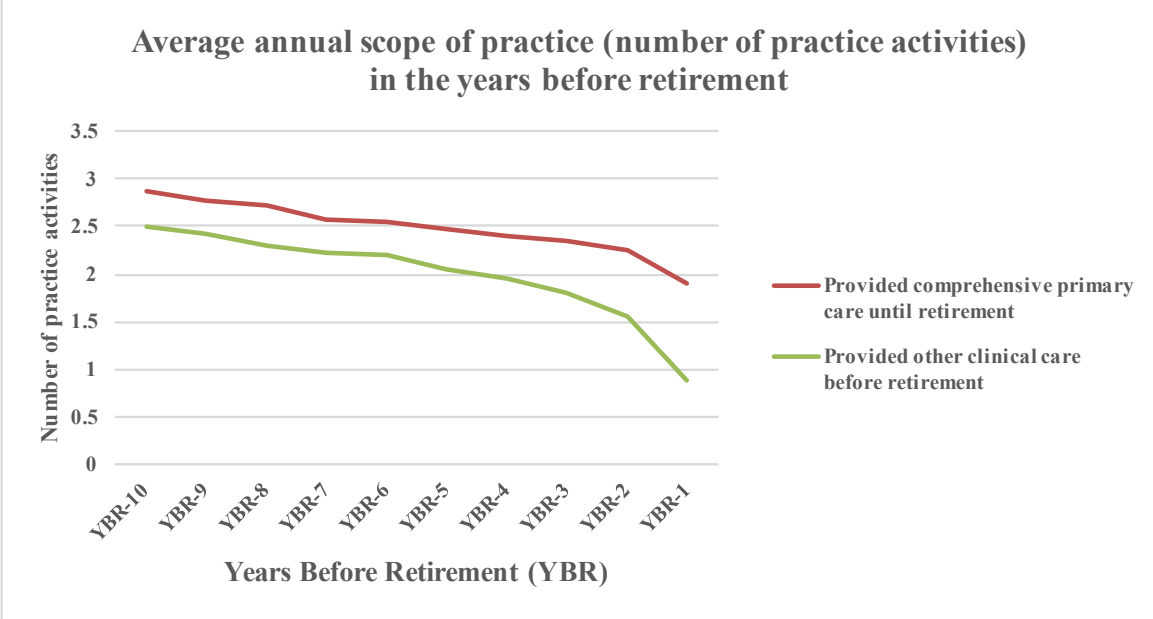
Figure 11. Average annual payments in the years before retirement



Physicians also reduce their scopes of practice in the years before retirement. When all physicians (aged ≥ 55) who retire are considered, the decline seen in the number of practice activities in which physicians participate prior to retirement is similar to the decline in average annual workload that is seen over the same time period (Figure 12).

