

Examining screening mammography participation among women aged 40 to 74

Karena D. Volesky MA MSc Paul J. Villeneuve PhD

Abstract

Objective To examine participation in screening mammography among women aged 40 to 74 and identify which factors are associated with those women who participate in screening.

Design Secondary analysis of the cross-sectional 2012 Canadian Community Health Survey.

Setting Canada.

Participants A population-based national sample of 18 312 women aged 40 to 74.

Main outcome measures Women's participation in screening mammography in the 2 years preceding the 2012 Canadian Community Health Survey; women's preventive health activities (ie, having a regular doctor, a recent physical checkup, and a Papanicolaou test), which were adjusted for sociodemographic factors.

Results Participation in recent screening mammography was highest among women aged 60 to 69 (70.3%), followed by those aged 50 to 59 (63.4%) and those aged 70 to 74 (58.4%). Almost one-third (31.4%) of women aged 40 to 49 had had a screening mammogram in the past 2 years. Having a regular doctor (odds ratio [OR] = 3.30, 95% CI 2.90 to 3.73), a physical checkup in the past year (OR = 3.06, 95% CI 2.30 to 4.08), or a Pap test in the past 3 years (OR = 3.47, 95% CI 3.18 to 3.79) more than tripled the odds that women had had a recent screening mammogram.

Conclusion Aside from age being a factor associated with women's participation in screening mammography, factors related to women's health care use (having a regular doctor, a recent physical checkup, and a recent Pap test) demonstrated a stronger association with women aged 40 to 74 having had recent mammograms. The association between women's participation in screening and their preventive health activities implies that the doctor's office is an appropriate venue for conversations regarding the potential benefits and harms of screening mammography.

EDITOR'S KEY POINTS

- The aim of screening mammography is to reduce breast cancer mortality by detecting breast cancer in its early stages. This study examined participation in screening mammography among women aged 40 to 74 and identified the factors associated with participation.
- Although sociodemographic factors were associated with screening participation (ie, being married and having higher household income), factors related to health care use exerted a stronger effect. Having a regular doctor, a physical checkup in the past year, and a Papanicolaou test in the past 3 years were strongly related to whether women aged 40 to 74 participated in screening mammography.
- Discrepancies that emerged in screening participation levels across Canadian regions in the 40-to-49 and 70-to-74 age groups might be related to provincial and territorial differences in recommendations and policies regarding mammography screening.

This article has been peer reviewed.
Can Fam Physician 2017;63:e300-9

Le taux de participation à la mammographie de dépistage chez les femmes de 40 à 74 ans

Karena D. Volesky MA MSc Paul J. Villeneuve PhD

Résumé

Objectif Déterminer le taux de mammographies de dépistage chez les femmes de 40 à 74 ans et préciser ce qui caractérise les participantes à ce dépistage.

Type d'étude Une analyse secondaire de l'Enquête transversale sur la santé dans les collectivités canadiennes 2012.

Contexte Le Canada.

Participantes Un échantillon national de nature démographique comprenant 18 312 femmes âgées de 40 à 74 ans.

Principaux paramètres à l'étude La participation des femmes à une mammographie de dépistage au cours des 2 années précédant l'Enquête sur la santé des collectivités canadiennes 2012; les activités de nature préventive qu'elles ont effectuées (c.à-d. le fait d'être régulièrement suivie par un médecin, d'avoir un bilan de santé récent et d'avoir eu un test de Papanicolaou), ces activités étant ajustées en fonction des facteurs démographiques.

Résultats Ce sont les femmes de 60 à 69 ans qui ont eu le plus haut taux de mammographie de dépistage (70,3%), suivies de celles de 50 à 59 ans (63,4%) et de celles de 70 à 74 ans (58,4%). Près du tiers des femmes de 40 à 49 ans

avaient eu un tel dépistage durant la même période. Le fait d'avoir un médecin régulier (rapport de cotes [RC]=3,30, IC à 95% 2,90 à 3,73), d'avoir eu un bilan de santé dans l'année précédente (RC=3,06, IC à 95% 2,30 à 4,08) ou un Pap test au cours des 3 dernières années (RC=3,47, IC à 95% 3,18 à 3,79) faisait plus que tripler la probabilité d'avoir eu une mammographie de dépistage récente.

POINTS DE REPÈRE DU RÉDACTEUR

- Le but de la mammographie de dépistage est de réduire la mortalité causée par le cancer du sein grâce à un diagnostic précoce. Cette étude voulait connaître le degré de participation à cet examen chez les femmes de 40 à 74 ans et déterminer les facteurs associés à ce taux de participation.

