Mammography Utilization in Canadian Women Aged 50 to 69

Identification of Factors that Predict Initiation and Adherence

Christina M. Bancej, MSc[1]
Colleen J. Maxwell, PhD[2]
Jay Onysko, MA[1]
Michael Eliasziw, PhD[3]

ABSTRACT

Objective: To identify factors that predict initiation of mammography and adherence with biennial screening among Canadian women aged 50-69 years.

Methods: Using data from a longitudinal panel of Canadian women interviewed in the National Population Health Survey (NPHS) in 1994/95 and 2 and 4 years later, we estimated the relative risks (RR) of mammography initiation and adherence according to socio-demographic, health and lifestyle characteristics.

Results: Among 505 women with no history of mammography use at baseline, 23.0% and 41.4% initiated mammography by 2 and 4 years, respectively. Urban residence (RR=2.85) was most strongly associated with initiation by 2 years; younger age (50-54) and lower education also predicted initiation by 2 years. Younger age, birthplace outside Canada, and having a recent (<2 years) blood pressure check were associated with initiation by 4 years. Among 873 women reporting a recent (<2 years) mammogram at baseline, 88.7% also reported a recent mammogram within 2 years while 73.0% reported one at both the 2- and 4-year follow-up. Being a non-smoker was the strongest predictor of maintaining adherence both at the 2- (RR=1.18) and the 4-year (RR=1.37) follow-up.

Interpretation: Previously identified underserved groups of Canadian women (e.g., those with lower educational levels or born outside of Canada) were most likely to initiate mammography. Approximately 1 in 6 women aged 50 to 69 years remained never-users during follow-up, and fewer than half reported recent mammograms at all three survey cycles, suggesting the need to reinforce regular screening participation.

MeSH terms: Mass screening; mammography; cohort studies; surveys; health behaviours

La traduction du résumé se trouve à la fin de l'article.

1. Health Canada, Centre for Chronic Disease Prevention and Control, Ottawa, ON
2. Departments of Community Health Sciences and Medicine, University of Calgary and Institute of Health Economics, Calgary, AB
3. Departments of Community Health Sciences and Clinical Neurosciences, University of Calgary

Correspondence and reprint requests: Dr. Colleen J. Maxwell, Associate Professor, Departments of Community Health Sciences & Medicine, Faculty of Medicine, University of Calgary, 3330 Hospital Drive N.W., Calgary, AB T2N 4N1, Tel: 403-220-6557, Fax: 403-270-7307, E-mail: maxwell@ucalgary.ca

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Among Canadian women, breast cancer is the most frequently diagnosed cancer, a leading cause of premature death, and a significant economic burden, highlighting the importance of early detection and successful treatment.[1-3] Evidence from randomized controlled trials demonstrating the effectiveness of mammography screening in reducing breast cancer mortality for women aged 50-69,[4] prompted many countries to implement population-based screening programs.[5] The current Canadian recommendation states that women be offered and encouraged to initiate mammography screening at age 50 and continue every two years until age 69.[6] Based on recently adopted performance targets, Canadian programs, like those in other nations,[7-9] aim to screen at least 70% of women aged 50 to 69 and to re-screen at least 75% of previous attendees within 30 months of their last mammogram.[10]

Routine participation in mammography screening may be less than optimal. Although most women aged 50 to 69 years report at least one lifetime mammogram, fewer report time-appropriate mammograms (i.e., within the last 2 years), multiple age-appropriate screens[11-14] or repeat screening within recommended intervals.[15-20] Factors such as older age, birthplace outside of Canada, rural residence, lacking a family physician, and negative lifestyle characteristics have been associated with lower participation among Canadian women.[11,14,21,22] Repeat screening has been associated with younger age, white race, higher socio-economic status, insurance and medicare status,[16-20] but has not been assessed among Canadian women.

The aims of the present study were two-fold: i) among never-screened women, to investigate which factors best predict mammography initiation within 2 and 4 years; and ii) among recently-screened women, to investigate which factors best predict continued adherence to screening over 2 and 4 years. We examined data for Canadian women aged 50 to 69 years assessed in the 1994/95 National Population Health Survey (NPHS) and who were followed two and four years later.

