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Is Depression a Barrier or Opening for Mammography? A Canadian Community Health Survey

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Abstract

Introduction: Depression is reported as a risk factor for lack of mammography screening. The current study aims at investigating an association between depression and use of mammogram screening among elderly Canadian women.

Method: This population-based, cross-sectional study utilized the Canadian Community Health Database (CCHS).The samples were from 10 provinces across Canada including 22,662 women aged 40 and above who answered questions on depression, mammography, socio-demographic status, and health-care utilization. The Short-Form of The Composite International Diagnostic Interview identified women with depression; depressed women were defined as those with score ≥ 5.

Results: Following adjustment for confounders, the odds of reported mammogram were 1.3 (95%CI 1.2-1.5) for depressed compared to non-depressed women. Age was an effect modifier in this relationship between utilizing mammography screening and depression. Moreover, the odds of reported mammography were the highest for 60-69 year old depressed women (AOR 2.9, 95%CI 0.9-8.6), compared with their counterparts in the youngest age group (40-49 years). Having a regular family doctor was strongly associated with reported mammography (OR 2.2, 95%CI 1.9-2.5).

Conclusions: Depression among elderly women is positively associated with utilization of mammography screening. Longitudinal studies are needed to explore the effect of age as an effect modifier. Further studies can investigate the impact of other competing factors such as anxiety. Reasons for the increased utilization of mammography screening among elderly women should further be explored.

Introduction

In 2016, 64 Canadian women were diagnosed with breast cancer every day, out of whom 14 died [1]. Early detection of breast cancer heavily relies on timely breast self examination, age appropriate mammography, and clinical breast examination, leading to a higher survival rate of 95% if the cancer is diagnosed early [2]. Relative risk reduction of using a mammogram, as the most common method of breast cancer screening, was estimated to be 23% among women 40-49 years old [3,4]. In British Columbia, only 59% of women aged 50 to 69 utilized screening programs despite the non-referral nature of screening and following a strong campaign to promote mammography [5,6].

Risks associated with non-screening include of age, ethnicity, marital status, low economic status, medical use, and depression [7-12]. However, the literature examining mammography among women with mental disorders has been contradictory. Some report high rates of receipt of mammograms among women with mental disorders [13,14], while others report the presence of psychiatric conditions as a predictive factor for a lower rate of mammography [15-17]. A multi-central study found no significant difference in mammography rates among women who screened negative and positive for any mental illness (56% and 53%, respectively) [18]. Some believe that women with mental health conditions may be more likely to interact with the health care system and therefore are more likely to be screened, while others believe that women with depression are less likely to be concerned about preventative screening practices [15].

The studies above are limited by small sample sizes [13,14], highly homogenous study populations [16], and use of substandard scales to diagnose depression [13,17]. A wide range of age groups are studied but no sub-analysis is reported for various age strata [15,18] (Table 1). The current study aims to investigate the association between depression and mammogram screening of women aged 40 years and above, using population-based nationwide data from two cycle's of the Canadian Community Health Survey (CCHS). This survey improved upon sample size, used a standard tool for diagnosing depression (the Composite International Diagnostic Interview), and included a heterogeneous population.

Table 1: Characteristics of published studies on the association between depression and mammograms.

Study (Year)	Country	Sample size	Study Design	Age group	Study population	Depression Scale
Pirraglia (2004)	USA	3302	Cohort	45-52	5 ethnicity groups: Caucasian (48.1%), African American (27.4%), Japanese (9.8%), Chinese (8.8%), Hispanic (6%)	CES-D[1]
Carney (2002)	USA	21	Survey	18-91	Caucasian (94%)	Not standard
Friedman (1999)	USA	121	-	40 and older	-	DSM-IV[3]
Druss (2002)	USA	7525	Survey	50-69	Veterans	ICD_9 codes
Aro (2001)	Finland	587	Pre-post design	50	-	Not standard
Lasser (2003)	USA	526	Survey	40-70	White (52%), Hispanic (12%), Black (15%) Non-specified (9%)	PRIME-MD[2]