Figure 12. Average annual scope of practice in the years before retirement



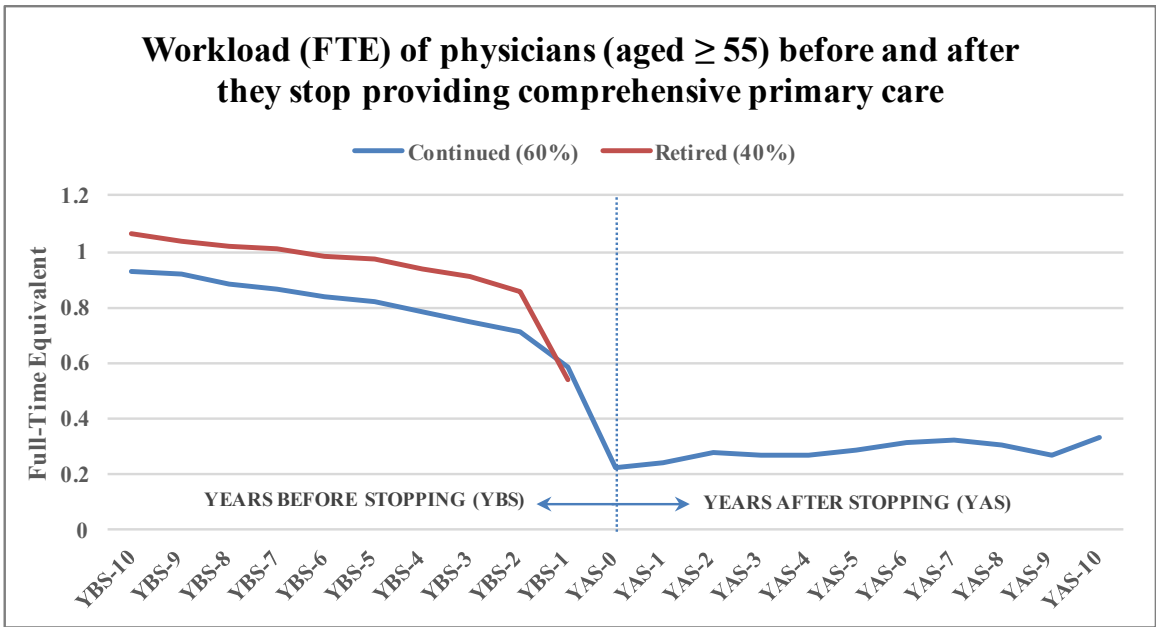


When physicians are grouped according to whether they provided comprehensive primary care up until the time they retired or whether they provided other clinical care prior to retirement, the rate of decline is similar between the two groups, but the average

number of practice activities differs. Although one might expect physicians who participate in fewer practice activities (or indeed who have only an office-based practice) to retire at the same time as they stop providing comprehensive primary care, we observed that the physicians who continued to practise were ones with narrower scopes of practice.

We explored the intersection between workload and scope of practice by identifying physicians (aged ≥ 55) who stop providing comprehensive primary care. We then looked both backward and forward in time at these physicians' workloads (Figure 13). Physicians who provide comprehensive primary care until retirement tend to work more than those who stop providing comprehensive care but provide other clinical care before retirement. Physicians who continue to provide clinical care after they stop providing comprehensive care work less after stopping than they did while they were providing comprehensive care. This likely represents a period of phased retirement for these physicians.

Figure 13. Workload of physicians before and after they stop providing comprehensive care



Discussion

In this section, we discuss the findings, context, and implications of changes in physicians' practice patterns over time, factors influencing practice patterns, and the average retirement age in our population of physicians. We present the implications of our findings for workforce planning and make recommendations with regards to incorporation of these results into workforce planning models. We also discuss the challenges of defining retirement and the strengths and limitations of this study.

Practice Patterns

Physicians change their practice patterns gradually over time. In and of itself, this may not be remarkable, but there is a clear need for workforce planning to capture how medical practice patterns change, and the implications thereof, in a more robust way. Whether examined prospectively (looking at physicians' entire career trajectories) or retrospectively (looking back in time from the endpoint of retirement), aging seems to result in steady, modest changes in the provision of services. Physicians reduce their workloads and narrow their scopes of practice gradually as they approach the ends of their careers. These results are consistent with the findings of other studies of physicians (Pong, 2011; Chan 2002b). Our study is the first to document what happens at the intersection between changes in workload and changes in scope of practice near the ends of physicians' careers. Because physicians' workloads and scopes of practice are inextricably linked, and therefore should be considered in tandem, we contribute a consolidated understanding of physicians' end-of-career practice patterns that will facilitate more accurate and effective workforce planning.

The results of this study bring us closer to being able to predict how much service a physician is likely to provide at any given stage of his or her career. We have identified the age at which physicians begin to reduce workloads, the rate at which workloads decline, and the average age at which physicians stop providing patient care. This information, taken together, may allow for more precise and accurate physician supply calculations at the population level.

