2009 STUDENT AWARD WINNER

Detection of Later Stage Breast Cancer in First Nations Women in Ontario, Canada

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ABSTRACT

Objective: To compare the distribution of stage at breast cancer diagnosis between First Nations (FN) and non-FN women, and to investigate factors associated with later diagnosis in FN women.

Methods: A case-case design was employed to compare FN women (N=287) to a frequency-matched random sample of women (N=671) from the general population diagnosed with breast cancer in the Ontario Cancer Registry. Women were matched (2:1) on period of diagnosis (1995-1999, 2000-2004), age at diagnosis (<50 vs. ≥50), and Regional Cancer Centre (RCC). Stage and data relevant to the determinants of stage were collected from medical charts at the RCCs. The association between stage (stage II+ vs. I) and FN status was modeled using logistic regression analyses; for FN women, the association between risk factors and stage was examined.

Results: FN women (66%) were diagnosed with a later stage significantly more often than non-FN women (56%). FN women with a non-screened cancer (OR 5.03, 95% CI 2.48-10.21) and those who were overweight or obese (OR 2.98, 95% CI 1.27-6.98 and OR 4.46, 95% CI 1.95-10.21, respectively) were significantly more likely to be diagnosed at a later stage. Having a comorbidity reduced the odds of a later stage (OR 0.51, 95% CI 0.27-0.96) in FN women.

Conclusion: This study demonstrates the need for FN women, in particular those who are not accessing the health care system, to participate in breast screening programs aimed at detecting breast cancers earlier with a better prognosis. These findings suggest that the cancer care system in Ontario should better target this population through increasing awareness and access to screening.

Key words: Breast neoplasms; diagnosis; risk factors; Indigenous population; Ontario

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

Breast cancer is the most common cancer among women in Ontario, with an estimated 8,700 cases diagnosed in 2009.[1] The age-standardized incidence rate for breast cancer among Ontario women is 102 per 100,000.[1] While this rate has stabilized across the province, that is not the case for all populations within the province. In fact, while still significantly lower than in the general population, the incidence of breast cancer in Ontario's First Nations (FN) people is increasing,[2] and "survival following a diagnosis is significantly worse" (Dr. Loraine Marrett, April 27, 2009). Little research has been conducted investigating cancer patterns of Indigenous populations (including FN, Métis or Inuit populations) in Canada. When examined, lower incidence and mortality rates for Indigenous compared to non-Indigenous populations are found for all cancers combined and for many specific sites.[2-5]

Increasingly, there is a growing literature outside of Canada on breast cancer prognosis comparing Indigenous to non-Indigenous populations within the same geographical area. All of these studies found poorer breast cancer survival among the Indigenous populations.[6-15] Some studies comparing the distribution of stage at diagnosis have found the Indigenous populations were more often diagnosed at a later stage than respective non-Indigenous reference groups,[6,9,10,12,14,15] however others have found no difference in the distribution of breast cancer stage.[7,8,13] Since the leading determinant of breast cancer survival is the stage in which cancer is detected,[16,17] it is important to understand this distribution in a population whose incidence is on the rise.[2] The purpose of this study was to compare the distribution of stage at breast cancer diagnosis between FN and non-FN women, and to investigate factors associated with later diagnosis in FN women.

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METHODS

Study population

As race or ethnicity is not recorded in the Ontario Cancer Registry (OCR), it is not possible to routinely estimate cancer incidence or mortality rates for any Aboriginal population directly from OCR data. Therefore, a cohort of Ontario FN people was created through linking of the OCR and mortality files with the Ontario files of FN people 'with Status' from Indian and Northern Affairs Canada (from 1968 to 1991).[2]

Our study employed a case-case design, comparing FN women diagnosed with invasive breast cancer in 1995-2004 and seen at one of Ontario's specialized cancer centres, known as Regional Cancer Centres (RCCs), with a frequency-matched random sample of general population women diagnosed in the same time period.[18] The RCCs deliver all cancer radiotherapy in the province and are often involved in the treatment and planning. All FN women satisfying study eligibility criteria were included; the general population sample were frequency matched (2:1) on the following design variables: period of diagnosis (1995-1999 and 2000-2004), age at diagnosis (<50 vs. ≥50), and RCC first attended.

Data collection

Stage and data relevant to the determinants of stage were collected from medical charts at the RCCs. Two trained chart abstractors reviewed centre charts to abstract all data elements manually between October 2007 to August 2008. A pilot test revealed 94% accuracy between the two abstractors pre-study.