- Même si plusieurs facteurs sociodémographiques influençaient le taux de participation au dépistage (p. ex. le fait d'être mariée et d'avoir un revenu familial plus élevé), les facteurs liés à la santé avaient encore plus d'influence. Ainsi, le fait d'avoir un médecin régulier, d'avoir eu un bilan de santé au cours de l'année précédente et d'avoir eu un test de Papanicolaou au cours des 3 années précédentes étaient des facteurs très importants pour inciter les femmes de 40 à 74 ans à participer au dépistage.

- Les taux de participation différents observés dans les diverses régions du Canada chez les groupes d'âge de 40 à 49 ans et de 70 à 74 ans pourraient être dus à des différences entre les provinces et territoires dans les politiques et les recommandations relatives à la mammographie de dépistage.

Cet article a fait l'objet d'une révision par des pairs.
Can Fam Physician 2017;63:e300-9

Conclusion Même si l'âge est un facteur qui module la participation des femmes à la mammographie de dépistage, ce sont les facteurs liés à l'utilisation des soins de santé (le fait d'avoir un médecin régulier, d'avoir eu un bilan de santé ou un Pap test récents) qui se sont avérés les plus importants pour inciter les femmes de 40 à 74 à subir une mammographie de dépistage. Cette association entre la participation des femmes au dépistage et leurs activités de nature préventive souligne le fait que le cabinet du médecin est un lieu approprié pour aborder le sujet des avantages et des inconvénients éventuels de ce type d'examen.

It is estimated that in 2016 breast cancer was the cause of death for 4900 Canadian women and was diagnosed in 25 700 women—representing more than a quarter (25.8%) of new cancer cases in women.¹ Women aged 50 to 69 are estimated to have accounted for a little more than half of new cases (51.0%).¹ Modifiable factors associated with breast cancer include alcohol consumption, smoking, hormone replacement therapy, and postmenopausal obesity.²⁻⁴ Biologic factors associated with increased risk of breast cancer include older age, having a first-degree relative with breast cancer, reproductive factors, genetic predisposition, and clinically diagnosed denser breast tissue.³⁻⁵

Screening mammography represents a secondary preventive strategy against breast cancer death and is indicated for asymptomatic women within a certain age range, often between the ages of 50 and 69.⁶ Its aim is to reduce breast cancer mortality.⁶ However, screening mammography can also lead to false-positive results, overdiagnosis, overtreatment, and psychological distress.⁷ The overall mortality benefits of screening mammography among women aged 40 to 59 were called into question by findings from the Canadian National Breast Screening Study. After 25 years of follow-up, women aged 40 to 59 who received an annual mammogram experienced no reduction in breast cancer mortality compared with those who underwent physical examination alone.⁸ However, after evaluating data from 20 cohort and 20 case-control studies, the International Agency for Research on Cancer concluded that for women aged 50 to 69, the benefits of screening mammography outweighed the harms, and that for women aged 40 to 49 the evidence was too limited to draw conclusions.⁹

In the literature, a 25% to 30% reduction in breast cancer mortality is often attributed to biannual screening mammography among women aged 50 to 69.¹⁰ Some authors contend that the literature on screening mammography exaggerates its benefits and minimizes the associated harms such as false-negative results, overdiagnosis, and overtreatment.^{7,10,11} Two international studies found that women vastly overestimated mammography's ability to reduce breast cancer mortality.^{12,13} A lack of knowledge of the harms associated with screening mammography might unduly influence women in favour of mammography.^{7,10,11}

An analysis of Canadian Community Health Survey (CCHS) data showed that levels of mammography use among women aged 50 to 69 increased from 40% in 1990 to 72% in 2001—mammography use remained stable until 2008.¹⁴ Subsequent to 2008, the Canadian Task Force on Preventive Health Care (CTFPHC) revised its guidelines on screening mammography. The age for routine screening was extended from 69 to 74 years; the time interval between screening for women aged 50 to 69 was extended from 2 years to 2 to 3 years;

and it was recommended that women aged 40 to 49 *not* be routinely screened (previous guidelines did not address this age group).¹⁵ The CTFPHC reported an unfavourable benefit-harm profile for women aged 40 to 49; this finding underscores the importance of quantifying this age group's participation. Canadian literature reporting on factors influencing mammography participation has typically focused on women aged 50 to 69.^{14,16-19} However, the CTFPHC's revised guidelines point to the need to expand on the collection of information on participation levels to include women aged 40 to 49 and 70 to 74.

