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Do baby boomers use more healthcare services than other generations? Longitudinal trajectories of physician service use across five birth cohorts

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Author Contributions

Mayilee Canizares was the lead author on this paper. Her contributions included study design, statistical analysis, and drafting of the manuscript. Monique Gignac contributed to the design of the study, interpretation of results, and critically revised the manuscript. Sheilah Hogg-Johnson contributed to the design, provided statistical advice, and critically commented on the manuscript's content. Richard Glazier and Elizabeth Badley are the graduate supervisors of the lead author and provided guidance on the study design, analysis, and structure of the manuscript. All authors read and approved the final manuscript and are accountable for all aspects of the study.

Competing Interests

We have read and understood BMJ Open policy on declaration of interests and declare that we have no competing interests.

ABSTRACT

Objective: In light of concerns for meeting the provision of healthcare services given the large numbers of aging baby boomers, we compared the trajectories of primary care and specialist services use across the lifecourse of five birth cohorts and examined factors associated with birth cohort differences.

Design: Longitudinal Panel.

Setting: Canadian National Population Health Survey (1994-2011).

Population: Sample of 10186 individuals aged 20-69 years in 1994 and who were from five birth cohorts: Generation X (born: 1965 – 1974), Younger Baby Boomers (born: 1955 – 1964), Older Baby Boomers (born: 1945 – 1954), World War II (born: 1935 – 1944), and pre-World War II (born: 1925 – 1934).

Main outcomes: Use of primary care and specialist services.

Results: Although the overall pattern suggested less use of physician services by each successive recent cohort, this masked differences in primary and specialist care use by cohort. Multilevel analyses comparing cohorts showed that Gen Xers and younger boomers, particularly those with multimorbidity, were less likely to use primary care than earlier cohorts. In contrast, specialist use was higher in recent cohorts, with Gen Xers having the highest specialist use. These increases were explained by the increasing levels of multimorbidity. Education, income, having a regular source of care, sedentary lifestyle, and obesity were significantly associated with physician services use, but only partially contributed to cohort differences.

Conclusion: The findings suggest a shift from primary care to specialist care among recent cohorts, particularly for those with multimorbidity. This is of concern given policies to promote primary care services to prevent and manage chronic conditions. There is a need for policies to address important generational differences in healthcare preferences and the balance between primary and specialty care to ensure integration and coordination of healthcare delivery.

STRENGTHS AND LIMITITATION OF THIS STUDY

- No study has compared the patterns of primary care and specialist service use among baby boomers and other generations.
- Large longitudinal data, spanning 18 years, enabled us to compare different cohorts at the same chronological age.
- Our analytical methodology integrated changes in healthcare use indicators with changes in factors associated with them.
- The interpretation of the findings is limited due to the inability to identify the specific conditions for which individuals are consulting with physicians.
- The data are self-reported and the bias associated with inaccuracies and reporting errors is unknown.

INTRODUCTION

Older age is typically associated with worse health, higher healthcare use (1-3) and increased healthcare costs (4-6). Consequently, the large number of aging baby boomers (born 1945-1964), who are now 50+ years of age, are generating concerns for the provision of health services in North America and elsewhere. Two issues have been raised: the large size of the cohort and the belief that baby boomers are different in their needs and attitudes toward healthcare from their predecessors (7-11). Baby boomers grew up at a time of social change, economic growth and prosperity with improved access to education, employment opportunities, and with access to health and welfare services (12-14). They are the first generation to have access to antibiotics and other effective medications. On one hand, these advances have the potential to improve the health of boomers and reduce their need for healthcare services. On the other hand, these advantages have also contributed to longer life expectancy and improvements in survival. As a result people are living longer with the potential of developing multiple chronic conditions and hence needing more healthcare services (15, 16).

Parallel to these changes, baby boomers and succeeding generations have also been part of a shift to consumer driven healthcare where people define themselves first as consumers and then as patients. This consumer market has positioned health as an individual right and, as a result many people have proactive behaviors towards their health decisions and selection of services (17-19). Boomers are often avid consumers of health information and are more willing to try new treatments than previous generations (20, 21). Yet, how changes in prosperity, medical care improvements, and the rise in medical consumerism impact baby boomers' use of health services remains to be examined. Studies have not investigated whether there are generational differences in healthcare use, including consultations with primary physicians and

specialists. Formulating policy changes and interventions to accommodate the needs of this large cohort will require a thorough understanding of these patterns and the diverse factors affecting healthcare use in boomers and other cohorts.

Andersen and Newman's behavioural model of health services is useful for identifying factors related to healthcare use (22, 23). In their framework, healthcare use is conceptualized as a function of predisposing (e.g. age, sex, education), enabling (e.g. income, regular source of care), and need (e.g. chronic health conditions) factors. Behavior-related risk factors (e.g. obesity) also can be included in the framework. Previous research has found cohort differences related to a number of factors relevant to healthcare use of baby boomers and other cohorts. For example, improvements in the standard of living and education attainment since the 1950s (24, 25) might be expected to reduce the need for healthcare among baby boomers and succeeding generations. Declines in smoking rates in recent cohorts (26-28) also are likely to be related to better health and reduced healthcare (29, 30). However, trends of increased obesity and sedentary lifestyles in each succeeding recent cohort (29, 31-34) are risk factors for worse health and may result in increased healthcare use (30, 35, 36). Few studies have explicitly compared need factors like chronic health conditions across cohorts. An Australian study found that Gen Xers reported more diabetes than baby boomers (34) and a study from the United Kingdom (37) found that boomers had more hypertension and diabetes than their predecessors. In contrast, a study of U.S. women found no differences in arthritis prevalence between baby boomers and the previous generation (38).

Given the lack of evidence on patterns of healthcare use among baby boomers compared to other generations, this study uses longitudinal panel data spanning 18 years to compare use of physician services (primary care and specialist care) across five birth cohorts: Generation X

(born: 1965–1974), Younger Baby Boomers (born: 1955–1964), Older Baby Boomers (born: 1945–1954), World War II (born: 1935–1944), and pre-World War II (born: 1925–1934). The overall goal was to: a) compare primary care and specialist services use over the lifecourse across birth cohorts; and b) to examine cohort differences in predisposing, enabling, need, and behavioural risk factors that could explain cohort differences in the lifecourse trajectories of primary care and specialist use.

METHODS

Study setting and population

We used data from the longitudinal component of the Canadian National Population Health Survey (NPHS) spanning 18 years from 1994 to 2011. The NPHS, established in 1994/1995 (cycle 1), is a representative sample of the household population residing in Canada's ten provinces. The survey excluded persons living on Indian Reserves and Crown Lands, residents of health institutions, full-time members of the Canadian Forces Bases and some remote areas in Ontario and Québec. The NPHS retained individuals who moved to long-term care institutions and those who died over the course of the survey (39). We included participants who were between 20 and 69 years old in 1994, contributed to at least three cycles of data, and had complete information about the outcomes at baseline (1994). This resulted in a sample of 10186 individuals with an average of 7 cycles of data. The University of Toronto Ethics Committee approved the study.

Data sharing

The survey is not publicly available and authorization from Statistics Canada is required to access the data. Therefore there are no additional data available.

Primary outcomes

At each cycle, participants were asked about their use of healthcare in the previous 12 months. Canada has a national healthcare policy which provides universal coverage for all medically necessary hospital and physician services with no copayments or other patient charges. Access to specialists is by referral from other physicians, usually a family physician/general practitioner (FP/GP). Participants were asked to report the number of consultations with FP/GPs or specialists (excluding eye care) in the 12 months prior to their interview. Because our focus was to study services for health conditions and not well-care visits for screening and immunization, we included only participants with two or more FP/GP visits or at least one visit to a specialist. In this paper we use the terms "primary care" to have the same meaning as "FP/GP". Furthermore, specialists like those in general internal medicine do not have primary care roles in Canada.

Predictors

Cohort membership and age were based on year of birth. Participants were allocated in five birth cohorts: Generation X (born: 1965 – 1974), Younger Baby Boomers (born: 1955 – 1964), Older Baby Boomers (born: 1945 – 1954), World War II (born: 1935 – 1944), and pre-World War II (born: 1925 – 1934). We used Andersen and Newman's model of factors related to healthcare use to select variables (23). Measures of *predisposing factors* were gender and education. Education was measured as years of schooling and was grouped for analyses as: <12 years, 12-15 years, and 16+ years. *Enabling factors* were household income and having a regular source of care. Household income was collected at each cycle and categorized into quartiles of the distribution at each survey year with a separate category representing missing values. We used the presence of chronic conditions as an indicator of *need* for care. At each

cycle, respondents indicated yes/no to the presence of 17 chronic conditions diagnosed by a healthcare professional. The number of chronic conditions was grouped as: none, 1, and 2+.

We also examined *behavioral risk factors*: smoking, obesity, physical activity, and sedentary lifestyle. Participants were grouped as: current smoker, former smoker, and non-smoker (those who never smoked). We grouped BMI as: underweight (<18.5), normal weight (18.5-24.9), overweight (25.0-29.9), moderate obese (30.0-34.9), and severe obese (≥35.0) (40). The survey asked a series of questions about participation in physical activities like walking for exercise, running, gardening and collected the time per week participants usually spent walking (bicycling) to work, school or while doing errands. Responses were used to group individuals as physically active (during leisure time or active commuting) vs. inactive based on Statistics Canada derived variables (39). Lastly, participants who reported that they "usually sit during the day and don't walk around very much" were considered to have a sedentary lifestyle.

Statistical analysis

Comparing birth cohorts is complex because cohort differences are linked to the effects of aging as well as societal and environmental changes affecting the population as a whole (period effects). Therefore, in addition to age, it is pertinent to consider period effects (e.g. survey year), as these may obscure cohort effects unless they are properly modeled. However, studies aiming to estimate the effects of age, period, and cohort are hindered by the identification problem; that is, age, period, and cohort are linearly dependent (41). Because of this linearity, there is no unique solution to models including the three effects simultaneously. As a result, they cannot be modeled at once. One way to deal with this problem is to directly estimate age and cohort effects (as fixed effects) while accounting for variability across periods (random effect) (See discussion

in (42) and (41)). To do this, we fitted cross-classified multilevel models in which observations were nested within individuals and individuals were nested within time periods (41).

We started with a model with age and cohort (Model 1). In the next steps we added predisposing, enabling, and behavioral risk factors (Model 2). And lastly we added need factors (Model 3) and examined variations in the age and cohort estimates. In all models, age was centered at 39 years (the mean of the distribution for the five cohorts at baseline (1994)). Models were fitted using PROC GLIMMIX from SAS 9.4 including incomplete cases up to the point at which they drop out or died and likelihood estimators were used that adjust for non-response assuming the data are missing at random. The significance of variables was assessed by Wald tests.

Supplementary analyses

We conducted three sets of supplementary analyses. First, we repeated the analyses using the number of visits to FP/GPs, to specialists, and the total number of visits as the outcomes. We also modeled primary care use defined as having at least one visit to FP/GPs. Secondly, using the number of chronic conditions as a global measure of need for care precluded us from elucidating the effects of individual chronic conditions in explaining cohort differences in the outcomes. Therefore, we repeated the analysis 17 times by adding each individual chronic condition to the models and examined changes in the cohort coefficients. Lastly, we examined the impact of attrition in our analyses by comparing the results of the models including indicator variables identifying participants who dropped-out or died before the end of the study and the results of restricting the analyses to individuals with complete data in the nine cycles.

Patient involvement

This study is based on a population survey that did not involve patients.