Variable definitions

Breast cancer was defined as a diagnosis of primary invasive breast cancer of any histological type. We utilized the American Joint Committee on Cancer TNM classification scheme for staging breast cancers.[19] The TNM system is an expression of the anatomic extent of disease and is based on three components: T- the extent of the primary tumour, N- the absence or presence and extent of regional lymph node involvement and M- the absence or presence of distant metastasis. Stage at diagnosis was aggregated into a binary variable (stage I and stages II+). Distance to RCC was computed by calculating the straight line distance (to the nearest kilometre) between a RCC and a woman's residence (postal code) at diagnosis.[20] Method of detection was grouped as 'screened' for women whose breast cancer was detected through participation in either routine mammography or the Ontario Breast Screening Program. Those considered 'not screened' included women whose breast cancer was detected by themselves, by a physician or other health professional. Family history was defined as having a first-degree relative with breast cancer and/or ovarian cancer. Body mass index was calculated as weight in kg divided by height in m^2 and was defined as (normal weight = BMI <25kg/m^2; overweight = BMI ≥25 to <30kg/m^2; obese = BMI ≥30kg/m^2).[21] Comorbidity was defined as having concurrent health conditions at the time of diagnosis that are likely to influence the probability of mortality, decrease the adherence to the treatment regime or result in procedural or drug contraindication. The 17 conditions considered were those specified in the Charlson index.[22] Because of the risk of current and/or former active cigarette smoking on breast cancer survival,[23] we grouped all the 'ever smokers' together.

Table 1. Distribution of Design Variables Used for Matching of First Nations and Non-First Nations Women Diagnosed with Breast Cancer between 1995-2004 in Ontario, Canada

Factors	First Nations Women (n=287) N (%)	Non-First Nations Women (n=671) N (%)
Age at diagnosis (years)		
<50	104 (36)	242 (36)
≥50	183 (64)	429 (64)
Mean (sd)	55.9 (12.8)	57.7 (14.1)
Year of diagnosis		
1995-1999	136 (47)	317 (47)
2000-2004	151 (53)	354 (53)
Regional Cancer Centre		
Southern Centres		
Ottawa Hospital Cancer Centre	21 (7)	51 (8)
Cancer Centre of Southeastern Ontario (Kingston)	34 (12)	78 (12)
Odette Cancer Centre (Toronto)	16 (6)	33 (5)
Princess Margaret Hospital (Toronto)	18 (6)	32 (5)
Juravinski Cancer Centre (Hamilton)	54 (19)	117 (17)
Southwest Regional Cancer Centre (London)	23 (8)	57 (8)
Windsor Regional Cancer Centre	2 (1)	5 (1)
Northern Centres		
Northeast Regional Cancer Centre (Sudbury)	61 (21)	141 (21)
Northwestern Regional Cancer Centre (Thunder Bay)	58 (20)	157 (23)

Statistical analysis

The distribution of design variables used for matching, including age at diagnosis (<50 vs. ≥50), period of diagnosis (1995-1999, 2000-2004), and RCC location (see list in Table 1), was compared between FN and non-FN women using a Pearson chi-square test. Logistic regression analyses examined associations of FN status with stage (I and II+) at breast cancer diagnosis, and method of detection (screened, non-screened), since it is an important determinant of stage, as well as potential confounders (including distance to a RCC, BMI, comorbidity, and smoking status). Odds ratios (OR) and corresponding 95% confidence intervals were computed from models adjusted for matching variables. The primary OR of interest relating stage to FN status was also estimated in multivariate analysis adjusted for matching variables, method of detection and potential confounders.

For FN women, exploratory unadjusted and multivariate models were developed to examine the association of stage at diagnosis with variables of interest (including distance to a RCC, method of detection, BMI, and comorbidity). All analyses were conducted using SAS version 9.1 (SAS Institute) and statistical significance of all tests was evaluated using two-sided p-values.

Ethical approval was obtained from the Human Subjects Ethics Review Committee of the University of Toronto. In addition, ethics for the chart abstractions was obtained from universities and hospitals affiliated with each of the RCCs.

RESULTS

We identified 309 eligible FN women in the OCR diagnosed in 1995-2004, compared to 55,501 women diagnosed with breast cancer in the same time period and age range in the general population. Charts were available for 287 (93%) of the FN women, and 671 (90%) of the selected 743 non-FN women.

