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Participation and retention in the breast cancer screening program in New Brunswick Canada

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ABSTRACT

New Brunswick (NB) Canada uses its breast cancer screening service program to assess the extent to which eligible NB women are complying with mammography guidelines. While many studies have investigated factors associated with participation in periodic breast cancer screening in Canada and elsewhere, most work has relied on self-reported surveys or smaller scale primary data collection. Using a longitudinal administrative dataset for NB over the period 1996–2011 of 255,789 eligible women aged 45–69, this study examined demographic, socioeconomic and geographic factors associated with initial participation in regular screening at age 50 and ongoing retention in the program. Logistic regression was used to examine correlates of initial screening, while rescreening participation was estimated using survival analysis accounting for rescreening episodes. Initial screening participation was lower for women born outside of NB, many women living farther away from screening centers, women in rural areas, and higher for married women. In contrast, retention was higher for rural women and women recently arrived in NB. For both participation and retention, regional disparities across health zone persisted after controlling for observable personal and locational factors. The analysis highlights important characteristics to be targeted to increase screening but also that how health zones operate their screening programs exerts a very significant effect on the use of screening services by eligible women. This offers lessons for the design and evaluation of any cancer screening program.

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1. Introduction

Breast cancer is the most commonly diagnosed cancer among women and has the second highest mortality rate after lung cancer (Canadian Cancer Society's Advisory Committee on Cancer Statistics, 2016). Since the establishment of a breast cancer screening program in Canada beginning with British Columbia in 1988 and followed by the other Canadian provinces over the following ten years, breast cancer mortality rates have continued to decrease even while breast cancer incidence has fluctuated or stabilized (Canadian Cancer Society's Advisory Committee on Cancer Statistics, 2016). National guidelines in Canada recommend biennial mammography for asymptomatic women aged 50–69 and these guidelines have not changed for many years (Ringash, 2001; The Canadian Task Force on Preventive Health Care, 2011). Recent guidelines recommend biennial mammography for asymptomatic women aged 70–74 though based on weaker evidence (The Canadian Task Force on Preventive Health Care, 2011) so for continuity we focus on women aged 50–69 in this paper.

Participation and retention are two key dimensions for studies focusing on breast cancer screening and the degree of adherence of women to screening guidelines. The Public Health Agency of Canada defines participation as receiving a mammogram through an organized screening program and retention as returning for a mammogram through an organized screening program within 30 months of a previous mammogram (Canadian Partnership Against Cancer, 2015; Canadian Partnership Against Cancer, 2013). A recent performance report indicates that Canadian screening programs are not reaching target levels of 70% for overall participation nor the targets for retention following an initial screen (75%) or a subsequent screen (90%) (Canadian Partnership Against Cancer, 2015).

Participation studies investigate factors associated with utilization of breast cancer screening services, which include either initial screening or subsequent screening in a time period. Studies identified demographic (Zapka et al., 1989), geographical (Lerman et al., 1990), socioeconomic factors (Zapka et al., 1989; Katz and Hofer, 1994; Maxwell et al., 2001) and psychological factors (Zapka et al., 1989; Lerman et al., 1990) contributing to variation in participation in breast cancer screening. For example, less education, minority ethnicities, etc. have been associated with lower participation in screening programs. Lower screening rates among Canadian women living in rural areas

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have been attributed to attitudinal differences than access to a screening center (McDonald and Sherman, 2010).

Earlier studies on participation included individuals who participated both in initial screening and subsequent screening. For most participants commencing involvement in a screening program at age 50, initial screening and retention with subsequent screening in accordance with guidelines would require at least eleven episodes of rescreening by age 69, assuming they remain asymptomatic. Thus there is considerable interest in considering the dynamics of the decisions to get (re)screened over the eligible age range. Conditional on initial screening, retention rates have been found to be relatively high for subsequent screening, in contrast to initial screening rates, and this is reflected in the higher screening targets for subsequent rescreening (Canadian Partnership Against Cancer, 2015; Canadian Partnership Against Cancer, 2013). Among those studies examining rescreening (Song and Fletcher, 1998; Sabogal et al., 2000; Barr et al., 2001; Rauscher et al., 2005; Bobo et al., 2004; Rosenberg et al., 2005; Calvocoressi et al., 2005; Fox et al., 2004), some have identified demographic (Song and Fletcher, 1998; Sabogal et al., 2000; Rauscher et al., 2005; Rosenberg et al., 2005; Fox et al., 2004), socioeconomic (Song and Fletcher, 1998; Sabogal et al., 2000), psychological factors (Rauscher et al., 2005; Fox et al., 2004), medical history (Bobo et al., 2004), and cost (Bobo et al., 2004) as correlated with rescreening.