Furthermore, the results suggest that changes in scope of practice in general, and key activities in particular, can be used instead to identify a group of physicians who are approaching retirement. The vast majority of primary care physicians continue to provide comprehensive primary care from year to year. Some of these physicians (40%) retire at the same time as they stop providing comprehensive primary care, but the remaining 60% continue providing clinical care for an average of three more years.

We argue that physicians who stop providing comprehensive primary care but continue to practice have chosen a form of phased retirement. This sizeable (and growing) pool of physicians could be leveraged to provide flexibility in the primary care workforce. In the context of a shortage of physicians relative to the need for medical service, these physicians may be convinced to continue to provide clinical services, such as episodic primary care, in order to meet population demand. Conversely, in the context of a physician surplus, these are physicians who may be convinced to transition away from the provision of clinical services and encouraged instead to pursue teaching, administration, or mentoring of younger colleagues.

Physicians in the phased retirement stage of their careers may be considered to be a workforce "buffer" with the potential to respond to changes in demand for medical care. We have shown that after physicians stop providing comprehensive primary care, they continue with activities that were previously part of their practices. (This intuitively makes sense: aging physicians may not be prepared to learn new skills or engage in new practice settings near the ends of their careers.) In the context of declining comprehensiveness (Chan, 2002b), our findings portend a workforce that, while interested in maintaining participation in the workforce, is potentially less able to provide service in a variety of settings. In order to foster a flexible workforce, policy-makers may need to provide incentives for physicians of all ages to continue to practise in settings – such as nursing home care – where future demand is anticipated.

Factors Influencing Practice Patterns

Evidence from the United States suggests that female physicians maintain higher activity rates for longer than their male colleagues, perhaps to compensate for decreased work activity during childbearing years (Staiger, 2009). We found that female primary care physicians in Ontario consistently work less than male physicians throughout their careers, and that they retire five years earlier than their male colleagues. Similarly, female physicians in British Columbia have been found to retire 4.8 years earlier than male physicians (Lindsay Hedden, personal communication, October 24th, 2016). It is possible that female physicians' care-giving responsibilities with regards to aging parents or spouses account for this difference, but further research is necessary to explore the underlying reasons for our observations.

Likewise, internationally trained physicians have larger average workloads and retire two years later than their Canadian-trained colleagues. In jurisdictions such as Saskatchewan, where IMGs make up a large proportion of the physician workforce (as of 2015, 52.5% of

the physician workforce in that province was trained internationally) (CIHI, 2016), these differences in workforce participation may have a bearing on the predicted capacity of the physician workforce to provide primary care services. As such, incorporation of this information into workforce planning models would improve their utility and facilitate workforce policy decisions.

Retirement Age

In our population of Ontario primary care physicians, the average retirement age of physicians aged 55 or older was 70.5 when retirement was defined as $0 of billings in current and future years.

A study of physicians in British Columbia used a multivariate approach to look at the age of retirement in physicians aged 50 or older. Using a retirement threshold of < $10,000 of billings, the average age at retirement with all variables held in the reference population was 64.4 (Lindsay Hedden, personal communication, October 24th, 2016). If we apply the same threshold to our population, we find the average retirement age to be 70.0, although it should be noted that our population does not include physicians aged between 50 and 54. Inclusion of these physicians would likely lower the average retirement age slightly.

Estimates of retirement age produced by different studies cannot immediately be assumed to be comparable. Differences must be examined closely, and the possibility that they are artifacts of differences in datasets must be entertained. There is no "gold standard" definition of retirement, and how each study defines and measures retirement undoubtedly influences the estimated retirement age. For example, some studies estimate retirement from clinical practice, while others focus on retirement from any activity, and yet others use retirement by self-report (probably the least reliable estimate). We have shown that different measures of retirement using health administrative data can alter the estimated average retirement age by almost two years. Furthermore, characteristics of the physician population – such as the age structure or the proportion of female physicians or IMGs – can also influence the average retirement age. Other factors related to the context in which physicians practise – the regulatory climate, the organization and funding of the health care system, or the economic milieu – may account for differences in retirement age. Methodology aside, reasons for the difference in average retirement age between physicians in Ontario and British Columbia are as yet unknown, although provincial regulations regarding maintenance of competence, lifestyle considerations, or differences in the datasets, are possible factors.