RESULTS

Descriptive

In 1994 there were 10186 participants who met the inclusion criteria: 1384 in the pre-World War II cohort, 1596 in the World War II cohort, 2205 older baby boomers, 2778 younger baby boomers, and 2223 Gen Xers. Generally, physician services use was higher in women than men overall and for both primary care and specialist use (Table 1). Women reported having a regular source of care more often than men in all cohorts, with the exception of the pre-World War II cohort. Education and income were higher for younger boomers and Gen Xers. Men reported slightly higher household income than women in all cohorts. Dropping-out of the study was the most common source of attrition among baby boomers and Gen Xers and death in the pre-World War II cohort (Table 1). In preliminary analyses we found significant differences in the outcomes and predictors by gender, therefore results are presented for women and men separately.

Cohort differences in healthcare use

Cohort differences in the overall the pattern of physician services were modest and suggested less use of services by each successive recent cohort. However, these modest differences masked marked cohort differences in primary care and specialist care (Table 2). We therefore analysed data for primary care and specialist care separately.

In addition, the age and cohort patterns of physician services use were different for men and women. For women, primary care use declined around age 40, and then increased as they

grew older; whereas for men primary care use increased steadily with increasing age. Although specialist use increased with increasing age for women and men, this increase was more marked for men than women (Figure 1a and b respectively). In addition to age effects, we found significant cohort differences in primary care use for women but not men (Table 2, Figure 1a). Comparing women at corresponding ages indicated that Gen Xers and younger boomers had the lowest primary care use. Likewise, there were significant cohort differences in specialist use for both women and men. In contrast to primary care use, comparing people at the same ages there was higher specialist use in each succeeding recent cohort (Table 2, Figure 1b). In all models we controlled for the potential of period effects. We found only a minimal variability across years for primary care use by women and no differences for men. No significant period effects were seen for specialist use (Table 2).

Explaining cohort differences

Predisposing, enabling, and behavioural risk factors

There were significant associations of predisposing, enabling and behavioral risk factors with primary care and specialist care use (Tables 3 and 4, Model 2) that were somewhat attenuated once the number of chronic conditions was entered into the models (Model 3). Specifically, there were no differences in primary care use related to education (predisposing factor), but education was significantly associated with specialist use: women and men with higher education were more likely to visit specialists than those with lower education. For enabling factors, income was significantly associated with primary care use for men only: those in the top income quartile were less likely to visit FP/GPs than those in the bottom quartile (OR=0.89, 95% CI: 0.81-0.99). Income was not significantly associated with specialist use for either women or men. Women and men with a regular source of care were more likely to consult with FP/GPs and see

specialists. Behavioral risk factors were significantly associated with primary care and specialist use. Those who reported sedentary lifestyles and physically active women were more likely to consult with both types of practitioners. Smoking was not associated with primary care use, but it was associated with specialist use for men: former smokers were more likely to visit specialists than non-smokers (OR=1.15, 95% CI: 1.04-1.26). Obesity was not significantly associated with specialist use, but obese women were more likely to see FP/GPs.

Need factors: Impact of chronic conditions

As might be expected, the presence of chronic conditions was a significant and a strong predictor of both primary care and specialist use. When we introduced the number of chronic conditions to the models, cohort differences in specialist care use were no longer significant (Tables 3 and 4, Model 3). In contrast, the opposite effect was seen for primary care use: cohort differences were augmented for women and became significant for men. Because of the dramatic change in the cohort effects we hypothesized that there may be a differential impact of the number of chronic conditions on primary care use by birth cohort. To test this hypothesis we conducted analyses that included interaction terms between chronic condition groups with age and cohort (Table A1 Supplementary Material). The interactions with both age and cohort were significant. As shown in Figure 2, there were large cohort differences for women and men reporting two or more chronic conditions. When compared at corresponding ages, we found lower primary care use in each succeeding recent cohort. No cohort differences were seen for those with one or no chronic conditions.

Supplementary analyses

Findings of the models examining the number of visits to physicians were similar to our main results. Analyses that included each individual chronic condition revealed that cohort differences

were virtually unchanged. This suggests that having multiple conditions, and not any specific condition, explained the cohort differences in the age-trajectories of physician service use. Our models adjusting for drop-outs and mortality showed, as expected, higher overall primary care and specialist use among those who died during follow up, but no impact on the effect of predisposing, enabling, need, and behavioral risk factors on the outcomes. Further comparisons between those who died and those who were alive at the end of the study indicated that, although the age-trajectory was steeper for those who died, cohort differences and the relationships of predisposing, enabling, need, and behavioral risk factors remained unchanged. As a result, these analyses did not change the conclusions drawn from the main findings (Tables available upon request).

DISCUSSION

This is the first study to compare the lifecourse trajectories of physician visits among pre-boomers, baby boomers, and Gen Xers. We found a modest decrease in the overall use of physician services in recent cohorts compared to previous cohorts. Specifically, the findings highlighted that there were different age and cohort patterns of primary care and specialist care use, suggesting an important shift in the pattern of healthcare use over time. Moreover, substantial cohort differences in primary care use were revealed when our additional analyses considered the differential impact of chronic conditions on physician services use. These analyses yielded marked cohort differences for those with multimorbidity. They showed lower primary care use in each succeeding recent cohort, so that at the same age Gen Xers were less likely to use primary care than younger baby boomers and so on. In contrast to primary care use, we found that younger boomers and Gen Xers were more likely to report using specialist care. However, these cohort differences disappeared when healthcare needs, namely the number of

chronic conditions, were taken into account. Juxtaposition of these findings suggest that there may be a shift from primary care to specialist care in more recent cohorts (e.g. Gen Xers, younger boomers), particularly for those with multimorbidity.

Comparison with other studies

The lower primary care use for those with multimorbidity in recent cohorts is concerning for several reasons. First, more recent cohorts (i.e. younger individuals) reported the most multimorbidity (43). It's unclear whether this reflects positive changes to the healthcare system with better access, earlier diagnosis and treatment or whether it reflects poorer health in more recent generations. Evidence from previous studies suggests both factors may play a role (15, 44, 45). Second, studies have highlighted the important role of FP/GPs in the integration and coordination of healthcare, especially for patients with chronic conditions (45-49). Our finding that cohort differences in specialist use were no longer apparent after accounting for healthcare needs suggests that use of specialists by birth cohorts was largely related to need for care. Of potential concern, however, is that those with greater need for care are individuals from recent cohorts who may be developing multimorbidity at younger ages compared to their predecessors (43). An additional concern is that specialist services typically focus on chronic health conditions singly with the associated duplication of care and increased costs (46). This finding highlights the need to assess the balance between primary and specialty care to optimize healthcare delivery.

Our finding of greater use of specialists in conjunction with the lower primary care use among those with multimorbidity may also reflect changes in patient's preferences and expectations of more recent cohorts like Gen Xers and younger baby boomers (18, 20). Alternatively, they also may be related to changing practice patterns of FP/GPs. Some research

indicates that FP/GPs may be more likely to refer younger patients to specialists for the management of their chronic conditions (50, 51). It is also possible that members of recent cohorts have access to specialist investigations and treatment that were not available to earlier generations, which may account for differences across cohorts. Lastly, in Canada there have been an increase in the number of specialist relative to the number of FP/GPs over time, which may also contribute to the higher specialist use among recent generations (52). Future research is needed to examine primary care referrals, as well as patients' preferences and expectations in understanding the lower primary care use by individuals with multimorbidity.

Our study is consistent with previous research indicating greater healthcare use with older age (1-3, 53) and extends these findings by accounting for cohort effects. Predisposing, enabling, and behavioral risk factors were important predictors of overall primary care and specialist use, but did not contribute to explaining the cohort differences in primary care and specialist use. Specifically, our findings of overall higher physician use by women are in line with previous studies (1, 2). Also in keeping with past research were the findings of educational inequities in healthcare use: individuals with greater education were more likely to have used specialist care independently of the number of chronic conditions (1-3). Income showed variable findings and was only important for primary care use among men, such that lower income men were more likely to visit FP/GPs (44, 53-55). Finally, similar to other studies we found that obese individuals, current smokers, physically inactive, and/or individuals with sedentary lifestyle used more health services (30, 56-59).

Strengths and Limitations

An advantage of this study is that longitudinal data enabled us to compare different cohorts at the same chronological age. The majority of the evidence on healthcare use in the population derives

from cross-sectional studies (2, 3, 53). However, it is impossible to study cohort effects in cross-sectional studies as comparing two cohorts at the same time point means that one is older than the other. Our approach provides an attractive methodology as we could integrate changes in healthcare use indicators with changes in factors associated with healthcare use. At the same time, the study has several limitations, particularly related to the survey's general methodology. Although data were collected about healthcare use and chronic conditions, there was no direct link between the two factors. Consequently, the interpretation of the findings is limited due to the inability to identify the specific conditions for which individuals are consulting with physicians. In addition, the NPHS data are self-reported and the bias associated with inaccuracies and reporting errors is unknown. It has been found that self-reports of healthcare use may underestimate actual physician visits, particularly among those with higher volumes of visits (60). However, because we dichotomized the outcomes, we do not expect that these under-reports affected our results and conclusions. Furthermore, additional analyses examining the number of visits provided similar results. Another limitation is participant attrition over the long follow-up time. We were able to examine the impact of mortality and loss to follow up in our results. These analyses did not change our conclusions.

Conclusions

We found that overall cohort differences in physician services use were modest, but when examining use of primary and specialist care separately, cohort differences were larger for specialist use and in the opposite direction to that of primary care use. The higher specialist use and the lower primary care use of those with multimorbidity in recent cohorts suggest that there has been a shift from primary to specialty care among baby boomers and Gen Xers. Our findings underscore the importance of research and policies addressing generational differences in

healthcare practices, expectations, and preferences to ensure coordination and integration of healthcare delivery. If the trend of greater multimorbidity, lower primary care use, and higher specialist use among recent cohort continues, the organization and provision of healthcare in the near future will continue to face great challenges.

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Table 1. Characteristics of birth cohorts at baseline (1994). Canadian National Population Health Survey (NPHS), 1994-2010

	Pre-World War II (1925-1934)		World War II (1935-1945)		Older baby boomer (1945-1954)		Younger baby boomer (1955-1964)		Generation X (1965-1974)	
	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men
N	787	597	857	739	1150	1055	1510	1268	1201	1022
Outcomes										
% physician services use	75.2	66.6	69.9	57.9	67.3	51.7	71.3	48.4	76.7	43.1
% Primary care users	69.5	59.6	64.1	51.8	60.4	46.5	63.4	43.5	69.3	38.5
% Specialist users	31.9	30.0	31.2	24.5	31.4	19.2	33.4	17.2	34.1	13.1
Enabling factors										
Mean age	63.7	63.8	53.8	53.6	43.6	43.8	33.9	34.0	24.2	24.2
Mean years of schooling	10.7	10.7	11.7	11.8	13.2	13.1	13.3	13.4	13.5	13.5
Predisposing factors										
Mean household income [a]	40.7	45.4	54.7	59.0	59.7	62.3	53.6	56.2	49.7	54.7
% with regular doctor	94.7	93.1	93.6	88.7	90.1	80.6	89.8	78.9	87.8	70.3
Behavioral Risk Factors										
% smokers (current or former)	54.4	80.8	53.1	76.8	56.8	71.7	62.0	63.8	59.1	54.4
Mean BMI	26.1	26.6	26.2	26.9	25.3	26.5	24.2	26.0	23.4	24.7
% obese	18.5	18.9	16.3	16.6	16.1	14.7	11.6	11.4	10.1	10.0
% physically inactive	44.1	49.1	41.9	39.3	38.7	46.4	42.1	48.0	47.0	55.0
% sedentary	17.1	19.9	17.2	21.4	22.7	22.0	20.4	21.3	22.1	18.2
Need factors										
Mean number of chronic conditions	1.6	1.4	1.3	1.0	0.9	0.7	0.8	0.6	0.7	0.5
% with 1 chronic condition	29.7	32.9	29.7	36.1	31.8	29.9	28.5	30.1	26.5	26.5
% with 2+ chronic conditions	43.0	38.2	34.6	25.0	21.2	17.5	18.7	13.5	18.4	10.7
Attrition [b]										
% died	30.3	48.9	11.7	19.3	5.4	6.1	1.7	3.1	1.7	2.6
% dropped-out	19.8	21.0	20.2	25.3	23.5	23.5	28.0	30.2	34.1	37.8

BMI, Body Mass Index. [a] in Canadian dollars and expressed in thousands. [b] Proportions calculated based on the status at the end of the study.

