CERVICAL CANCER SCREENING IN IMMIGRANT POPULATIONS IN BRITISH COLUMBIA: PARTICIPATION RATES AND SOCIODEMOGRAPHIC CHARACTERISTICS OF USE

by

JENNIFER LEE FLETCHER

B.A., Queens University, 2002
B.Sc.H., Queen's University, 2004

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF SCIENCE

in

THE FACULTY OF GRADUATE STUDIES

(Population and Public Health)

THE UNIVERSITY OF BRITISH COLUMBIA

(Vancouver)

September 2011

Abstract

Background: The Pap screening practices of British Columbia's immigrant population and the specific barriers they face in accessing cervical cancer screening services are not well understood. This study attempts to gain a broad understanding of patterns in immigrant women's use of Pap screening programs, exploring rates of Pap screening participation, sociodemographic correlates of use and reported barriers to access for immigrant women in the BC relative to those of native-born Canadians in the province.
Methods: Self-reported data on use of Pap screening services, immigration status and sociodemographic information were obtained from the Canadian Community Health Survey Cycle 3.1 for female respondents 18 to 69 years of age living in British Columbia. Lifetime and three-year Pap screening participation rates were calculated and multivariate logistic regression methods used to model the relationship between Pap screening participation and sociodemographic variables thought to be potential correlates of screening. Subgroup analyses of screening participation based on the racial or ethnic origin and country of birth of immigrant women were also conducted.
Results: Immigrant women were found to participate in Pap screening, both over the lifetime and within the last three years, at rates significantly lower than those of non-immigrant women. Only 79% of immigrant women report having had a Pap test during their lifetime, compared to 93% of non-immigrant women. Those figures drop to 66% of immigrant women and 78% of non-immigrant women for Pap screens within the last three years. Many of the sociodemographic correlates of use are similar in the immigrant and non-immigrant populations, but often with different impacts on screening participation between the two groups. East Asian and South Asian immigrant women in particular report rates of screening participation below those of non-immigrant women, while participation rates among European immigrants are comparable to those of native-born Canadians.
Conclusions: Subgroups of immigrant women in British Columbia are currently under-served by existing Pap screening programs in the province. Culturally-appropriate programs and policies are required to improve screening participation in these groups,

thereby helping to decrease the cervical cancer burden presently being borne by these populations.

Preface

This study was reviewed and approved by the Behavioural Research Ethics Board at the University of British Columbia (Certificate # H09-03275).

The work presented in this thesis was conceived and conducted by the candidate under the supervision and guidance of the supervisory committee: Dr. Arminée Kazanjian, Dr. Chris Richardson and Dr. Chis Bajdik. The thesis manuscript was prepared by the candidate with evaluation and feedback from the supervisory committee.

Table of Contents

List of Tables

List of Figures

List of Abbreviations

BC: British Columbia
BCCA: British Columbia Cancer Agency
CCHS: Canadian Community Health Survey
CCSP: Cervical Cancer Screening Program
HPV: Human Papilloma Virus
MSP: Medical Services Plan
Pap: Papanicolaou test

Acknowledgements

I offer my sincerest gratitude to my thesis supervisor Dr. Arminée Kazanjian and my committee members, Drs. Chris Richardson and Chris Bajdik, for their guidance through every stage of this project. In addition to providing invaluable expertise, you have been a wonderful team to work with.

This project was supported in part by a Western Regional Training Centre studentship funded by the Canadian Health Services Research Foundation, Alberta Heritage Foundation for Medical Research and Canadian Institutes of Health Research. Thank you to Dr. Sam Sheps, Isabella Losinger and my fellow WRTC students, from whom I have learned so much. Graduate Research Assistant funding was also provided by the Canadian Institutes of Health Research project “A Methodology to Understand Cancer Screening Behaviour of Culturally Diverse Populations.”

I would also like to thank the Statistics Canada Research Data Centre at the University of British Columbia, in particular Lee Grenon and Cheryl Fu, for assistance with gaining access to and deciphering the data used in this study.

Special thanks are owed to my mom for her endless encouragement and support. Your unwavering faith in me means more than I could ever say. And last, my heartfelt gratitude must go to Matt for his constant cheerleading and occasional proof-reading, as well as for always providing distractions exactly when they were needed.

To my mom

CHAPTER 1: Introduction

1.1 Purpose

Cervical cancer is the second most common cancer among women worldwide (1). With an average of 25.9 years of life lost per person affected, the burden associated with this disease is significant, higher than that of breast cancer (19.3 years lost per person) (2). Survivors of cervical cancer, as well as their partners and families, often experience lifelong declines in their quality of life, with many treatments having long-term negative impacts on sexual, reproductive, and psychosocial functioning (3, 4). That said, cervical cancer is also one of the easiest forms of cancer to prevent, recognize and cure in its early stages. Taking an average of two to three decades to develop, this type of cancer is particularly amenable to preventive screening, which aims to detect precancerous lesions of the cervix that can be intercepted before they progress to invasive disease.

The Papanicolaou (Pap) test, first developed in the 1920s, is a widely used screening tool for cervical cancer. It involves the collection of a sample of cells from the outer opening of the cervix using a small spatula or brush, which, when stained and examined under a microscope, can reveal the presence of abnormal cells indicative of cervical cancer or its precursor lesions. The introduction of a Pap screening program in British Columbia, which began in 1949, has resulted in a 78% reduction in incidence and a 72% reduction in the mortality associated with this disease in the province (5). However, the benefits of this program have not been evenly distributed throughout the population. Immigrant women represent one subpopulation believed to be more commonly afflicted with cervical cancer, largely as a result of lower levels of participation in Pap screening (6).

Immigrant population refers to people born outside of Canada who have been permitted by Canadian immigration authorities to live in the country permanently. Immigrants constitute 27.5% of the British Columbia population, a figure that has continued to grow since the mid 1900s (7). Except for Ontario, British Columbia has the

highest proportion of foreign born population in Canada. Immigrants represent a culturally and ethnically diverse group. More than half of the immigrants currently living in British Columbia were born in Asia or the Middle East (8), but that hasn't always been the case. Prior to the 1970s, Europe was the region of birth for the majority of British Columbia's immigrants (9). These trends in region of birth, as well as level of education, age at arrival and fluency in English, change over time and contribute to the ever-changing make-up of British Columbia's immigrant population.