Financial issues have been implicated in the decision to retire (Beehr et al., 2000; Pannor Silver, 2016). We noticed that the average retirement age of physicians coincides with the age at which taxpayers are obliged to convert funds in Registered Retirement Savings Plans (RRSPs) into Registered Retirement Income Funds (RRIFs). Minimum amounts must be paid out of RRIFs each year and these amounts are taxable. If the conversion from RRSPs to RRIFs and subsequent payouts increase physicians' incomes enough to shift them into a higher tax bracket, physicians may decide that the income they garner from working may not justify the extra tax they will need to pay, and they may be more likely to retire. In 1998, the age at which physicians were required to convert their RRSPs to RRIFs changed from 71 to 69. If tax rules strongly impact physicians' retirement decision-making, we would expect to see a trend toward retirement at a younger age after 1998. In fact, using the $0 billing threshold, the average retirement age between 1992 and 1997 was 68.8, while between 1998 and 2006 (when the tax rules changed again) it was 70.6. We conclude that this particular tax regulation did not influence retirement behaviour to the extent of lowering the average retirement age.

Defining Retirement

Previous research has suggested that retirement, rather than being a categorical endpoint, is a transition process that physicians go through near the ends of their careers (Pannor Silver, 2016; Shultz & Wang, 2011). Attempting to describe and study a process such as this using a single endpoint is reductionist and risks overlooking potentially important information. Accordingly, in this study we decided to use a threshold-based approach to defining and measuring retirement. Instead of choosing one definition of retirement to the exclusion of all others, we identified a primary definition and several other definitions and measures that could be used to clarify how the retirement process unfolds for primary care physicians. By examining how each definition influences a given outcome, relative to the other definitions, we now understand the implications of the choice of one definition over another.

Our study primarily identified physicians who retired from clinical practice. Physicians deemed retired in our study may have continued with non-clinical activities (such as teaching, research, or administration) that are not remunerated through OHIP and were therefore not captured in our data. Since the capacity of physicians to provide medical services to patients is usually the primary consideration for workforce planners, we feel that retirement from clinical practice was a relevant and appropriate retirement endpoint.

A definition of retirement based on licensure identifies physicians who transition to retirement by relinquishing their licenses; physicians who maintain their licenses are still

considered to be part of the workforce. In reality, physicians who are retired from clinical practice may maintain their licenses because they continue to teach, do administrative tasks or research, or perhaps for reasons related to their self-esteem and identity as physicians (Petterson, 2016; Pannor Silver, 2016). Our primary definition of retirement – $0 of billings in current and future years – may be a more useful measure than licensure because it is conservative enough to capture non-participation in the clinical workforce without overestimating the number of physicians available to provide medical services to patients.

All of the other retirement thresholds used in our study were based on measures of clinical activity, and we have documented relative differences in estimates produced by each threshold. A retirement threshold of < 0.33 FTE produced the most generous estimates of retired physicians. Given that 22% of physicians who meet this threshold continued to work for up to 5 years, with as many as 7% continuing for up to 10 years, our feeling is that this threshold is likely a less appropriate measure of retirement than others.

Knowledge of the relative differences between thresholds can allow researchers to choose the most appropriate measure of retirement. For example, if overestimation of physicians is a concern, a more conservative threshold would serve best, but if a "buffer" of minimally-active physicians is desired, then a more generous threshold may be chosen. Since thresholds of < 0.10 FTE and < $20,000 produce almost identical estimates, either one could be used, depending on the data available.

