Breast Cancer Screening in the United States and Canada, 1994: Socioeconomic Gradients Persist

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A B S T R A C T

Objectives. This study compared rates of annual mammography screening across socioeconomic status between the United States and Canada in 1994.

Methods. Population-based cross-sectional surveys were used to compare the rates.

Results. Screening rates were higher in the United States than in Canada for women aged 50 to 69 years (47.3% vs 38.8%; $P<.01$). Women with higher education and with higher incomes were more likely to receive screening in both countries, with no significant differences between countries.

Conclusions. For women aged 50 to 69 years, screening rates in Canada have substantially increased relative to those in the United States. However, disparities in screening across levels of socioeconomic status persist in both countries. (*Am J Public Health*. 2000; 90:799–803)

Despite substantial increases in the use of mammography screening during the 1980s and early 1990s, women of low socioeconomic status (SES) are much less likely to receive recommended screening procedures.[1–3] One of the goals of the US Healthy People 2000 objectives is to increase rates of mammography screening for women 50 years and older. Although these objectives set the same target for women of low SES as for those with high SES,[4] it may be difficult to achieve these objectives without specific interventions to increase screening among women of low SES.

In an earlier study, we found that the association of income with mammography screening in the United States in 1990 was similar to that observed in the Canadian province of Ontario, where insurance coverage is uniform and universal and requires virtually no patient cost-sharing.[5] That research suggested that minimizing financial barriers to mammography screening does not necessarily ensure high rates of use.[6,7]

There were several limitations to our study, however. First, the comparison between the United States and Canada was restricted to Ontario. Second, the comparison was restricted to a cross-sectional observational study that used data from 1990. Thus, we could not address trends in screening among women of different levels of SES. In particular, since 1990, there have been several initiatives intended to increase mammography screening rates throughout the United States and Canada, especially among women of lower SES. In the United States, new initiatives have primarily focused on minimizing financial barriers to screening by offering mammography and some screening-related services free of charge to women lacking health insurance.[6,8] Canadian providers and organizations have also taken a more proac-

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tive approach to increasing screening rates by establishing new programs that directly offer women screening without a physician's referral.[9,10] Established in 1994, the biannual Canadian National Population Health Survey (CAN-NPHS) provides an important opportunity to update and expand our previous findings because it is the first population-based health survey that is representative of the entire Canadian population.

In this study, we compare rates of mammography screening in the United States and Canada in 1994 across groups of different levels of SES. Given the lack of financial barriers in Canada and the increased emphasis on providing mammography without a physician's referral, we hypothesized that Canada might be more successful than the United States in reducing differences in screening rates by SES.

Methods

Study Population

The study population was a sample representative of all noninstitutionalized women aged 40 and older living in Canada (n = 4914) and the United States (n = 6556) in 1994.

Data

We used the 1994 CAN-NPHS and the US National Health Interview Survey (US-NHIS) Year 2000 Objectives Supplement, population-based surveys that collected detailed information on health care use, health behaviors, and sociodemographic factors from a sample of the civilian noninstitutionalized population.[11,12] In 1994, the CAN-NPHS sampled 58 439 persons in 20 725 households via in-person interview (response rate = 88.7%), while the US-NHIS sampled 116 179 persons in 45 705 households via in-person interview (response rate = 94.1%). Sampling design, mode of questioning, and questions about mammography screening were similar in the 2 surveys.

Variables

The dependent variable was mammogram use within the prior 12 months. Independent variables for the descriptive part of the analyses were age group (40–49, 50–69, 70 and older) and region (5 Canadian regional variables [British Columbia; Midwest, including Saskatchewan, Alberta, and Manitoba; Ontario; Quebec; and East, including New Brunswick, Newfoundland, and Nova Scotia] and 4 US-NHIS regional variables [West, Midwest, South, and Northeast]).