The Pap screening practices of the province's immigrant population and the specific barriers it faces in accessing cervical cancer screening services are not well understood. Immigrants often display differences in their determinants of health, health status, health beliefs, practices, and access to health services from those of native-born Canadians, which can have a significant impact on their Pap screening behaviours. Studies conducted thus far on the Pap screening practices of British Columbia's highly heterogeneous immigrant population have tended to focus on immigrants of a specific ethnicity or country of birth that reside in a particular community (10-13). While these studies are useful in providing insights about those particular populations, the results can be difficult to generalize to other ethnic groups or communities within the province. The current study aims to gain a broader understanding of patterns in immigrant women's use of Pap screening programs in British Columbia and how they compare to those of Canadian-born women in the province, a necessary first step in the identification of subgroups particularly at-risk for under-participation in Pap screening and for the development of culturally-appropriate programs and policies designed to improve screening participation in these groups.

1.2 Study Objectives

The primary objectives of this study are:

1. To compare a) lifetime and three-year age-specific Pap screening participation rates and b) sociodemographic correlates of screening for immigrant women in British Columbia to those of British Columbians born in Canada.

2. To explore differences in Pap screening participation rates among subgroups of immigrant women based on self-reported cultural or racial background and country of birth.

3. To compare the reported barriers of use for Pap screening of immigrant and non-immigrant women in the province.

1.3 Thesis Overview

This thesis is composed of five chapters. The current chapter introduces the study purpose and objectives. The following chapter, Chapter 2, provides an overview of the empirical literature and conceptual theory that informed the design of this study and the context in which it is placed. This includes a review of the cervical cancer control program in British Columbia, cervical cancer causes and risk factors and new developments in cervical cancer prevention and how these may impact existing control programs in the province. The chapter then synthesizes the literature regarding inequities in cervical cancer screening, methods for measuring screening participation in culturally diverse populations and finally, sociodemographic correlates of Pap screening participation. Chapter 3 describes the study methodology, followed in Chapter 4 by the study results. The final chapter centres on the research and health policy implications of this work, strengths and limitations of the study, and concluding remarks.

CHAPTER 2: Literature Review

2.1 Cervical Cancer Control in British Columbia

A centralized Pap screening program designed to detect precancerous lesions of the cervix was introduced in British Columbia (BC) in 1949 by Dr. H.K. Fidler, Director of the BC Cytology Laboratory and a pathologist at Vancouver General Hospital (14). The first of its kind in Canada, this Pap screening program was originally established as a pilot project to determine the efficacy of the cervical smear technique. By 1955 it was believed the Pap test's value had been confirmed and the decision was made to test its effects on cervical cancer incidence and mortality by screening all women over the age of 20 in the province on an annual basis (15). The program grew rapidly, with approximately 12,000 smears taken in 1955 and 536,800 in 1985. 26,000 cases of cervical cancer were detected and treated during that 30 year period. The incidence of cervical cancer fell by 78% and mortality by 72%, decreases believed to be a direct result of the cervical cancer screening program (14). Today over 500,000 screens are performed through the BC Cervical Cancer Screening Program (CCSP) each year on over 540,000 women, representing 79% of eligible women in 2009 (16). It is estimated that just 160 women will be diagnosed with cervical cancer in the province this year and 50 will die from it (17).

While generally acknowledged to be an effective method of detecting and preventing cervical cancer, the Pap test is not without its limitations. One of the most common criticisms of the Pap test relates to its ability to distinguish those who have cervical cancer from those who do not (18, 19). The effectiveness of a screening test is commonly assessed using a combination of two measures: sensitivity and specificity. Sensitivity refers to the ability of a test to correctly identify those who truly have a disease, as defined by a definitive diagnostic test or gold standard, while specificity refers to the ability of a test to correctly identify those who do not have a disease (20, 21). The sensitivity and specificity of the Pap test vary depending upon a number of factors, including the specific cytological technique used, the type of cervical cancer in question, the skills of the technologist examining the sample and the quality of the

sample collected (18, 22, 23) (see Table 2.1). Estimates of the sensitivity of Pap screening range from 11 to 99%, with the majority clustering in the 55 to 65% range, while those for specificity range between 14 and 97%, with the majority falling around 95 to 97% (24-26). One should note, however, that there has never been a controlled prospective study of Pap screening, so caution should be taken when interpreting these figures (27).

Table 2.1 Factors associated with variations in Pap screening sensitivity and specificity.

Factor	Associated with higher sensitivity &/or specificity	Associated with lower sensitivity &/or specificity	BC Cervical Cancer Screening Program
Cytological technique	Liquid-based	Conventional	Conventional
Cancer type	Squamous cell carcinoma	Adenocarcinoma*	Squamous cell carcinoma predominates
Sample Collection	Collection from outer opening of cervix and stored appropriately	Collection from other sites or inappropriate storage	1.9% of samples collected in 2007 were classified as unsatisfactory (17)
Training and Skill of Technician	Increased training and experience	Limited training and experience	Maintains its own BCCA School of Cytotechnology training program

* There is some evidence to suggest that this has been improving in recent years (28).

Screening tests with low sensitivities and/or specificities can have a variety of negative consequences, both for individual women, as well as for society at large. A test with a low sensitivity will be more likely to miss women with cervical cancer or abnormal cervical lesions, resulting in false negatives. The effects of false negatives can potentially be very severe, with easily treatable precursor lesions progressing to invasive cancers before being detected. To compensate for the relatively low sensitivity of Pap screening, regular, repeated screening is recommended. Given the long lag time in the development of most cervical cancers, the majority of women who participate in regular screening are likely to have their cancers detected at early stages, even if missed in a single test (29).

Figure 2.1 Definitions of sensitivity, specificity and associated terms.

Sensitivity: The ability of a test to correctly identify those who truly have a disease, as defined by a definitive diagnostic test or gold standard (i.e. the proportion of persons with a disease correctly identified by a test).

Specificity: The ability of a test to correctly identify those who do not have a disease, as defined by a definitive diagnostic test or gold standard (i.e. the proportion of persons without a disease correctly identified by a test).

Positive Predictive Value (PPV): The proportion of individuals with positive test results who are correctly identified.

Negative Predictive Value (NPV): The proportion of individuals with negative test results who are correctly identified.

False Positive: Individuals identified by the screening test as having a disease when in fact they do not.

False Negative: Individuals identified by the screening test as not having a disease when in fact they do.

Failure to correctly classify women without cervical abnormalities results in false positives and is more frequent with tests that have low specificities. While on the surface this may seem less concerning than false negatives, serious adverse effects can also result from false positives. These include needless anxiety and worry for the women receiving the false abnormal results, excess burden on the health care system as more women undergo additional expensive (and ultimately unnecessary) testing, and potential decreases in the trust women have in the test, something that could have an impact on future screening participation (20).