Table 2. Age and cohort effects (Model 1) on physician services use: Results from logistic cross-classified multilevel models. Canadian National Population Health Survey, 1994-2010.

	Any physician use	Primary Care	Specialist Care
	OR (95% CI)	OR (95% CI)	OR (95% CI)
Women			
Fixed effects			
Age and Cohort Effects			
Linear age [a]	0.99 (0.98 ; 0.99) ***	0.99 (0.98 ; 1.00) ***	1.01 (1.00 ; 1.02) **
Birth cohort			
(Ref: Pre-World War)			
World War II	1.23 (1.04 ; 1.45) *	1.08 (0.91 ; 1.29)	1.38 (1.20 ; 1.58) ***
Older Baby Boomer	1.08 (0.90 ; 1.31)	0.96 (0.77 ; 1.19)	1.49 (1.25 ; 1.78) ***
Younger Baby Boomer	0.94 (0.76 ; 1.15)	0.84 (0.63 ; 1.10)	1.48 (1.19 ; 1.83) ***
Generation X	0.91 (0.73 ; 1.15)	0.79 (0.64 ; 0.99) **	1.67 (1.29 ; 2.15) ***
Random effects [b]			
Individual	1.32 (1.28 ; 1.34) ***	1.39 (1.31 ; 1.47) ***	0.91 (0.85 ; 0.97) ***
Period (Survey year)	0.01 (0.00 ; 0.03)	0.01 (0.00 ; 0.01) *	0.00 (-0.04 ; 0.04)
Men			
Fixed effects			
Age and Cohort Effects			
Linear age	1.03 (1.02 ; 1.03) ***	1.02 (1.01 ; 1.03) ***	1.03 (1.02 ; 1.04) ***
Birth cohort			
(Ref: Pre-World War)			
World War II	1.32 (1.10 ; 1.59) **	1.16 (0.97 ; 1.39)	1.32 (1.11 ; 1.58) ***
Older Baby Boomer	1.36 (1.12 ; 1.66) **	1.09 (0.90 ; 1.33)	1.36 (1.10 ; 1.69) ***
Younger Baby Boomer	1.47 (1.18 ; 1.82) **	1.03 (0.81 ; 1.30)	1.52 (1.18 ; 1.96) ***
Generation X	1.48 (1.16 ; 1.88) **	0.99 (0.99 ; 0.99)	1.73 (1.27 ; 2.37) ***
Random effects			
Individual	1.27 (1.11 ; 1.34) ***	1.37 (1.31 ; 1.43) ***	0.87 (0.79 ; 0.95) ***
Period (Survey year)	0.01 (0.00 ; 0.04)	0.00 (-0.04 ; 0.04)	0.04 (-0.02 ; 0.10)

OR, Odd Ratio; 95% CI, 95% Confidence Interval.
*** *p<0.0001,* ** *p<0.01,* * *p<0.05,* † *p<0.1.*
[a] Age was centered at the mean of the distribution in 1994 (39 years). Models included a quadratic age term.
[b] Estimates are variances.

Table 3. Predisposing, enabling, behavioral, and need factors as predictors of physician use for women: Results from logistic cross-classified multilevel models [a]. Canadian National Population Health Survey, 1994-2010.

	Primary Care		Specialist Care	
	Model 2	Model 3	Model 2	Model 3
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Age and Cohort Effects				
Linear age [b]	0.85 (0.84 - 0.86) ***	0.71 (0.70 - 0.73) ***	1.03 (1.03 - 1.04)	0.92 (0.92 - 0.93) ***
Birth cohort (Ref: Pre-World War)				
World War II	1.04 (0.89 - 1.22)	0.86 (0.54 - 1.38)	1.38 (1.11 - 1.71)	1.15 (0.92 - 1.44)
Older Baby Boomer	0.85 (0.69 - 1.06)	0.68 (0.45 - 1.01)	1.38 (1.13 - 1.68)	1.06 (0.86 - 1.30)
Younger Baby Boomer	0.71 (0.53 - 0.96) ***	0.55 (0.39 - 0.79) ***	1.31 (1.10 - 1.56)	0.95 (0.79 - 1.15)
Generation X	0.64 (0.44 - 0.93) ***	0.48 (0.28 - 0.81) ***	1.45 (1.14 - 1.83) **	0.97 (0.75 - 1.25)
Predisposing, Enabling, and Behavioral Risk Factors				
Education (Ref: 16+ years)				
12-16 years	0.96 (0.78 - 1.19)	0.99 (0.81 - 1.21)	0.79 (0.66 - 0.96) *	0.81 (0.68 - 0.97) *
<12 years	0.91 (0.72 - 1.15)	0.93 (0.75 - 1.15)	0.57 (0.46 - 0.69) ***	0.57 (0.47 - 0.70) ***
Income quartiles (Ref: Bottom (Q1))				
Q2	0.92 (0.85 - 1.00) †	0.96 (0.89 - 1.05)	0.95 (0.88 - 1.03)	0.99 (0.92 - 1.07)
Q3	0.94 (0.86 - 1.03)	0.98 (0.90 - 1.07)	1.00 (0.92 - 1.09)	1.06 (0.97 - 1.15)
Top (Q4)	0.96 (0.87 - 1.05)	1.00 (0.91 - 1.10)	1.03 (0.95 - 1.13)	1.10 (1.01 - 1.19) *
Missing	0.86 (0.73 - 1.02) †	0.89 (0.75 - 1.04)	0.94 (0.81 - 1.10)	0.98 (0.84 - 1.14)
Have regular source of care	3.82 (3.45 - 4.23) ***	3.51 (3.17 - 3.89) ***	1.44 (1.30 - 1.60) ***	1.30 (1.17 - 1.44) ***
Smokers (Ref: never)				
Current	1.01 (0.91 - 1.11)	0.92 (0.84 - 1.01)	1.06 (0.97 - 1.16)	0.99 (0.91 - 1.07)
Former	1.07 (0.98 - 1.16)	1.01 (0.93 - 1.09)	1.13 (1.04 - 1.22) **	1.07 (0.99 - 1.15) †
BMI (Ref: Normal) [c]				
Underweight	1.08 0.89 - 1.30)	1.08 (0.90 - 1.30)	1.11 (0.93 - 1.33)	1.12 (0.94 - 1.33)
Overweight	1.31 (1.22 - 1.42) ***	1.24 (1.15 - 1.33) ***	1.06 (0.99 - 1.14) †	1.00 (0.93 - 1.07)
Moderate obese	1.81 (1.62 - 2.01) ***	1.52 (1.37 - 1.68) ***	1.18 (1.07 - 1.29) ***	1.01 (0.92 - 1.11)
Severe obese	2.10 (1.80 - 2.45) ***	1.53 (1.32 - 1.77) ***	1.30 (1.15 - 1.48) ***	0.99 (0.87 - 1.12)
Physically inactive	0.90 (0.85 - 0.95) ***	0.90 (0.85 - 0.96) ***	0.88 (0.83 - 0.92) ***	0.88 (0.83 - 0.93) ***
Sedentary lifestyle	1.09 (1.02 - 1.17) *	1.07 (1.00 - 1.14) ***	1.13 (1.06 - 1.21) ***	1.11 (1.04 - 1.18) **
Need for Healthcare				
Chronic conditions (Ref: none)				
1		2.03 (1.89 - 2.17) ***		1.73 (1.61 - 1.86) ***
2+		3.30 (3.03 - 3.60) ***		4.98 (4.49 - 5.54) ***

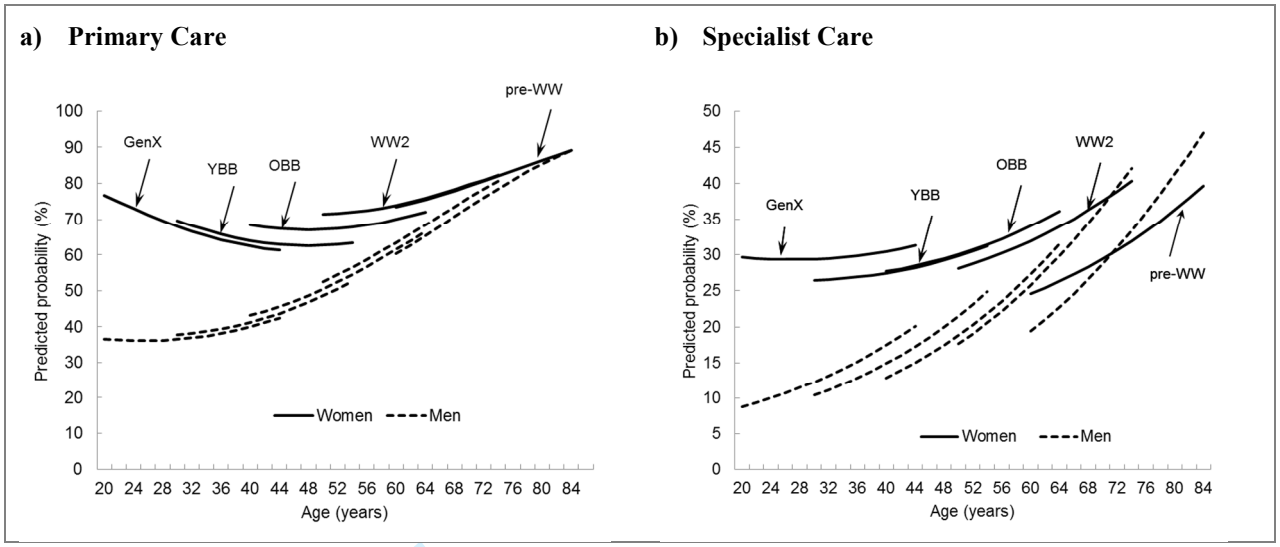
BMI, Body Mass Index; OR, Odd Ratio; 95% CI, 95% Confidence Interval. *** *p<0.0001,* ** *p<0.01,* * *p<0.05,* † *p<0.1.* [a] Models include period (survey year) as a random effect. [b] Age was centered at the mean of the distribution in 1994 (39 years). Models included a quadratic age term. [c] Severe obese (>=35.0), Moderate Obese (30.0-34.9), Overweight (25.0-29.9), Underweight (<18.5), Normal (18.5-24.9).

Table 3. Predisposing, enabling, behavioral, and need factors as predictors of physician use for men: Results from logistic cross-classified multilevel models [a]. Canadian National Population Health Survey, 1994-2010.