A search of the published literature to date yielded no study reporting Canadian mammography participation and factors that influence women's participation based on population-based data collected after 2008. This study focuses on screening mammography, and thus differs from many of the previous analyses of the CCHS data, which did not differentiate between screening and diagnostic mammography.^{14,16-18} Using data from the 2012 CCHS, this study examined participation in screening mammography among women aged 40 to 74 and identified the factors that are associated with those women who participate in screening.

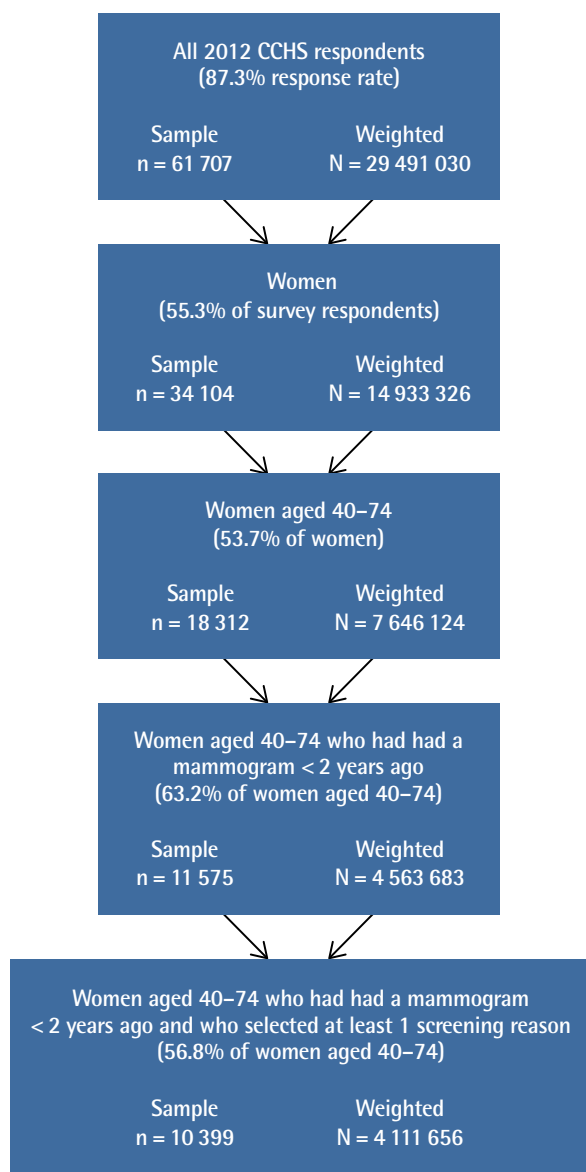
METHODS

Data source

This study used survey data from Statistics Canada's (a Canadian federal department) cross-sectional 2012 CCHS microdata file. The survey data are collected via telephone interviews. As the microdata file is for public use and contains anonymized data, ethics approval was not necessary. The CCHS includes Canadian residents 12 years of age and older from all provinces and territories, excluding people residing in institutions, full-time members of the Canadian Forces, and those living on First Nations reserves, in the Region of Nunavik, and in des Terres-Cries-de-la-Baie-James.²⁰ For calculations based on the survey data to be representative of the Canadian population, Statistics Canada assigns each CCHS respondent a weight that corresponds to the number of individuals in the Canadian population that she or he represents.²¹ The study sample consisted of 18 312 women aged 40 to 74, weighted to represent 7.6 million women aged 40 to 74 in the Canadian population (**Figure 1**).²¹

Variables

The CCHS asked women aged 35 or older the following questions: "Have you ever had a mammogram, that is, a breast x-ray?" (yes or no); and "When was the last time?" (<6 months, 6 months to <1 year, 1 to <2 years, 2 to <5 years, and ≥5 years ago). Women whose responses were recorded as "don't know,"

Figure 1. Selection of study sample from the 2012 CCHS survey respondents

CCHS—Canadian Community Health Survey.

