

Papanicolaou test utilization and frequency of screening opportunities among women diagnosed with cervical cancer

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ABSTRACT

Background: Although the importance of Papanicolaou (Pap) smear test screening in reducing the incidence of cervical cancer is well established, in 1994–95 one in 4 women in Manitoba aged 18 to 69 years reported never having had a Pap test or not having had a Pap test in the last 3 years. The objectives of this study were to examine the screening history of women in Manitoba diagnosed with invasive cervical cancer and to explore whether opportunities for screening were missed.

Methods: In this case-control study women aged 18 years and older who resided in Manitoba and were diagnosed with invasive cervical cancer between 1989 and 2001 were each matched by age and area of residence to 5 controls, (N = 4009). Conditional logistic regression analyses were used to examine the association between Pap test utilization and the likelihood of diagnosis with invasive cervical cancer. Generalized linear models using the negative binomial distribution were used to assess the association between cancer status and rates of prior Pap testing and of opportunities to be screened. Logistic generalized estimating equation models were used for the analysis of physician characteristics.

Results: Forty-six percent of women in Manitoba diagnosed with invasive cervical cancer and 67% of the control group had received a Pap test in the 5 years before the case's diagnosis. After adjustment for age, income and residence, the rate of Pap testing was significantly higher in the control group (rate ratio [RR] = 1.57, 95% confidence interval [CI] 1.44–1.73). Conversely, when cervical cancer was the outcome, women who had not had Pap tests were more likely to be diagnosed with invasive cervical cancer (odds ratio [OR] = 2.77, 95% CI 2.30–3.30) than women who did have a Pap test. Although women diagnosed with invasive cervical cancer had fewer Pap tests, they had had as many opportunities to be screened as controls (RR = 1.04, 95% CI 0.96–1.12). Compared with urban family physicians, rural family physicians were less likely to provide Pap tests (OR = 0.68, 95% CI 0.58–0.80) and specialists were more likely to provide Pap tests (OR = 1.70, 95% CI 1.30–2.22).

Conclusions: Women who were diagnosed with invasive cervical cancer in the province of Manitoba, Canada, had fewer Pap tests but the same frequency of opportunities to be screened as matched controls. These results reinforce the need to educate women about cervical cancer screening and the importance of receiving Pap tests.

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ALTHOUGH RATES OF CERVICAL CANCER ARE LOW IN Canada, the incidence of the disease could be further reduced by the detection of precursor lesions and early-stage cancers in large populations of asymptomatic women through screening with the Papanicolaou (Pap) test,¹ promoting Pap testing among women and physicians, and appropriately following up abnormal results.² Despite the evidence that screening using a Pap test decreases the incidence of cervical cancer, and in spite of efforts to promote Pap testing, 1 in 4 women aged 18 to 69 who participated in Statistics Canada's 1994–95 National Population Health Survey reported never having had a Pap test or not having a Pap test in the last 3 years.³

Several reasons have been identified in the literature as to why women do not obtain cervical cancer screening. Patient factors that influence screening include socioeconomic and demographic characteristics, and knowledge and attitudes about cervical cancer.^{1,4–9} The probability of being screened tends to increase with education and income, and is lower for non-Canadian born women, those who do not speak English and those who have negative beliefs about cancer.^{6,8,9} System and physician factors that influence screening include lack of regular health care, patients' inability to access screening services, and missed opportunities to screen by health care providers.¹⁰ "Missed opportunities" are instances when a woman has contact with a health care provider but the provider does not perform or recommend the screening test when it would be appropriate to do so.¹⁰ Physician characteristics that have been associated with missed opportunities to provide preventive care such as a Pap test include type of specialty, education, physician gender and practice location.^{11–14}

The objectives of this study were to examine the screening history of women diagnosed with invasive cervical cancer, to explore whether there were missed opportunities for screening and to investigate the influence of physician characteristics on Pap test utilization in the province of Manitoba.