	Primary Care		Specialist Care	
	Model 2	Model 3	Model 2	Model 3
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Age and Cohort Effects				
Linear age [b]	1.08 (1.08 - 1.08) ***	0.85 (0.85 - 0.85) ***	1.28 (1.27 - 1.29) ***	1.08 (1.08 - 1.09) ***
Birth cohort (Ref: Pre-World War)				
World War II	1.08 (0.82 - 1.43)	0.87 (0.64 - 1.19)	1.35 (1.06 - 1.72) **	1.12 (0.88 - 1.41)
Older Baby Boomer	0.99 (0.77 - 1.28)	0.70 (0.53 - 0.93) ***	1.36 (1.09 - 1.71) **	1.00 (0.81 - 1.24)
Younger Baby Boomer	0.86 (0.68 - 1.09)	0.54 (0.42 - 0.70) ***	1.51 (1.21 - 1.87) **	0.99 (0.81 - 1.20)
Generation X	0.79 (0.57 - 1.08)	0.46 (0.32 - 0.65) ***	1.73 (1.32 - 2.28) ***	1.04 (0.81 - 1.34)
Predisposing, Enabling, and Behavioral Risk Factors				
Education (Ref: 16+ years)				
12-15 years	1.20 (0.98 - 1.48)	1.19 (0.98 - 1.43)	0.76 (0.63 - 0.92) **	0.75 (0.63 - 0.90) ***
<12 years	1.20 (0.96 - 1.50)	1.17 (0.96 - 1.44)	0.6 (0.49 - 0.74) ***	0.58 (0.48 - 0.71) ***
Income quartiles (Ref: Bottom (Q1))				
Q2	0.90 (0.82 - 0.99) ***	0.94 (0.86 - 1.04)	1.01 (0.91 - 1.11)	1.07 (0.97 - 1.18)
Q3	0.90 (0.81 - 0.99) ***	0.94 (0.85 - 1.04)	1.03 (0.93 - 1.14)	1.10 (0.99 - 1.22) †
Top (Q4)	0.84 (0.75 - 0.93) ***	0.89 (0.81 - 0.99) ***	0.98 (0.88 - 1.09)	1.07 (0.96 - 1.18)
Missing	0.69 (0.56 - 0.87) ***	0.71 (0.57 - 0.88) ***	0.98 (0.78 - 1.23)	1.01 (0.81 - 1.26)
Have regular source of care	3.36 (3.06 - 3.68) ***	3.03 (2.77 - 3.32) ***	2.14 (1.93 - 2.39) ***	1.86 (1.67 - 2.06) ***
Smokers (Ref: never)				
Current	0.96 (0.86 - 1.07)	0.92 (0.83 - 1.02)	1.01 (0.91 - 1.13)	0.97 (0.87 - 1.07)
Former	1.16 (1.06 - 1.28)	1.09 (0.99 - 1.19)	1.21 (1.10 - 1.33) ***	1.15 (1.04 - 1.26) ***
BMI (Ref: Normal) [c]				
Underweight	1.38 (0.90 - 2.10)	1.29 (0.85 - 1.97)	1.24 (1.04 - 1.49) ***	0.96 (0.80 - 1.14)
Overweight	1.14 (1.05 - 1.23) ***	1.12 (1.04 - 1.21) ***	1.04 (0.93 - 1.17)	0.91 (0.82 - 1.02)
Moderate obese	1.45 (1.29 - 1.62) ***	1.30 (1.17 - 1.45) ***	0.92 (0.85 - 1.00) †	0.90 (0.83 - 0.97) ***
Severe obese	2.09 (1.72 - 2.54) ***	1.69 (1.40 - 2.03) ***	1.30 (0.86 - 1.97)	1.23 (0.81 - 1.86)
Physically inactive	0.98 (0.92 - 1.04)	0.95 (0.89 - 1.01)	1.09 (1.02 - 1.16) *	1.06 (1.00 - 1.14) †
Sedentary lifestyle	1.21 (1.12 - 1.30) ***	1.14 (1.06 - 1.23) ***	1.28 (1.19 - 1.38) ***	1.21 (1.12 - 1.31) ***
Need for Healthcare				
Chronic conditions (Ref: none)				
1		2.27 (2.11 - 2.44) ***		2.03 (1.87 - 2.21) ***
2+		4.04 (3.69 - 4.43) ***		6.86 (5.99 - 7.87) ***

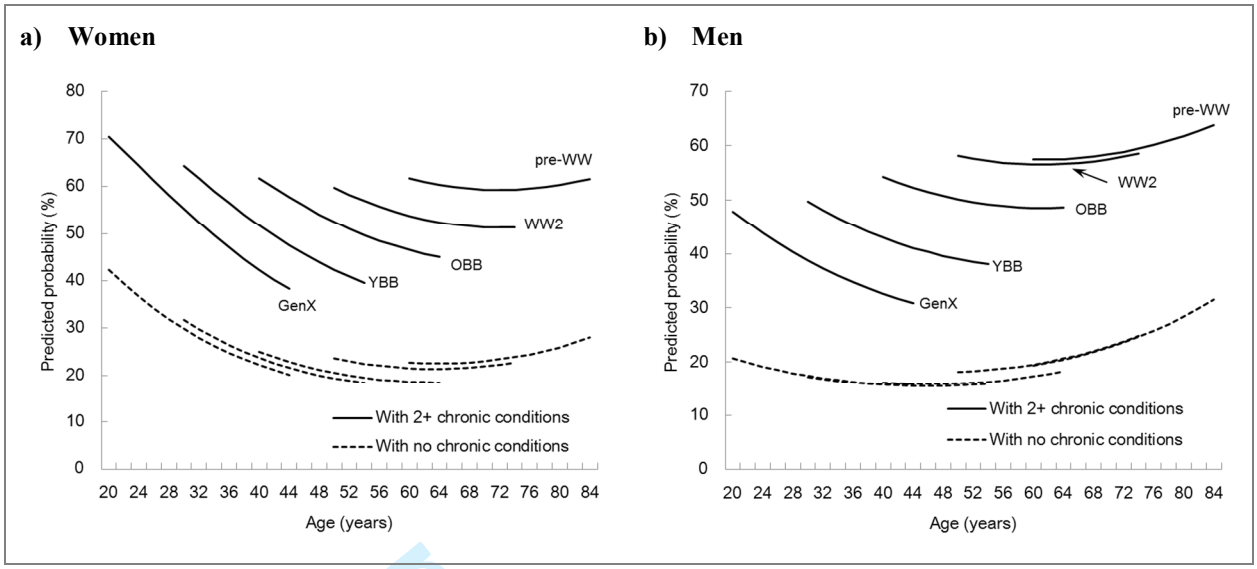
BMI, Body Mass Index; OR, Odd Ratio; 95% CI, 95% Confidence Interval. *** *p<0.0001,* ** *p<0.01,* * *p<0.05,* † *p<0.1.* [a] Models include period (survey year) as a random effect. [b] Age was centered at the mean of the distribution in 1994 (39 years). Models included a quadratic age term. [c] Severe obese (>=35.0), Moderate Obese (30.0-34.9), Overweight (25.0-29.9), Underweight (<18.5), Normal (18.5-24.9).

Figure 1. Age-trajectories and birth cohort for a) Primary Care use and b) Specialist Care use.



GenX: Generation X; YBB: Younger Baby Boomer; OBB: Older Baby Boomer; WW2: World War II; pre-WW: pre-World War II.
Values are predictions from the fixed part of models in Table 2.

Figure 2. Age-trajectories of Primary Care use by number of chronic conditions and birth cohort.



GenX: Generation X; YBB: Younger Baby Boomer; OBB: Older Baby Boomer; WW2: World War II; pre-WW: pre-World War II.

Predictions from models with interactions between chronic condition groups and age, and with birth cohort. Models included predisposing, enabling, behavioral risk, and need factors (Table A1).

Table A1. Differential impact of the number of chronic conditions by birth cohort: Results from logistic cross-classified multilevel models [a]. Canadian National Population Health Survey, 1994-2011.

	Women	Men
	Estimate (S.E.)	**Estimate (S.E.)**
Intercept	-0.945 (0.177) ***	-1.722 (0.184) ***
Linear age [b]	-0.033 (0.004) ***	-0.006 (0.004) **
Quadratic age	0.001 (0.0001) ***	0.001 (0.0001) ***
Birth cohort (Ref: Pre-World War)		
Generation X	-0.407 (0.192) ***	-0.156 (0.200)
Younger Baby Boomer	-0.319 (0.167) **	-0.171 (0.174)
Older Baby Boomer	-0.248 (0.148)	-0.141 (0.153)
World War II	-0.066 (0.137)	0.009 (0.141)
Predisposing, Enabling, and Behavioral Risk Factors		
Education (Ref: 16+ years)		
<12 years	-0.044 (0.060)	0.008 (0.062)
12-15 years	0.013 (0.049)	0.014 (0.052)
Income quartiles (Ref: Top (Q4))		
Bottom (Q1)	0.041 (0.049)	0.156 (0.052)
Q2	-0.018 (0.045)	0.045 (0.046)
Q3	0.032 (0.041)	0.042 (0.041)
Missing	-0.086 (0.082)	-0.179 (0.106)
Have regular source of care	1.142 (0.049) ***	1.012 (0.043) ***
Smokers (Ref: never)		
Current	-0.049 (0.044)	-0.062 (0.048)
Former	0.023 (0.038)	0.080 (0.043)
BMI (Ref: Normal) [c]		
Severe obese	0.457 (0.069) ***	0.530 (0.088) ***
Moderate obese	0.402 (0.049) ***	0.264 (0.051) ***
Overweight	0.197 (0.034) ***	0.110 (0.037) ***
Underweight	0.081 (0.088)	0.248 (0.198)
Physically inactive	0.101 (0.027) ***	0.047 (0.029) ***
Sedentary lifestyle	0.071 (0.033) **	0.124 (0.036) ***
Need for healthcare		
Chronic conditions (Ref: none)		
2+	1.943 (0.198) ***	2.040 (0.220) ***
1	0.885 (0.197) ***	1.082 (0.205) ***
Age by Chronic conditions (Ref: None)		
2+	-0.012 (0.006) ***	-0.016 (0.006) ***
1	-0.005 (0.006) ***	-0.005 (0.006) ***
Birth Cohort by Chronic conditions (Ref: None)		
2+ conditions: Generation X	-0.999 (0.251) ***	-1.098 (0.278) ***
Younger Baby Boomer	-0.707 (0.203) ***	-0.639 (0.222) ***
Older Baby Boomer	-0.369 (0.168) **	-0.216 (0.182)
World War II	-0.257 (0.151)	-0.045 (0.165)
One condition: Generation X	-0.431 (0.249)	-0.565 (0.257)
Younger Baby Boomer	-0.312 (0.204)	-0.368 (0.211)
Older Baby Boomer	-0.116 (0.170)	-0.154 (0.176)
World War II	0.044 (0.157)	-0.254 (0.162)

BMI, Body Mass Index; OR, Odd Ratio; 95% CI, 95% Confidence Interval. *** $p<0.0001$, ** $p<0.01$, * $p<0.05$, † $p<0.1$. [a] Models include period (survey year) as a random effect. [b] Age is centered at the mean of the distribution in 1994 (39 years). [c] Severe obese (>=35.0), Moderate Obese (30.0-34.9), Overweight (25.0-29.9), Underweight (<18.5), Normal (18.5-24.9).

