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Determinants of Mammography Usage across Rural and Urban Regions of Canada

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SEDAP Research Paper No. 238

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Determinants of Mammography Usage across Rural and Urban Regions of Canada

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Abstract

Breast cancer is a leading source of mortality among Canadian women; however early detection via mammography considerably improves survival rates. Accordingly, national guidelines advocate biennial screening for asymptomatic women aged 50 to 69 years. Unfortunately many women do not abide by such recommendations, and there is some evidence that compliance rates are lower in rural areas. This report explores the extent of regional variation within and between Canadian provinces using a new and more detailed set of rural indicators based on economic zones of influence. We find the incidence of ever having a mammogram and screening within the last two years are significantly lower for women most removed from large urban centers. This result is obtained after controlling for demographic and socio-economic characteristics, concentration of physicians and specialists in the local area and whether the woman has a regular family doctor. An important reason for the observed differences across rural and urban areas is found to be awareness of the need for regular screening. We also observe that differences in mammography usage between rural and urban areas vary significantly across Canadian provinces.

Key words: mammography, cancer screening, rural health, women's health

JEL Classification: I18, I19, R23

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Résumé

Le cancer du sein est une des causes principales de mortalité chez les femmes canadiennes. Cependant, la détection précoce par la mammographie améliore considérablement le taux de survie. En conséquence, les directives nationales préconisent le dépistage biennal pour les femmes asymptomatiques âgées de 50 à 69 ans. Malheureusement, beaucoup de femmes ne suivent pas ces recommandations, en particulier dans les zones rurales. Ce rapport examine l'ampleur des variations régionales au sein et entre les provinces canadiennes à partir de nouveaux indicateurs ruraux plus précis basés sur les zones d'influence économique. Nous observons que la probabilité de ne jamais avoir effectué une mammographie de dépistage au cours des deux dernières années est nettement plus faible chez les femmes les plus éloignées des grands centres urbains. Ce résultat est obtenu après le contrôle des caractéristiques socio-économiques et démographiques, la concentration de médecins et de spécialistes dans la région de résidence et si la femme a un médecin de famille régulier. La prise de conscience de la nécessité d'un dépistage régulier apparait comme une raison importante expliquant les différences observées entre les zones rurales et urbaines. Nous observons également que les différences du recours à la mammographie observées entre les zones rurales et urbaines varient considérablement entre les provinces canadiennes.

1. Introduction

Breast cancer is a common disease and leading source of cancer mortality among Canadian women. It is estimated that one of every nine women will develop breast cancer during her lifetime; while one of every 25 will die prematurely from malignancy [24]. Breast cancer correlates related to lifestyle choices include obesity, physical inactivity and excessive alcohol consumption. Given these avertable risk factors, medical professionals advocate healthy lifestyles to minimize incidence. Nevertheless genetic and demographic risk factors, specifically age, are not modifiable; thus health officials rely on early detection to efficiently manage breast cancer. Detection modalities include clinical and self breast examinations, as well as mammography. Studies suggest that timely discovery and quality treatment considerably improve survival rates [8]. In particular, some evidence indicates that mammography screening could reduce breast cancer mortality by one third [11].

Since the incidence of breast cancer is most prevalent in women aged 50 to 69 years [22], Health Canada recommends biennial mammography for asymptomatic women in this age group. There is more controversy regarding the effectiveness of mammography for women younger than 50 and older than 69 years [12]. This debate has important implications for policy as it defines the target population for national guidelines. The challenge is to balance benefits of screening with potential harms which include anxiety, exposure to radiation, discomfort and nuisances of false positive results. Moreover justifying the cost of mammography for women younger than 50 years is debatable when servicing a large number of women who may be at relatively low risk of developing breast cancer. For women older than 69 years, breast cancer is prevalent and

mammography is effective as chances of false positive results fall with age; however benefits of regular screening are reduced by increased intolerance to evaluation and treatment, as well as shorter life expectancy and lower quality of life due to other illness. Unfortunately many women in the target age group do not participate in regular screening. Maxwell et al report that 54 percent of Canadian women aged 50 to 69 years engage in timely mammography [17]. This is much lower than objectives set by organized programs which endeavour to achieve 70 to 80 percent compliance. Participation in screening is found to be correlated with socio-economic and demographic characteristics, particularly age [17,18,21,24], marital status [18] and educational attainment [18,21,32,37,38].

Although Canada is a relatively urbanized country, around 20 percent of the population resides in rural areas [20]. After controlling for other factors, some studies have found that rural women in Canada are less likely to have a mammogram compared to those in urban areas [6,17,18]; although other work finds no relationship between mammography use and uban/rural status [29]. Since mammography requires a physician referral and availability of diagnostic equipment, barriers to access may arise from increased wait times, distance to mammography technology and transportation [17,18,29]. Moreover there may be differences in attitudes and practices between rural and urban doctors [6]. Disparities in knowledge and attitudes toward risk and treatment of breast cancer may also exist between rural and urban women [13,17,32,38]. (There is also literature on the use of health services between rural and urban residents for Canada overall [9,33] and particular Canadian provinces [3,8,10,25]. See [46] for an overview. See also [7] for a comprehensive assessment of the health of rural residents in Canada.)