[1]Center for Epidemiologic Studies Depression scale
[2]Primary Care Evaluations of Mental Disorders
[3]Diagnostic and Statistical Manual of Mental Disorders, 4th Edition (DSM-IV) criteria

Materials and Method

Data source

Data for this study were obtained from the CCHS Cycle 3.1 and 4.1. The CCHS cycles were administered throughout all regions in Canada. The CCHS is a nationally representative cross-sectional survey conducted by Statistics Canada peer groupings and collects data on health status, health care utilization, and other determinants of health. The target populations for this analysis include women aged 12 years and above living in private dwellings in Canada's 10 provinces and 3 territories. Individuals are excluded if they live in institutions, on First Nations reserves, on government-owned land, or in certain remote regions. Thus, the CCHS represents approximately 98% of the Canadian population aged 12 years and older.

Study sample

The current study focused on Canadian women aged 40 years and above; the age range is consistent with women at higher risk of breast cancer [6]. Respondents are asked questions about their general health and health care behavior, including mammogram screening. Questions on depression, having a family doctor, and how often they have seen their family doctors in the past 12 months are included. Excluded from the study were men, women younger than 40 years of age, those who did not answer the mammography and depression modules, those who reported mastectomies, and those who had a history of receiving diagnostic mammograms for breast cancer. The mammogram was considered diagnostic if the respondent reported that it was for a previously detected lump, as follow-up for treatment, or for other breast health problems. The sample from cycles 3.1 and 4.1 was further restricted to women who responded to the optional depression module from 6 regions in each cycle (Cycle 3.1: Nova Scotia, Prince Edward Island, Quebec, Alberta, Saskatchewan, and British Columbia; Cycle 4.1: Nova Scotia, New Brunswick, Quebec, Alberta, Yukon and Northwest Territories). Consequently, our final analytic sample included 22,662 women (Figure1). Multivariate analysis of samples with and without missing data produced similar ORs with less than 1% difference. With 22,662 women, we had sufficient power (type I error=0.05, type 2 error=0.20) to detect a difference in the prevalence of mammogram screening by depression status equal to 0.09 from the baseline of 0.46 [19].

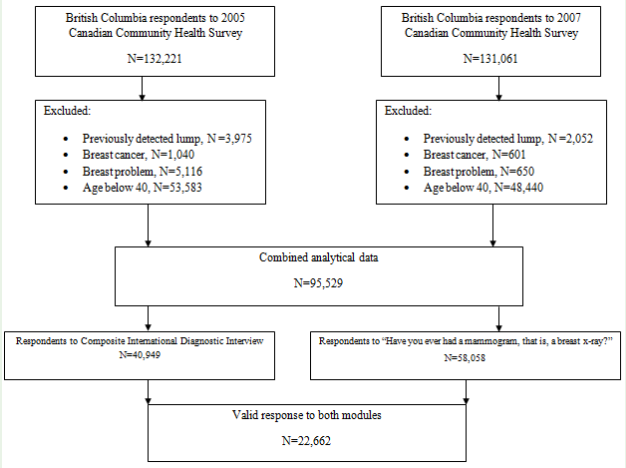

Figure 1: Derivation of study sample from two CCHS databases (CYCLE 3.1 and 4.1).

Measurement of recent mammogram screening

The outcome variable, recent mammogram screening was assessed through the question "Have you ever had a mammogram, that is, a breast x-ray?"

Measurement of depression

The key explanatory variable of interest (depression) was derived from a Short-Form scale of items from the Composite International Diagnostic Interview (CIDI-SF). The CIDI-SF uses a point-based scoring algorithm that incorporates the number of symptom-based criteria necessary to diagnose depression. This widely used structured instrument produces diagnoses according to the definitions and criteria of the Diagnostic and Statistical Manual of Mental and Behavioral Disorders (ICD-10) [20]. Scores on the CIDI-SF scale range from 0 to 8, with higher scores indicating higher levels of depression. Individuals were categorized into two groups based on scores of <5 (not depressed) or ≥ 5 (depressed). Individuals with a score of ≥5 are considered to have at least a 90% probability of being diagnosed as having experienced a major depressive episode in the past 12 months [21].