STROBE Statement—Checklist of items that should be included in reports of ***cohort studies***

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract **Within the title page 1 and the Design section of the abstract page 5**
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found **Results and Conclusions in the abstract page 5**
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported **Introduction pages 7-9**
Objectives	3	State specific objectives, including any prespecified hypotheses **Introduction pages 8-9**
Methods		
Study design	4	Present key elements of study design early in the paper **Introduction pages 8-9 and Methods page 9**
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection **Methods page 9**
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up **This study is a secondary analysis of data collected by Statistics Canada. The original study has been described elsewhere as reference in the Methods page 9**
		(*b*) For matched studies, give matching criteria and number of exposed and unexposed **NA**
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable **Methods pages 10-11**
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group **Methods pages 10-11**
Bias	9	Describe any efforts to address potential sources of bias **Methods page 12**
Study size	10	Explain how the study size was arrived at **NA**
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why **Methods pages 10-11**
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding **Methods pages 11-12**
		(*b*) Describe any methods used to examine subgroups and interactions **NA**
		(*c*) Explain how missing data were addressed **Methods page 12**
		(*d*) If applicable, explain how loss to follow-up was addressed **Methods page 12**
		(*e*) Describe any sensitivity analyses **Methods page 12**
Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study,

		completing follow-up, and analysed **Methods page 9, Results page 13, Table 1**
		(b) Give reasons for non-participation at each stage **NA**
		(c) Consider use of a flow diagram **NA**
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders **Results page 12, Table 1**
		(b) Indicate number of participants with missing data for each variable of interest **Results page 13 and Table 1.**
		(c) Summarise follow-up time (eg, average and total amount) **Methods page 9**
Outcome data	15*	Report numbers of outcome events or summary measures over time **Results pages 13-14, Table 2 and Figure 1**
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included. **Results pages 13-15, Tables 2-4**
		(*b*) Report category boundaries when continuous variables were categorized **Methods pages 10-11**
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period **N/A**
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses **Results pages 15-16, Figure 2, table 5**
Discussion		
Key results	18	Summarise key results with reference to study objectives **Discussion page 16**
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias **Discussion pages 18-19**
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence **Discussion pages 17-20**
Generalisability	21	Discuss the generalisability (external validity) of the study results **Discussion pages 17-20**
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based **Within the acknowledgements**

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at http://www.strobe-statement.org.

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Do baby boomers use more healthcare services than other generations? Longitudinal trajectories of physician service use across five birth cohorts

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Do baby boomers use more healthcare services than other generations? Longitudinal trajectories of physician service use across five birth cohorts

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ABSTRACT

Objective: In light of concerns for meeting the provision of healthcare services given the large numbers of aging baby boomers, we compared the trajectories of primary care and specialist services use across the lifecourse of five birth cohorts and examined factors associated with birth cohort differences.

Design: Longitudinal Panel.

Setting: Canadian National Population Health Survey (1994-2011).

Population: Sample of 10186 individuals aged 20-69 years in 1994/95 and who were from five birth cohorts: Generation X (born: 1965 – 1974), Younger Baby Boomers (born: 1955 – 1964), Older Baby Boomers (born: 1945 – 1954), World War II (born: 1935 – 1944), and pre-World War II (born: 1925 – 1934).

Main outcomes: Use of primary care and specialist services.

Results: Although the overall pattern suggested less use of physician services by each successive recent cohort, this masked differences in primary and specialist care use by cohort. Multilevel analyses comparing cohorts showed that Gen Xers and younger boomers, particularly those with multimorbidity, were less likely to use primary care than earlier cohorts. In contrast, specialist use was higher in recent cohorts, with Gen Xers having the highest specialist use. These increases were explained by the increasing levels of multimorbidity. Education, income, having a regular source of care, sedentary lifestyle, and obesity were significantly associated with physician services use, but only partially contributed to cohort differences.

Conclusion: The findings suggest a shift from primary care to specialist care among recent cohorts, particularly for those with multimorbidity. This is of concern given policies to promote primary care services to prevent and manage chronic conditions. There is a need for policies to address important generational differences in healthcare preferences and the balance between primary and specialty care to ensure integration and coordination of healthcare delivery.

STRENGTHS AND LIMITITATION OF THIS STUDY

- No study has compared the patterns of primary care and specialist service use among baby boomers and other generations.
- Large longitudinal data, spanning 18 years, enabled us to compare different cohorts at the same chronological age.
- Our analytical methodology integrated changes in healthcare use indicators with changes in factors associated with them.
- The interpretation of the findings is limited due to the inability to identify the specific conditions for which individuals are consulting with physicians.
- The data are self-reported and the bias associated with inaccuracies and reporting errors is unknown.

INTRODUCTION

Older age is typically associated with worse health, higher healthcare use [1-3] and increased healthcare costs. [4-6] Consequently, the large number of aging baby boomers (born 1945-1964), who are now 50+ years of age, are generating concerns for the provision of health services in North America and elsewhere. Two issues have been raised: the large size of the cohort and the belief that baby boomers are different in their needs and attitudes toward healthcare from their predecessors.[7-11] Baby boomers grew up at a time of social change, economic growth and prosperity with improved access to education, employment opportunities, and with access to health and welfare services.[12-14] They are the first generation to have access to antibiotics and other effective medications. On one hand, these advances have the potential to improve the health of boomers and reduce their need for healthcare services. On the other hand, these advantages have also contributed to longer life expectancy and improvements in survival. As a result people are living longer with the potential of developing multiple chronic conditions and hence needing more healthcare services.[15 16]

Parallel to these changes, baby boomers and succeeding generations have also been part of a shift to consumer driven healthcare where people define themselves first as consumers and then as patients. This consumer market has positioned health as an individual right and, as a result many people have proactive behaviors towards their health decisions and selection of services.[17-19] Boomers are often avid consumers of health information and are more willing to try new treatments than previous generations. [20 21] Yet, how changes in prosperity, medical care improvements, and the rise in medical consumerism impact baby boomers' use of health services remains to be examined. Studies have not investigated whether there are generational differences in healthcare use, including consultations with primary physicians and specialists. Formulating

policy changes and interventions to accommodate the needs of this large cohort will require a thorough understanding of these patterns and the diverse factors affecting healthcare use in boomers and other cohorts.

Andersen and Newman's behavioural model of health services is useful for identifying factors related to healthcare use.[22 23] In their framework, healthcare use is conceptualized as a function of predisposing (e.g. age, sex, education), enabling (e.g. income, regular source of care), and need (e.g. chronic health conditions) factors. Behavior-related risk factors (e.g. obesity) also can be included in the framework. Previous research has found cohort differences related to a number of factors relevant to healthcare use of baby boomers and other cohorts. For example, improvements in the standard of living and education attainment since the 1950s [24 25] might be expected to reduce the need for healthcare among baby boomers and succeeding generations. Declines in smoking rates in recent cohorts [26-28] also are likely to be related to better health and reduced healthcare. [29 30] However, trends of increased obesity and sedentary lifestyles in each succeeding recent cohort [29 31-34] are risk factors for worse health and may result in increased healthcare use. Few studies have explicitly compared need factors like chronic health conditions across cohorts. An Australian study found that Gen Xers reported more diabetes than baby boomers[34] and a study from the United Kingdom [37] found that boomers had more hypertension and diabetes than their predecessors. In contrast, a study of U.S. women found no differences in arthritis prevalence between baby boomers and the previous generation.[38]

Given the lack of evidence on patterns of healthcare use among baby boomers compared to other generations, this study uses longitudinal panel data spanning 18 years to compare use of physician services (primary care and specialist care) across five birth cohorts: Generation X (born: 1965–1974), Younger Baby Boomers (born: 1955–1964), Older Baby Boomers (born:

1945–1954), World War II (born: 1935–1944), and pre-World War II (born: 1925–1934). The overall goal was to: a) compare primary care and specialist services use over the lifecourse across birth cohorts; and b) to examine cohort differences in predisposing, enabling, need, and behavioural risk factors that could explain cohort differences in the lifecourse trajectories of primary care and specialist use.

METHODS

Study setting and population

We used data from the longitudinal component of the Canadian National Population Health Survey (NPHS) spanning 18 years from 1994 to 2011. The NPHS, established in 1994/1995 (cycle 1), is a representative sample of the household population residing in Canada's ten provinces. The survey excluded persons living on Indian Reserves and Crown Lands, residents of health institutions, full-time members of the Canadian Forces Bases and some remote areas in Ontario and Québec. The NPHS retained individuals who moved to long-term care institutions and those who died over the course of the survey. [39] We included participants who were between 20 and 69 years old in 1994, contributed to at least three cycles of data, and had complete information about the outcomes at baseline (1994). This resulted in a sample of 10186 individuals with an average of 7 cycles of data. The University of Toronto Ethics Committee approved the study.

Data sharing

The survey is not publicly available and authorization from Statistics Canada is required to access the data. Therefore there are no additional data available.

Primary outcomes

At each cycle, participants were asked about their use of healthcare in the previous 12 months. Canada has a national healthcare policy which provides universal coverage for all medically necessary hospital and physician services with no copayments or other patient charges. Access to specialists is by referral from other physicians, usually a family physician/general practitioner (FP/GP). Participants were asked to report the number of consultations with FP/GPs or specialists (excluding eye care) in the 12 months prior to their interview. Because our focus was to study services for health conditions and not well-care visits for screening and immunization, we defined primary care use as reporting two or more FP/GP visits and specialist use as reporting at least one visit to a specialist. In this paper we use the term "primary care" to have the same meaning as "FP/GP". Furthermore, specialists like those in general internal medicine do not have primary care roles in Canada.

Predictors

Cohort membership and age were based on year of birth. Participants were allocated in five birth cohorts: Generation X (born: 1965 – 1974), Younger Baby Boomers (born: 1955 – 1964), Older Baby Boomers (born: 1945 – 1954), World War II (born: 1935 – 1944), and pre-World War II (born: 1925 – 1934). We used Andersen and Newman's model of healthcare use to select variables.[23] Measures of *predisposing factors* were gender and education. Education was measured as years of schooling and was grouped for analyses as: <12 years, 12-15 years, and 16+ years. *Enabling factors* were household income and having a regular source of care. Household income was collected at each cycle and categorized into quartiles of the distribution at each survey year with a separate category representing missing values. We used the presence of chronic conditions as an indicator of *need* for care. At each cycle, respondents indicated

yes/no to the presence of 17 chronic conditions diagnosed by a healthcare professional. The number of chronic conditions was grouped as: none, 1, and 2+.

We also examined *behavior-related factors*: smoking, obesity, physical activity, and sedentary lifestyle. Participants were grouped as: current smoker, former smoker, and non-smoker (those who never smoked). We grouped BMI as: underweight (<18.5), normal weight (18.5-24.9), overweight (25.0-29.9), moderate obese (30.0-34.9), and severe obese (≥35.0).[40] The survey asked a series of questions about participation in physical activities like walking for exercise, running, gardening and collected the time per week participants usually spent walking (bicycling) to work, school or while doing errands. Responses were used to group individuals as physically active (during leisure time or active commuting) vs. inactive based on Statistics Canada derived variables.[39] Lastly, participants who reported that they "usually sit during the day and don't walk around very much" were considered to have a sedentary lifestyle.

Statistical analysis

Comparing birth cohorts is complex because cohort differences are linked to the effects of aging as well as societal and environmental changes affecting the population as a whole (period effects). Therefore, in addition to age, it is pertinent to consider period effects (e.g. survey year), as these may obscure cohort effects unless they are properly modeled. However, studies aiming to estimate the effects of age, period, and cohort are hindered by the identification problem; that is, age, period, and cohort are linearly dependent.[41] Because of this linearity, there is no unique solution to models including the three effects simultaneously. As a result, they cannot be modeled at once. One way to deal with this problem is to directly estimate age and cohort effects (as fixed effects) while accounting for variability across periods (random effect) (See discussion

in [41] and [42]). To do this, we fitted cross-classified multilevel models in which observations were nested within individuals and individuals were nested within time periods.

We started with a model with age and cohort (Model 1). In the next steps we added predisposing, enabling, and behavior-related factors (Model 2). And lastly we added need factors (Model 3) and examined variations in the age and cohort estimates. In all models, age was centered at 39 years (the mean of the distribution for the five cohorts at baseline (1994/95)). Models were fitted using PROC GLIMMIX from SAS 9.3 including incomplete cases up to the point at which they drop out or died and likelihood estimators were used that adjust for non-response assuming the data are missing at random. The significance of variables was assessed by Wald tests.