While important, the detection of precursor markers or early stage disease through screening would not on its own be sufficient to effect the kinds of changes in morbidity and mortality that have been observed in BC. The World Health Organization has outlined a number of criteria for the development of effective public screening programs, which are summarized below in Figure 2.2. These include the availability of acceptable treatments for patients with the identified disease, available facilities for diagnosis and treatment and having policies in place regarding which patients get

Figure 2.2 World Health Organization's principles of early disease detection (30).

The condition sought should be an important health problem.
There should be an accepted treatment for patients with recognized disease.
Facilities for diagnosis and treatment should be available
There should be a recognizable latent or early symptomatic stage.
There should be a suitable test or examination.
The test should be acceptable to the population.
The natural history of the condition, including development from latent to declared disease, should be adequately understood.
There should be an agreed policy on whom to treat as patients.
The cost of case-finding (including diagnosis and treatment of patients diagnosed) should be economically balanced in relation to possible expenditure on medical care as a whole.
Case-finding should be a continuing process and not a "once and for all" project.

treated. BC's CCSP is operated by the BC Cancer Agency (BCCA), and monitoring the outcomes of screening, ensuring adequate follow-up of women with abnormal Pap test results and treating identified cases are all part of their mandate.

Pap tests are covered under BC's Medical Services Plan (MSP), the public health insurance system in the province, and are regularly performed by family physicians, obstetricians, gynecologists, nurse practitioners, registered nurses, and midwives. All BC residents eligible for MSP coverage under the Canada Health Act, subject to a three month waiting period. BC residents migrating from other parts of Canada can maintain coverage through their former medical plan during the waiting period, while new residents to Canada may require private health insurance during that period. The Interim Federal Health Program provides similar, temporary health insurance to refugees, protected persons and refugee claimants. Application for MSP coverage is required, usually at the time of arrival in BC.

Pap tests collected in BC are sent to the Cervical Cancer Screening Laboratory of the Provincial Health Services Authority for processing, cytologic interpretation and follow-up recommendations. Since most mildly abnormal cervical cells resolve on their own, the most common follow-up for this type of Pap test result is a repeat test every six months for two years. For more severe or persistent abnormal findings, colposcopy

and/or cervical biopsy might be warranted. A colposcopy is performed by a specialist who uses a colposcope (a type of microscope) to examine the cervix for any abnormalities. A cervical biopsy, whereby a small sample of tissue is taken from the cervix and sent to the laboratory for examination, may be performed during this procedure. In 2008 in BC 3,117 women (0.6% of women screened) were referred for colposcopy based on the results of their Pap tests, with 85% of those complying within one year (16).

Confirmation of pre-cancerous lesions through colposcopy and/or biopsy often results in treatment with cryosurgery, which freezes and destroys infected cells, or other procedures to excise the problem tissue. However, since one third to two thirds of women with pre-cancerous cervical lesions never go on to develop invasive cancer (31), depending upon the grade or severity of the detected abnormal tissue and in consultation with their physicians, some women may choose to adopt a conservative monitoring approach instead. In a large BC study, the risk of developing intermediate or high grade cervical lesions following treatment was found to range from 2% to 35% in the first six years after treatment, depending upon the grade of the initial lesion, treatment type and age of the woman (32).

2.2 Cervical Cancer Causes and Risk Factors

Cervical cancer is caused by the Human Papilloma Virus (HPV). Both males and females are susceptible to infection with HPV and, in addition to cervical cancer, it is associated with anogenital and head and neck cancers, and genital warts. Dozens of HPV types exist, but more than 99.5% of invasive cervical cancers are associated with one of the 18 ‘high-risk types’ (19). Just two of these, HPV-16 and HPV-18, have been shown to be responsible for 70% of all cases (33). That said, these same strains are also the most common strains seen in young women with normal cytology, suggesting that HPV infection is a necessary but not sufficient cause of cervical cancer. In fact, HPV is the most common sexually transmitted virus in North America, with lifetime risks of contracting it estimated to be as high as 70% among Canadian women (34). The

majority of these infections are cleared spontaneously by the immune system within one to two years of exposure; progression to cancer is a rare occurrence.

Several additional factors associated with increased risk of cervical cancer have been identified. These include smoking, multiple pregnancies, low socioeconomic status, a large number of sexual partners, early age at first sexual intercourse, infection with other sexually transmitted diseases including HIV, use of the synthetic nonsteroidal estrogen diethylstilboestrol (DES), a family history of cervical cancer, and long-term use of oral contraceptives (6, 35, 36). Some of these factors, such as a large number of sexual partners, may increase cervical cancer risk by increasing the probability of contracting HPV, while others, such as a family history of the disease, may exert their effects through increased biological susceptibility. It is also true that some of these risk factors are likely to be interrelated. For example, smoking, a large number of sexual partners and infection with other sexually transmitted diseases may all be relevant risk factors for women who are likely to engage in risky behaviours. The net effect of such combinations of risk factors on cervical cancer risk has yet to receive much attention in the published literature.

While all of these factors are potential targets for interventions to reduce the burden of cervical cancer, it is participation in Pap screening programs that represents what is arguably the most important alterable predictor of cervical cancer. Established guidelines for Pap screening frequency attempt to take into account the sensitivity and specificity of the Pap test, along with the natural history of cervical cancer. The Canadian Task Force on Preventive Health Care has suggested annual Pap screening begin following the initiation of sexual activity or at age 18, whichever is earlier. Following two normal annual smears, they suggest that screening frequency can be reduced to once every three years in non-high-risk groups until age 69, at which time screening can cease (37). Current BCCA guidelines are similar to these Canadian guidelines. They too call for screening to commence following the onset of sexual activity and to continue until age 69. However, they recommend annual screening for three years, decreasing the frequency to once every two years following three normal

tests (16). Since the optimal Pap screening interval is unknown (29), such variations in guidelines between countries and between provinces within Canada are not unexpected, with unknown effects on cervical cancer incidence and mortality.

BCCA reports that of those diagnosed with invasive squamous cell carcinomas in 2006, 64.1% had not received a Pap test in the previous 5 years and a further 5.8% had not been screened within the previous 3 years (38). Similar results were observed in a Manitoba study, where just 46.4% of cervical cancer cases had received a Pap test in the previous 5 years, compared to 66.8% of the control group (39).[1] In that study, the odds of a woman who had not had a Pap test in the previous 5 years being diagnosed with invasive cervical cancer were 2.8 times higher than those of a women who had received a Pap test. Of course, non-participation in Pap screening programs may also be associated with some of the risky behaviours linked to increased cervical cancer risk, which could explain, at least in part, this increased risk of disease. However, these studies do lend support to the notion that further increases in regular Pap screening participation have the potential to significantly impact cervical cancer incidence and mortality.