Covariates

Several variables were included in the analysis of depression and mammography to adjust for potential confounding effects. These variables included age (40-49, 50-59, 60-69, 70-79 and 80+ years), marital status (married/common law, widowed/separated/divorced, single/never married), household income distribution (deciles), education (less than high school, high school graduate, some post-secondary education, post-secondary graduate) and cultural/racial

status (white vs. visible minority). Household distribution of income is categorized into 10 deciles, where decile 1 equals being in the 10% of households with the lowest income compared to the national level, and decile 10 incomes being the other end of the scale. Health seeking behaviors included of two questions: whether the individual has a regular doctor (Yes/No), and number of consultations with a family physician/general practitioner in the previous year.

Analysis

Analysis was conducted using SAS version 9.1 for Windows (SAS Institute, Cary, NC). Unadjusted analysis was performed to assess the relationship between mammogram screening and depression, as well as survey covariates. A Chi-square test was used to estimate the differences between categorical variables and an ANOVA test was used to obtain the association between number of physician visits and mammogram screening. Forward multivariate logistic regression modeling was conducted to examine the relationship between depression and the outcome variable, mammogram screening behavior, adjusted for potential confounders. To develop this model, variables having statistically significant associations with the mammography screening behavior (such as socio-demographic characteristics and health service-use) were entered sequentially. After each addition, variables that were not significant were considered for removal. The final model included the key explanatory variable-depression-as well as all of the statistically significant variables. Adjusted Odds Ratio (AOR) and 95% CI were reported after testing for co-linearity and interactions. A subgroup analysis of age was undertaken. Weighted estimates are reported and probability weights are included in the analyses [20].

Results

Sixty-one percent of women aged 40 and above without a history of breast cancer, mastectomy, lump or any other problem with their breast reported ever having a mammogram.

Baseline Characteristics

Distributions of baseline characteristics are presented in Table 2. Approximately 5.4% of women in the sample were characterized as having depression. The majorities of women were married (67.5%), post-secondary graduates (65.7%), and white (90.4%). The largest percentage of women with depression was found in the first two household income deciles (24.4%). The vast majority had a regular family doctor (91.4%) and the mean number of consultations with a family physician in the previous year was 4.3(±8.6 SD). Associations between depression and all potential confounders were assessed and all variables were considered as potential confounders.

Unadjusted analysis

In the unadjusted analyses, all the measured baseline characteristics were significantly associated with ever having a mammogram (Table 2 and 3). The odds of ever having a mammogram were 20% less for

Table 2: Baseline characteristics and bi-variable associations with mammography testing (within previous 2 years) among Canadian women aged above 50 years (without breast cancer or breast problems): CCHS CYCLE 3.1.

	Frequency (n=22,662)	%	Mammogram Yes (n=17031)	Mammogram No (n=5631)	P value
Depression					
No	21349	94.6	94.7	94.1	0.001
Yes	1313	5.4	5.3	5.9	
Socio-demographic variables					
Age group, years					
40-49	5305	33.9	22.5	64.7	
50-59	6108	28.6	33.9	14.2	
60-69	4941	18.5	23.0	6.4	<0.001
70-79	3873	12.4	14.5	6.9	
80+	2435	6.5	6.1	7.8	
Education					
< High school	5093	13.8	14.2	12.6	
High school graduate	2713	10.4	10.7	9.6	<0.001
Other post-secondary	1174	5.3	4.7	6.8	
Post-secondary graduate	12906	65.7	65.5	66.4	
Household Income Distribution					
Decile 1or 2	6001	24.4	23.4	26.9	
Decile 3 or 4	4207	21.3	21.6	20.5	
Decile 5 or 6	3338	19.2	19.2	19.8	<0.0001
Decile 7 or 8	2861	18.3	18.3	18.3	
Decile 9 or 10	2719	16.7	17.6	14.5	
Marital status					
Married/common law	11802	67.5	67.8	66.5	
Widowed/separated/divorced	8636	25.0	25.6	23.4	<0.0001
Single, never married	2288	7.5	6.6	10.1	
Ethnicity					
White	21152	90.4	91.8	86.9	<0.0001
Visible minority	1378	9.56	8.2	13.1	
Regular family doctor					
No	1761	8.6	6.2	14.9	<0.001
Yes	20897	91.4	93.8	85.1	
Mean Number of consultations with family doctor/GP in previous year (SD)	4.3(±8.6)		4.4(±8.5)	3.8(±9.0)	<0.0001