Our study addresses a number of limitations in the existing literature. Many previous studies relied on self-reported data (Zapka et al., 1989; Lerman et al., 1990; Katz and Hofer, 1994; Maxwell et al., 2001; McDonald and Sherman, 2010; Tang et al., 2000) and examined initial rescreening only (Song and Fletcher, 1998; Barr et al., 2001; Bobo et al., 2004; Calvocoressi et al., 2005; Fox et al., 2004) or first and second follow-up (Rauscher et al., 2005; Bancej et al., 2005) only, without considering initial screening or retention over a longer period of time. Some existing studies have used administrative data on individuals participating in screening programs to study compliance with guidelines (Kiran et al., 2014; Corkum et al., 2014; Vigod et al., 2011) but use of Canadian administrative data has been limited (Bancej et al., 2005). To the best of our knowledge, no study in Canada has yet statistically investigated demographic, and socio-economic determinants of screening together, along with geographic factors such as travel distance to a screening center (see CPAC, 2014 (Canadian Partnership Against Cancer, 2014), for breast cancer screening rates decomposed by a range of income, demographic and geographic measures using survey and administrative data).

2. Materials and methods

We conduct an analysis of initial participation in screening and retention in the screening program using province-wide administrative data from multiple sources available over a 16 year period, 1996–2011. Screening data are linked at the individual level with cancer registry, resident data and citizen data on all women in the Province of New Brunswick Canada (NB) who were eligible for breast cancer screening through the provincial program. Almost all women are enrolled in the provincial health insurance system, with the only exceptions being certain women in the military or police and certain temporary residents to Canada.

2.1. Data sources

There are four main NB administrative data sources used for this study: Medicare Decision Support System (MDSS), breast cancer screening service (BCSS), Provincial Cancer Registry, and Vital Statistics data are all linked at the individual level by provincial Medicare number. MDSS yields population data for breast cancer screening by providing a record of the age, sex, language preference, Medicare insurance eligibility period, postal code and other demographic information on all NB residents who have been issued a Medicare card for provincially funded public health insurance.

The breast cancer screening program was introduced in NB in 1995 and extended across the province over the next year. The number of screening sites in NB did not change over the sample period nor were there any major changes to overall program organization once the program had been rolled out province-wide. While the number of administrative regional health authorities was reduced from 7 to 2 through amalgamation, the operation of the screening program remained at the level of the underlying health zones. For this reason we expect that there could be significant variation in screening uptake across zones.

The BCSS screening database provides a range of data on participants in the breast cancer screening program, including date and location of the screening, purpose of the screening, and information on participants such as education level. Women must have been screened at least once in order to be recorded in the BCSS screening database, so MDSS data allow women to be identified who are eligible for screening but never participated. Both BCSS and MDSS are longitudinal by design and linkable across individual and time.

Since a woman is eligible for enrollment in the screening program if she was not previously diagnosed with breast cancer, the NB Cancer Registry is used to identify any diagnosed cancer among women in the MDSS. Women with cancer diagnosed prior to age 50 are excluded from the linked sample, while a subsequent cancer diagnosis is treated as a right censored observation in the duration analysis. Similarly, women who died within the age range of eligibility for screening or who left the province are also treated as right censored. From BCSS, 131,591 subjects were extracted. From MDSS, records were extracted from all women aged 45–69 years between 1996 and 2011. In total, data on 255,789 women were extracted from MDSS.

The combined working dataset was assembled by the NB Department of Health and provided to the research team on the closed computer network of the NB Institute for Research, Data and Training on the UNB Fredericton campus. Ethics approval for this project was granted by the UNB Research Ethics Board.

2.2. Variables

The participation analysis focused on the initial participation decision of eligible women within 30 months of turning 50 in any year between 1996 and 2011. Demographic variables included marital status, preferred language (English or French), years living in NB and the previous place of residence if the individual previously moved to NB.

The Postal Code Conversion File was used to map individuals' postal codes to Statistics Canada geocodes for Dissemination Area (a neighborhood of 400–700 people). Urban/rural status is also derived from this procedure, which we categorize as: major cities (Moncton, Saint John, Fredericton), smaller cities and larger towns, and rural areas. To measure neighborhood SES, dissemination area was used to link to average household income in quartiles and % with a university degree from the Census of Canada 1996, 2001, and 2006. Other controls measured at the level of the woman's dissemination area included the % of French speakers as an indicator for a Francophone community, and % people using neither French nor English. Since these variables reflect area-level proportions, there are no obvious categorizations for these variables like there are for income quartiles. Thus we report results arising from a ten percentage point increase in the variable.

Determining travel distance is complicated by the fact that assigned screening facility is only observed for women who actually receive screening so must be imputed for those never screened. Imputation is not straight forward since a woman may not necessarily be assigned to her nearest screening site. Thus, for those women who received screening during the sample period, driving distance between residence postal codes and the postal code of the assigned screening site is calculated but for women who were never screened a screening center is

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