Efforts to change guidelines can be problematic. For many women, Pap tests have become synonymous with physical exams, so changes in Pap screening guidelines may have impacts beyond cervical cancer and require accompanying patient education (29). Discussions about guideline changes can also reveal tensions between individual patient preferences and public health policy. For example, Austin (40) explores what the impact would be of a change in the American screening frequency guideline from once every year to once every three years. Such a change would likely result in a small increase in the incidence and mortality associated with cervical cancer, but with significant cost savings. While policy makers may determine this is an 'acceptable risk', individual women may find this risk unacceptable but be prohibited

[1] Pap tests occurring within the six months prior to diagnosis were excluded to rule out tests that may have been done for diagnostic rather than screening purposes.

from maintaining their annual screening regimen. These types of tensions between societal and individual perspectives are common in health care debates.

One of the more controversial aspects of the cervical cancer screening guidelines is the age at which screening should cease. As noted above, BC guidelines call for screening to stop after age 69. Similar age-defined guidelines exist in other Canadian provinces, as well as those of the US Preventive Services Task Force and American Cancer Society. Other organizations, including the American College of Obstetricians and Gynaecologists, recommend lifelong screening (41). With changing life expectancies and family and social structures over the past several decades, cervical cancer risk factors for older women have also changed. More nuanced versions of Pap screening guidelines propose targeted screening of those over age 69 who would benefit the most from continued screening, something that becomes more feasible with the introduction of electronic management systems into screening program organizations (42).

2.3 New Developments in Cervical Cancer Prevention

One application of the knowledge about the causal link between HPV and cervical cancer is the use of HPV DNA testing as a screening test for disease. Samples for HPV DNA tests are collected similarly to a Pap test, using a brush or swab inserted into the cervical canal to collect cells from the cervix, which are then sent to a lab for DNA testing and typing. One of the most common assays used is the Hybrid Capture 2, which tests simultaneously for the presence of 13 high-risk HPV types. Since HPV is a necessary cause of cervical cancer, women not infected with HPV can effectively be ruled out as being at risk for cervical cancer. However, given the high rates of transient HPV infection among young women, a positive test in this age group would not necessarily indicate a looming case of cervical cancer. As a result, many proposed guidelines call for HPV DNA testing alone in women 30 years and older, but combining it with cytology for younger women (18). An added benefit of HPV DNA testing over or in addition to Pap testing is the increased ability to detect adenocarcinomas, but a down-side is that this type of testing is more expensive (approximately $90 for HPV

DNA testing versus $40 for traditional Pap testing) (31). The relative effectiveness and cost-effectiveness of HPV DNA testing compared to Pap testing in detecting cervical cancer and the feasibility of introducing HPV DNA testing in the BC context are currently being explored by BCCA in its HPV FOCAL study. The effect that HPV testing will have on the future of the CCSP remains to be seen.

Another application of this causal link has been the development of vaccines against HPV as a method of primary prevention of cervical cancer. The link between HPV and cervical cancer was first established in the 1980s, but initially received little attention from the Canadian public. With cervical cancer currently the 13th most common cancer among Canadian women (17), relatively few individuals living today have been personally affected by this disease, so more common types of cancer have tended to dominate public and media attention. This changed in 2005 when, as a prelude to the release of its HPV vaccine Gardasil, Merck initiated a media campaign aimed at increasing awareness of HPV and its link to cervical cancer ("Tell someone" and "Make the Connection"). Unfortunately, since the ultimate goal of the campaign was to create a wide market for their coming vaccine, some of the information propagated through this media campaign was misleading. The threat of cervical cancer to adolescents was inflated, the subpopulations most at risk largely ignored, and the transient nature of most HPV infections completely glossed over (43). The result has been a growing awareness of, and confusion about, cervical cancer, its incidence, causes, risk factors and treatment (44, 45).

In March 2007 the Government of Canada announced funding of $300 million earmarked for provinces and territories to establish publicly funded HPV vaccination programs for school-age girls. This announcement followed reports from the National Advisory Committee on Immunization (46) and Canadian Immunization Committee (47) calling for population-wide HPV vaccination programs to be established in Canada. Beginning with Nova Scotia, Ontario and Prince Edward Island in 2007 and followed by the remaining provinces, including BC, in 2008, optional in-school HPV vaccination programs were implemented for girls in grades ranging from 4 to 7. By June 2008 more

than one million doses of Gardasil, the only HPV vaccine approved for sale in Canada at the time, had been distributed (48) at a cost of approximately $400 per series, making it the most expensive childhood vaccine on record.

While many view the introduction of HPV vaccines and the establishment of publicly funded vaccination programs as an exciting opportunity to confront cervical cancer incidence on a new front, concerns have been raised about the goals, potential implications, and costs of these programs. For one, no specific goals have been identified, making it impossible to measure the effectiveness of the programs (49). Additionally, since HPV types not included in the vaccine are associated with cervical cancer, screening programs will still be required to detect the cancers that will continue to occur (50), although hopefully at a much lower rate. This means that the costs of vaccination are in addition to those of existing Pap screening programs and not in place of them (31), and there are opportunity costs associated with this, as those funds are no longer available for other health spending priorities. Some have argued that these costs will be offset by decreasing the frequency of Pap screening, but it remains unclear how this will be managed, especially in light of the low vaccine uptake rates in the province (51). The many unknowns about the vaccine, including the optimum age, dose and duration of protection, are also concerning and leave questions about the future costs of the vaccination programs largely unanswered (49, 50, 52). Finally, fears have been raised that the vaccination programs may lead women to adopt a false sense of security when it comes to safer sex practices and/or screening programs (50), which could result in backtracking on the gains made thus far.

Given the current uncertainty surrounding HPV DNA testing and the many lingering questions regarding the effectiveness and cost-effectiveness of the HPV vaccines, it seems likely that Pap testing will remain a key feature of cervical cancer screening programs in BC for the foreseeable future.

2.4 Inequities in Cervical Cancer Screening

Variations in health are common, and sometimes expected. For example, since cancer risk increases with age, we expect older populations to have a higher incidence of cancer than younger populations. However when those inequalities are unjust, unfair or avoidable they become issues of social justice - inequities. Braveman and Gruskin define equity in health as “the absence of systematic disparities in health between groups with different levels of underlying social advantage or disadvantage – that is wealth, power, or prestige” (53). In the case of cervical cancer, incidence and mortality rates are not evenly distributed across the Canadian population (6). Differences in the prevalence of various risk factors may partially explain the observed disparities, but it is inequitable utilization of screening services that is believed by many to be the major contributing factor (35).