The purpose of this research is to establish the extent to which mammography usage varies between women in rural and urban areas of Canada, and to assess possible explanations for any observed differences. Unlike previous research on health services use between rural and urban areas, we expand what constitutes a rural area to include alternative definitons. The heterogeneity of rural regions can be significant, from fringe areas of major urban centers to geographically isolated communities with low population density and large distances to hospitals. We define rural areas based on the extent to which they are within metropolitan zones of influence (MIZ in Statistics Canada terminology). As an alternative, we use an expanded set of five urban/rural categories that distinguish among various types of rural areas [3,9]. This research also examines differences in mammography use by province, and between rural and urban areas within particular provinces. While federal agencies support the development of mammography guidelines, provincial governments maintain responsibility for administering health care. They have authority to actively or passively promote services within their constituency, and may have different health priorities and financial resources [14]. Therefore it is of interest to identify the effect of provincial variation in the administration of health care on mammography usage between and within particular provinces.

Using econometric techniques and data from the Canadian Community Health Survey (CCHS), this study identifies factors contributing to mammography usage including demographic, socio-economic, informational, geography and community variables, as well as variables intended to capture the supply of physician and medical services by area. The next section describes the theoretical framework and reviews

current literature within the context of this model. Data and empirical methods are presented in Section 3. Section 4 reports descriptive statistics and regression results, and then considers a number of extensions to the main approach. Policy implications, limitations and research opportunities are considered in the final section.

2. Model framework

The Anderson Behavioural Model and its refinements remain one of the most commonly used analytical frameworks when studying the determinants of various forms of health service use [4,34,35]. Variation in health service usage is explained and predicted by independent contributions of pre-disposing, enabling and need factors. Pre-disposing variables describe propensity to use medical services. They comprise genetic and psychological attributes, demographic factors (age and gender), social structure (education, occupation and ethnicity) and health beliefs (attitudes, values and knowledge). Enabling variables include community catalysts (health care personnel and infrastructure) and personal factors (income, health insurance, travel requirements, wait times and access to regular care). The Anderson model also considers perceived and evaluated need as fundamental determinants of health service usage. Perceived need includes individual care-seeking behaviour and observance of medical regimes. Evaluated need relates to professional assessment of health status and necessity of treatment. For instance, there is a positive correlation between mammography compliance and having breast ailments [32,37,38]. Zapka et al found that 17 percent of women reported having a mammogram to investigate breast irregularities [37]. However we are interested in screening usage by asymptomatic women and the degree of

compliance with recommended guidelines; thus we focus mainly on the role of pre-disposing and enabling factors in mammography usage as they are mostly likely to be affected by policy initiatives.

Rural/Urban status

The variable characterizing distance from urban centers is the main focus of this research and enters the Anderson Model as an enabling factor. It will reflect proximity to health centers with the necessary diagnostic equipment and the associated costs of travel to obtain screening services [15]. As well, there is ample evidence that physician referral is a primary determinant of mammography utilization [17,18,21,29,32,37,38], with Zapka et al finding that 83 percent of women would partake in breast screening if recommended by a doctor [38]. Differences in access to physician care, reasons for physician visits and physician attitudes toward breast screening may differ between rural and urban areas; however the direction of effect is not obvious. For example, Abdel et.al [1] find that physicans in large urban areas of Ontario are less likely to adhere to screening guidelines compared to their rural counterparts. Related to this, Zapka et al report that gynaecologists and internalists are more likely to recommend breast screening [37], and medical specialists are more highly concentrated in larger urban centers. Urban/rural status may also be correlated with important pre-disposing factors such as individual health beliefs. Bryant and Mah [6] find that while knowledge of breast cancer and barriers to mammography are comparable between rural and urban women, fewer than half of rural women agree that breast cancer is curable given early detection.

Province

Province of residence can also reflect a range of enabling factors for mammography utilization. Moreover screening in accordance with recommended guidelines is found to vary across Canadian provinces, from 41 percent in Newfoundland to 69 percent in British Columbia [17]. Katz et al [14] suggest that while federal agencies support the development of mammography guidelines at a national level, provincial governments maintain responsibility for administering health care and have various approaches to encouraging timely mammography usage. While all Canadian provinces and territories offer mammography services to female residents through organized screening initiatives, programs differ by how long they have been in operation and the resources devoted to achieving stated objectives [23,31].

Income and Education

Family income is another enabling factor in the Anderson Model, and low income is found to be negatively related with mammography use [5,18,21,32,37,38]. This finding may reflect a range of underlying factors. For instance, women with minimal income are possibly under or unemployed. Also, such women may be less likely to engage in discretionary self-care and/or may have minimal access to supplementary medical insurance. Education is very strongly correlated with family income and is also found to be positively related with mammography usage [18,21,32,37,38]. In the Anderson model, education also enters as a pre-disposing factor since it may be that educated individuals are more knowledgeable about the risks of disease and advantages of preventive care.