Table 3: Unadjusted and adjusted ORs and 95% CI of variables associated with mammography among Canadian women aged 40 years and older: CCHS Cycle 7, 2007.

	Unadjusted OR OR	95%CI	Adjusted OR AOR	95%CI
Depression				
No	Ref	Ref	Ref	Ref
Yes	0.81	0.7-0.9	1.3	1.1-1.5
Socio-demographic variables				
Age group, years		Ref		Ref
40-49	Ref	7.2-8.1	Ref	6.5-7.9
50-59	7.6	11.3-	7.2	11.8-
60-69	12.11	12.9	13.6	15.7
70-79	7.1	6.7-7.6	7.7	6.7-8.9
80+	2.8	2.6-3.0	3.1	2.6-3.7
Education				
< High school	Ref	Ref	Ref	Ref
High school graduate	0.9	0.8-0.9	0.7	0.7-0.8
Other post-secondary	0.9	0.9-1.0	0.8	0.7-0.8
Post-secondary graduate	0.9	0.9-1.0	1.0	0.9-1.2
Household Income Distribution				
Decile 1or 2	0.8	0.8-0.9	0.5	0.4-0.5
Decile 3 or 4	1.0	0.9-1.1	0.7	0.6-.8
Decile 5 or 6	0.9	0.9-1.1	0.7	0.6-0.8
Decile 7 or 8	0.9	0.9-1.0	0.8	0.7-0.9
Decile 9 or 10	Ref	Ref	Ref	Ref
Marital status				
Married/common law	Ref	Ref	Ref	Ref
Widowed/separated/ divorced	0.5	0.4-0.5	0.9	0.8-1.0
Single, never married	1.1	1.0-1.1	0.9	0.9-1.1
Ethnicity				
White	Ref	Ref	Ref	Ref
Visible minority	0.6	0.5-0.6	0.8	0.7-0.9
Regular family doctor				
No	Ref	Ref	Ref	Ref
Yes	2.7	2.5-2.8	2.2	1.9-2.5
Mean Number of consultations with family doctor/GP in previous year (per additional consultation)	1.3	1.2-1.4	1.2	1.2-1.4

depressed women relative to non-depressed women (OR 0.8, 95% CI 0.7-0.9). Women who reported undergoing a mammogram were also more likely to be between 60-69 years of age, and be currently married/ common law. They were also more likely to be white, have education less than high school, and have a household income distribution of less than deciles 9 and 10. Moreover, the odds of having a regular family doctor were 2.7 times greater for women who reported ever having a mammogram in comparison with those who did not report having had a mammogram. The mean number of visits was higher among this group (Table 2 and 3).

Adjusted analysis

After adjusting for potential confounders and established covariates, presented in Table 2, depression was no longer negatively associated with mammograms, as the direction of the effect changed from unadjusted OR of 0.8 to the adjusted OR of 1.3 (95% CI 1.2-1.5) (Table 2). This change occurred following the introduction of the age variable in the model. Moreover, in the adjusted model, the odds of reported mammography varied across age strata and were higher for women 60-69 years old, compared with women in the youngest age group (40-49 years), controlling for all other variables. Consistent with the unadjusted model, the adjusted odds of reported mammography varied across various age strata. Since the effect of depression is different among different age groups, age can be considered an effect modifier. This analytical intuition was confirmed by a Cochran-Mantel-Haenszel (CMH) test. We performed CMH to test the null hypothesis that depression and reported mammography are independent when conditioned on age as the confounder. The non-significant CMH test estimate (P=0.925) suggested that there is no association between depression and mammograms after controlling for age. A Breslow-Day test for homogeneity of the odds ratios was found to be significant (P<0.0001) suggesting the evidence that OR's differ across age strata. Therefore, reporting the summary OR for the association between depression and reported mammograms is not feasible.