Immigrant women, the focus of this study, represent one subpopulation in BC believed to be participating in Pap screening programs at rates lower than the general population (54-57). Immigrants often display differences in their determinants of health, health status, health beliefs, practices, and access to health services from those of native-born Canadians, which has implications for Pap screening participation.

Immigrants constitute 27.5% of the British Columbia population, a figure that has continued to grow since the mid 1900s (7). This is a highly culturally and racially heterogeneous population, coming to Canada from all regions of the world. Trends in region of birth have changed over time. In recent years, greater proportions of the province’s immigrant population have been coming from East Asia, the Philippines, South Asia, India and West Central Asia and the Middle East, while the proportion from the United Kingdom, traditionally a strong source of immigrants for Canada, has dropped (58). Asia and the Middle East are now the birth place for 54% of BC’s immigrant population; Europe the place of birth for a further 31%.

In terms of their health needs, immigrants display some unique characteristics. New immigrants to Canada are, on average, healthier than the average native-born

Canadian. They are less likely to report having a chronic condition upon arrival in the country (59, 60) or to report poor health (60, 61). The fact that immigrants must undergo a physical examination as part of the immigration process might be one factor that contributes to this apparent superior health (62), since we may be effectively selecting a healthier population for immigration. However, in what Rumbault has termed the 'paradox of assimilation', length of time since immigration is positively correlated with a loss of this health advantage (63), possibly as a result of acculturative stress, changes in socioeconomic status, isolation and loss of a pre-existing support system, lack of knowledge of existing services or barriers in accessing health services, and/or a wider power differential with health professionals (63-65). All of these factors may also influence screening behaviour.

Several studies have been done looking at specific ethnic or racial groups in BC to explore rates of participation in Pap screening programs and access barriers being encountered by those groups (10-13, 66, 67), but little has been done looking at the immigrant population in the province as a whole. While much of the Canadian research is likely to apply to BC, the unique make-up of this province's immigrant population and the environments in which they live are likely to result in some peculiarities as well, making this an area in need to further study and a motivating factor for the current research.

2.5 Measuring Screening Participation In Culturally Diverse Populations

In order to examine the Pap screening practices of immigrant women, one must first be able to measure screening participation. One of the most common methods for measuring screening participation is self-report (13, 68). This type of measure provides a relatively quick and inexpensive means of obtaining information about the use of health services. Normally collected through surveys, self-reported measures of health services utilization also allow for the simultaneous collection of data related to sociodemographic factors that may be related to screening participation. Self-reported data on Pap screening history are routinely collected in national surveys, including Statistic Canada's Canadian Community Health Survey.

One limitation to note about self-report measures, however, is the tendency of women to inaccurately report their screening history (69). A number of studies comparing women's self-reported screening history with documented screening from medical charts and pathology records report that in most cases women over-report rates of screening, sometimes by as much as 20% (70, 71). Concordance rates between self-reported and medical record-verified measures of Pap screening have been found to vary based on a number of sociodemographic variables. For example, in a study by Mamoon et al (71)., self-reported screening rates in New South Wales, Australia were between 9% and 19% higher than those calculated using registry-based screening data, depending upon the region in which the woman lived. Ethnicity may also be a factor. Examining a cohort of multiethnic, multilingual women living in Alameda County, California, McPhee et al. (72) found validation rates varied from 65.9% for Latina women to 85.1% for white women.

One method for examining the accuracy of self-reported measures is to look at their sensitivity and specificity. The concept is the same as was described above for the Pap cytology test itself (see Figure 2.1). Sensitivity refers to the ability of self-reported measures to correctly identify those who have truly been screened, while specificity refers to their ability to correctly identify those who have not been screened. The sensitivity and specificity of self-reported measures of Pap screening from known published studies are presented in Table 2.2. Unfortunately no such work has been published based on BC or Canadian populations, making it difficult to determine the accuracy of self-reported measures in this context. However, one would expect to see results similar to those observed in other culturally-diverse Western nations.

As can be seen from these results, the sensitivity of self-reported measures of Pap screening participation is high, meaning that those who have truly been screened are fairly accurate in the reporting of their past screening behaviours. There is some evidence to suggest that this varies depending upon the time period being considered, but sensitivity remained high even when women were asked to recall screening events

Table 2.2 Sensitivity and specificity of self-reported measures of Pap screening.

Authors	Study Participants	Sensitivity	Specificity
Bowman, 1991 (73)	English-speaking women 18 to 70 years New South Wales, Australia	93%	55%
Bowman, 1997 (74)	English-speaking women 18 to 70 years New South Wales, Australia	88.8% past 1 year 97.0% past 2 years 96.3% past 3 years 95.8% past 4 years	63.7% past 1 year 49.3% past 2 years 41.7% past 3 years 37.9% past 4 years
Gordon, 1993 (75)	US Medical Insurance Plan, predominantly white, early 50s to late 60s.	97.2%	34.9%
McGovern, 1998 (76)	Urban, low-income population in Minneapolis	82.0%	71.8%
Newell, 2000 (70)	Women in New South Wales, Australia	97.7%	45.0%
Paskett, 1996 (77)	Low-income minority women (majority African-American) in North Carolina	97.1%	15.4%
Sawyer, 1989 (78)	Black women living in rural areas of North Carolina	95%	47%

up to four years ago. Specificity, on the other hand, is poor for self-reported measures, meaning that women who have not been screened do not accurately report their non-participation in screening programs. Observed values ranged from 15.4% to 71.8%, with the majority in the 40 – 55% range. This combination of high sensitivity and low specificity supports the assertion that screening rates obtained using self-reported measures are likely to be over-estimates of the true rates.

There are several reasons for this discordance between self-reported and objectively measured Pap screening participation rates. Firstly, inaccuracies in the recall of past Pap tests can be an issue. Since Pap screening is a relatively infrequent behaviour, usually occurring once every one to three years, some women may misreport the date of their last test because they are unable to accurately recall it. While we tend to think of memories as discrete, chronological, photograph-like re-creations of events in the mind, they are in fact subject to change as a result of information or experiences occurring after the event (79). One important phenomenon is telescoping, which occurs when respondents mistakenly report events as occurring during the identified time period that actually happened earlier or later. For example, a woman asked to report whether she had received a Pap test within the last year may report yes

if she inaccurately recalls her Pap test of two years ago as having occurred more recently. Since vivid experiences are recollected as more recent, this phenomenon may be particularly common among women who view pelvic examinations as embarrassing or unpleasant (78).