Demographic factors

Other pre-disposing factors for mammography use include age [17,18,21,41], martial status [18], ethnicity, immigration status and language [5,17,18,21]. Language barriers may be an impediment to participation in breast screening as limited ability to speak English or French is found to be negatively correlated with mammography usage [5,21]. Particularly in rural areas, health services in alternate languages may not be available and information campaigns relaying the importance of breast health may be less effective in reaching such women. Immigrant characteristics are also found to be important, with women from Asia being less likely to have a mammogram compared to those born in Canada [17,18]. This may reflect lack of awareness regarding breast health and the importance of regular screening. As well, recent immigrants may have low levels of social support or community involvement which may be an important determinant of screening behavior [18]. Furthermore patriarchal social systems and traditional gender roles in some Asian cultures allow minimal time and incentives for preventive care [2]. Immigrant status and characteristics of immigrants such as year of arrival and country of origin have also been found to be important determinants of the takeup of cervical cancer screening in Canada [19,36].

More generally, there is significant evidence that personal beliefs about breast cancer and mammography play a very important role in the takeup of regular screening [13,17,30,32,38]. For example, approximately 50 percent of women who forego mammography believe it is unnecessary [3,17]. Moreover participation is positively related to believing that cancer can be cured [32]. Personal beliefs also likely vary by income, education, literacy level and geographic location.

3. Data and Methods

Data are from three consecutive waves of the CCHS for years 2000-01, 2002-03, and 2004-05. The CCHS is national biennial survey of approximately 130,000 individuals that collects detailed information on a wide-range of health status, behaviour and service utilization of Canadians. It encompasses persons older than 11 years residing in all provinces and territories but excludes individuals living on Crown lands, full-time military personnel, on-reserve Aboriginal persons and residents of institutions. We define our sample as adult women aged 40 to 69 years who reside in one of Canada's ten provinces as residents of the Northwest Territories, Yukon and Nunavut are omitted due to small sample sizes. The sample size for estimation is 78,403 observations. Our pooled data are merged with information obtained from the Canadian Institute for Health Information (CIHI) on the number of physicians and medical specialists per 100,000 for each health region.

We focus on identifying the determinants of mammography screening that accord with Health Canada guidelines for women aged 50-69; thus our key dependent variable is binary. It takes the value 1 if the woman had a mammogram in the previous two years and 0 otherwise. For comparison purposes, we also specify an alternative binary variable that takes the value 1 if the woman has ever had a mammogram and 0 otherwise. Explanatory variables in the statistical analysis include age and age-squared, indicators for marital status (single, widowed/separated/divorced and married), education level (less than high school, high school only, some post-secondary and degree or higher), mother tongue (English, French and other), immigrant status (years in Canada and year

of arrival), total family income (binary indicators for various income groups) and whether the woman has a regular family doctor.

To assess how mammography varies between rural and urban areas, we use two measures of geographic remoteness. Our main measure is based on Census Metropolitan Area and Census Agglomeration Influenced Zones (MIZ). The MIZ definition is used to differentiate among areas outside of CMAs (census metropolitan areas with a population of at least 100,000) and CAs (census agglomerations with a population of more than 10,000 but less than 100,000) by grouping census subdivisions (CSDs) in such areas into categories based on commuting flows of the employed labour force [20]. For a CSD to be classified as 'Strong MIZ', 30 percent or more of its workforce must commute to a CMA/CA. 'Moderate MIZ' and 'Weak MIZ' comprise CSDs with commuting flows of five to 30 and zero to five percent respectively. CSDs classified as 'No MIZ' have commuting flows to CMA/CAs of less than 40 people and are considered to be the most remote areas based on commuting flows to urban centers. In CCHS data, CAs are further differentiated into 'tract CA' and 'non-tract CA' based on whether the CA contains a census tract which is a small, relatively stable geographic area with a population of 2,500 to 8,000 [20]. A large majority of the Canadian population resides in CMAs or CAs. Among women aged 40 to 69 years, 65 percent live in a CMA while 15 percent live in a CA. Outside of CMA/CAs, 5 percent live in zones strongly influenced by a CMA/CA, 8 percent live in zones of moderate influence, 6 percent live in zones of weak influence and 1 percent live in zones of no influence. Unfortunately the CCHS did not use MIZ in 2001 so analysis using this measure of remoteness is restricted to the 2002-3 and 2004-5 waves of the CCHS.

Our second measure is consistently defined over all three waves of the CCHS. It differentiates between rural regions, as well as areas within and outside of CMA/CAs. Individuals are classified as living in one of the following regions: 1) urban core: CSDs within a CMA/CA that have a population of at least 10,000; 2) rural fringe: CSDs within a CMA/CA that have a population of less than 10,000; 3) urban outside of CMA/CA: CSDs that have a population of at least 1,000 but less than 10,000 and a population density of at least 400 people per square kilometre; and 4) rural outside of CMA/CA but not otherwise classified as urban. Previous research has examined how different types of health services use by older Canadians have varied across rural and urban regions classified according to this specification [3,9].

Statistical analysis is via Logit, and population weights and robust standard errors are used to compute all p-values. All regressions include indicator variables for survey year and province of residence.