Table 4: Adjusted Odds Ratios (AOR) and 95% confidence intervals (95%CI) of the association between depression and ever having a mammogram done among Canadian women stratified by age group, Canadian Community Health Survey Cycle 3.1 and 4.1, 2005 and 2007.

Age group	AOR	95%CI
40-49	1.5	1.2-1.8
50-59	0.8	0.6-1.1
60-69	2.9	0.9-8.6
70-79	1.0	0.4-2.4
80+	0.5	0.1-2.4

We performed an analysis stratified by age group to test for possible effect modification of the association between depression and reported mammograms. As shown in Table 4, age group was an effect modifier of this relationship. The odds of reporting mammography was 2.9 times greater for depressed women aged 60-69 compared with their non-depressed counterparts with a wide CI (95% CI 0.9-8.6). Among seniors (aged 70-79) the relationship between depression and reported mammograms was not significant (AOR 1.0; 96% CI 0.4-2.4). The odds of reported mammograms for depressed women between 50-59 years of age were 0.8 compared to their non-depressed counterparts (95% CI 0.6-1.1) but this association was non-significant. The same protective effect was observed for women more than 80 years of age (AOR 0.5, 95% CI 0.1-2.4). The odds of reported mammography receipt were 50% higher for 40-49 year olds than all other age groups.

All other measured socio-demographic characteristic maintained significant associations as well as direction of effect except marital status and post-secondary education, which lost their significance as the CI crossed one for both variables (Table 3). Having a regular family doctor remained strongly associated with reported mammography (OR 2.2 95% CI 1.9-2.5).

Discussion

Our study set out with the aim of assessing the association between depression and reported mammograms. In contrast to earlier findings, depressed Canadian women were more likely to report mammography compared with non-depressed women after controlling for confounding variables. The majority of studies with

a cross-sectional design, clinical [22] or community-based [15,23], suggest that depression is associated with reduced breast cancer screening. For example, a Canadian population-level study reported a lower rate of mammography compliance among depressed women [19]. This CCHS study (Cycle 2.1) was limited to the Ontario population (n=4042) aged 50 to 68.

A longitudinal Canadian National Population Health Survey (1996-2004), however, failed to find evidence that depression is an important determinant of participation in preventive health care activities [24]. Similar to our study, they used CIDI-SF to identify depressed women and analyzed data from 1868 women aged 50-69. Our nation-wide cross-sectional survey provided a much bigger sample size with a broader range of age categories.

We also found that age modified the effect of depression on reported mammograms. Depressed older women (aged 50-80+) were more likely to report a mammogram compared with their younger counterparts (40-49 years old). Sub analysis by age suggested that 60-69 year old depressed women had the highest OR of reported mammograms (2.9, 95% CI 0.9-8.6). The same pattern was observed for 40-49 years old with lower OR (2.9 vs. 1.5) but tighter CI (95% CI 1.2-1.8).

A Canadian study of CCHS data also reported an age-interaction between depression and reported screening. Their finding, however, was inconsistent with ours as reduced testing was reported for the 40-59 age groups [25].