Methods

Study design and population. This study used a case-control design. Cases included all women 18 years of age and older residing in Manitoba who were diagnosed with invasive cervical cancer between 1989 and 2001. Eighteen years of age was chosen as a cut-off, as this is the youngest target age for the Manitoba Cervical Cancer Screening Program. Five controls were selected for each case. Women who had ever had cervical cancer or malignant neoplasms, excluding non-melanoma skin

cancer, or who had had a total hysterectomy during the study period, were excluded. Only cases and controls who were Manitoba residents for the entire period from 1984 to 2001 were included (1984 was chosen to provide at least 5 years of data on cases diagnosed in 1989). Cases and controls were matched by age (± 1 year) at the index date, and by area of residence at the time of the case's diagnosis using the forward sortation area (FSA) (i.e., the first 3 characters of the postal code). Residence was also determined at the time of the case's diagnosis. Urban residence included the cities of Winnipeg, Brandon, Portage and Thompson, each of which has a population of at least 10 000. All other areas of the province were considered rural. Ethics approval was received from the Health Research Ethics Board at the University of Manitoba and the Health Information Privacy Committee (HIPC) at Manitoba Health. This study was supported by a grant from the CancerCare Manitoba Foundation.

Data sources. Cases of cervical cancer were identified through the Manitoba Cancer Registry (MCR), while controls were identified through the Manitoba Health Insurance Plan Registration (MHPR) file. The MCR is a population-based registry that records all new cancer patients who are Manitoba residents at the time of diagnosis. The provincial Department of Health maintains the MHPR for the purpose of administering the Manitoba Health Insurance Plan. Manitoba residents are not required to pay a premium for health insurance, which ensures that virtually everyone in the province is included in the MHPR. A record on the MHPR is created when a person registers with the health insurance system. The record includes a termination date and code when a person dies or moves out of the province.

The Manitoba Physician Claims Database was used to determine Pap test utilization and hysterectomy status. This database is generated by claims filed by physicians for payment of services and includes a billing tariff code and the date of service. All 7 possible Pap test tariff codes were used in this study, including the code that laboratories use to receive payment. Although Manitoba Pap test guidelines recommend that women have a Pap test at least once every 2 years following 3 consecutive normal results on annual Pap tests,¹⁵ we chose a 5-year interval because not all women are screened according to the recommended guidelines. The 5-year time frame was intended to allow a sufficiently long interval in which screening could take place.

Physician data — including specialty, gender, graduation date and graduation location (Canadian v. foreign graduate) — were abstracted from the Physician Master File, which is a list of all Manitoba physicians with a billing number. A brief analysis of Pap test

frequency and physician type revealed that family practitioners, internal medicine specialists, obstetrician/gynecologists, general surgeons, emergency medicine physicians and pediatricians provided 99.99% of all Pap tests. Therefore, only physicians in these areas of practice were included in the study (N = 2419).

Data derived from the 1996 Canadian Census were used to estimate the patient's income at the time of diagnosis by average household income per enumeration area (approximately 500 to 600 individuals and 150 to 200 households).

Opportunity to be screened. An opportunity to be screened was defined as any visit to a physician made during the 5 years before the diagnosis of the case, excluding visits that occurred fewer than 10 months after a Pap test; any visit during this time frame was not considered an opportunity to be screened because the woman did not need a screening Pap test. The 6 months before the diagnosis of the case was also excluded, to rule out Pap tests that might have been done for diagnostic rather than screening purposes.

Data analysis. Generalized linear regression models using the negative binomial distribution were conducted to assess the association between cancer status and rates of prior Pap testing and rates of opportunities to be screened (i.e., a matched cohort analysis). When invasive cervical cancer was treated as a dependent variable (i.e., case-control design), we conducted a conditional logistic regression analysis to examine the association between Pap test utilization and invasive cervical cancer. We tested for an interaction between region of residence and income, because other research in Manitoba has found this to be significant.¹⁶ For analyses examining physician characteristics, logistic generalized estimating equation models using an independent correlation matrix to account for correlated data within the dataset were conducted. This allowed for unbiased estimates of the association between the likelihood of having a Pap test at any given visit and various physician characteristics. Data analyses were performed using SAS Version 9.1 (SAS Institute, Cary, NC).

Results

Rate of Pap testing. A total of 4009 women were included in the study (666 cases and 3343 controls). The mean age at the time of diagnosis of invasive cervical cancer was 50 years. The mean income was \$39 175 for cases and \$42 280 for controls. Although cases

and controls were matched by area of residence using postal code FSAs, average income is slightly different because it is based on enumeration areas, which are smaller than FSAs.