“refused,” or “not stated” to the questions asking if they ever had a mammogram and when the last time was were excluded from the analysis of mammography participation. Women were also asked, “Why did you have it?” As multiple responses were accepted, a respondent could have legitimately reported reasons suggesting that she had received both screening and diagnostic mammograms. For example, a woman who had undergone screening mammograms over several years and then had undergone a diagnostic mammogram to investigate a lump might have responded “screening” and “follow-up

of a breast problem.” However, for the purposes of this study, women who responded that their screening reasons included “part of regular checkup or routine screening,” “age,” “family history of breast cancer,” or “using hormone replacement therapy” and who indicated that they had had a mammogram less than 2 years ago were considered to have participated in screening mammography and are herein referred to as *screening participants*. Women who reported that the only screening reason was “previously detected lump” or “follow-up of breast cancer treatment” or “breast problem” were considered to have participated in diagnostic mammography. Finally, women whose only response to “Why did you have it?” was “other” were excluded from the analysis.

The CCHS participants were asked to provide their height and weight, from which we calculated their body mass index. Other variables were selected based on their association with breast cancer and their inclusion in similar studies; they included the following: age, marital status, number of years since immigration, household income, education attainment, having a regular doctor, number of years since last physical checkup and last Papanicolaou test, frequency of alcohol consumption, smoking status, and province or territory.^{2,4,14,16-19}

Frequencies, bivariate tabulations, and logistic regressions were performed to examine associations between independent variables and being a screening mammography participant in the 2 years before the 2012 CCHS interview using SPSS software, version 22.²² Odds ratios (ORs) and their associated 95% CIs were calculated, and then the model was adjusted for age, marital status, and household income.

RESULTS

In the weighted sample of women, most were Canadian born, were married or in common-law relationships, had household incomes of \$60 000 or greater, and had graduated from a postsecondary institution (**Table 1**). Most women were non-smokers (81.2%), had a regular doctor (92.0%), and had had a physical checkup in the past 2 years (70.7%).

Most women who had had a mammogram reported having done so within the past 2 years (60.6%) (**Table 2**). Of the women who reported a screening mammogram in the past 2 years, 15.9% also cited a diagnostic reason for having that mammogram (data not shown). Most screening participants reported 1 screening reason (88.8%), and 9.8% reported 2 screening reasons (data not shown). The percentage of women who cited at least 1 diagnostic reason for screening was substantially lower than the percentage of women who cited at least 1 screening reason (10.8% compared with 69.1%, respectively). By age group, 31.4% of women aged 40

Table 1. Characteristics of women aged 40 to 74 in the CCHS sample and in the Canadian population, 2012: Data for 18 312 women aged 40–74 in the CCHS data set were weighted to represent 7.6 million women in the Canadian population in the same age range in 2012.

PARTICIPANT CHARACTERISTICS	SAMPLE, N (%)*	WEIGHTED, N (%)*
Total	18 312 (100.0)	7 646 124 (100.0)
Age group, y		
• 40–49	3859 (21.1)	2 403 118 (31.4)
• 50–59	5895 (32.2)	2 611 514 (34.2)
• 60–69	6310 (34.5)	2 005 841 (26.2)
• 70–74	2248 (12.3)	625 651 (8.2)
Marital status		
• Single or never married	2135 (11.7)	721 087 (9.4)
• Widowed, separated, or divorced	5083 (27.8)	1 576 884 (20.6)
• Married or common law	11 034 (60.3)	5 327 502 (69.7)
• Missing	60 (0.3)	20 651 (0.3)
No. of years since immigration		
• 0–9 y	224 (1.2)	237 976 (3.1)
• ≥ 10 y	2411 (13.2)	1 594 196 (20.9)
• Not an immigrant	15 107 (82.5)	5 506 743 (72.0)
• Missing	570 (3.1)	307 209 (4.0)
Educational attainment		
• Less than secondary school	2947 (16.1)	1 039 957 (13.6)
• Secondary school graduation	4141 (22.6)	1 681 850 (22.0)
• Postsecondary graduation	10 594 (57.9)	4 633 508 (60.6)
• Missing	630 (3.4)	290 809 (3.8)
Household income		
• < \$20 000	2328 (12.7)	692 930 (9.1)
• \$20 000–\$39 999	4492 (24.5)	1 547 502 (20.2)
• \$40 000–\$59 999	3729 (20.4)	1 449 498 (19.0)
• \$60 000–\$79 999	2591 (14.2)	1 115 459 (14.6)
• ≥ \$80 000	5156 (28.2)	2 838 410 (37.1)
• Missing	16 (< 0.1)	2325 (< 0.1)
Regular doctor		
• No	1512 (8.3)	613 220 (8.0)
• Yes	16 792 (91.7)	7 031 661 (92.0)
• Missing	8 (< 0.1)	1243 (< 0.1)
No. of years since last physical checkup		
• > 2 y	2328 (12.7)	1 374 036 (18.0)
• 1–2 y	1255 (6.9)	1 540 249 (20.1)
• < 1 y	12 502 (68.3)	3 871 929 (50.6)
• Missing	2227 (12.2)	859 910 (11.3)