A second reason has to do with social desirability. Social desirability bias refers to the tendency of individuals to falsely claim socially desirable traits (80). The importance of cervical cancer screening is periodically promoted by the media and medical communities. As a result, most women in BC know they should be participating on a regular basis (81). Those who do not participate may report being screened in order to appear to be conforming to these social norms. Since social norms and tendencies to provide socially desirable responses can vary depending upon a number of factors, including age and culture, social desirability bias has the potential to distort the true effect size in studies comparing screening rates between different groups (82).

Finally, knowledge about Pap tests and awareness of when one has been conducted, a requirement for accurate self-reporting, may be low in particular groups of women. Kleinman and Kopstein found that some women confuse pelvic examinations and Pap tests, assuming that any time a pelvic examination is conducted a Pap test has been performed (83). This may lead women to believe that they have had a Pap test when they have not and could prevent them from receiving one when they need it. Such an error is more likely to occur among women with lower levels of education, those with language barriers, and those who are unfamiliar with the health care system (83), variables that are important when examining the behaviours of culturally diverse populations.

In light of these limitations, other measures of Pap screening participation have been proposed and utilized, but they too have limitations. Medical records provide an objective, more reliable estimate of screening behaviour; however accessing and auditing medical records can be arduous and time-consuming, making it difficult to scale-up to population-level studies. In areas such as BC where population screening

registries exist, very accurate population-level estimates can be obtained. But while rich in screening data, such data sources are often lacking in the sociodemographic information needed to perform sub-group analyses. Linkage with other data sets offers exciting opportunities to overcome this limitation, but gaining access to such data can take years.

Given the difficulties encountered with these alternate measures, self-reported measures continue to be a popular option for examining screening behaviour and will be the type of measure used in this study. Sensitivity analysis will be used to assess the impact of the potential biases discussed above on the results obtained. Sensitivity analysis provides a means of quantifying the importance of various sources of error and allows one to explore whether or not a specific bias could plausibly explain a given result (84). It is a technique for systematically changing the study parameters, such as the sensitivity and specificity of self-reported measures for immigrant and non-immigrant women, to determine the effect such changes would have on the results and measures of association observed.

2.6 Correlates of Pap Screening Participation

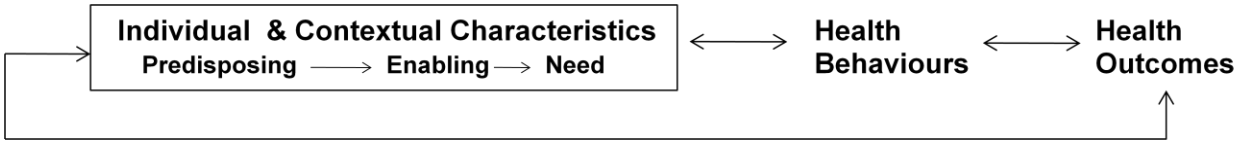
In seeking to understand women's Pap screening behaviours, a vast array of personal, social and system-level variables have been reported in the literature as potentially influential. Andersen's Behavioural Model of Health Services Utilization is used in this study as a framework for describing and understanding these relationships. Andersen's Behavioural Model of Health Services Utilization is one of the most frequently used and well-known theoretical frameworks for the study of health services utilization. Unlike models such as the Health Belief Model and Theory of Planned Behaviour, the Behavioural Model of Health Services Utilization positions environmental factors, which have been shown to play a significant role in cervical cancer screening participation, as central components in the determination of health behaviours.

This model conceptualizes the use of health services as the product of a complex interaction between individual, societal and contextual-level factors. Developed in the

1960s, the Behavioural Model was used originally to assist in understanding why families use health services, as well as to define and measure equitable access to health care and aid in the development of policies to promote equitable access (85). In the years since its original publication, the model has undergone numerous revisions, including a shift in the unit of analysis from the family to the individual and the incorporation of a wider variety of factors shown to be associated with health service utilization (85, 86). The Behavioural Model has also been adapted for use as a framework for understanding utilization in specific subpopulations, including minorities, low income, children, women, elderly, and homeless (86, 87).

The Behavioural Model of Health Services Utilization posits that there are three types of factors that exert an influence an individual's use of health services: 1) *predisposing factors*, which reflect the individual's propensity to utilize health services; 2) *enabling factors* that facilitate access to and use of services; and 3) *need-based factors* that motivate care seeking (88). Within each of these categories, the Behavioural Model incorporates both individual- and contextual-level factors. Acting together, this confluence of factors determines *realized access*, or actual use of health care services. Recent versions of the model (85) have also integrated feed-back loops that recognize the effects that health outcomes, including perceived health, evaluated health and consumer satisfaction, and health behaviours, such as personal health practices, processes of medical care and even use of health services, can have on future health behaviours. A summary of this model is presented in Figure 2.3.

Figure 2.3 Behavioural Model of Health Services Utilization.



2.6.1 Predisposing Factors

In addition to immigration status (discussed above), a number of sociodemographic factors have been shown to be associated with participation in Pap screening programs. One of the most significant ones is age. Studies across the United

States and Canada have reported that 3-year Pap screening participation rates decrease as women age. Blackwell et al. (55) found that the odds of Canadian women 40-49 years of age reporting participation in Pap screening were 40% lower than those of women 18-29, while those of women 50-69 were 83% lower. Hislop et al. (89) found that reported Pap screening participation among Chinese women in BC ranged from 70% for women 40-59 to 19% for women 70-79. Using more recent data from BC's rich CCSP database, fine-grained age analyses were conducted that revealed some slight deviations from this trend. After adjusting for hysterectomy, women ages 20 to 29 years in the province have been shown to be the least likely to have had a Pap test within the last three years (90). After that age, rates jump rapidly and then begin to decline, looking much like the trends observed elsewhere. Whether this difference in trends is related to true differences between the BC population and that of other areas or whether it is the result of other social changes that occurred during the mid-2000s, such as an increase in the age at which women become pregnant, an event that has been shown to be associated with increases in Pap screening participation (91-93), is unclear. It is also unknown whether these same trends hold true for immigrant women in BC, since the CCSP does not collect information on immigration status.