Supplementary analyses

We conducted three sets of supplementary analyses. First, we repeated the analyses using the number of visits to FP/GPs, to specialists, and the total number of visits as the outcomes. We also modeled primary care use defined as having at least one visit to FP/GPs. Secondly, using the number of chronic conditions as a global measure of need for care precluded us from elucidating the effects of individual chronic conditions in explaining cohort differences in the outcomes. Therefore, we repeated the analysis 17 times by adding each individual chronic condition to the models and examined changes in the cohort coefficients. Lastly, we examined the impact of attrition in our analyses by comparing the results of the models including indicator variables identifying participants who dropped-out or died before the end of the study and the results of restricting the analyses to individuals with complete data in the nine cycles.

Patient involvement

This study is based on a population survey that did not involve patients.

RESULTS

Descriptive

In 1994/95 there were 10186 participants who met the inclusion criteria: 1384 in the pre-World War II cohort, 1596 in the World War II cohort, 2205 older baby boomers, 2778 younger baby boomers, and 2223 Gen Xers. Generally, physician services use was higher in women than men overall and for both primary care and specialist use (Table 1). Women reported having a regular source of care more often than men in all cohorts, with the exception of the pre-World War II cohort. Education was higher for younger boomers and Gen Xers while older boomers had the highest income. Men reported slightly higher household income than women in all cohorts. Dropping-out of the study was the most common source of attrition among baby boomers and Gen Xers and death in the pre-World War II cohort (Table 1). In preliminary analyses we found significant differences in the outcomes and predictors by gender, therefore results are presented for women and men separately.

Cohort differences in healthcare use

Cohort differences in the overall pattern of physician services were modest and suggested less use of services by each successive recent cohort. However, these modest differences masked marked cohort differences in primary care and specialist care (Table 2). We therefore analysed data for primary care and specialist care separately.

In addition, the age and cohort patterns of physician services use were different for men and women. For women, primary care use declined around age 40, and then increased as they

grew older; whereas for men primary care use increased steadily with increasing age. Although specialist use increased with increasing age for women and men, this increase was more marked for men than women (Figure 1a and b respectively). In addition to age effects, we found significant cohort differences in primary care use for women but not men (Table 2, Figure 1a). Comparing women at corresponding ages indicated that Gen Xers and younger boomers had the lowest primary care use. Likewise, there were significant cohort differences in specialist use for both women and men. In contrast to primary care use, comparing people at the same ages there was higher specialist use in each succeeding recent cohort (Table 2, Figure 1b). In all models we controlled for the potential of period effects. We found only a minimal variability across years for primary care use by women and no differences for men. No significant period effects were seen for specialist use (Table 2).

Explaining cohort differences

Predisposing, enabling, and behavioural risk factors

There were significant associations of predisposing, enabling and behavior-related factors with primary care and specialist care use (Tables 3 and 4, Model 2) that were somewhat attenuated once the number of chronic conditions was entered into the models (Model 3). Specifically, there were no differences in primary care use related to education (predisposing factor), but education was significantly associated with specialist use: women and men with higher education were more likely to visit specialists than those with lower education. For enabling factors, income was significantly associated with primary care use for men only: those in the top income quartile were less likely to visit FP/GPs than those in the bottom quartile (OR=0.89, 95% CI: 0.81-0.99). Income was not significantly associated with specialist use for either women or men. Women and men with a regular source of care were more likely to consult with FP/GPs and see

specialists. Behavior-related factors were significantly associated with primary care and specialist use. Those who reported sedentary lifestyles and physically active women were more likely to consult with both types of practitioners. Smoking was not associated with primary care use, but it was associated with specialist use for men: former smokers were more likely to visit specialists than non-smokers (OR=1.15, 95% CI: 1.04-1.26). Obesity was not significantly associated with specialist use, but obese women were more likely to see FP/GPs.

Need factors: Impact of chronic conditions

As might be expected, the presence of chronic conditions was a significant and a strong predictor of both primary care and specialist use. When we introduced the number of chronic conditions to the models, cohort differences in specialist care use were no longer significant (Tables 3 and 4, Model 3). In contrast, the opposite effect was seen for primary care use: cohort differences were augmented for women and became significant for men. Because of the dramatic change in the cohort effects we hypothesized that there may be a differential impact of the number of chronic conditions on primary care use by birth cohort. To test this hypothesis we conducted analyses that included interaction terms between chronic condition groups with age and cohort (Table A1 Supplementary Material). The interactions with both age and cohort were significant. As shown in Figure 2, there were large cohort differences for women (2a) and men (2b) reporting two or more chronic conditions. When compared at corresponding ages, we found lower primary care use in each succeeding recent cohort. No cohort differences were seen for those with one or no chronic conditions.

Supplementary analyses

Findings of the models examining the number of visits to physicians were similar to our main results. Analyses that included each individual chronic condition revealed that cohort differences

were virtually unchanged. This suggests that having multiple conditions, and not any specific condition, explained the cohort differences in the age-trajectories of physician service use. Our models adjusting for drop-outs and mortality showed, as expected, higher overall primary care and specialist use among those who died during follow up, but no impact on the effect of predisposing, enabling, need, and behavior-related risk factors on the outcomes. Further comparisons between those who died and those who were alive at the end of the study indicated that, although the age-trajectory was steeper for those who died, cohort differences and the relationships of predisposing, enabling, need, and behavior-related factors remained unchanged. As a result, these analyses did not change the conclusions drawn from the main findings (Tables available upon request).

DISCUSSION

This is the first study to compare the lifecourse trajectories of physician visits among pre-boomers, baby boomers, and Gen Xers. We found a modest decrease in the overall use of physician services in recent cohorts compared to previous cohorts. Specifically, the findings highlighted that there were different age and cohort patterns of primary care and specialist care use, suggesting an important shift in the pattern of healthcare use over time. Moreover, substantial cohort differences in primary care use were revealed when our additional analyses considered the differential impact of chronic conditions on physician services use. These analyses yielded marked cohort differences for those with multimorbidity. They showed lower primary care use in each succeeding recent cohort, so that at the same age Gen Xers were less likely to use primary care than younger baby boomers and so on. In contrast to primary care use, we found that younger boomers and Gen Xers were more likely to report using specialist care. However, these cohort differences disappeared when healthcare needs, namely the number of

chronic conditions, were taken into account. Juxtaposition of these findings suggest that there may be a shift from primary care to specialist care in more recent cohorts (e.g. Gen Xers, younger boomers), particularly for those with multimorbidity.

Comparison with other studies

The lower primary care use for those with multimorbidity in recent cohorts is concerning for several reasons. First, more recent cohorts (i.e. younger individuals) reported the most multimorbidity.[43] It is unclear whether this reflects positive changes to the healthcare system with better access, earlier diagnosis and treatment or whether it reflects poorer health in more recent generations. Evidence from previous studies suggests both factors may play a role.[15 44 45] Second, studies have highlighted the important role of FP/GPs in the integration and coordination of healthcare, especially for patients with chronic conditions.[45-49] Our finding that cohort differences in specialist use were no longer apparent after accounting for healthcare needs suggests that use of specialists by birth cohorts was largely related to need for care. Of potential concern, however, is that those with greater need for care are individuals from recent cohorts who may be developing multimorbidity at younger ages compared to their predecessors.[43] An additional concern is that specialist services typically focus on chronic health conditions singly with the associated duplication of care and increased costs.[46] This finding highlights the need to assess the balance between primary and specialty care to optimize healthcare delivery.

Our finding of greater use of specialists in conjunction with the lower primary care use among those with multimorbidity may also reflect changes in patient's preferences and expectations of more recent cohorts like Gen Xers and younger baby boomers.[18 20] Alternatively, they also may be related to changing practice patterns of FP/GPs. Some research indicates that FP/GPs may be more likely to refer younger patients to specialists for the management of their

chronic conditions.[50 51] It is also possible that members of recent cohorts have access to specialist investigations and treatment that were not available to earlier generations, which may account for differences across cohorts. Lastly, in Canada there have been an increase in the number of specialist relative to the number of FP/GPs over time, which may also contribute to the higher specialist use among recent generations.[52] Future research is needed to examine primary care referrals, as well as patients' preferences and expectations in understanding the lower primary care use by individuals with multimorbidity.

Our study is consistent with previous research indicating greater healthcare use with older age [1-3 53] and extends these findings by accounting for cohort effects. Predisposing, enabling, and behavior-related factors were important predictors of overall primary care and specialist use, but did not contribute to explaining the cohort differences in primary care and specialist use. Specifically, our findings of overall higher physician use by women are in line with previous studies.[1 2] Also in keeping with past research were the findings of educational inequities in healthcare use: individuals with greater education were more likely to have used specialist care independently of the number of chronic conditions.[1-3] Income showed variable findings and was only important for primary care use among men, such that lower income men were more likely to visit FP/GPs.[44 53-55] Finally, similar to other studies we found that obese individuals, current smokers, physically inactive, and/or individuals with sedentary lifestyle used more health services.[30 56-59]

Strengths and Limitations

An advantage of this study is that longitudinal data enabled us to compare different cohorts at the same chronological age. The majority of the evidence on healthcare use in the population derives from cross-sectional studies.[2 3 53] However, it is impossible to study cohort effects in cross-

sectional studies as comparing two cohorts at the same time point means that one is older than the other. Our approach provides an attractive methodology as we could integrate changes in healthcare use indicators with changes in factors associated with healthcare use. At the same time, the study has several limitations, particularly related to the survey's general methodology. Although data were collected about healthcare use and chronic conditions, there was no direct link between the two factors. Consequently, the interpretation of the findings is limited due to the inability to identify the specific conditions for which individuals are consulting with physicians. In addition, the NPHS data are self-reported and the bias associated with inaccuracies and reporting errors is unknown. It has been found that self-reports of healthcare use may underestimate actual physician visits, particularly among those with higher volumes of visits.[60] However, because we dichotomized the outcomes, we do not expect that these under-reports affected our results and conclusions. Furthermore, additional analyses examining the number of visits provided similar results. Another limitation is that we were not able to examine the effect of ethnicity/cultural background as the vast majority (93.2%) of participants identified themselves as White. [39] Lastly, there was attrition over the long follow-up time. We were able to examine the impact of mortality and loss to follow up in our results. These analyses did not change our conclusions.

Conclusions

We found that overall cohort differences in physician services use were modest, but when examining use of primary and specialist care separately, cohort differences were larger for specialist use and in the opposite direction to that of primary care use. The higher specialist use and the lower primary care use of those with multimorbidity in recent cohorts suggest that there has been a shift from primary to specialty care among baby boomers and Gen Xers. Our findings

underscore the importance of research and policies addressing generational differences in healthcare practices, expectations, and preferences to ensure coordination and integration of healthcare delivery. If the trend of greater multimorbidity, lower primary care use, and higher specialist use among recent cohort continues, the organization and provision of healthcare in the near future will continue to face great challenges.

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Disclosure

Access to the data was through the Statistics Canada Research Data Centres (RDC) Program, which was approved by the Social Sciences and Humanities Research Council of Canada. RDCs are operated under the provisions of the Statistics Act in accordance with all the confidentiality rules and are accessible only to researchers with approved projects. The findings and conclusions of this paper are those of the authors and do not necessarily represent the official position of Statistics Canada.