METHODS

Data for the present study were drawn from a longitudinal panel of Canadian

TABLE I

Relative Risks (95% CI) for Mammography Initiation at 2- and 4-year Follow-up According to Baseline Socio-demographic, Health and Lifestyle Factors Among 505 Canadian Women (Aged 50 to 69 Years) Reporting Never-Use at Baseline (1994/95)

Factor§	Initiation by 2-Year Follow-up		Initiation by 4-Year Follow-up	
	Age-Adjusted RR (95% CI)	Adjusted RR† (95% CI)	Age-Adjusted RR (95% CI)	Adjusted RR† (95% CI)
Age Group				
50-54	1.00	1.00	1.00	1.00
55-59	0.47 (0.25-0.87)*	0.45 (0.26-0.78)*	0.66 (0.45-0.97)*	0.68 (0.48-0.96)*
60-64	0.46 (0.24-0.89)*	0.44 (0.25-0.80)*	0.67 (0.45-0.99)*	0.72 (0.50-1.03)
65-69	0.62 (0.34-1.15)	0.51 (0.29-0.88)*	0.64 (0.40-1.01)*	0.63 (0.42-0.94)*
Residence				
Rural	1.00	1.00	1.00	
Urban	2.72 (1.46-5.04)**	2.85 (1.53-5.33)**	1.33 (0.93-1.9)	
Education				
Elementary / Some Secondary	1.00	1.00	1.00	
High School or Greater	0.56 (0.35-0.90)*	0.54 (0.34-0.86)**	0.76 (0.57-1.02)	
Birthplace				
Canada	1.00	||	1.00	1.00
Other than Canada	2.54 (1.69-3.83)****		1.62 (1.21-2.16)**	1.55 (1.19-2.03)**
Last Blood Pressure Check				
<2 Years	3.20 (0.33-31.5)		2.04 (1.22-3.39)**	1.98 (1.18-3.33)**
≥2 Years / Never	1.00		1.00	1.00
Last Pap Smear				
<2 Years	1.76 (0.99-3.14)		1.39 (1.00-1.91)*	‡
≥2 Years / Never	1.00		1.00	

* $p<0.05$; **$p<0.01$; ***$p<0.001$; ****$p\leq0.0001$
† obtained from generalized linear model, adjusted for all other factors included in column.
‡ failed to remain statistically significant at $p\leq0.1$ in final model
§ factors considered, but not found significant ($p<0.05$) in age-only adjusted models included: income, labour force activity in past year, languages spoken, marital status, voluntary group membership, social support, having a regular physician, number of medical consultations in past year, frequency of physical activity, restrictions of activity, smoking status, hormone replacement therapy use.
|| Removed from the final model due to sample size limitations

women interviewed in the NPHS in 1994/95 and 2 (1996/97) and 4 years (1998/99) later. The NPHS sampling frame consisted of household residents aged 12+ years from all Canadian provinces. Individuals were sampled using a multistage probability design with stratification and clustering at various stages. Details of the sampling procedures, design and response rates appear elsewhere.[23,24] Efforts to limit losses to follow-up included an initial personal contact to gather baseline data. During follow-up, telephone interviews were conducted unless the respondent requested a personal interview or did not have a telephone.[25]

Study participants met the following inclusion criteria: women aged 50 to 69 in 1994/95 (baseline interview); household residents of Canadian provinces; provided consent to share data with Health Canada and provincial governments; and provided complete baseline and mammography information during one or more of the follow-up surveys (1996/97 and 1998/99). During each interview, women were asked: "Have you ever had a mammogram, that is, a breast x-ray?" and, if so, "When was the last time?" Reason for obtaining the last mammogram was not available in 1998/99 and some recent diagnostic mammograms will have been preceded by screening. Therefore, no distinction was made between screening and diagnostic mammograms. Inconsistent responses across survey cycles (a total of 46 reports of never use during follow-up among women reporting mammography use at baseline) were recoded based on findings from mammography self-report validation studies[11,12,26-29] and previous work with the NPHS.[30,31]

Generalized linear modelling[32] was used to identify the factors that best predicted mammography initiation and continued adherence during the 2- and 4-year follow-up periods. The factors considered in the model had been previously reported to be associated with mammography use among Canadian women in cross-sectional studies.[11,14,21,22] Variables significant ($p\leq0.05$) in age-adjusted models were entered into multivariate models. Variable groups that were significant ($p\leq0.1$) in multivariate analyses were retained in final models. Estimates were weighted to reflect baseline population characteristics. Relative risks (RR) with 95% confidence intervals (CI) were used to summarize the findings. Percentage and relative risk estimates were weighted to reflect population characteristics. To account for stratification and clustering in the NPHS design, confidence intervals were calculated using exact standard errors generated through bootstrap resampling methods.