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Table 1 continued from page e304

PARTICIPANT CHARACTERISTICS	SAMPLE, N (%)*	WEIGHTED, N (%)*
No. of years since last Papanicolaou test		
• > 5 y	3952 (21.6)	1 310 732 (17.1)
• 3-5 y	1382 (7.6)	503 794 (6.6)
• < 3 y	11 275 (61.6)	5 053 922 (66.1)
• Missing	1703 (9.3)	186 553 (10.2)
BMI category		
• Obese (≥ 30.0 kg/m ²)	4198 (22.9)	1 547 640 (20.2)
• Overweight (25.0-29.9 kg/m ²)	5464 (29.8)	2 166 713 (28.3)
• Normal weight (18.5-24.9 kg/m ²)	7302 (39.9)	3 378 774 (44.2)
• Underweight (< 18.5 kg/m ²)	367 (2.0)	166 912 (2.2)
• Missing	981 (5.4)	386 085 (5.1)
Frequency of alcohol consumption		
• ≥ 4 times per wk	3396 (18.5)	903 859 (11.8)
• 1-3 times per wk	4849 (26.5)	2 012 753 (26.3)
• < 3 times per mo to < once per mo	3717 (20.3)	2 731 194 (35.7)
• Missing	6350 (34.7)	1 998 318 (26.1)
Smoking status		
• Daily	3016 (16.5)	1 120 110 (14.7)
• Occasionally	584 (3.2)	270 329 (3.5)
• Not at all	14 633 (79.9)	6 209 718 (81.2)
• Missing	79 (0.4)	45 967 (0.6)

BMI—body mass index, CCHS—Canadian Community Health Survey.
*Not all percentages add to 100 owing to rounding.

Table 2. Mammography participation among Canadian women by age group, 2012: Data for 16 858 women aged 40-74 in the CCHS data set were weighted to represent 7.1 million women in the Canadian population in the same age range in 2012.

MAMMOGRAPHY PARTICIPATION	AGE GROUPS, N (%)*				TOTAL, N (%)
	40-49 Y	50-59 Y	60-69 Y	70-74 Y	
Have ever had mammogram	1 265 539 (52.9)	2 284 727 (88.4)	1 874 475 (94.6)	574 943 (94.3)	5 999 684 (79.3)
Had mammogram < 2 y ago	899 171 (37.6)	1 765 104 (68.9)	1 508 586 (76.5)	390 822 (64.8)	4 563 683 (60.6)
Had mammogram 2 to < 5 y ago	213 677 (8.9)	345 055 (13.5)	193 202 (9.8)	101 773 (16.9)	853 707 (11.3)
Had mammogram for diagnostic reasons [†]	309 860 (12.9)	270 928 (10.5)	181 812 (9.2)	58 351 (9.6)	820 951 (10.8)
Had mammogram for screening reasons [†]	958 705 (40.1)	2 041 901 (79.0)	1 715 677 (86.6)	513 391 (84.2)	5 229 674 (69.1)
Had mammogram < 2 y ago for screening reasons [†]	750 060 (31.4)	1 623 962 (63.4)	1 385 467 (70.3)	352 167 (58.4)	4 111 656 (54.6)

CCHS—Canadian Community Health Survey.

*Women whose responses were "don't know," "refused," or "not stated" to the questions asking if they ever had a mammogram and when was the last time they had a mammogram were excluded.

[†]Previously detected lump and follow-up of breast cancer were coded as diagnostic reasons for mammograms. Women who indicated their age, having regular checkup or routine screening, having family history of breast cancer, or using hormone replacement therapy as reasons for having a mammogram were considered screening participants.

to 49, 63.4% of women aged 50 to 59, 70.3% of women aged 60 to 69, and 58.4% of women aged 70 to 74 were screening participants. **Table 3** shows that within the 40-to-49 age group there was a 37.2% point difference between the province with the highest screening participation rate (Prince Edward Island) and the province with the lowest rate (Quebec). Regional variation was lowest within the 50-to-59 age group.

Aside from age, the factors most strongly associated with being a screening participant were having a regular doctor (OR = 3.30, 95% CI 2.90 to 3.73), having had a physical checkup in the past year (OR = 3.06, 95% CI 2.30 to 4.08), and having had a Pap test in the past 3 years (OR = 3.47, 95% CI 3.18 to 3.79) (**Table 4**).