Flow into and out of the workforce was much more common than we anticipated. Many physicians met thresholds for retirement (even licensure) in a given year, only to contribute again to the workforce in subsequent years. Our stipulation that physicians must meet and stay below a given threshold in order to be considered retired – the *current and future years* component of our definition of retirement – is a strength of this study, enabled by longitudinal data. This approach minimizes the misclassification of physicians who take time away from clinical practice for reasons other than retirement.

On the other hand, we may have overestimated retirement to a certain degree because we were unable to distinguish between attrition related to retirement and attrition for other reasons, such as migration. For example, an older physician who moves from Ontario to Nova Scotia to be closer to her grandchildren and continues to practise in Nova Scotia would appear to us to be retired but in reality would still be in the workforce. The absence of detailed, physician-level data on a national scale prevents us from being able to estimate how much of the attrition we identified is actually related to migration. Such data would allow for better characterization of the flow of physicians across the country,

and since physician workforce planning in Canada is typically done at a provincial level, would help provinces to make better workforce planning decisions.

Workforce Planning

At the moment, the state of workforce planning in Canada is quite variable. Some provinces are still in the process of physician workforce censuses, while others such as Ontario, use well-developed needs-based planning models. But even Ontario struggles with identifying and predicting retirement.

Approaches currently used in workforce planning models to estimate retirement include head counts, retirement rates, age, and age-adjusted FTE. The results of our analyses of physician workload and scope of practice suggest that careful consideration be given to how physician attrition is modeled. Differences in workforce participation between male and female physicians, across physicians' entire career trajectories, are particularly relevant. In the context of a feminizing primary care workforce, planning for the primary care workforce of the future using physician head counts alone risks overestimating physician supply. Also, since physicians work less as they age, and since a significant proportion of the primary care workforce stops providing comprehensive primary care three years before actually retiring, using solely retirement age or workload-based estimates of attrition for workforce planning also increases the chance of overestimating the supply of physicians providing these services. The ideal workforce planning approach considers demographic factors, workload, and scope of practice when estimating the supply of physicians available to provide medical care.

Our work demonstrates that it is possible to take into consideration additional factors that are relevant to physician retirement. Incorporation of our findings into the component of workforce planning models that predicts outflow from the workforce may improve the accuracy and utility of these models.

Strengths and Limitations

We believe that the data we used for our research are the most comprehensive physician workforce data available in Canada. The longitudinal nature of these data allowed us to link physician characteristics with their practice patterns and retirement behaviours, and to examine changes in outcomes over time in a way that other research methodologies – cross-sectional or survey-based – simply do not permit. We were able to control for individual variation and generate a dynamic picture of physicians' changing practice

patterns. The combination of these data with a longitudinal methodology has proved to be a powerful tool for health workforce research.

Although the data span a period of 22 years, we do not have practice pattern information for the full career of any single physician or group of physicians. We have to piece together information from physicians at different stages in their careers in order to paint a picture of a physician's typical career trajectory. Generational effects on physician workload were apparent in some measures of workload but not in others, and so we were unable to draw strong conclusions about whether the behaviour of physicians has changed over time. Further research is necessary to better characterize differences between generations of physicians that may influence their retirement behaviours.

Although the data we used in this study are quite comprehensive, information about other factors that undoubtedly influence physicians' retirement decisions are not yet available in these datasets, and may never be. As data linkages become more powerful, it is possible that we will be able to conduct analyses that include some other relevant variables – such as income tax data or census information about spouses and dependents, for example – and therefore to draw even more robust conclusions. Qualitative research may be undertaken to further fill in gaps in our understanding of issues surrounding physician retirement.

There is no consensus about what constitutes the best measure of physician workload. Rather than use a single measure of workload, we chose five separate measures, which we examined in tandem, in order to generate a more complete picture of physicians' workloads. For the most part, these five measures produced very similar results, and in the cases where they didn't – such as payments in the years before retirement – we were able to generate hypotheses and test them to come up with explanations. More research is necessary to determine the best way to quantify the clinical activity that physicians engage in.