In the 5-year period before the diagnosis date of the case — excluding the 6 months before diagnosis — 63% of all women in the study received at least one Pap test, but this incidence was unevenly distributed between cases and controls (Table 1). Only 46.4% of cases had received a Pap test, compared with 66.8% of controls. The mean number of Pap tests over the 5-year period was 0.87 for cases and 1.38 for controls. The mean number of Pap tests for women who had received at least 1 Pap test was 2.62 for cases and 2.66 for controls.

After adjustment for age, income and residence, the rate of Pap tests was found to be significantly higher for controls than for cases (rate ratio [RR] = 1.57, 95% confidence interval [CI] 1.44–1.73) (Table 2). The rate of Pap tests decreased with age (RR = 0.80, 95% CI 0.78–0.81) and increased with income (RR = 1.06, 95% CI 1.04–1.07). Region of residence was also significant: urban women had a higher rate of Pap tests than rural women (RR 1.22, 95% CI 1.15–1.30). However, there was no interaction between region of residence and income in this analysis.

Rate of cervical cancer diagnosis. Analyses of the association between prior Pap testing and the development of cervical cancer indicated that women who had not had a Pap test in the 5 years before diagnosis were more likely to be diagnosed with invasive cervical cancer than women who had received a Pap test during that period (odds ratio [OR] = 2.77, 95% CI 2.30–3.30) (Table 3). Increasing income had an inverse effect on the likelihood of being diagnosed with invasive cervical cancer (OR = 0.78, 95% CI 0.69–0.89). The analysis did not include region of residence and age, as these variables were the basis for matching cases and controls and therefore would have no effect on the OR. However, an additional model tested the interaction between residence and income and found that the interaction was not significant.

Screening opportunities. The mean number of opportunities to be screened in the 5 years before diagnosis was 17.8 for cases and 18.2 for controls. Multivariate generalized linear analysis using the negative binomial distribution indicated no difference between cases and controls with respect to frequency of opportunities to be screened (RR = 1.04, 95% CI 0.96–1.12) (Table 4). Age at diagnosis and income both had a significant effect on frequency of opportunities to be screened; increasing age was associated with more frequent opportunities (RR = 1.20, 95% CI 1.18–1.22), while increasing income was associated with less frequent opportunities (RR = 0.94, 95% CI 0.92–0.95).

Table 1: Characteristics and Pap test utilization of study participants in the 5-year period before diagnosis of invasive cervical cancer (N = 4009)

Characteristics	Cases (n = 666)	Controls (n = 3343)
Mean age, years	50.0	50.1
Mean income, \$	39 175	42 280
Rural residence (%)	203 (29.9)	1016 (30.0)
Pap test (%)	309 (46.4)	2233 (66.8)
Mean number of Pap tests (SD)	0.87 (\pm 1.16)	1.38 (\pm 1.29)
Mean number of Pap tests for women who had at least 1 (SD)	2.62 (\pm 0.76)	2.66 (\pm 0.78)

SD = standard deviation

Table 2: Adjusted rate ratios of Pap tests in the 5-year period before diagnosis of invasive cervical cancer

Category	Rate ratio (95% CI)
Controls	1.57 (1.44–1.73)
Cases (reference)	1.00
Age (by 10-year increase)*	0.80 (0.78–0.81)
Income (by \$10 000 increase)*	1.06 (1.04–1.07)
Urban	1.22 (1.15–1.30)
Rural (reference)	1.00

*There is no reference category for age or income because they were treated as continuous variables in the analysis.
 Note: A generalized linear regression models using the negative binomial distribution was used. Each rate ratio is adjusted for all other variables in the model. Pap test is the outcome and cervical cancer (case v. control) is the predictor, so analyses appropriate for a matched cohort design were used.
 CI = confidence interval

Table 3: Adjusted odds ratios of being diagnosed with invasive cervical cancer*

Category	Odds ratio (95% CI)
No Pap test	2.77 (2.30–3.30)
Pap test (reference)	1.00
Income (by \$10 000 increases) [†]	0.78 (0.69–0.89)

*Includes the 5-year period before diagnosis of invasive cervical cancer.
[†]There is no reference category for income because income was treated as a continuous variable in the analysis.
 Note: A conditional logistic regression was used to examine the association between Pap test utilization and invasive cervical cancer. This table does not include region of residence and age because these variables were the basis for matching cases and controls, and therefore would have no effect on the odds ratio.
 CI = confidence interval

Table 4: Adjusted rate ratios of the opportunity to be screened in the 5-year period before diagnosis of invasive cervical cancer

Category	Rate ratio (95% CI)
Controls	1.04 (0.96-1.12)
Cases (reference)	1.00
Age (by 10-year increases)*	1.20 (1.18-1.22)
Income (by \$10 000 increases)*	0.94 (0.92-0.95)
Urban	1.02 (0.96-1.09)
Rural (reference)	1.00

*There is no reference category for age or income because they were treated as continuous variables in the analysis.