TABLE 1—Characteristics of the Study Population for Breast Cancer Screening, 1994

	Canada (n = 4914)	United States (n = 6556)
Median age, y	57	57
Married, %	65.8	61.0
Education,[a] %		
Some high school	35.9	24.5
High school graduate	15.9	40.0
Some college	35.7	18.3
College graduate	12.4	17.2
Income in US$,[a] %		
<15 200	22.4	24.0
<45 600	56.1	45.2
≥45 600	21.5	30.8
Race/ethnicity		
White	90.8	84.2
Black	1.4	10.5
Other[b]	7.8	5.3
Insurance status, %		
None	. . .	10.3
Medicaid	. . .	5.8
Medicare	. . .	31.1
Private	. . .	52.0

[a]Between-country difference was significant ($P < .01$).
[b]In Canada, this category was made up largely of persons of South Asian and Chinese descent; only 4% were people of Hispanic descent.

In the multivariate analyses, the principal independent variables of interest were country, family income, and education. We used a purchase power parity factor (0.763) to adjust Canadian dollars to US dollars.[13] In both surveys, family income was coded as an ordinal variable (6 dummy variables from the lowest category of US $15 200 to the highest category of greater than US $45 600). These categories were chosen because they minimized overlap between the ordinal categories in the 2 surveys. Education was categorized as some high school, high school graduate, some college, and college graduate. Additional covariates in the main multivariate analysis included family size (continuous), marital status (currently married vs other), and age (5-year age groups). In a secondary multivariate analysis, we included additional covariates: race/ethnicity (White, Black, Asian, other) and, for the United States only, insurance status (none, Medicaid, Medicare, private).

Analysis

The pertinent data from both surveys were combined into a single analytic file. We first examined differences in screening rates by region and age group. We then examined the independent associations of education and income with mammography use for women aged 50 to 69 years in each country, controlling for family size, marital status, and age by logistic regression. We chose this age range because professional societies in both countries uniformly recommended annual screening in this age group at the time of the study.[14,15] Country interactions with income and education were assessed to test the primary hypotheses of this study. The statistical significance of individual regression coefficients and groups of regression coefficients was assessed with *z* tests and Wald tests, respectively.

Importantly, because many of the results were significantly different for the province of Quebec compared with the other provinces of Canada, we excluded Quebec from the main multivariate analyses. Instead, we report the results for Quebec separately.

Because both surveys used complex sampling designs, all analyses were performed with analytic weights. Variances for the regression coefficients were calculated by using a Huber-White robust estimator. All analyses were run with Stata version 5.0 (Stata Corp, College Station, Tex).

Secondary Analyses

Because of the very low proportion of Blacks and Hispanics in Canada (see Table 1), we repeated the main analyses, excluding these women from the sample, and found no differences in our results. We report adjusted odds ratios for the group combined. To examine the impact of the US uninsured population on the association of

SES with screening, we repeated the main analyses, excluding the uninsured from the US sample.

Results

Demographics

Table 1 shows population characteristics by country. The populations were similar in age and marital status. The distribution of education and income in the 2 country samples was different ($P<.01$). In particular, the proportion of subjects who were not high school graduates was higher in Canada than in the United States. The proportion in the highest income category was lower in Canada than in the United States. Approximately 10% of women in the US sample population reported no insurance in the prior month. The proportion of uninsured women was greater for lower-income groups than for higher-income groups: 15% of women with the lowest incomes were uninsured compared with 3% of women with the highest incomes.

Rates of Screening

Table 2 shows that screening rates were higher in the United States than in Canada (40.0% vs 30.7%; $P<.01$); however, between-country screening rates differed across age groups ($P<.05$). These differences were smallest for women aged 50 to 69 (47.3% in the United States vs 38.8% in Canada).

Screening rates differed across region within both countries, but this variation was significant only within Canada. In the United States, screening rates for women aged 50 to 69 years were highest in the Northeast (51.7%) and lowest in the South (44.3%). In Canada, screening rates for this age group were highest in British Columbia (53.8%) and lowest in Quebec (29.8%).

Association of SES With Screening

Table 3 shows the odds of receiving a mammogram in the prior year for women with higher education and income levels compared with women with the lowest education and income levels (the reference groups) in the United States and Canada. The positive association of screening with education was somewhat greater in Canada than in the United States, but this between-country difference was not statistically significant; for instance, the adjusted odds ratio for screening for college graduates vs those with less than a high school diploma was 1.3 (95% confidence interval [CI] = 0.9, 1.9) in the United States and 1.7 (95% CI = 1.3, 2.0) in Canada.