RESULTS

A total of 1,637 women had baseline and follow-up data. When follow-up mammography information was missing, responses from the women's most recent survey cycle were used. Missing responses occurred infrequently for all covariates (<1.0% of 1996/97 respondents) except income (4.6% of 1996/97 respondents) and were collapsed with the reference category. Among the 1,637 women interviewed in 1994/95, 1,132 (72.3%) reported a previous mammogram and 505 (27.7%) did not. Among the 505 women who reported never having had a mammogram at baseline, 116 (27.4%) reported having received a mammogram within the subsequent 2 years; 209 (43.2%) received a mammogram within 4 years of follow-up; and 296 (56.8% of baseline never users; 15.7% of all women aged 50-69 at baseline) did not initiate mammography over the course of follow-up. Of the 1,132 women with a previous mammogram, 259 (17.1%) reported a mammogram in the distant past (>2 years ago) and were excluded from the present analyses. Among the 873 women who reported a recent

TABLE II

Relative Risks (95% CI) for Continued Adherence with Mammography Screening at 2- and 4-year Follow-up According to Baseline Socio-demographic, Health and Lifestyle Factors Among 873 Canadian Women (Aged 50 to 69 Years)§ Reporting a Recent (<2 years) Mammogram at Baseline (1994/95)

Factor§,||	Continued Adherence at 2 Years		Continued Adherence at 4 Years	
	Age-Adjusted RR (95% CI)	Age-Adjusted RR† (95% CI)	Age-Adjusted RR (95% CI)	Age-Adjusted RR† (95% CI)
Age Group				
50-54	1.00		1.00	1.00
55-59	1.01 (0.94-1.08)		0.98 (0.89-1.09)	0.96 (0.87-1.05)
60-64	1.00 (0.92-1.08)		0.91 (0.82-1.02)	0.92 (0.83-1.01)
65-69	0.93 (0.85-1.04)		0.81 (0.69-0.96)**	0.79 (0.68-0.93)**
Household Income				
<$30,000	1.00		1.00	
≥$30,000	1.05(0.99-1.11)		1.18(1.07-1.29)***	‡
Educational Attainment				
Elementary / Some Secondary	1.00		1.00	1.00
High School or Greater	1.01 (0.95-1.08)		1.27 (1.13-1.42)****	1.21 (1.09-1.35)***
Birthplace				
Canada	1.00		1.00	¶
Other than Canada	1.02(0.94-1.09)		1.21(1.10-1.33)***	
Current Smoking Status				
Smoker	1.00	1.00	1.00	1.00
Non-smoker	1.19 (1.08-1.31)***	1.18 (1.07-1.30)***	1.43 (1.22-1.68)****	1.37 (1.17-1.61)****
Hormone Replacement				
Yes	1.09 (1.03-1.14)***	1.08 (1.03-1.13)*	1.09 (1.01-1.19)*	‡
No	1.00	1.00	1.00	

* $p<0.05$; **$p<0.01$; ***$p<0.001$; ****$p\leq0.0001$
† obtained from generalized linear model adjusted for all other factors in column.
‡ failed to remain statistically significant at $p\leq0.1$ in final model.
§ factors considered, but not found significant ($p<0.05$) in 2- and 4-year follow-up age-only adjusted models included: urban residence, languages spoken, labour force activity in past year, marital status, voluntary group membership, social support, having a regular physician, number of medical consults in the past year, time since last Pap smear, frequency of physical activity, restrictions of activity.
|| Most or all respondents who did not have a recent blood pressure check were adherent at 2-year follow-up; therefore, the age-adjusted model did not converge and this variable could not be examined.
¶ Removed from final model due to sample size limitations

(<2 years) mammogram at baseline, 755 (88.7%) reported a subsequent mammogram by the 2-year follow-up and 626 (73.0% of baseline adherers; 43.8% of all women aged 50-69 at baseline) reported a recent mammogram at both the 2- and 4-year follow-up.