While ICES takes many steps to optimize data quality, each variable has its own strengths and limitations, and the variable that characterizes physicians as providing comprehensive primary care is a case in point. The definition of comprehensive primary care is broad enough to include physicians who provide comprehensive primary care in a variety of ways. For example, one physicians may see patients in an office-based practice, look after hospital inpatients, and work in several other settings as well, while another may see a variety of patients in the office and look after the full spectrum of their health care needs, without practising in any additional settings. Although these practices are quite different, both of these physicians would be characterized as providing comprehensive primary care. It would be very difficult, if not impossible, for a physician

who did not provide office-based care to be characterized as providing comprehensive primary care according to this definition. Likewise, it would be unlikely that a physician with an office-based practice who also worked in other settings would no longer be characterized as providing comprehensive primary care if he stopped working in one of the non-office settings.

We used this variable for two purposes: first, to exclude family physicians who never provided office-based care, and second, to identify physicians who stopped providing comprehensive primary care near the ends of their careers. Our focus was on identifying physicians who were providing services that were unique – office-based comprehensive primary care – and on the transitions of physicians away from this activity. For the purposes of our research, this variable was useful, but questions remain about whether a single variable can accurately represent the complexity and diversity of physicians' practice patterns.

Finally, because the data do not include physicians working in Community Health Centres or Nurse Practitioners providing comprehensive primary care services, we have under-censused the primary care workforce to a certain degree. A comprehensive understanding of the primary care workforce and its role in providing patient care services will only be achieved when information about all providers delivering primary care services is available.

Conclusions

This study is a comprehensive examination of the retirement behaviours of primary care physicians in Ontario. Using 22 years of longitudinal health administrative data, we characterized changes in the practice patterns (workload and scope of practice) of primary care physicians over time.

We found that aging results in gradual, modest changes in the provision of services, rather than abrupt declines, and that physicians reduce their workloads and narrow their scopes of practice in the years leading up to retirement. A significant proportion of the primary care workforce stops providing comprehensive care three years before actually retiring. Practice patterns and retirement behaviour are influenced by physician gender and location of training.

Our study highlights the importance of considering not just *how much* physicians work, but also *what* they do and *who* they are. Using only head counts, retirement age, or workload-based estimates of attrition for workforce planning risks overestimating the supply of physicians providing primary care services. Ideally, demographic factors, workload, and scope of practice should be considered when estimating the supply of physicians available to provide medical care.

Our study also draws attention to the challenge of defining and measuring retirement. We argue that a threshold-based approach to measuring retirement may yield a more nuanced understanding of the transitions that happen at the ends of physicians' careers.

Next Steps

Our study sets the stage for a number of potential areas for further research and investigation:

1 – In order to facilitate the prediction of exactly which physicians are likely to retire and when, quantitative modeling of the influence of the factors we have identified on practice patterns and retirement behaviours is necessary. This would allow our findings to be more easily integrated into workforce planning models.

2 – Our results quantify findings related to physician retirement in terms of *who*, *what*, *when*, and *where*. Further investigation of *why*, using qualitative methods to identify and clarify underlying reasons for the patterns we have identified would enrich our understanding of end-of-career issues.

3 – We noticed considerable attrition from practice across the age spectrum, and believe that further investigation of practice patterns – and attrition – of younger physicians is necessary. Because our data are limited to Ontario, we can't tell how much of the attrition we observed was related to migration out of the province. Detailed, physician-level data on a national scale would allow us to better understand flows through the workforce that impact service provision and workforce planning at local levels.

4 – We have learned a lot about retirement behaviours of primary care physicians, but we do not believe that our findings can be generalized to specialist physicians. Further research is necessary to explore the end-of-career practice patterns of both medical and surgical specialists.