Note: A multivariate generalized linear model using the negative binomial distribution on the number of opportunities to be screened was used. Each relative rate is adjusted for all other variables in the model.

CI = confidence interval

Table 5. Adjusted odds ratios of the likelihood of a Pap test, by physician characteristic, in the 5-year period before diagnosis of invasive cervical cancer

Physician characteristic*	Number of physicians	Odds ratio (95% CI)
Rural family physician	717	0.68 (0.58-0.80)
Specialist	546	1.70 (1.30-2.22)
Urban family physician (reference)	1661	1.00
Subset (53% of all visits deemed to be an opportunity to be screened) [†]		
Canadian graduate	470	1.20 (1.04-1.39)
Foreign graduate (reference)	277	1.00
Female physician	273	1.99 (1.75-2.26)
Male physician (reference)	474	1.00
Rural family physician	237	0.80 (0.75-0.87)
Specialist	102	4.39 (4.09-4.70)
Urban family physician (reference)	510	1.00

*Adjusted for patient age and income.

[†]Adjusted for patient age, income, and all other variables in the model.

Note: Logistic GEE models using an independent correlation matrix that account for correlated data within the dataset were conducted. There was no main effect of case-control status on the association between physician characteristics and Pap tests, nor was there an interaction of case-control status on any other variable.

CI = confidence interval; GEE = generalized estimating equation

Area of residence (urban v. rural) had no effect on frequency of opportunities to be screened (RR = 1.02, 95% CI 0.96–1.09).

Physician characteristics. Compared with urban family practitioners, rural family practitioners were less likely (OR = 0.68, 95% CI 0.58–0.80) and specialists more likely (OR = 1.70, 95% CI 1.30–2.22) to provide Pap tests (Table 5).

Data on location of graduation (Canadian v. foreign), physician gender and practice type were

available for 53% of the visits deemed an opportunity to be screened (N = 58 029 visits). All effects were adjusted for patient age, income and all other variables included in the model. Compared with foreign graduates, Canadian graduates were more likely to provide a Pap test (OR = 1.20, 95% CI 1.04–1.39). Female physicians were more likely to provide a Pap test than male physicians (OR = 1.99, 95% CI 1.75–2.26). As in the first model, rural family physicians were less likely (OR = 0.80, 95% CI 0.75–0.87) and specialists were more likely (OR = 4.39,

95% CI 4.09–4.70) to provide Pap tests than urban family physicians.

Discussion

The Pap test is one of the most effective tools available for the early detection of cervical cancer. However, optimal utilization levels have still not been reached. In this study, 36% of Manitoban women had not had a Pap test in a 5-year period. Although the mean number of Pap tests was slightly higher for controls in comparison with cases, the mean number of Pap tests for women who had received at least 1 Pap test was similar. This finding suggests that having at least 1 Pap test increases the likelihood of subsequent tests, and thus reinforces the importance of ensuring that testing is initiated. Women who had never had a Pap test were almost 3 times as likely to be diagnosed with invasive cervical cancer as women who had received at least 1 Pap test. However, although women diagnosed with invasive cervical cancer had fewer Pap tests, their opportunities to be screened were as frequent as those of study controls.

These findings in Manitoba are consistent with previous research that has investigated the relationship between history of Pap test utilization and the risk of cervical cancer; these studies also reported an increased risk of cervical cancer for non-recipients and irregular recipients of Pap testing.¹⁷⁻²¹ Women who lived in urban areas of Manitoba and those with higher incomes had more Pap tests and a lower risk of being diagnosed with cervical cancer. Other research has found that cervical screening is provided more consistently in urban areas than in rural areas, and that the incidence of Pap tests decreases with decreasing income.²²⁻²⁴ Studies in other jurisdictions have also found that a high percentage of women diagnosed with invasive cervical cancer had multiple contacts with the health care system in the 3 to 5 years before diagnosis, but had not been screened for cervical cancer.²⁵⁻²⁸