Predictors of mammography initiation

After adjusting for statistically significant baseline covariates, women over the age of 55 years and those with higher education were *less likely* to initiate mammography, whereas women residing in urban areas were more likely to initiate use during the 2-year follow-up (Table I). Being born outside of Canada and having a recent blood pressure check predicted initiation within 4 years. Birthplace outside Canada also predicted initiation in age-adjusted analyses at 2 years, but could not be examined in multivariate analyses due to sample size limitations.

Predictors of continued mammography adherence

After adjusting for statistically significant baseline covariates, not currently smoking was the strongest factor associated with remaining adherent at 2 and 4 years follow-up. Use of hormone replacement therapy was associated with a slightly increased likelihood of continued adherence at the 2-year, but not at the 4-year follow-up (Table II). At 4 years follow-up, higher educational attainment was predictive of continued adherence, whereas women aged 65-69 at baseline (aged 69-73 at follow-up) were less likely to report continued adherence.

INTERPRETATION

This prospective study of mammography use in Canadian women aged 50-69 indicates that although approximately 1 in 6 remained never-users during the follow-up, most participated in mammography at some point in time. However, fewer than half of all women aged 50-69 (43.8%) reported ongoing adherence to mammography. Although Canadian organized programs report high levels of retention, with 86.3% of previously screened target-aged women returning within 30 months of their index screen, participation rates in provincial programs remain well below the target of 70%. In order to optimize the public health impact of breast screening in Canada, improving recruitment among women aged 50 to 69 and increasing long-term adherence to mammography will be critical.

Whether barriers to first-time screening differ from those for repeat mammography is a compelling question. This study found that factors that foster ongoing participation differ from those that precipitate initiation. Such differences may assist in the identification of underserved populations and in the development of strategies to increase the effective implementation of population-based screening. Both theoretical constructs and empirical findings suggest that interventions to increase initiation, based on mitigating knowledge, attitudes and behaviours that pose barriers to adoption, provide little guidance on how to encourage women to sustain healthy behaviours once adopted.[33] Strategies that reward, reinforce and prompt continued use should be emphasized among mammography users. Such efforts should include initiatives to address logistical and access challenges, lack of physician referral, women's negative experiences with mammography and perceptions that routine screening is unnecessary or not reassuring.[14,15,33-35]

Women most likely to remain adherent over time had positive lifestyle practices

(e.g., non-smokers), higher socio-economic status (e.g., post-secondary degree or highest household income grouping) and reported use of hormone replacement therapy. Age was not a strong determinant of adherence, except by 4-year follow-up among women 65-69 at baseline (i.e., aged 69-73 at follow-up), reflecting, in part, less intensive efforts to recall women over the age of 70 for routine screening. Physicians may be more likely to discuss mammography with women taking hormone replacement therapy because of its association with increased risk of breast cancer, prompting continued screening when renewing their prescriptions. Smokers have been identified as an underscreened group with knowledge, attitudes and beliefs about mammography that are barriers to participation.[36] However, little is known regarding whether a patient's smoking status influences the likelihood of physician referral for screening. The observed predictors of adherence are similar to those for recent screening prevalence identified in cross-sectional studies. This finding is not unexpected, since most prevalent users are adherers.[14]

Since initiators comprise a small portion of recent or ever users, initiatives targeting underserved groups may need to be operational for extended periods before prevalence, as measured through cross-sectional surveys, is increased. The strongest predictor of initiation in the present study, was urban residence, suggesting that, in Canada, rural-dwelling women continue to experience screening access barriers. Interestingly, our longitudinal data suggest that other previously-identified underserved groups of Canadian women (e.g., women with lower educational attainment, those born outside of Canada)[14] were more likely to initiate use. These new findings may reflect cumulative effects of recent strategies designed to reduce barriers to screening among underserved groups of Canadian women.[37-40] However, changes in the composition of the group of women born outside of Canada may also contribute to increased initiation. It also remains uncertain if the increased likelihood of initiation among previously underserved women will translate into continued adherence. Sample size limitations precluded comprehensive assessment of continued adherence among women born outside of Canada. This cohort of women aged 50 to 69 may also represent late adopters, as many women initiate mammography screening at an earlier age. However, knowledge of determinants to increase recruitment of previously unscreened target-aged women, particularly late adopters, will be critical to increase participation.