5 – Finally, ongoing knowledge translation efforts are necessary to ensure that what we have learned in the research sphere can be used in the policy sphere, for the ultimate benefit of patients.

Appendices

Appendix 1

Database	Data
ICES Physician Database (IPDB)	Year of birth, sex, location of training, country where medical school was located, RIO score, payments, FTE, visits, comprehensive primary care provision
Corporate Provider Database (CPDB)	Practice model
Ontario Health Insurance Plan (OHIP) Claims Database	Panel size, number of days worked, participation in clinical activities
Client Agency Program Enrolment (CAPE) Database	Panel size
CONTACT Database	Panel size

Appendix 2

File Number: 04-15-27 **Date (mm/dd/yyyy):** 06/05/2015

Université d'Ottawa
Bureau d'éthique et d'intégrité de la recherche

University of Ottawa
Office of Research Ethics and Integrity

Ethics Approval Notice

Social Sciences and Humanities REB

Principal Investigator / Supervisor / Co-investigator(s) / Student(s)

First Name	Last Name	Affiliation	Role
Ivy	Bourgeault	School of Management / School of	Principal Investigator

File Number: 04-15-27

Type of Project: Professor

Title: End-of-career practice patterns of Canadian physicians

Approval Date (mm/dd/yyyy)	Expiry Date (mm/dd/yyyy)	Approval Type
06/05/2015	06/04/2016	Ia

(Ia: Approval, Ib: Approval for initial stage only)

Special Conditions / Comments:
N/A

Appendix 3

Year	Total number of physicians in the cohort	Increment
1992	11,122	
1993	12,092	970
1994	12,420	328
1995	12,882	462
1996	13,379	497
1997	13,688	309
1998	14,084	396
1999	14,430	346
2000	14,850	420
2001	15,244	394
2002	15,670	426
2003	16,077	407
2004	16,458	381
2005	16,850	392
2006	17,261	411
2007	17,717	456
2008	18,210	493
2009	18,730	520
2010	19,303	573
2011	19,921	618
2012	20,545	624
2013	21,240	695

Appendix 4

Examples of RIO scores and classifications:

	Community	RIO Score
Major Urban (0-9)	Ottawa	0
	Kingston	0
	Belleville	6
Non-Major Urban (10-39)	Peterborough	11
	Cornwall	12
	Brockville	20
	Carleton Place	24
	Arnprior	32
	Smiths Falls	33
	Renfrew	39
Rural (≥ 40)	Pembroke	51
	Petawawa	57
	Killaloe	69
	Deep River	70
	Barry's Bay (Madawaska Valley)	73

Appendix 5

Physician remuneration models:

Remuneration Model	Description
Fee-For-Service (FFS)	Physicians are compensated by the government for each service rendered
Reformed-FFS	Physicians receive a base payment that covers certain services and they bill FFS for other services.
Capitation	Physicians receive a set fee for each patient on their roster. The fee may be adjusted by age, sex, or morbidity.
Capitation and Family Health Team (FHT)	Physicians receive a set fee for each patient, as well as funding to work together with other professionals to provide primary health care for a community.
Community Health Centre (CHC)	Physicians are compensated by salary, often based on units of time.
Other	A variety of other remuneration models

Appendix 6

In order to be characterized as providing comprehensive primary care in a given year, physicians must:

- Work > 44 days/year
- Bill at least once in at least 7 of 22 activity areas:
  -Mini/Minor assessments
  -General assessment/re-assessment
  -Intermediate assessment
  -Annual health exam – child
  -Geriatric care
  -Primary mental health care
  -Hospital care
  -Housecalls
  -Chronic care/long-term care visits
  -Emergency department or equivalent
  -Vision care
  -Palliative care
  -Flu shots
  -Other immunization
  -Office lab procedures
  -Allergy shots
  -Other injections
  -Pap smears
  -Anticoagulant therapy
  -Pre-operative assessment
  -Diabetes management
  -Smoking cessation

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