One possible reason for our finding that controls had as many opportunities to be screened as cases may be that under-screened women lack continuity of care and thus may be more likely to visit a physician for acute problems only. In Manitoba, a steady relationship between continuity of care and better preventive health care has been observed.²⁹ Therefore, an ongoing relationship with a family practitioner is crucial, even in a health care system that provides universal access to care. Conversely, although preventive services might not traditionally be offered in walk-in clinics, these practice settings can be successful in doing so: 55% of patients who attended an inner-city walk-in clinic for an

acute medical problem and who were inadequately screened accepted a same-day appointment for a Pap test.³⁰ We also found that older women had more opportunities to be screened than younger women, likely because they visit a doctor more frequently. Women in higher income brackets had fewer opportunities to be screened than their counterparts in lower income brackets. This could be because these women do not need to visit a doctor as frequently, or because they had been receiving Pap tests on a regular basis, which would result in fewer of their health care visits being counted as an opportunity to be screened.

Our study found that certain physicians were more likely than others to provide a Pap test. The increased provision of Pap tests by specialists (including obstetricians/gynecologists) may relate to their specific training, a focus on women's health and focused reasons for patient visits. Previous research has found that women who see obstetricians/gynecologists are more likely to be younger and have higher education and income levels than those who do not see these specialists, and therefore may request a Pap test more frequently.³¹ This is particularly worrisome, since women are less likely to see an obstetrician/gynecologist as they get older, yet cervical cancer incidence and mortality rates are higher among older women.¹ Therefore, the physicians most likely to treat older women may be less likely to provide a Pap test.

Patients of female physicians were also more likely to receive Pap tests than patients of male physicians. Female physicians have been found to devote more time to preventive services than male physicians, even when patient gender and health status were controlled for in the analysis.³²⁻³⁴ Patients have been shown to prefer a physician of the same gender for genital and rectal examinations.^{32,35} However, in 1 study female patients were no more likely to refuse an examination from a male physician than from a female physician.³³ The unavailability of a female chaperone may also affect male physicians' likelihood of providing a Pap test. Nevertheless, obstetricians/gynecologists do not seem to experience these screening barriers to the same degree, based on their rates of Pap test provision.

This study has several important strengths. Many previous studies collected data from patient and physician surveys, introducing the possibility of non-response, recall, interviewer and acquiescence bias.³⁶ By collecting Pap test history and health care provider information from linked Manitoba Health administrative databases whose reliability has been extensively evaluated, we eliminated these sources of bias in this study. Information on all cancer cases diagnosed over a 12-year period was available, making the study sample very comprehensive. Information on hysterectomy was also available, which was an

important limitation in previous studies that used administrative data to examine Pap test utilization.³⁷

Our research, however, was not able to differentiate between a patient refusing to have a Pap test and a physician not offering the test. In addition, Pap tests processed at a public laboratory from salaried physicians who do not submit claims for the services they provide may not be captured, which could result in fewer Pap tests being reported than were actually performed. However, it is estimated that the physician claims data captures at least 95% of all Pap tests performed in Manitoba.^{4,18} Data on whether a physician was a Canadian graduate, graduation year and physician sex were incomplete; therefore, the results must be interpreted cautiously. Finally, a previous case-control study that examined the screening history of women diagnosed with invasive cervical cancer removed cases of microinvasive cancer (International Federation of Gynecology and Obstetrics [FIGO] stage IA) from the main analyses because they have an excellent prognosis and may be considered a success of screening (most would not have been diagnosed in the absence of screening).²¹ In our study, only 15% of the cases for whom data on availability were available were stage IA. We included stage IA cases because the likelihood of being diagnosed with invasive cervical cancer for women who did not have a Pap test was much larger than for women who did have a Pap test (OR = 2.77). If stage IA cases were removed, the effect of not having had a Pap test would likely be even larger. Moreover, their inclusion is unlikely to affect findings on the opportunity to be screened because we found no difference between the cases and controls.

Conclusion

The results of this study show that women who have been diagnosed with invasive cervical cancer had fewer Pap tests but had as many opportunities to be screened as matched controls. Although some women may not get a Pap test because they do not visit a health care provider, a lack of contact with the health care system is not the main reason why many women are under-screened. These results reinforce the necessity for health care providers to seek every opportunity to educate women about preventive cervical cancer screening and to provide Pap tests regardless of the setting of care and the continuity of the relationship with the patient.

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