The distribution of matching variables was similar between the FN and non-FN women (Table 1). In logistic regression analyses, adjusted only for the matching variables, a statistically significant

Table 2. Odds Ratios (OR) and 95% Confidence Intervals (CI) Comparing Stage at Diagnosis (Stage I vs. II+) and Risk Factors between First Nations and Non-First Nations Women Diagnosed with Breast Cancer between 1995-2004 in Ontario, Canada (n=958)

Diagnostic Factors	First Nations Women (n=287) N (%)	Non-First Nations Women (n=671) N (%)	Adjusted‖ OR (95% CI)	Adjusted¶ OR (95% CI)
Stage at diagnosis				
Stage I	95 (34)	284 (44)	1.00	1.00
Stage II+	188 (66)	366 (56)	1.55 (1.16-2.08)‡	1.21 (0.81-1.81)
Unstageable	4	21		
Method of detection				
Screened	64 (23)	192 (30)	1.00	1.00
Non-screened	217 (77)	456 (70)	1.51 (1.08-2.13)§	1.51 (0.96-2.37)
Unknown	6	23		
Distance to Regional Cancer Centre				
0-15 km	53 (18)	266 (39)	1.00	1.00
>15-100 km	98 (34)	217 (32)	2.11 (1.41-3.14)†	2.12 (1.27-3.54)†
>100 km	136 (47)	188 (28)	5.18 (3.39-7.90)*	5.09 (3.03-8.56)*
Body mass index (BMI)				
Normal weight (<25kg/m²)	44 (17)	211 (37)	1.00	1.00
Overweight (≥25 to <30kg/m²)	85 (33)	194 (34)	2.22 (1.46-3.39)†	2.46 (1.49-4.07)†
Obese (≥30kg/m²)	128 (50)	163 (29)	3.98 (2.64-6.00)*	3.80 (2.32-6.23)*
Unknown	30	103		
Comorbidity				
No	180 (64)	534 (82)	1.00	1.00
Yes	102 (36)	118 (18)	2.80 (2.01-3.90)*	2.48 (1.60-3.86)*
Unknown	5	19		
Smoking status				
Never smoker	81 (32)	296 (51)	1.00	1.00
Ever smoker	172 (68)	284 (49)	2.21 (1.62-3.02)*	2.34 (1.60-3.43)*
Unknown	34	91		

Unknown and unstageable data are not included in the statistical tests.
‖ Models were adjusted for age at diagnosis, period at diagnosis, and RCC
¶ Model was adjusted for age at diagnosis, period at diagnosis, stage at diagnosis, method of detection, distance to RCC, BMI, comorbidity, and smoking status
* p-value <0.0001
† p-value <0.001
‡ p-value <0.01
§ p-value <0.05

Table 3. Odds Ratios (OR) and 95% Confidence Intervals (CI) for Risk of Stage of Breast Cancer Diagnosis (Stage II+ vs. Stage I) in First Nations Women (n=212) Diagnosed between 1995-2004 in Ontario, Canada

Diagnostic Factors	Unadjusted OR (95% CI)	Adjusted‖ OR (95% CI)
Age at diagnosis (years)		
≥50	1.00	1.00
<50	1.88 (1.10-3.22) §	1.05 (0.53-2.10)
Method of detection		
Screened	1.00	1.00
Non-screened	4.02 (2.24-7.22)*	5.03 (2.48-10.21)*
Distance to Regional Cancer Centre		
0-15 km	1.00	1.00
>15-100 km	0.95 (0.47-1.91)	0.85 (0.37-1.96)
>100 km	1.39 (0.71-2.73)	1.56 (0.70-3.47)
Body mass index (BMI)		
Normal weight (<25kg/m²)	1.00	1.00
Overweight (≥25 to <30kg/m²)	2.24 (1.05-4.79)§	2.98 (1.27-6.98)§
Obese (≥30kg/m²)	3.03 (1.47-6.26)†	4.46 (1.95-10.21)†
Comorbidity		
No	1.00	1.00
Yes	0.59 (0.36-0.99)§	0.51 (0.27-0.96)§

‖ Model was adjusted for age at diagnosis, method of detection, distance to RCC, BMI, and comorbidity
* p-value <0.0001
† p-value <0.001
‡ p-value <0.01
§ p-value <0.05

association was found for FN status and later stage at diagnosis (OR 1.55, 95% CI 1.15-2.08). FN women (66%) were more likely to be diagnosed at a later stage than non-FN women (56%). Other significant associations revealed that non-FN women were more likely to have their breast cancer diagnosed by screening than FN women, FN women traveled further to a RCC compared to non-FN women, FN women were more likely to have a higher BMI, presence of comorbidity and a history of smoking (Table 2).