4. Results

Sample statistics on mammography use

Figure 1 illustrates incidence of ever having a mammogram and having a mammogram within two years of the survey date, disaggregated by geographic category. Women residing in No MIZ are least likely to have had a mammogram in the last two years and to report ever having a mammogram. Strong, Moderate and No MIZ are comparable to each other; while all are individually and jointly different from CMA. Strong and Moderate MIZ are not generally considered remote; however mammogram incidence is comparable to the most remote indicator, No MIZ. Figures 2 and 3 illustrate

mammography incidence across urban/rural areas disaggregated by provincial group. Overall there are marked provincial differences in mammography usage. Atlantic Canada and the Western provinces have the highest proportions of both women receiving mammograms in the last two years and reporting ever having a mammogram, while the Prairie provinces have the lowest proportions. Interestingly, while a relatively large proportion of women in Quebec have had at least one mammogram, the proportion of women having mammograms in the last two years is among the lowest of the Canadian provinces. Across urban/rural areas, patterns are varied. For women in Weak and No MIZ zones (aggregated because of small sample sizes), rates of mammography usage within the last two years are lower relative to urban women in the Western provinces but are higher for those in Atlantic Canada and Quebec. Women in the Prairie provinces have lower rates of mammography compared to other provinces across all geographic areas, but there is little difference across urban/rural regions within the Prairie provinces. Similar results are apparent for the incidence of ever having a mammogram.

Incidence of ever having a mammogram and having a mammogram within two years are disaggregated by age group and MIZ in Figures 4 and 5. Not surprisingly, women aged 40 to 49 years (who fall outside of the age range for recommended regular mammography) have substantially lower rates of screening compared to women aged 50 to 59 and 60 to 69 years. Across urban/rural regions, mammography rates are generally comparable for women aged 40 to 49 and 60 to 69 years. The main differences appear to be for those aged 50 to 59 years, where women in this age range residing in No MIZ have lower rates of mammography than for other regions. It appears there are delays for

younger women in this age group in obtaining screening according to Health Canada guidelines.

Regression Analysis

Table 1 gives Logit regression results for the determinants of ever having a mammogram and for having a mammogram in the last two years, expressed as odds ratios. These regressions capture differences across provinces in a fairly restrictive way using a set of provincial indicator variables. To aid interpretation, it should be noted that with each explanatory variable set equal to its mean, the predicted probability of having had at least one mammogram is 79 percent, or odds of approximately 4 to 1.

Considering our urban/rural indicators, it can be seen that while all rural and urban areas have lower rates of mammography compared to CMAs, the largest differences are for women residing in No MIZ rural areas. This is true for both incidence of having a mammogram in the last two years and for whether the woman ever had a mammogram. Thus lower mammography usage in these rural areas as illustrated by Figure 1 is not fully explained by differences in age, socio-economic status, likelihood of having a family doctor or other observable factors. Moreover it is not explained by differences in the concentration of doctors and specialists across health regions. Thus, estimated differences are reflecting other urban/rural such as access to facilities or attitudinal differences toward screening on the part of women and/or their physicians. We return to this issue later in the discussion.

Province of residence is also an important determinant of mammography use whereby Nova Scotia and Alberta have higher odds relative to Ontario, and Manitoba and Saskatchewan have lower odds. For timely mammography in the last two years,

women in New Brunswick have higher odds while those in Quebec have lower odds. Differences may be attributable to disparities in organized screening programs at the provincial level. While women aged 50 to 69 years are accepted and regularly recalled in all provincial programs, the effectiveness of the recall and degree of compliance may vary. Moreover while we control for age in the regressions, marked provincial differences in program parameters for women aged 40 to 49 years may be contributing to the estimated provincial effects. For example, Newfoundland and Saskatchewan do not accept women aged 40 to 49 years while Manitoba only accepts women in this age group into mobile mammography clinics following physician referral. Furthermore Nova Scotia, Alberta and British Columbia unconditionally accept and annually recall women aged 40 to 49 years whereas Ontario does not. These features are reflected in the data – restricting the sample to women aged 50 to 69 years and re-estimating generally results in provincial differences that are smaller and less likely to be significant, with some exceptions. For mammograms in the last two years, female residents of British Columbia and Nova Scotia are now significantly less likely to report having a mammogram compared to Ontario residents, other things equal. Women in Nova Scotia are also less likely to report ever having a mammogram. Women in the Prairie provinces remain less likely to have had a mammogram after restricting the sample to women aged 50 to 69 years. However imposing this age restriction on the data has little effect on the estimated odds ratios for our measures of remoteness.

In general, demographic and socio-economic determinants of timely mammography are comparable to those characterizing incidence of ever having a mammogram. That is, greater incidence of screening is found for married women and

for those who were previously married compared to single women; women who speak French and women who speak both official languages are more likely to screen compared to women who speak English only; and screening rates are positively correlated with both educational attainment and family income. Women who speak neither English nor French are less likely to screen which implies that language barriers and/or cultural norms are hindering regular mammography. As well, recent immigrants are less likely to have had a mammogram but are not significantly less likely to have had a timely mammogram. This implies that recent immigrants had less access or less takeup of screening in their home countries but catch up to mammography rates of Canadian-born women. In fact mammography rates for immigrant women who have been in Canada more than 10 years and those of Canadian-born women are comparable.