Author Contributions

Mayilee Canizares was the lead author on this paper. Her contributions included study design, statistical analysis, and drafting of the manuscript. Monique Gignac contributed to the design of the study, interpretation of results, and critically revised the manuscript. Sheilah Hogg-Johnson contributed to the design, provided statistical advice, and critically commented on the manuscript's content. Richard Glazier and Elizabeth Badley are the graduate supervisors of the lead author and provided guidance on the study design, analysis, and structure of the manuscript. All authors read and approved the final manuscript and are accountable for all aspects of the study.

Competing Interests

We have read and understood BMJ Open policy on declaration of interests and declare that we have no competing interests.

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Table 1. Characteristics of birth cohorts at baseline (1994/95). Canadian National Population Health Survey (NPHS), 1994-2011

	Pre-World War II (1925-1934)		World War II (1935-1944)		Older baby boomer (1945-1954)		Younger baby boomer (1955-1964)		Generation X (1965-1974)	
	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men
N	787	597	857	739	1150	1055	1510	1268	1201	1022
Outcomes										
% physician services use	75.2	66.6	69.9	57.9	67.3	51.7	71.3	48.4	76.7	43.1
% Primary care users	69.5	59.6	64.1	51.8	60.4	46.5	63.4	43.5	69.3	38.5
% Specialist users	31.9	30.0	31.2	24.5	31.4	19.2	33.4	17.2	34.1	13.1
Enabling factors										
Mean age	63.7	63.8	53.8	53.6	43.6	43.8	33.9	34.0	24.2	24.2
Mean years of schooling	10.7	10.7	11.7	11.8	13.2	13.1	13.3	13.4	13.5	13.5
Predisposing factors										
Mean household income [a]	40.7	45.4	54.7	59.0	59.7	62.3	53.6	56.2	49.7	54.7
% with regular doctor	94.7	93.1	93.6	88.7	90.1	80.6	89.8	78.9	87.8	70.3
Behavior-related factors										
% smokers (current or former)	54.4	80.8	53.1	76.8	56.8	71.7	62.0	63.8	59.1	54.4
Mean BMI	26.1	26.6	26.2	26.9	25.3	26.5	24.2	26.0	23.4	24.7
% obese	18.5	18.9	16.3	16.6	16.1	14.7	11.6	11.4	10.1	10.0
% physically inactive	44.1	49.1	41.9	39.3	38.7	46.4	42.1	48.0	47.0	55.0
% sedentary	17.1	19.9	17.2	21.4	22.7	22.0	20.4	21.3	22.1	18.2
Need factors										
Mean number of chronic conditions	1.6	1.4	1.3	1.0	0.9	0.7	0.8	0.6	0.7	0.5
% with 1 chronic condition	29.7	32.9	29.7	36.1	31.8	29.9	28.5	30.1	26.5	26.5
% with 2+ chronic conditions	43.0	38.2	34.6	25.0	21.2	17.5	18.7	13.5	18.4	10.7
Attrition [b]										
% died	30.3	48.9	11.7	19.3	5.4	6.1	1.7	3.1	1.7	2.6
% dropped-out	19.8	21.0	20.2	25.3	23.5	23.5	28.0	30.2	34.1	37.8

BMI, Body Mass Index. [a] in Canadian dollars and expressed in thousands. [b] Proportions calculated based on the status at the end of the study.

Table 2. Age and cohort effects (Model 1) on physician services use: Results from logistic cross-classified multilevel models. Canadian National Population Health Survey, 1994-2011

	Any physician use OR (95% CI)	Primary Care OR (95% CI)	Specialist Care OR (95% CI)
Women			
Fixed effects			
Age and Cohort Effects			
Linear age [a]	0.99 (0.98 ; 0.99) ***	0.99 (0.98 ; 1.00) ***	1.01 (1.00 ; 1.02) **
Birth cohort			
(Ref: Pre-World War)			
World War II	1.23 (1.04 ; 1.45) *	1.08 (0.91 ; 1.29)	1.38 (1.20 ; 1.58) ***
Older Baby Boomer	1.08 (0.90 ; 1.31)	0.96 (0.77 ; 1.19)	1.49 (1.25 ; 1.78) ***
Younger Baby Boomer	0.94 (0.76 ; 1.15)	0.84 (0.63 ; 1.10)	1.48 (1.19 ; 1.83) ***
Generation X	0.91 (0.73 ; 1.15)	0.79 (0.64 ; 0.99) **	1.67 (1.29 ; 2.15) ***
Random effects [b]			
Individual	1.32 (1.28 ; 1.34) ***	1.39 (1.31 ; 1.47) ***	0.91 (0.85 ; 0.97) ***
Period (Survey year)	0.01 (0.00 ; 0.03)	0.01 (0.00 ; 0.01) *	0.00 (-0.04 ; 0.04)
Men			
Fixed effects			
Age and Cohort Effects			
Linear age	1.03 (1.02 ; 1.03) ***	1.02 (1.01 ; 1.03) ***	1.03 (1.02 ; 1.04) ***
Birth cohort			
(Ref: Pre-World War)			
World War II	1.32 (1.10 ; 1.59) **	1.16 (0.97 ; 1.39)	1.32 (1.11 ; 1.58) ***
Older Baby Boomer	1.36 (1.12 ; 1.66) **	1.09 (0.90 ; 1.33)	1.36 (1.10 ; 1.69) ***
Younger Baby Boomer	1.47 (1.18 ; 1.82) **	1.03 (0.81 ; 1.30)	1.52 (1.18 ; 1.96) ***
Generation X	1.48 (1.16 ; 1.88) **	0.99 (0.99 ; 0.99)	1.73 (1.27 ; 2.37) ***
Random effects			
Individual	1.27 (1.11 ; 1.34) ***	1.37 (1.31 ; 1.43) ***	0.87 (0.79 ; 0.95) ***
Period (Survey year)	0.01 (0.00 ; 0.04)	0.00 (-0.04 ; 0.04)	0.04 (-0.02 ; 0.10)

OR, Odd Ratio; 95% CI, 95% Confidence Interval.
*** *p<0.0001,* ** *p<0.01,* * *p<0.05,* † *p<0.1.*
[a] Age was centered at the mean of the distribution in 1994/95 (39 years). Models included a quadratic age term.
[b] Estimates are variances.

Table 3. Predisposing, enabling, behavior-related, and need factors as predictors of physician use for women: Results from logistic cross-classified multilevel models [a]. Canadian National Population Health Survey, 1994-2011

	Primary Care		Specialist Care	
	Model 2	Model 3	Model 2	Model 3
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Age and Cohort Effects				
Linear age [b]	0.85 (0.84 - 0.86) ***	0.71 (0.70 - 0.73) ***	1.03 (1.03 - 1.04)	0.92 (0.92 - 0.93) ***
Birth cohort (Ref: Pre-World War)				
World War II	1.04 (0.89 - 1.22)	0.86 (0.54 - 1.38)	1.38 (1.11 - 1.71)	1.15 (0.92 - 1.44)
Older Baby Boomer	0.85 (0.69 - 1.06)	0.68 (0.45 - 1.01)	1.38 (1.13 - 1.68)	1.06 (0.86 - 1.30)
Younger Baby Boomer	0.71 (0.53 - 0.96) ***	0.55 (0.39 - 0.79) ***	1.31 (1.10 - 1.56)	0.95 (0.79 - 1.15)
Generation X	0.64 (0.44 - 0.93) ***	0.48 (0.28 - 0.81) ***	1.45 (1.14 - 1.83) **	0.97 (0.75 - 1.25)
Predisposing, Enabling, and Behavior-related				
Education (Ref: 16+ years)				
12-16 years	0.96 (0.78 - 1.19)	0.99 (0.81 - 1.21)	0.79 (0.66 - 0.96) *	0.81 (0.68 - 0.97) *
<12 years	0.91 (0.72 - 1.15)	0.93 (0.75 - 1.15)	0.57 (0.46 - 0.69) ***	0.57 (0.47 - 0.70) ***
Income quartiles (Ref: Bottom (Q1))				
Q2	0.92 (0.85 - 1.00) †	0.96 (0.89 - 1.05)	0.95 (0.88 - 1.03)	0.99 (0.92 - 1.07)
Q3	0.94 (0.86 - 1.03)	0.98 (0.90 - 1.07)	1.00 (0.92 - 1.09)	1.06 (0.97 - 1.15)
Top (Q4)	0.96 (0.87 - 1.05)	1.00 (0.91 - 1.10)	1.03 (0.95 - 1.13)	1.10 (1.01 - 1.19) *
Missing	0.86 (0.73 - 1.02) †	0.89 (0.75 - 1.04)	0.94 (0.81 - 1.10)	0.98 (0.84 - 1.14)
Have regular source of care	3.82 (3.45 - 4.23) ***	3.51 (3.17 - 3.89) ***	1.44 (1.30 - 1.60) ***	1.30 (1.17 - 1.44) ***
Smokers (Ref: never)				
Current	1.01 (0.91 - 1.11)	0.92 (0.84 - 1.01)	1.06 (0.97 - 1.16)	0.99 (0.91 - 1.07)
Former	1.07 (0.98 - 1.16)	1.01 (0.93 - 1.09)	1.13 (1.04 - 1.22) **	1.07 (0.99 - 1.15) †
BMI (Ref: Normal) [c]				
Underweight	1.08 0.89 - 1.30)	1.08 (0.90 - 1.30)	1.11 (0.93 - 1.33)	1.12 (0.94 - 1.33)
Overweight	1.31 (1.22 - 1.42) ***	1.24 (1.15 - 1.33) ***	1.06 (0.99 - 1.14) †	1.00 (0.93 - 1.07)
Moderate obese	1.81 (1.62 - 2.01) ***	1.52 (1.37 - 1.68) ***	1.18 (1.07 - 1.29) ***	1.01 (0.92 - 1.11)
Severe obese	2.10 (1.80 - 2.45) ***	1.53 (1.32 - 1.77) ***	1.30 (1.15 - 1.48) ***	0.99 (0.87 - 1.12)
Physically inactive	0.90 (0.85 - 0.95) ***	0.90 (0.85 - 0.96) ***	0.88 (0.83 - 0.92) ***	0.88 (0.83 - 0.93) ***
Sedentary lifestyle	1.09 (1.02 - 1.17) *	1.07 (1.00 - 1.14) ***	1.13 (1.06 - 1.21) ***	1.11 (1.04 - 1.18) **
Need for Healthcare				
Chronic conditions (Ref: none)				
1		2.03 (1.89 - 2.17) ***		1.73 (1.61 - 1.86) ***
2+		3.30 (3.03 - 3.60) ***		4.98 (4.49 - 5.54) ***

BMI, Body Mass Index; OR, Odd Ratio; 95% CI, 95% Confidence Interval. *** $p<0.0001$, ** $p<0.01$, * $p<0.05$, † $p<0.1$. [a] Models include period (survey year) as a random effect. [b] Age was centered at the mean of the distribution in 1994/95 (39 years). Models included a quadratic age term. [c] Severe obese (>=35.0), Moderate Obese (30.0-34.9), Overweight (25.0-29.9), Underweight (<18.5), Normal (18.5-24.9).