DISCUSSION

For more than a decade, mammography participation rates among Canadian women aged 50 to 69 have remained stable; 72.7% of women in 2001, 72.5% in 2008,¹⁴ and 72.2% in 2012 reported having had a mammogram in the past 2 years. The finding that screening was most likely among women aged 50 to 69 was not surprising, as this is the age group most commonly targeted by health care providers and screening programs and is the group most likely to benefit from screening mammography. Participation in screening mammography in the 2 years preceding interviews was highest among women aged 60 to 69. Women are encouraged to begin screening mammography at age 50, but it might

take time to establish a routine or women might not have their first screening until their mid or late 50s.

As more than half of women aged 70 to 74 (58.4%) participated in screening mammography just 1 year after the CTFPHC extended its recommendation to routinely screen women up to the age of 75, one can conclude that most women did not cease screening mammograms at age 69.¹⁵ In 2011, the CTFPHC contraindicated screening mammography for women aged 40 to 49 on the basis that its potential harmful effects outweigh its potential benefits¹⁵; however, 31.4% of women in this age group participated in screening. The discrepancies that emerged in provincial or territorial screening participation levels for women aged 40 to 49 and 70 to 74 probably relate to differences in the age of eligibility and public messaging. Although national guidelines are provided by the CTFPHC, health care is the responsibility of the provinces or territories, and differences among jurisdictions in medical practices, recommendations, and policies for screening mammography might influence screening mammography participation.

Although sociodemographic factors were associated with screening participation (ie, being married and having higher household income), factors related to health care use exerted a stronger effect. Having a regular doctor, a physical checkup in the past year, and a Pap test in the past 3 years were strongly related to whether women aged 40 to 74 participated in screening mammography in 2012. The associations with having a regular doctor and a physical checkup in the past year are consistent with the finding that women aged 50 to 69

Table 3. Screening mammography participation among Canadian women by age group and region, 2012: Data for 16 858 women aged 40-74 in the CCHS data set were weighted to represent 7.1 million women in the Canadian population in the same age range in 2012.

REGION	AGE GROUPS OF SCREENING MAMMOGRAPHY PARTICIPANTS, N (%)**				TOTAL
	40-49 Y	50-59 Y	60-69 Y	70-74 Y	
Ontario	307 030 (30.8)	623 259 (64.3)	570 336 (74.2)	139 998 (64.1)	1 640 623 (55.5)
British Columbia	139 471 (41.1)	201 185 (61.1)	198 473 (68.2)	42 132 (58.7)	581 261 (56.3)
Alberta	100 845 (45.8)	183 152 (66.5)	122 969 (69.2)	31 635 (62.7)	438 601 (60.6)
Saskatchewan	13 960 (25.0)	45 015 (59.7)	30 358 (58.4)	9082 (49.7)	98 415 (48.8)
Manitoba	26 178 (30.5)	58 124 (65.6)	41 908 (70.6)	12 961 (56.5)	139 171 (54.2)
Quebec	97 468 (18.9)	389 201 (63.1)	313 743 (69.4)	89 662 (52.5)	890 074 (50.7)
New Brunswick	11 712 (22.3)	38 824 (61.3)	35 839 (67.2)	8741 (51.7)	95 116 (51.1)
Nova Scotia	29 581 (45.2)	51 001 (60.1)	36 135 (58.9)	11 337 (50.4)	128 054 (54.7)
Prince Edward Island	5629 (56.1)	6221 (54.0)	6125 (52.8)	1871 (65.2)	19 846 (55.1)
Newfoundland and Labrador	15 914 (42.6)	24 399 (59.8)	27 843 (68.9)	4609 (57.8)	72 765 (57.5)
Territories	2273 (31.4)	3582 (55.2)	1739 (49.2)	138 (35.4)	7732 (43.8)

CCHS—Canadian Community Health Survey.

*Women whose responses were "don't know," "refused," or "not stated" to the questions asking if they ever had a mammogram and when was the last time they had a mammogram were excluded.

**Women who reported that they had had a mammogram less than 2 y ago and selected age, having regular checkups or routine screening, having family history of breast cancer, or using hormone replacement therapy as reasons for having a mammogram were considered screening participants.