Extensions

Our first extension involves estimating similar logit models for women aged 40 to 69 years separately by province (or provincial group depending on sample size). As in the descriptive statistics, Newfoundland, Prince Edward Island, Nova Scotia and New Brunswick are grouped as Atlantic, Manitoba and Saskatchewan are the Prairies, and Alberta and British Columbia are Western. Although the latter two provinces are different, preliminary results indicate that their relationships between remoteness and mammography usage are comparable. In the interest of brevity, we only report results that relate to the urban/rural region of residence. Results are contained in Tables 2 and 3. For incidence of ever having a mammogram, there are no significant differences across MIZ types relative to CMAs for the Atlantic provinces, Quebec and the Prairie provinces; although the odds ratio is lowest for No MIZ in the latter two provincial

groups. Moreover there are also no clear patterns for Ontario; however the result for Moderate MIZ likely reflects the fact that large proportions of Northern Ontario are classified as Moderate MIZ by Statistics Canada. For the Western provinces, all MIZ types have lower mammography use compared to CMAs (though not always significant), and the odds are lowest in No MIZ. Patterns are very similar for incidence of mammography within the last two years, as indicated in Table 5.

Our second extension is to re-estimate the main specifications using a series of urban/rural indicators rather than indicators based on MIZ zones. The categories are CMA/CA urban core, CMA/CA urban fringe, CMA/CA rural fringe, urban areas outside of CMA/CAs and rural areas outside of CMA/CAs. Results confirm that mammography usage is significantly lower in rural areas outside of CMA/CAs relative to residents of a CMA/CA urban core; although differences are less pronounced than is the case for No MIZ. The estimated odds ratios for rural areas outside of CMA/CAs are 0.889 (p value = 0.006) for whether women ever had a mammogram, and 0.902 (p value = 0.003) for whether women had a mammogram in the last two years. Estimated odds ratios for provinces or provincial groups are comparable to what was reported earlier; thus it appears that some heterogeneity remains across regions within this rural category.

Our third extension considers incidence of other breast cancer screening modalities including a clinical exam in the last two years and self-exam in the last three months. Some caution should be used in interpreting these results since the relevant CCHS survey questions were only asked of women in a subset of health regions. Incidence of clinical breast exams is found to be substantially lower in No MIZ, Weak MIZ, and Moderate MIZ than for other types of regions: between 10 and 15 percent of

women in these areas report having a clinical breast exam compared to an overall incidence of 25.6 percent. There are no discernible patterns in incidence of breast self-exams. Thus it appears that lower incidence of mammography usage may arise more from rural womens' interactions with physicians than from barriers to mammography technology per se.

Our final extension considers this point in more detail by examining differences in stated reasons for why a mammogram was not obtained, based on CCHS questions asked of women aged 50 to 69 years. In the CCHS, respondents were asked to select among 12 reasons for foregoing mammography including cost, transportation, fear, wait times, beliefs and knowledge. Across the various regions, women in No MIZ are least likely to have 'not got around to it' and most likely to have 'thought it was unncecessary'. Although 'not available in my area' is the reason given by less than one percent of all women, it is the reason given by over four percent of women in No MIZ. Considering the importance of physician referral as a determinant of mammography usage, it is notable that there are only small differences across MIZ categories in the proportion of women stating that their doctor thought it unnecessary to have a mammogram.

5. Discussion

We used cross-tabular and regression techniques to explore the correlates of mammography usage that included demographic, socio-economic, informational, community and supply-side factors. Specifically screening is more likely to occur among respondents with higher socio-economic status, older women and those who

have had a physician referral. It is less likely for recent immigrants and women whose mother tongue is neither English nor French. These results are generally coincide with the literature. Of particular interest in this analysis are the results for how mammography usage varies by degree of remoteness, where rural areas outside of CMA/CAs are disaggregated by degree of economic integration with adjacent larger population centres. Overall women living in CMAs have the highest rates of mammography usage while women in No MIZ areas have the lowest screening rates, after controlling for a range of other factors. Recent research [19] has found that individuals living in Canadian regions outside of CMA/CAs are less likely to visit a doctor during the year (but are no less likely to have a stay in hospital or unmet health care needs). This might contribute to lower mammography use for women in rural areas; however our main regression results control for differences across regions, both in concentration of doctors and specialists and for whether the woman has access to a regular physician. The implication is that physician supply per se is not the main factor causing the disparity in screening. Descriptive statistics related to reasons for foregoing mammography indicate that while there are minor regional differences in the proportion of women reporting that mammography was not available, the proportion of women reporting this as the main reason for foregoing mammography is less than five percent even in No MIZ. As well, there do not appear to be marked differences in the proportion of women reporting that their physician did not feel it was ncessary. Instead, results suggest that disparate mammography usage arises more because of differences in incidence of women thinking that mammography is not necessary. This suggests that information campaigns raising awareness about the importance of mammography

should be targeted at rural women in particular. It seems reasonable that information campaigns to boost compliance might be used in conjunction with greater employment of mobile mammography clinics in rural areas, where women are less likely to have a family doctor. While British Columbia, Manitoba, Saskatchewan and New Brunswick have implemented such clinics and report some successes [27], a more comprehensive evaluation of their impact should be conducted using other data sources.

It is important to note the differences in mammography use across provinces, both overall and by remoteness of the region of residence. For instance, the Atlantic Provinces exhibit minimal regional variation but women living outside of CMAs in Western Provinces have significantly lower odds of mammography compared to their urban counterparts. Differences in takeup rates across provinces can arise for a variety of reasons. Provincial screening programs confront capacity challenges in terms of facilities, workforce and infrastructure [26]. Moreover some have difficulty obtaining lists of eligible women. The extent to which such factors are also contributing to urban/rural differences across provinces is a question for future research.