TABLE 2—Mammography Screening Rates[a] by Region and Age Group, 1994

Region	Aged 40–49	Aged 50–69	Aged 70 and Older	All
United States				
Northeast (n = 1405)	39.5	51.7	28.8	41.7
Midwest (n = 1629)	32.1	45.3	33.5	38.0
South (n = 2076)	35.4	44.3	32.1	38.5
West (n = 1246)	37.8	50.4	39.2	43.4
All (n = 6556)	36.0	47.3	32.8	40.0
Canada				
East (n = 1094)	23.3	31.9	12.7	24.9
Ontario (n = 1520)	19.9	41.1	26.1	30.4
Quebec (n = 689)	25.4	29.8	18.7	26.2
Midwest (n = 1031)	22.4	41.0	29.6	31.8
British Columbia (n = 600)	38.6	53.8	27.2	42.7
All (n = 4914)	24.3	38.8	24.1	30.7

[a]Percentage of women reporting that they had received a mammogram in the prior year.

There was also a very similar positive association of income with screening in both countries; for example, the odds ratio was 2.5 (95% CI = 1.7, 3.4) in the United States and 2.1 (95% CI = 1.4, 3.4) in Canada for women with family incomes greater than US $45 600.

In a secondary analysis, we used the US sample to examine the association of insurance status with screening and found that uninsured women were less likely than insured women to have had a screening mammogram in the prior 12 months (odds ratio [OR] = 0.3; 95% CI = 0.2, 0.5). When we eliminated women who were uninsured in the US sample from the main analysis of between-country differences in screening, we found that income disparities in screening remained.

Results From Quebec

Annual screening rates in Quebec were the lowest among all regions in both countries for the target population (aged 50 to 69 years), and there was little evidence of targeting in this age group; for example, the screening rate was 29.8% for women aged 50 to 69 and 25.4% for women aged 40 to 49. There was no association in Quebec between screening and income. By contrast, as noted above, there was a positive association between screening and income for all other provinces. The interaction between region (Quebec vs all other provinces combined) and income groups was significant ($P<.05$).

Discussion

We previously showed that in 1990, screening rates were substantially higher in the United States than in the Canadian province of Ontario and that there were disparities by SES in both regions. This study updated and expanded on these findings by using comparable 1994 data representative of the United States and Canada.

Between-Country Differences in Screening Rates

Overall, screening rates were higher in the United States than in Canada in 1994, but the gap between countries appeared to have narrowed substantially since 1990. This was particularly evident in the target population, women aged 50 to 69, where the province of British Columbia had the highest screening rate among regions in both countries. We previously showed that in 1990, the mammography rate for this age group in Ontario was half that for the same age group in the United States (20% vs 43%).[5] Between 1990 and 1994, the screening rate doubled in Ontario, while in the United States the growth was much lower.

Between-country differences in screening rates across age groups can be partly explained by differences in clinical policies. In both countries, clinical policies have consistently recommended annual screening for women aged 50 to 69.[14,15] For these women, screening rates were more similar in the 2 countries. However, unlike guidelines in the United States, clinical policies in Canada have not endorsed the screening of women aged 40 to 49, nor of women 70 and older. For these 2 age groups, screening was substantially higher in the United States. There was substantially more variability across regions in Canada than in the United States. Regions in Canada had the highest and the lowest screening rate found in North America for the target population. We speculate that 2 factors may explain this greater variability in Canada. First,

TABLE 3—Odds Ratios[a] (95% Confidence Intervals) For Mammogram Use in the Prior Year For Women Aged 50–69, By Country