Table 4. Odds ratios for select characteristics for CCHS sample of women aged 40–74 who were screening mammography participants, 2012

PARTICIPANT CHARACTERISTICS*	SCREENING MAMMOGRAPHY PARTICIPATION†		UNADJUSTED OR (95% CI)*	ADJUSTED OR (95% CI)††
	SAMPLE, %‡	WEIGHTED, %§		
Age group, y				
• 40–49	29.1	31.4	Reference	Reference
• 50–59	63.9	63.4	4.79 (4.37–5.24)	5.11 (4.65–5.60)
• 60–69	69.4	70.3	6.48 (5.91–7.11)	7.61 (6.89–8.40)
• 70–74	57.9	58.4	3.62 (3.23–4.05)	4.53 (4.01–5.13)
Marital status				
• Never married	47.6	41.3	Reference	Reference
• Widowed, separated, or divorced	56.8	54.5	1.54 (1.39–1.71)	1.06 (0.95–1.19)
• Married or common law	60.1	56.5	1.77 (1.61–1.95)	1.27 (1.14–1.42)
No. of years since immigration				
• 0–9 y	34.1	43.7	Reference	Reference
• ≥ 10 y	59.9	58.4	3.10 (2.23–4.19)	1.48 (1.07–2.05)
• Not an immigrant	57.9	54.3	2.91 (2.18–3.88)	1.43 (1.04–1.96)
Educational attainment				
• Less than secondary school	55.5	54.1	Reference	Reference
• Secondary school graduation	59.4	54.3	1.17 (1.05–1.29)	1.19 (1.06–1.33)
• Postsecondary graduation	57.8	55.1	1.07 (0.98–1.17)	1.24 (1.12–1.37)
Household income				
• < \$20 000	50.0	47.6	Reference	Reference
• \$20 000–\$39 999	57.9	54.5	1.40 (1.26–1.56)	1.31 (1.17–1.46)
• \$40 000–\$59 999	59.6	56.8	1.51 (1.35–1.69)	1.50 (1.33–1.69)
• \$60 000–\$79 999	60.1	53.0	1.53 (1.36–1.73)	1.69 (1.47–1.93)
• ≥ \$80 000	58.4	55.9	1.42 (1.28–1.57)	1.96 (1.73–2.22)
Regular doctor				
• No	32.6	28.5	Reference	Reference
• Yes	59.9	56.9	3.37 (3.00–3.77)	3.30 (2.90–3.73)
No. of years since last physical checkup				
• > 2 y	39.0	32.0	Reference	Reference
• 1–2 y	61.9	58.4	2.74 (2.10–3.59)	2.40 (1.80–3.22)
• < 1 y	66.8	64.5	2.07 (1.58–2.72)	3.06 (2.30–4.08)
No. of years since last Papanicolaou test				
• > 5 y	47.7	42.2	Reference	Reference
• 3–5 y	46.9	43.8	0.96 (0.85–1.09)	1.11 (0.97–1.26)
• < 3 y	64.3	60.8	2.15 (1.99–2.33)	3.47 (3.18–3.79)
BMI category				
• Obese (≥ 30.0 kg/m ²)	57.9	54.3	Reference	Reference
• Overweight (25.0–29.9 kg/m ²)	61.2	57.8	1.18 (1.08–1.28)	1.09 (0.99–1.19)
• Normal weight (18.5–24.9 kg/m ²)	56.1	54.0	0.93 (0.85–1.00)	0.96 (0.88–1.05)
• Underweight (< 18.5 kg/m ²)	45.1	37.6	0.58 (0.47–0.73)	0.63 (0.50–0.81)

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PARTICIPANT CHARACTERISTICS*	SCREENING MAMMOGRAPHY PARTICIPATION†		UNADJUSTED OR (95% CI)*	ADJUSTED OR (95% CI)††
	SAMPLE, %‡	WEIGHTED, %§		
Frequency of alcohol consumption				
• ≥ 4 times per wk	63.9	57.7	Reference	Reference
• 1-3 times per wk	60.3	55.0	0.85 (0.76-0.96)	1.06 (0.94-1.20)
• < 3 times per mo	56.4	54.3	0.71 (0.64-0.79)	0.90 (0.80-1.01)
Smoking status				
• Daily	45.5	44.5	Reference	Reference
• Occasionally	51.6	46.7	1.32 (1.10-1.59)	1.41 (1.16-1.73)
• Not at all	60.4	56.8	1.92 (1.77-2.09)	1.73 (1.59-1.90)
Region				
• Ontario	59.2	55.5	Reference	Reference
• British Columbia	59.1	56.3	0.99 (0.89-1.10)	1.02 (0.91-1.14)
• Alberta	62.0	60.6	1.14 (1.01-1.29)	1.12 (0.98-1.27)
• Saskatchewan	51.8	48.8	0.74 (0.64-0.85)	0.71 (0.61-0.83)
• Manitoba	54.5	54.2	0.81 (0.71-0.94)	0.78 (0.67-0.91)
• Quebec	56.2	50.7	0.93 (0.85-1.02)	0.97 (0.88-1.07)
• New Brunswick	56.5	51.1	0.97 (0.83-1.14)	0.98 (0.83-1.16)
• Nova Scotia	55.7	54.7	0.88 (0.75-1.04)	0.90 (0.76-1.07)
• Prince Edward Island	59.0	55.1	0.98 (0.76-1.28)	0.95 (0.72-1.26)
• Newfoundland and Labrador	59.9	57.5	1.14 (0.95-1.38)	1.17 (0.96-1.43)
• Territories	43.0	43.8	0.51 (0.40-0.65)	0.60 (0.46-0.78)