Findings from this research are accompanied by several caveats. Firstly the CCHS is based on self-reporting; thus data are subject to recall bias. Moreover reporting errors may vary systematically by language, education and immigration factors. Sample selection flaws may distort results and affect generalizability. In particular, women living on Crown lands, full-time military personnel, residents of Northern territories, on-reserve Aboriginal women and those in institutions are excluded. While the CCHS includes women afflicted with breast cancer who would necessarily have had a mammogram as part of diagnosis and treatment, incidence of breast cancer in the data is

very low and should not significantly affect the results. However, it is not possible to differentiate between women who should or do practice regular preventative breast screening from those for whom mammography is medically prescribed. Determinants of compliance are likely to be quite different in each case.

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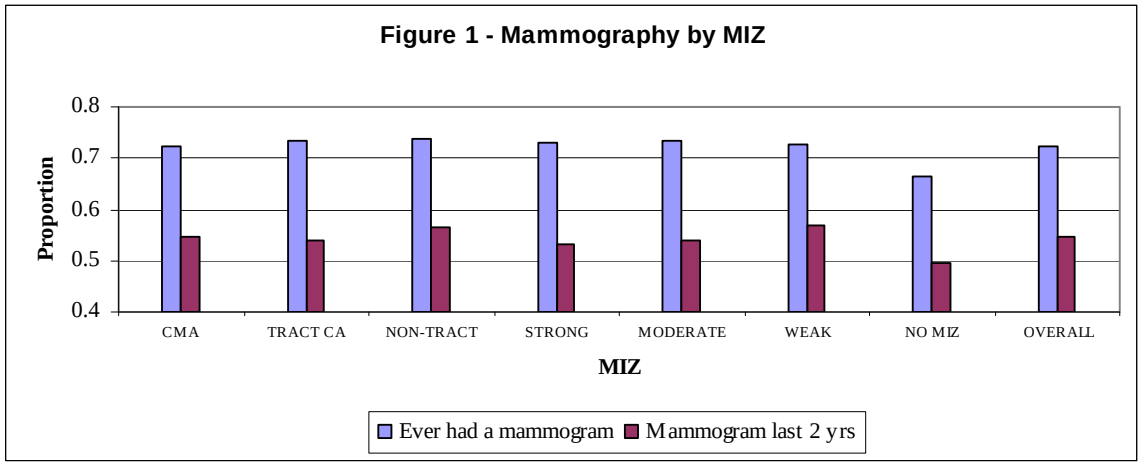
Figure 1 - Mammography by MIZ
Proportion
0.8
0.7
0.6
0.5
0.4
CMA
TRACT CA
NON-TRACT
STRONG
MODERATE
WEAK
NO MIZ
OVERALL
MIZ
Ever had a mammogram
Mammogram last 2 yrs

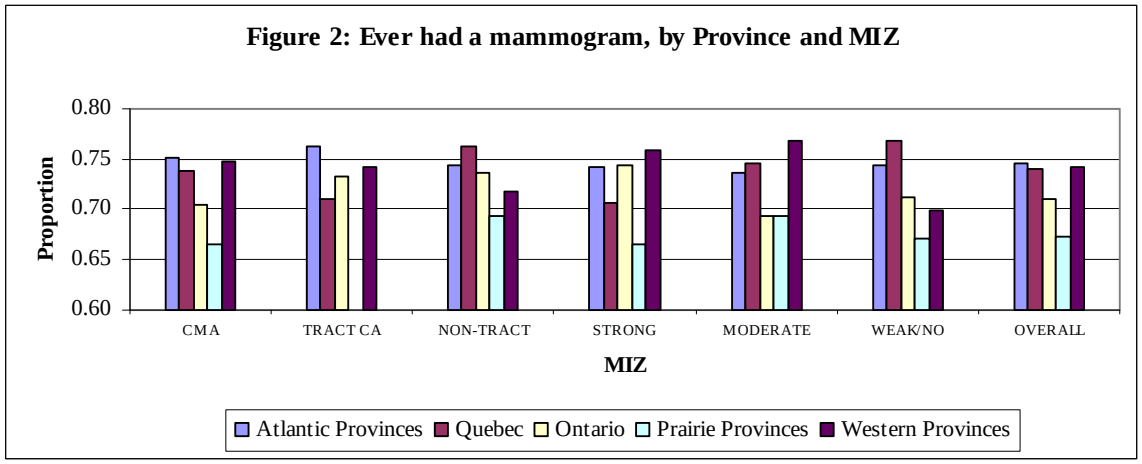
Figure 2: Ever had a mammogram, by Province and MIZ
Proportion
0.80
0.75
0.70
0.65
0.60
CMA
TRACT CA
NON-TRACT
STRONG
MODERATE
WEAK/NO
OVERALL
MIZ
Atlantic Provinces
Quebec
Ontario
Prairie Provinces
Western Provinces