The following limitations should be considered when interpreting the results of the present study. The data may underrepresent select groups of underserved women (e.g., those from geographically remote or low SES settings and survey non-respondents). Because we relied on previously collected survey data, we were unable to assess women's attitudes, beliefs and knowledge regarding breast cancer and preventive health practices and other potentially modifiable barriers to initiation or ongoing adherence.[41-44] In addition, our predictors of initiation and adherence were baseline characteristics, which may vary over time. Two further concerns are our reliance on self-report and potential misclassification of diagnostic mammography as screening. Given that women tend to underestimate the time since their most recent mammogram by an average of three months or more,[26-29,45-50] and that diagnostic mammography comprises approximately 10-15% of screening mammography in this population,[14] our results likely overestimate adherence. However, in the absence of any data source detailing all screening mammography conducted in Canadian women, longitudinal population-based surveys offer the best approach for monitoring participation and retention both within and external to organized screening programs.

In summary, the present study provides estimates of mammography initiation and adherence, highlights recent changes in mammography initiation among previously underserved groups of Canadian women, and contributes to a greater understanding of factors that promote initiation and ongoing adherence. Such findings may be useful to enhance recruitment and retention strategies to promote appropriate breast cancer screening behaviours among all target-aged Canadian women.

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RÉSUMÉ

Objectif : Établir les facteurs prédictifs de la décision de subir une première mammographie et de l'adhésion à l'examen de dépistage, à tous les deux ans, chez les Canadiennes entre 50 et 69 ans.

Méthodes : À partir des données recueillies auprès d'un groupe longitudinal de Canadiennes dans le cadre de l'Enquête nationale sur la santé de la population (ENSP) de 1994-1995, puis deux et quatre ans plus tard, nous avons estimé la probabilité relative (RR) qu'une Canadienne décide de subir une première mammographie et son adhésion à cette procédure en fonction des caractéristiques socio-démographiques et des facteurs liés à la santé et au style de vie.

Résultats : En utilisant comme groupe de référence 505 femmes n'ayant jamais subi de mammographie, on constate que 23,0 % ont subi une mammographie au cours de la deuxième année et 41,4 %, de la quatrième année. On a établi un lien de corrélation très étroit entre les résidentes des zones urbaines (RR=2,85) et la décision de subir une première mammographie au cours de la deuxième année; de la même manière, l'appartenance à un groupe d'âge (de 50 à 54 ans) et un niveau de scolarité moins élevé constituaient des variables prédictives de la décision de subir une première mammographie au cours de la deuxième année. On a établi un lien de corrélation entre, d'une part, les femmes plus jeunes, nées à l'étranger et qui ont récemment (<2 ans) subi un examen de la pression artérielle et, d'autre part, la décision de subir une mammographie avant la fin de la quatrième année. En prenant comme groupe de référence 873 femmes ayant indiqué avoir dernièrement (<2 ans) subi une mammographie par rapport à l'année de référence, on constate que 88,7 % d'entre elles ont également signalé avoir subi une mammographie au cours des deux dernières années tandis que 73 % ont indiqué avoir subi un examen de suivi au cours de la deuxième et de la quatrième année. Le statut de non-fumeur représentait la première variable prédictive en importance de la décision de subir un examen de suivi au cours de la deuxième (RR=1,18) et de la quatrième année (RR=1,37).

Interprétation : Les groupes de femmes canadiennes les moins bien desservies, que l'on a déjà identifiés (p. ex., les femmes qui ont un faible niveau de scolarité et qui sont nées à l'étranger) étaient les plus susceptibles de prendre la décision de subir une mammographie. Près d'une Canadienne sur six du groupe des 50 à 69 ans n'a pas utilisé ces services durant la période de suivi et moins de la moitié d'entre elles a indiqué avoir subi des mammographies au cours des trois cycles de l'étude, suggérant ainsi la nécessité d'accroître le taux de participation à des examens de dépistage périodiques.