BMI—body mass index, CCHS—Canadian Community Health Survey, OR—odds ratio.
 *Women who reported that they had had a mammogram less than 2 y ago and selected age, having regular checkups or routine screening, having family history of breast cancer, or using hormone replacement therapy as reasons for having a mammogram were considered screening participants.
 †Women whose responses were "don't know," "refused," or "not stated" to the questions asking if they ever had a mammogram and when was the last time they had a mammogram were excluded.
 ‡Data for 16 858 women aged 40-74 in the 2012 CCHS data set.
 §Data for 16 858 women aged 40-74 weighted to represent 7.1 million women aged 40-74 in the same age range.
 ††Adjusted for age, marital status, and household income.


who did not have a regular doctor and had not seen that doctor in the past year were far more likely to have not had a recent mammogram; however, the associations observed here were stronger than those found in previous studies.^{14,19} Specifically, Poole et al¹⁹ found that having had a checkup in the past year doubled the odds of having had a screening mammogram in the past 2 years, whereas we found that it tripled the odds.

Having a regular doctor, a recent physical checkup, and a recent Pap test are clearly related. This implies that conversations related to breast screening are initiated in doctors' offices and that doctors' offices are an appropriate venue for dialogue between the health practitioner and the patient on the benefits and harms of screening mammography. Smoking is a risk factor for breast cancer,² yet consistent with findings from the 2006 and 2008 CCHS,^{14,19} daily smokers were less likely to be screening participants. A more targeted approach to initiating discussion on screening mammography among smokers might be a consideration for doctors.

Limitations

Several limitations are inherent in the data set and in the application of this research. The data precluded a clear distinction on whether the last mammogram was for screening or diagnostic reasons. As the responses are not corroborated against clinical records, social desirability bias might be present, where women report their mammograms as having taken place more recently than they actually did. The CCHS responses are self-reported and are therefore subject to recall bias. Examining participation levels in light of whether women were at higher risk of developing breast cancer would have allowed one to look at differential patterns of screening across average- and high-risk individuals, but the CCHS does not include such questions. Also, women's perceptions of their risks of developing breast cancer and views of the potential benefits and harms of screening mammography are not solicited in the CCHS but might influence mammography uptake.

Conclusion

Aside from age being a factor associated with women's participation in screening mammography, factors related to health care use, namely, having a regular doctor, demonstrated a stronger association with women aged 40 to 74 having had recent mammograms than any sociodemographic or lifestyle-related factors. The jurisdiction-specific information found in this study should be of value to governments and advocacy and patient groups in assessing the effectiveness of their screening programs. Future research should consider corroborating mammography histories with clinical records, examining mammography participation in light of individual risk factors, and capturing information on women's perceptions of screening mammography. The CTFPHC's update of its 2011 guidelines is expected to be released some time this year, and given the 25-year follow-up results of the Canadian National Breast Screening Study, guidelines around screening mammography could change. The findings of this study provide baseline participation levels against which future participation can be compared. 

Ms Volesky is a doctoral student in the Department of Epidemiology, Biostatistics and Occupational Health at McGill University in Montreal, Que. **Dr Villeneuve** is Associate Professor in the Department of Health Sciences at Carleton University in Ottawa, Ont.

Acknowledgment

We are grateful to **Kathryn Wilkins** for her advice and editorial assistance.

Contributors

Ms Volesky developed the study, performed the analysis, and wrote the manuscript. **Dr Villeneuve** provided feedback on each step of the study and reviewed the manuscript.

Competing interests

None declared

Correspondence

Ms Karena D. Volesky; e-mail karena.volesky@mail.mcgill.ca

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