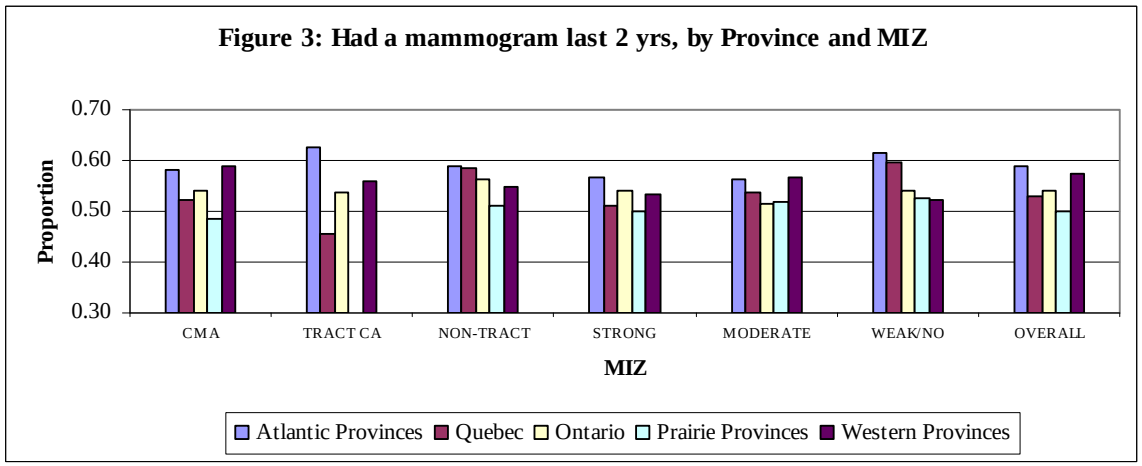
Figure 3: Had a mammogram last 2 yrs, by Province and MIZ
Proportion
0.70
0.60
0.50
0.40
0.30
CMA
TRACT CA
NON-TRACT
STRONG
MODERATE
WEAK/NO
OVERALL
MIZ
Atlantic Provinces
Quebec
Ontario
Prairie Provinces
Western Provinces