Several reasons can be given for our results. A previous Canadian task force on preventive health care [26] recommended against routine screening. However, individual decision making about screening following consultation with a physician was advised. Increased odds among the younger age group (40-49) could be contemplated as a push factor for breast screening imposed by the patient or primary care physician. A physician may be in an optimal position to intervene in screening outcomes among depressed women. Alternatively, women who report recent symptoms of anxiety or phobia [27] are more likely to accept an invitation for a screening [28]. Having a regular family doctor was the strongest independent predictor of reported mammograms in our study, further justifying this conclusion. It is also possible that women developed symptoms of anxiety and depression following diagnosis of a suspicious outcome during a breast self-examination, physician examination or mammogram.

Our finding of increased odds of reported mammograms among elderly depressed women (aged 60-69) is consistent with that of an American study where women in the same age category with post depressive symptoms were more likely to undertake a mammogram [29]. This finding could be explained by a variety of reasons. First, the elderly are reputed to have higher utilization of health services, either mental health or screening services. Second, the presence of depressive symptoms is consistently associated with greater use of non-mental health services [30,31], specifically among the elderly population [32]. If psychological distress leads patients to use non-preventive health services more frequently, this may actually facilitate their use of preventive health services by providing more opportunities for routine screening tests such as mammography [33,34]. Furthermore the Canadian clinical practice guideline recommends screening every two to three years for women in this age group. Third, elderly women are more prone to other screening demands such as counseling for early or late menopausal complications, other clinical disease prevention and other cancer screening measures. Thus, in the light of these demands, physicians have more opportunity to discuss screening for breast cancer. Finally, another explanation for the positive association between depression and reported mammograms in our study is that younger (40-49) and older (60-69) women with abnormal breast self-examination, or who receive warnings from their physician, may experience depression of a serious enough nature to be detected through the CIDI-SF. Similarly, other mood effects such as anxiety could compete with depression.

Several elements of our study strengthen its contribution to existing literature. First, we used nationally representative population-based data from 2005-2007. The high response rate of the community-based CCHS surveys from two cycles (3.1 and 4.1) and from 12 different regions argues that the results can be generalized to the population of Canada and perhaps other developed countries with similar screening guidelines and procedures. Second, the large sample size allowed for adjustment of known and important confounders while maintaining sufficient power to detect associations between depression and reported mammograms. Third, a standardized measure of depression, CIDI-SF, is used to identify the exposure group. This is a valid and reliable method that is widely used to produce diagnoses according to the criteria of the Diagnostic and Statistical Manual of Mental and Behavioral Disorders. Furthermore, a rigorous definition of depression is used (CIDI-SF score of ≥5) to classify depressed subjects. Finally, according to Canadian Screening guidelines, mammography and mental health care are publicly funded services that at least in theory should provide better access to services, limiting the effect of inaccessibility and providing a better picture of the association between depression and mammography screening. This point further provided us with the opportunity to freely assess the utilization of screening services.

Limitations of our study should also be acknowledged. First, the CCHS survey is a cross-sectional study, which prevents us from determining causality between depression and mammogram screening. Second, it is not apparent whether severe depression is associated with non-response to the CCHS survey. Thus, the findings might not be applicable to the most severely depressed population. It is equally likely that women who are severely depressed may also be the ones who are the least likely to undergo mammography screening. Third, self-reported mammography is prone to recall bias. Although we cannot verify the medical records to obtain this claim, the long process of registration, making an extra appointment and visiting the radiology department to undergo mammography makes it unlikely to be falsely reported. Fourth, the reported mammogram is derived from the question "have you ever had a mammogram" while depression was assessed within the last 12 month of CCHS study period. It is therefore possible that women had a different depression status at that time unrelated to their compliance to mammogram screening.

Conclusion

This large population-based study adds to evidence that depression is positively associated with screening mammograms and age has an interaction in this relationship. Longitudinal studies can better estimate this effect. There might be other competing factors such as anxiety at play in the relationship between depression and reported mammography. Increased utilization of public health

services for screening purposes among the depressed elderly on its own or as a result of increased risk of depression in elderly women could partly explain our findings. Further studies should focus on emotions such as cancer fear, anxiety, or worry that might affect the association between depression and adherence to screening. Indications for mammogram screening among elderly women should be checked against the frequency of visits to physicians.

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