After controlling for the design variables, method of detection and potential confounders, the OR estimate for stage is reduced from 1.55 to 1.21 and while still suggesting an increased odds of later stage of diagnosis for FN women, this is no longer statistically significant (Table 2). Results of distance to RCC, BMI, comorbidity and smoking status remained significant in the multivariate analysis.

Unadjusted models demonstrated that age of diagnosis, method of detection, BMI, comorbidity and smoking status were independently associated with stage at diagnosis (stage II+ vs. stage I) for FN women (Table 3). The multivariate analysis modeling stage in FN women shows that women who were not screened were 5 times more likely to detect their breast cancer at a later stage (OR 4.97, 95% CI 2.44-10.15). FN women with above normal weight at diagnosis had about a 3 to 5 times increased odds of a later diagnosis. The presence of comorbidity was significantly associated with reduced odds of a later stage for breast cancer diagnosis (OR 0.51, 95% CI 0.27-0.96).

DISCUSSION

This study reveals that in Ontario between 1995-2004, FN women were diagnosed with a later stage of breast cancer more often than non-FN women. These findings are consistent with those of previous studies investigating other Indigenous populations in Australia, New Zealand and the United States.[6,9,10,12,14,15,24]

Determinants of breast cancer stage at diagnosis have not previously been studied in Canadian Indigenous populations. In the Ontario FN population, significant associations were found for later stage with detection method, BMI and comorbidity. Although screening by mammography is a known determinant of stage irrespective of race or ethnicity,[25] as was supported by our findings, we

found that FN women were more likely to be diagnosed with a non-screened cancer. This warrants further investigation of screening practices, including increasing education in FN communities and improving access for FN women in Ontario.

Consistent with our results, BMI has also been determined to impact later stage at diagnosis in an urban Native American population.[9] In addition, as we found with Ontario FN women, increased levels of BMI have been reported in other Indigenous populations and have been recognized as a determinant of disease in these populations.[26]

Twice as many FN women had at least one comorbidity at diagnosis compared to non-FN women, and the most reported condition was diabetes, occurring in 23% of FN and 7% of non-FN women. However, the presence of comorbidity reduced the risk of later stage of breast cancer diagnosis. Similar analysis using the non-FN sample of women found that the presence of comorbidity significantly increased the risk of a later stage at diagnosis (results not shown). The literature has suggested associations between certain types of comorbidities and stage at breast cancer diagnosis. In an analysis of the Surveillance, Epidemiology and End Results program data in the United States, women with cardiovascular conditions had a reduced risk of later stage diagnosis, compared to women with, for instance, diabetes who had an increased risk of later stage breast cancer.[27] This is not consistent with our finding among FN women and therefore this result warrants further exploration of this relationship. Our findings do suggest possible differential use of the health care system by FN and non-FN women in Ontario. System and personal characteristics such as a lack of continuity of care, high health care worker turnover,[28] perceived care options,[29] low awareness of early symptoms, tardiness in seeking medical advice,[24] and a lack of culturally appropriate screening programs[30] have all been identified as barriers to cancer care in an Indigenous context. Health promotion programs may need to better target FN women, in particular those who are not accessing the health care system, to promote increased awareness and participation in screening programs in order to detect cancers when they are small and more curable.

There were a few limitations in this study. Only women who attended a RCC were eligible for inclusion (85% of all FN and 80% of all non-FN women with breast cancer during this study period). Ethnicity was identified from a database linkage, therefore the non-Status FN population could have included other FN women. However, upon abstraction of medical charts, we identified only one non-FN woman as being 'Aboriginal'. Second, although we collected information on distance to a RCC, we did not have access to data on distance to a screening centre, which may have been a more important factor for stage at diagnosis.

Stage at diagnosis is the most important determinant of breast cancer survival and the findings from this study that Ontario FN women are more likely to be diagnosed at a later stage than non-FN women, may explain the poorer survival rate observed in FN women. Other factors, with observed differences between FN and non-FN women may contribute to the differential survival. Future study is needed to identify survival determinants in FN women adjusting for stage at diagnosis.