Figure 4: Ever had a mammogram, by Age and MIZ

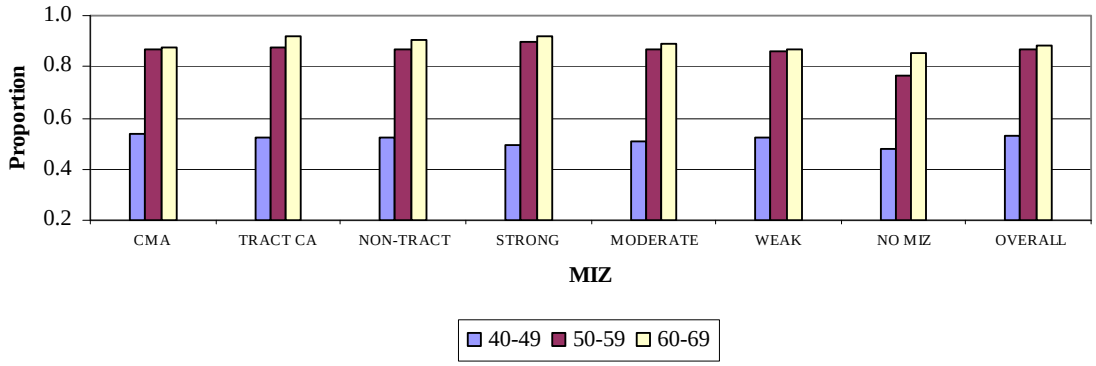

Figure 5: Had a mammogram last 2 years, by Age and MIZ

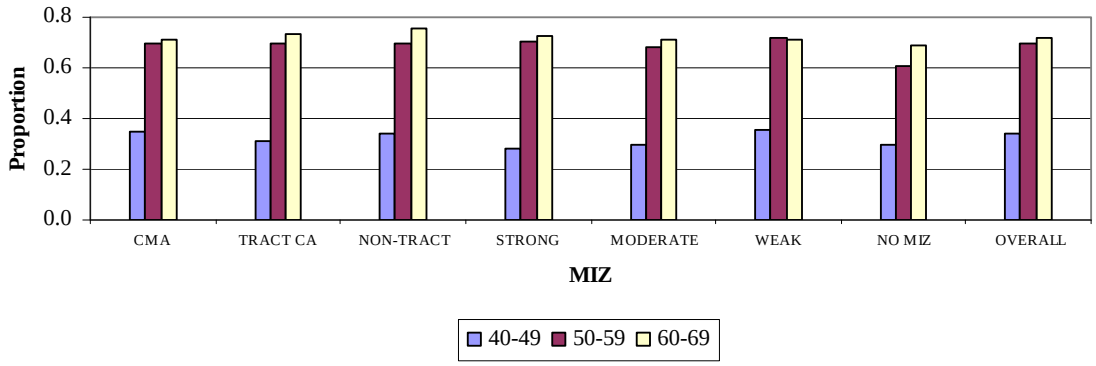

Table 1: Regression results for incidence of mammograms

	ever had a mammogram		mammogram last two years	
VARIABLE	OR	P-VALUE	OR	P-VALUE
REMOTENESS (CMA=1)				
Tract CA	0.918	0.204	0.851	0.002
Non-Tract CA	0.922	0.142	0.964	0.417
Strong Zone	0.937	0.372	0.845	0.003
Moderate Zone	0.904	0.093	0.849	0.001
Weak Zone	0.907	0.131	0.954	0.379
No MIZ	0.647	0.021	0.700	0.019
PROVINCE (ONT=1)				
Newfoundland	0.834	0.019	1.077	0.268
Prince Edward Island	0.827	0.111	0.970	0.774
New Brunswick	1.126	0.081	1.208	0.002
Nova Scotia	1.255	0.002	1.199	0.003
Quebec	1.020	0.759	0.800	0.000
Manitoba	0.768	0.001	0.736	0.000
Saskatchewan	0.784	0.001	0.848	0.012
Alberta	1.315	0.000	1.210	0.001
British Columbia	1.182	0.002	1.068	0.155
PRE-DISPOSING FACTORS				
Age	2.155	0.000	1.992	0.000
Age-Squared	0.994	0.000	0.994	0.000
Married	1.399	0.000	1.389	0.000
Separated/Divorced/Widowed	1.233	0.000	1.157	0.003
French	1.103	0.168	1.209	0.001
Bilingual	1.199	0.000	1.109	0.018
English Other	1.013	0.819	1.037	0.446
French Other	1.005	0.980	0.925	0.680
Neither Language	0.347	0.000	0.354	0.000
Foreign-born	0.975	0.636	0.986	0.754
Recent Immigrant	0.651	0.000	0.842	0.093
Less Than Secondary	0.829	0.000	0.796	0.000
Some Post-Secondary	1.085	0.211	1.005	0.930
Certificate or Diploma	1.144	0.001	1.080	0.024
Bachelor Degree	1.217	0.000	1.126	0.015
Bachelor Degree Plus	1.147	0.059	1.123	0.069
ENABLING FACTORS				
Income Less Than 10K	1.035	0.701	1.082	0.273
Income 20 to 40K	1.097	0.110	1.107	0.029
Income 40 to 60K	1.234	0.001	1.302	0.000
Income 60 to 80K	1.190	0.010	1.285	0.000
Income More Than 80K	1.228	0.002	1.284	0.000
Regular Doctor	1.340	0.000	1.203	0.000
Health Region Doctors	1.000	0.833	1.002	0.087
Health Region Specialists	1.000	0.942	1.000	0.399
	OBS	78403	OBS	78403
	PSEUDO R^2	0.163	PSEUDO R^2	0.123

Table 2: Incidence of ever having had a mammogram, selected results by provincial grouping

VARIABLE (CMA=1)	ATLANTIC		QUEBEC		ONTARIO		PRAIRIE		WESTERN	
	OR	P-VAL	OR	P-VAL	OR	P-VAL	OR	P-VAL	OR	P-VAL
Tract	0.903	0.638	0.834	0.439	1.034	0.715	-	-	0.756	0.012
Non-Tr	0.760	0.069	1.036	0.778	1.003	0.967	0.939	0.794	0.671	0.001
Strong	0.845	0.427	0.799	0.169	1.042	0.657	0.908	0.726	0.978	0.913
Moderate	0.845	0.254	0.950	0.687	0.744	0.001	1.276	0.287	0.870	0.340
Weak	0.890	0.439	1.140	0.546	0.823	0.129	1.122	0.613	0.700	0.002
No MIZ	0.865	0.764	0.764	0.502	1.314	0.573	0.555	0.090	0.381	0.001

Table 3: Incidence of having had a mammogram in the last two years, selected results by provincial grouping

VARIABLE (CMA=1)	ATLANTIC		QUEBEC		ONTARIO		PRAIRIE		WESTERN	
	OR	P-VAL	OR	P-VAL	OR	P-VAL	OR	P-VAL	OR	P-VAL
Tract	1.120	0.537	0.728	0.052	0.903	0.178	-	-	0.748	0.001
Non-Tr	0.913	0.468	1.227	0.057	0.969	0.637	0.928	0.747	0.756	0.004
Strong	0.903	0.582	0.949	0.653	0.851	0.037	0.892	0.658	0.701	0.022
Moderate	0.927	0.538	0.941	0.523	0.737	0.000	1.077	0.714	0.758	0.016
Weak	1.173	0.215	1.259	0.140	0.830	0.068	1.077	0.698	0.724	0.001
No MIZ	1.028	0.942	0.720	0.335	1.046	0.924	0.654	0.167	0.493	0.004

Table 4: Reasons for not yet obtaining a mammogram

REASON	Rural/Urban Status							
	CMA	CA - tract	CA – no tract	Strong MIZ	Mid MIZ	Weak MIZ	No MIZ	All
I have not gotten to it	0.284	0.331	0.319	0.287	0.275	0.298	0.204	0.290
I thought it not necessary	0.403	0.388	0.356	0.415	0.459	0.404	0.509	0.405
My doctor thought it not necessary	0.170	0.144	0.161	0.168	0.125	0.136	0.156	0.161
Fear	0.067	0.066	0.091	0.049	0.073	0.074	0.061	0.069
Not available in my area	0.003	0.008	0.010	0.013	0.023	0.029	0.043	0.009
Other	0.072	0.063	0.062	0.069	0.046	0.059	0.028	0.067

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