	United States	Canada
Age, y		
50–54	(Reference)	(Reference)
55–59	0.7 (0.6, 1.0)	1.0 (0.6, 1.5)
60–64	0.8 (0.6, 1.1)	1.0 (0.6, 1.5)
65–69	0.8 (0.6, 1.1)	1.0 (0.6, 1.5)
Married[b]	1.5 (1.2, 1.9)	1.4 (1.1, 1.8)
Family size[c]	0.7 (0.6, 0.8)	0.8 (0.7, 0.9)
Education		
Some high school	(Reference)	(Reference)
High school graduate	1.2 (0.9, 1.5)	1.4 (0.9, 2.1)
Some college	1.2 (0.8, 1.7)	1.6 (1.3, 1.9)
College graduate	1.3 (0.9, 1.9)	1.7 (1.3, 2.0)
Wald test (*P*)	2.6 (.5)	12.3 (<.01)
Income, US $1000		
<15.2	(Reference)	(Reference)
<22.8	1.0 (0.7, 1.4)	1.6 (1.0, 2.6)
<30.1	1.5 (1.1, 2.1)	1.5 (1.0, 2.4)
<38.0	2.0 (1.4, 2.9)	1.9 (1.2, 3.0)
<45.6	1.9 (1.3, 2.7)	1.8 (1.1, 3.0)
≥45.6	2.5 (1.7, 3.4)	2.1 (1.4, 3.4)
Wald test (*P*)	55.0 (<.01)	21.4 (<.01)

Note. OR = odds ratio; 95% CI = 95% confidence interval.
[a]Odds ratios were adjusted for all variables in the table using logistic regression. Wald tests are displayed only for group variables that were significant.
[b]Reference group for married is never married, widowed, or divorced.
[c]Family size is continuous.

the health care system of Canada is organized and financed at the provincial level. Although the provincial systems share fundamental attributes, many health care initiatives are implemented at this regional level. In particular, the intensity, comprehensiveness, and timing of ministry-financed breast cancer screening programs have varied across provinces. For instance, the British Columbia Ministry of Health has offered breast cancer screening through self-referral directly to women since 1988. In 1994, nearly half of all mammograms performed in the province were done through the screening program.[9] By contrast, Quebec and the Maritime Provinces had no special program during the study period.[16]

Association of SES With Screening

Although screening rates appear to have increased substantially in Canada, disparities across SES persist despite the lack of insurance-related economic barriers and the availability of self-referred screening opportunities in some provinces. Thus, other factors unrelated to these access-related barriers must play a dominant role in the cause of these disparities in Canada.[17–20] Women of high SES may be more knowledgeable about cancer screening or may have different attitudes about its benefits and risks. Women of higher SES may also have fewer barriers related to child care or transportation. Whether a physician recommends screening plays an important role in the use of screening services. Women of low SES may be seen by different physicians than women with higher SES.

Quebec

Our findings for the province of Quebec differed significantly from those for the other provinces of Canada. The very low annual screening rate in Quebec, combined with the small difference in rates for women aged 40 to 49 vs 50 to 69, suggests that very little targeting has occurred in the province. Indeed, Quebec has been slower to initiate programs to promote screening among physicians and the target population. This may reflect more general cultural differences related to attitudes toward preventive health between Quebec and the rest of Canada. For example, smoking rates among women appear to be much higher in Quebec than in the rest of Canada.[21]

Limitations

Several aspects of the study design merit comment. We used 2 different surveys to make our comparisons—an approach that could introduce systematic bias between countries. However, the sampling design, overall response rates, mode of questioning, and question formats for selected variables of the surveys were very similar. Furthermore, the variables chosen in the analysis are not highly subject to measurement error. The US-NHIS sample did have a higher percentage of missing values for income (15%, vs 6% in the CAN-NPHS), but the distribution of screening use, education, age, and marital status of respondents with and without income information did not differ between the 2 survey samples. Thus, we do not believe that our comparisons are substantially systematically biased by this issue.

Conclusion

Providers face special challenges in facilitating the provision of preventive medical care for the poor. Unfortunately, as we have now documented in our research, these challenges remain even under an optimal universal health insurance scenario such as exists in Canada. More targeted intervention programs aimed at increasing rates of screening have begun in both the United States and Canada. Further research is needed to assess the impact of these programs and other initiatives on SES disparities in breast cancer screening in the community over time. □

Contributors

S. J. Katz planned, designed, and conducted the study; analyzed and interpreted the data; and wrote the paper. J. Zemencuk reviewed the literature, helped interpret the findings, and edited the paper. T. Hofer helped plan and design the study, analyze the results, and write the paper.

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