Another variable important in any consideration of Pap screening participation is ethnicity. Studies conducted throughout North America have consistently found variations in screening behaviour by ethnic or cultural group. McDonald et al. (57) report 81% three-year Pap screening participation rates among native-born White Canadians, compared to 59% participation among foreign-born Chinese women, 58% among foreign-born South Asian women and 39% among foreign-born Japanese women. In the United States, Bazargan et al. (91) report 51% of Hispanic women in their study had never had a Pap screen, versus 22% of the African American women. One proposed explanation for this difference has to do with differences in cultural beliefs about health, health services utilization and preventive health practices. For example, Walker argues that in some cultures discussing a diagnosis of cancer is not socially acceptable and is thought to cause more symptoms and speed up the dying process, providing little incentive for these women to participate in screening (64). In other cultures, consulting a

health care provider in the absence of symptoms is not common practice (12, 89, 94) and procedures done in the absence of symptoms are considered invasive and unnecessary (64). BC's mix of women of all ethnicities almost certainly exerts an influence on screening behaviours in the province.

However, health beliefs are not fixed and there is evidence to suggest that providing culturally appropriate information and education about Pap testing and screening guidelines can increase participation in cervical cancer screening programs (3, 12, 94, 95). Through such education, one would hope to change negative beliefs about the effectiveness of Pap screening to detect cancer and the effectiveness of the health care system to treat detected abnormalities, both of which have been shown to increase the likelihood of participation in cervical cancer screening (12, 89, 96). This seems to be true of education more generally as well, since women with higher levels of education have been consistently shown to be more likely to participate in Pap screening on a regular basis (OR = 1.2–1.7 for women with some post-secondary education or higher compared to high school graduation only) (54, 57, 97).

Finally, family structure seems to be an important correlate of screening. Married women participate in Pap screening at higher levels (OR = 1.4–4.5) than do women who are not currently married (55, 57, 66, 98). This isn't especially surprising since associations between marital status and other health measures have also been reported. For example, married people in the United States have been found to have lower mortality rates than unmarried people (99). Given that the family structure of the immigrant population in BC is quite different from that of the native-born population (100), differences in marital status could contribute to screening participation differences between these two groups, although little has been done to examine whether marital status affects screening participation among immigrant women in the same way that is does among Canadian-born women.

All of the predisposing factors discussed so far are likely to apply to both immigrant and non-immigrant women, but there are a few additional variables that are

specific to immigrant women. Age at immigration has been observed to impact screening participation. Research shows that women arriving in Canada at a younger age are more likely to become regular participants in screening than are those who immigrate later in the life span (57). One explanation for this may be that younger, especially school-age children, are less likely to have fixed beliefs upon arrival and are more likely to integrate into the local culture and adopt health beliefs and behaviours that closely approximate those of Canadian-born women. Related to this is country of origin. Maxwell et al. (54) found that immigrant women born in Asia have consistently lower participation rates than immigrant women born in other regions (OR for never use = 4.1 compared to Canadian-born women) and several studies in BC have found that immigrant women born in China display significantly different screening behaviours than other groups (11, 66, 89). Cultural beliefs are likely to play a part in this, but another potential contributor is the magnitude of system differences between the country of origin and host country, leading to differing degrees of familiarity with Canadian-style health care systems and Pap screening programs. This familiarity is likely to increase among all immigrant groups with increasing time in Canada, which may, at least partially, explain the observation that Pap screening participation increases with time since immigration (57, 66). Also important is fluency in English. Women who are unable to communicate in English show lower rates of Pap screening participation (OR = 0.4-0.9) compared to English-speaking women (54, 57, 68). Among BC residents whose native tongue is not English, 11% reported not being able to communicate in either of Canada's official languages in 2006 (101). Rates were higher among subgroups whose mother tongue was Chinese (19.6%), Punjabi (18.2%), Vietnamese (14.5%) and Korean (12.8%). Given this, language barriers could present a barrier for specific immigrant subgroups in BC.

2.6.2 Enabling Factors

Enabling factors are those that facilitate access to and use of health services. In North America Pap screening is most often performed by physicians, so it is not surprising that having a regular doctor plays a significant role in whether or not women participate in screening (OR associated with non-participation = 0.3-0.4 for women who

have a regular source of care compared to those who do not) (55, 98). Much of the Pap screening done is opportunistic – women visit their physicians, who recommend being screened. In fact, receiving a physician recommendation is one of the strongest independent predictors of cervical cancer screening participation (OR = 2.0-2.9) (94, 102) and research suggests that immigrant women are not receiving appropriate recommendations from their physicians (12, 89, 91, 94-96, 103). It also then makes sense that frequent contact with the care provider is important. A study by Tu et al. (66) found that a recent physician visit was positively associated with regular Pap screening, with 69% of study participants with a physician visit in the last year reporting Pap having had a recent Pap screen versus 59% of women without a physician visit in the last year. In BC an estimated 9.9% of the population report not having access to a regular care provider (104), so these women may participate in Pap screening less frequently than is recommended.

While these general physician trends are telling, the relationship between physicians and screening participation has an additional layer of complexity. This complexity relates to practice variations between physicians. Decker et al. (39) found that rural family physicians in Manitoba were less likely to provide Pap tests than family physicians in other regions (OR = 0.68). Several studies have reported lower rates of screening among women living in rural areas (OR for non-participation = 1.2 – 1.3) (54, 57). Practice variations may be one contributing factor, as might especially acute physician shortages in these areas (105). Practice variations have also been observed among foreign medical graduates in Manitoba, who were found to be less likely than domestic medical graduates to perform Pap tests (39). Finally, women with female physicians are more likely to receive a regular Pap test than women with male physicians (11, 13, 39, 66). How these practice variations play out in the BC context is not well understood, but it is likely that such physician preferences and practices do have an impact on cervical cancer screening in the province.

Another important enabling factor, particularly for immigrant women, is competing needs. The immigrant experience is often one of great change and adaptation,

sometimes to a completely different outlook and way of life (106). The settlement and post-migratory periods can be times of great stress. Immigrant women may face language barriers, culture shock, loss of socioeconomic status, unemployment, isolation, loss of a pre-existing social support network and economic and social exclusion (65). Immigrant women in these situations face a number of pressing issues and demands, and screening for a health condition that is not of immediate concern may be low on their priority list (64, 65, 98). For many women, immigrant and non-immigrant alike, work and family responsibilities can take precedence over personal health concerns (95). Perceived gender roles and decision-making within the household may limit some women's ability to allocate resources to health maintenance and promotion (106). Culturally-derived gender roles may dictate that women must seek permission from their husbands or other male family members for medical appointments (95). For some or all of these reasons, cervical cancer screening may fall to the bottom of the priority list for particular women.