Table 4. Predisposing, enabling, behavior-related, and need factors as predictors of physician use for men: Results from logistic cross-classified multilevel models [a]. Canadian National Population Health Survey, 1994-2011

	Primary Care		Specialist Care	
	Model 2	Model 3	Model 2	Model 3
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Age and Cohort Effects				
Linear age [b]	1.08 (1.08 - 1.08) ***	0.85 (0.85 - 0.85) ***	1.28 (1.27 - 1.29) ***	1.08 (1.08 - 1.09) ***
Birth cohort (Ref: Pre-World War)				
World War II	1.08 (0.82 - 1.43)	0.87 (0.64 - 1.19)	1.35 (1.06 - 1.72) **	1.12 (0.88 - 1.41)
Older Baby Boomer	0.99 (0.77 - 1.28)	0.70 (0.53 - 0.93) ***	1.36 (1.09 - 1.71) **	1.00 (0.81 - 1.24)
Younger Baby Boomer	0.86 (0.68 - 1.09)	0.54 (0.42 - 0.70) ***	1.51 (1.21 - 1.87) **	0.99 (0.81 - 1.20)
Generation X	0.79 (0.57 - 1.08)	0.46 (0.32 - 0.65) ***	1.73 (1.32 - 2.28) ***	1.04 (0.81 - 1.34)
Predisposing, Enabling, and Behavior-related				
Education (Ref: 16+ years)				
12-15 years	1.20 (0.98 - 1.48)	1.19 (0.98 - 1.43)	0.76 (0.63 - 0.92) **	0.75 (0.63 - 0.90) ***
<12 years	1.20 (0.96 - 1.50)	1.17 (0.96 - 1.44)	0.6 (0.49 - 0.74) ***	0.58 (0.48 - 0.71) ***
Income quartiles (Ref: Bottom (Q1))				
Q2	0.90 (0.82 - 0.99) ***	0.94 (0.86 - 1.04)	1.01 (0.91 - 1.11)	1.07 (0.97 - 1.18)
Q3	0.90 (0.81 - 0.99) ***	0.94 (0.85 - 1.04)	1.03 (0.93 - 1.14)	1.10 (0.99 - 1.22) †
Top (Q4)	0.84 (0.75 - 0.93) ***	0.89 (0.81 - 0.99) ***	0.98 (0.88 - 1.09)	1.07 (0.96 - 1.18)
Missing	0.69 (0.56 - 0.87) ***	0.71 (0.57 - 0.88) ***	0.98 (0.78 - 1.23)	1.01 (0.81 - 1.26)
Have regular source of care	3.36 (3.06 - 3.68) ***	3.03 (2.77 - 3.32) ***	2.14 (1.93 - 2.39) ***	1.86 (1.67 - 2.06) ***
Smokers (Ref: never)				
Current	0.96 (0.86 - 1.07)	0.92 (0.83 - 1.02)	1.01 (0.91 - 1.13)	0.97 (0.87 - 1.07)
Former	1.16 (1.06 - 1.28)	1.09 (0.99 - 1.19)	1.21 (1.10 - 1.33) ***	1.15 (1.04 - 1.26) ***
BMI (Ref: Normal) [c]				
Underweight	1.38 (0.90 - 2.10)	1.29 (0.85 - 1.97)	1.24 (1.04 - 1.49) ***	0.96 (0.80 - 1.14)
Overweight	1.14 (1.05 - 1.23) ***	1.12 (1.04 - 1.21) ***	1.04 (0.93 - 1.17)	0.91 (0.82 - 1.02)
Moderate obese	1.45 (1.29 - 1.62) ***	1.30 (1.17 - 1.45) ***	0.92 (0.85 - 1.00) †	0.90 (0.83 - 0.97) ***
Severe obese	2.09 (1.72 - 2.54) ***	1.69 (1.40 - 2.03) ***	1.30 (0.86 - 1.97)	1.23 (0.81 - 1.86)
Physically inactive	0.98 (0.92 - 1.04)	0.95 (0.89 - 1.01)	1.09 (1.02 - 1.16) *	1.06 (1.00 - 1.14) †
Sedentary lifestyle	1.21 (1.12 - 1.30) ***	1.14 (1.06 - 1.23) ***	1.28 (1.19 - 1.38) ***	1.21 (1.12 - 1.31) ***
Need for Healthcare				
Chronic conditions (Ref: none)				
1		2.27 (2.11 - 2.44) ***		2.03 (1.87 - 2.21) ***
2+		4.04 (3.69 - 4.43) ***		6.86 (5.99 - 7.87) ***

BMI, Body Mass Index; OR, Odd Ratio; 95% CI, 95% Confidence Interval. *** *p<0.0001,* ** *p<0.01,* * *p<0.05,* † *p<0.1.* [a] Models include period (survey year) as a random effect. [b] Age was centered at the mean of the distribution in 1994 /95 (39 years). Models included a quadratic age term. [c] Severe obese (>=35.0), Moderate Obese (30.0-34.9), Overweight (25.0-29.9), Underweight (<18.5), Normal (18.5-24.9).

Figure 1. Age-trajectories and birth cohort for a) Primary Care use and b) Specialist Care use

GenX: Generation X; YBB: Younger Baby Boomer; OBB: Older Baby Boomer; WW2: World War II; pre-WW: pre-World War II.
Values are predictions from the fixed part of models in Table 2.

Figure 2. Age-trajectories of Primary Care use by number of chronic conditions and birth cohort

GenX: Generation X; YBB: Younger Baby Boomer; OBB: Older Baby Boomer; WW2: World War II; pre-WW: pre-World War II.

Predictions from models with interactions between chronic condition groups and age, and with birth cohort. Models included predisposing, enabling, behavioral risk, and need factors (Table A1).

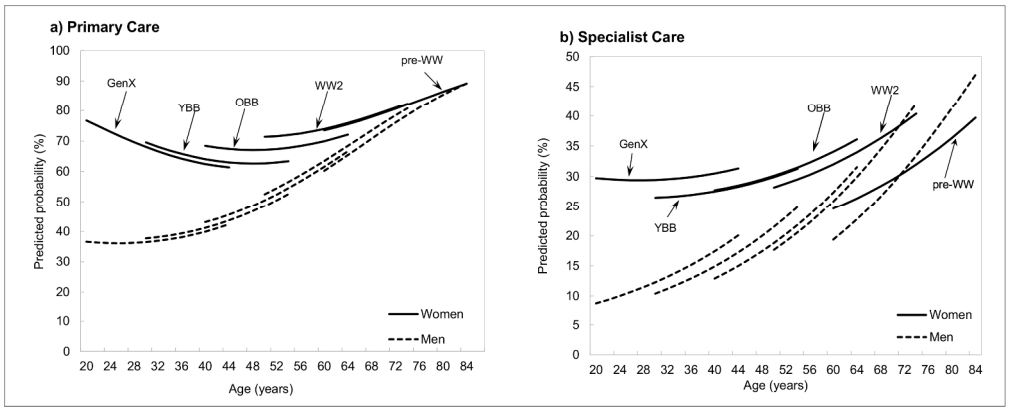

Figure 1. Age-trajectories and birth cohort for a) Primary Care use and b) Specialist Care use

238x95mm (300 x 300 DPI)

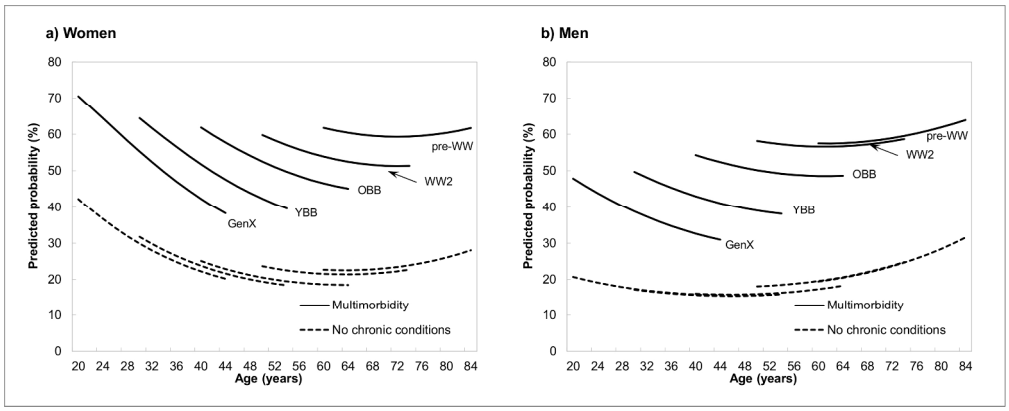

Figure 2. Age-trajectories of Primary Care use by number of chronic conditions and birth cohort

238x95mm (300 x 300 DPI)

Table A1. Differential impact of the number of chronic conditions by birth cohort: Results from logistic cross-classified multilevel models [a]. Canadian National Population Health Survey, 1994-2011

	Women	Men
	Estimate (S.E.)	**Estimate (S.E.)**
Intercept	-0.945 (0.177) ***	-1.722 (0.184) ***
Linear age [b]	-0.033 (0.004) ***	-0.006 (0.004) **
Quadratic age	0.001 (0.0001) ***	0.001 (0.0001) ***
Birth cohort (Ref: Pre-World War)		
Generation X	-0.407 (0.192) ***	-0.156 (0.200)
Younger Baby Boomer	-0.319 (0.167) **	-0.171 (0.174)
Older Baby Boomer	-0.248 (0.148)	-0.141 (0.153)
World War II	-0.066 (0.137)	0.009 (0.141)
Predisposing, Enabling, and Behavior-related Factors		
Education (Ref: 16+ years)		
<12 years	-0.044 (0.060)	0.008 (0.062)
12-15 years	0.013 (0.049)	0.014 (0.052)
Income quartiles (Ref: Top (Q4))		
Bottom (Q1)	0.041 (0.049)	0.156 (0.052)
Q2	-0.018 (0.045)	0.045 (0.046)
Q3	0.032 (0.041)	0.042 (0.041)
Missing	-0.086 (0.082)	-0.179 (0.106)
Have regular source of care	1.142 (0.049) ***	1.012 (0.043) ***
Smokers (Ref: never)		
Current	-0.049 (0.044)	-0.062 (0.048)
Former	0.023 (0.038)	0.080 (0.043)
BMI (Ref: Normal) [c]		
Severe obese	0.457 (0.069) ***	0.530 (0.088) ***
Moderate obese	0.402 (0.049) ***	0.264 (0.051) ***
Overweight	0.197 (0.034) ***	0.110 (0.037) ***
Underweight	0.081 (0.088)	0.248 (0.198)
Physically inactive	0.101 (0.027) ***	0.047 (0.029) ***
Sedentary lifestyle	0.071 (0.033) **	0.124 (0.036) ***
Need for healthcare		
Chronic conditions (Ref: none)		
2+	1.943 (0.198) ***	2.040 (0.220) ***
1	0.885 (0.197) ***	1.082 (0.205) ***
Age by Chronic conditions (Ref: None)		
2+	-0.012 (0.006) ***	-0.016 (0.006) ***
1	-0.005 (0.006) ***	-0.005 (0.006) ***
Birth Cohort by Chronic conditions (Ref: None)		
2+ conditions: Generation X	-0.999 (0.251) ***	-1.098 (0.278) ***
Younger Baby Boomer	-0.707 (0.203) ***	-0.639 (0.222) ***
Older Baby Boomer	-0.369 (0.168) **	-0.216 (0.182)
World War II	-0.257 (0.151)	-0.045 (0.165)
One condition: Generation X	-0.431 (0.249)	-0.565 (0.257)
Younger Baby Boomer	-0.312 (0.204)	-0.368 (0.211)
Older Baby Boomer	-0.116 (0.170)	-0.154 (0.176)
World War II	0.044 (0.157)	-0.254 (0.162)

BMI, Body Mass Index; OR, Odd Ratio; 95% CI, 95% Confidence Interval. *** *p<0.0001*, ** *p<0.01*, * *p<0.05*, † *p<0.1*. [a] Models include period (survey year) as a random effect. [b] Age is centered at the mean of the distribution in 1994/95 (39 years). [c] Severe obese (>=35.0), Moderate Obese (30.0-34.9), Overweight (25.0-29.9), Underweight (<18.5), Normal (18.5-24.9).