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RÉSUMÉ

Objectifs : Comparer la répartition des stades du cancer du sein au moment du diagnostic entre les femmes membres des Premières nations (PN) et les femmes qui n'en sont pas membres (non-PN), et étudier les facteurs associés au diagnostic tardif chez les femmes des PN.

Méthode : Nous avons mené une étude cas-cas pour comparer les femmes des PN (n=287) à un échantillon aléatoire apparié selon la fréquence, composé de femmes (n=671) de la population générale ayant un diagnostic de cancer du sein selon le Registre d'inscription des cas de cancer de l'Ontario. Les femmes ont été appariées (2:1) selon la période du diagnostic (1995-1999, 2000-2004), l'âge au diagnostic (<50 ans ou ≥50) et le Centre régional de cancérologie (CRC). Le stade et les données liées aux déterminants du stade ont été obtenus dans les dossiers médicaux des CRC. L'association entre le stade (stade II+ ou stade I) et l'appartenance ou non aux PN a été modélisée par régression logistique; pour les femmes des PN, nous avons examiné l'association entre les facteurs de risque et le stade.

Résultats : Les femmes des PN (66 %) ont été diagnostiquées à un stade plus tardif significativement plus souvent que les femmes non-PN (56 %). Les femmes des PN ayant un cancer non dépisté (RC 5,03, IC 95% 2,48-10,21) et celles qui faisaient de l'embonpoint ou qui étaient obèses (RC 2,98, IC 95% 1,27-6,98 et RC 4,46, IC 95% 1,95-10,21, respectivement) étaient de manière significative plus susceptibles de recevoir un diagnostic à un stade plus avancé. La présence d'une comorbidité réduisait la probabilité d'un diagnostic tardif (RC 0,51, IC 95% 0,27-0,96) chez les femmes des PN.

Conclusion : Cette étude montre que les femmes des PN, en particulier celles qui ne font pas appel au système de santé, auraient besoin de participer à des programmes de dépistage du cancer du sein qui visent à détecter ces cancers plus tôt pour en améliorer le pronostic. Le système de soins en cancérologie de l'Ontario devrait donc mieux cibler cette population en améliorant la sensibilisation et l'accès au dépistage.

Mots clés : tumeurs du sein; diagnostic; facteurs de risque; population indigène; Ontario

Approches et pratiques en évaluation de programme
Par Valéry Ridde et Christian Dagenais (éds.). Montréal, QC : Les Presses de l'Université de Montréal, 2009; 360 pp.

Mission accompli pour cet « ouvrage pédagogique » qui rassemble des textes de référence par des évaluateurs experts reconnus aussi bien que des exemples de pratiques évaluatives dans différents contextes. Voilà un livre-ressource, un livre-outil, exhaustif et convivial. Exhaustif, les approches émergentes trouvent leur place à coté du rappel des notions de base. Convivial, les textes sont assortis de schémas, de tableaux synthèse, de références pour « aller plus loin ». On apprécie le « Glossaire », la « Bibliographie », mais combien on regrette l'absence d'un « Index » des thèmes et des auteurs.

Un grand mérite de cet ouvrage est de rappeler d'entrée de jeu la diversité des approches et des outils en évaluation de programme. L'ensemble des chapitres répond bien à cette volonté de présenter le champ de l'évaluation de programme comme un univers diversifié à l'intérieur duquel l'évaluateur est appelé à effectuer des choix conceptuels, stratégiques et méthodologiques. Au-delà de la maîtrise des schémas expérimentaux et des techniques, l'évaluation se fonde d'abord sur un ajustement réussi entre un protocole d'évaluation et une question formulée à propos d'un objet d'évaluation et dans un contexte particulier. En ce sens, l'ouvrage de Ridde et Dagenais représente un « manuel » en français, polyvalent, hors discipline, qui vient combler un vide comme soutien à l'enseignement de l'évaluation.

Mais il y a plus. L'évaluation de programmes, sous ses différentes formes, est maintenant intégrée à la culture des organisations. À coté de ses fonctions reconnues pour la planification et la prise de décision, elle accompagne maintenant les organisations apprenantes ou les processus de gestion intégrée de la qualité. Elle intéresse des publics de plus en plus larges, désireux de se familiariser de façon rapide et efficace à ses approches et à ses méthodes. Ce livre sur les *Approches et pratiques en évaluation de programme,* c'est aussi un compagnon indispensable, pour l'évaluateur occasionnel, le promoteur, le client ou le participant de l'évaluation.

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