Finally, access to financial resources can have an effect on Pap screening participation. Canadian women from lower economic groups have been found to participate in Pap screening at rates below those of women from higher economic groups, a trend that has been observed for both lifetime and recent screening. (56, 66, 97, 107). In the publicly-funded Canadian (and BC) health care system, financial resources should not directly impede access to health services; however there are indirect ways through which this can occur. Women in lower paying jobs may not have benefits that provide paid medical leaves and be unable to afford time away from work for physician visits. Women with young children may be unable to secure childcare that would permit them to attend a clinic visit for Pap screening. Additionally, lower income may be a proxy for lower levels of education, which, as was discussed earlier, is associated with lower rates of Pap screening participation. Since recent immigrants in BC earn less on average than their non-immigrant counterparts (108), income is likely to be an important factor when examining screening participation differences between the two groups.

2.6.3 Need Factors

Perceived personal risk for cervical cancer is an important motivator for women to actively seek out a Pap test. While subgroups of immigrant women have been shown to be at higher risk for cervical cancer due to the increased prevalence of a multitude of risk factors for the disease (e.g. early marriages, multiparity, multiple abortions, lack of access to health services) (12), research suggests that this is often not reflected in their perceptions of risk (96). Confusion about the causes of cervical cancer abounds (44, 45), particularly among immigrant women (11-13, 96, 103). In a study of Vietnamese-Canadian women, many participants reported a belief that cleanliness in themselves and their partners and the will of a higher power play a role in susceptibility to cervical cancer (13). Johnson et al. (96) found that many Asian women in the United States believe that cervical cancer is caused by wind and that illness is a matter of “karma”. Thus even among immigrant women who do perceive themselves at risk for cervical cancer, the reasons for that perception of risk vary and could influence the types of actions they are willing to consider in order to decrease risk.

Perceptions of need for Pap testing may also be influenced by self-perceptions of overall health. In Juon et al.’s study looking at predictors of Pap smears among Korean-American women, a correlation was observed between higher self-reported health and decreased levels of Pap screening participation (94). This may be a function of physician contact, since women who are ill may be more likely to have contact with their doctor, who can then recommend screening. Alternatively, it may reflect a belief of decreased susceptibility to cervical cancer among women who perceive themselves to be healthy. This is an area for which little research exists and further investigation and validation needs to be undertaken.

CHAPTER 3: Methods

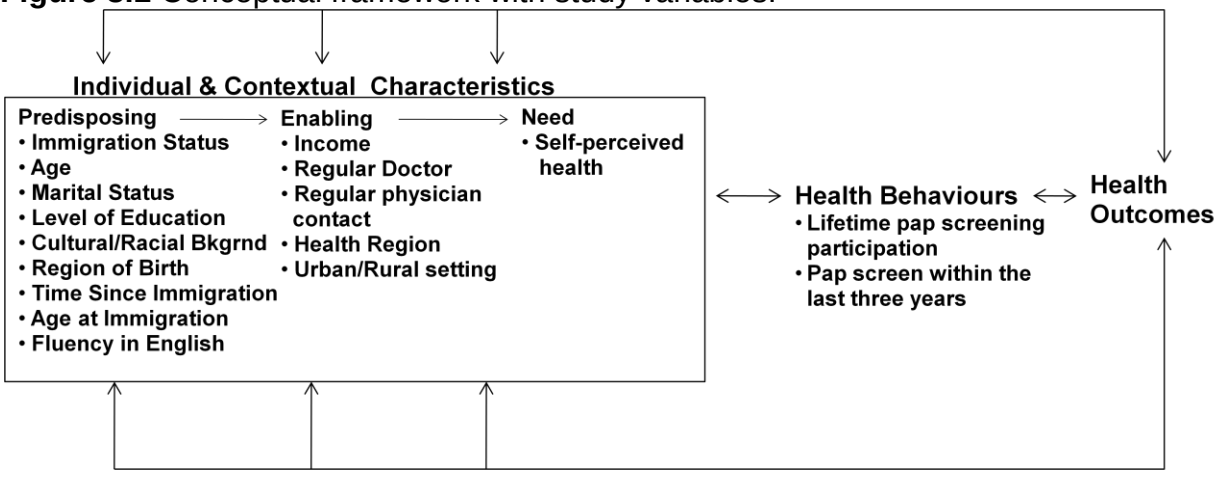
3.1 Study Design

The current study compared rates of Pap screening participation and sociodemographic correlates of use for immigrant women in BC to those of native-born Canadians using self-reported measures of screening behaviour and immigration status. A cross-sectional, population-based study design was adopted for the study. Subjects were identified through responses to a national health survey conducted by Statistics Canada. Immigration status, use of Pap screening services and sociodemographic information were determined using self-reported data provided by participants. Ethical approval was obtained from the University of British Columbia Behavioural Research Ethics Board.

3.2 Conceptual Framework

This study was informed by Andersen's Behavioural Model of Health Services Utilization. A summary of the model used, adapted from Andersen's Behavioural Model of Health Services Utilization (86) and Behavioural Model for Vulnerable Populations (87), is presented in Figure 3.1.

Figure 3.1 Conceptual framework with study variables.



3.3 Data Source

The Canadian Community Health Survey (CCHS) Cycle 3.1 provided the data for this study. The CCHS is a cross-sectional, population-based survey of 65,000 respondents conducted bi-annually by Statistics Canada to gather health-related data at the health region or combined health region level within Canada. Data are collected on individuals' health status, health care utilization and health determinants within 121 health regions across the country. To ensure reliable estimates for all health regions, a multi-stage, stratified, clustered sampling method is used, allocating sample sizes among the provinces and health regions according to the size of their respective populations (see http://www.statcan.gc.ca/cgi-bin/imdb/p2SV.pl?Function=getSurvey&SDDS=3226&lang=en&db=imdb&adm=8&dis=2 for more details about the CCHS sampling strategies). Sampled households are contacted either by telephone or in-person, and one household member aged 12 years or older is invited to participate. In addition to having the survey available in English and French, Statistics Canada makes the questionnaire available in Chinese, Punjabi and Inuktitut and has interviewers available in other languages as required. Responding to this survey is voluntary. A response rate of 77% was achieved for Cycle 3.1 in BC.

Cycle 3.1 of the CCHS, the most recent data available at the time this study was undertaken, was conducted between January and December 2005. This cycle of the survey included the Pap Smear Test question subset, which specifically collected data on individuals' Pap screening history. Access to anonymized, individual-level data was obtained through the Research Data Centre of Statistics Canada at the University of British Columbia.

3.4 Subjects

Female survey participants between the ages of 18 and 69 residing in the province of BC who responded to both the CCHS questions pertaining to immigration status and those related to Pap screening history were included in this study. A total of 5,893 women, composed of 1,756 immigrant women and 4,135 Canadian-born women, met the inclusion criteria for the study.

3.5 Study Variables

3.5.1 Dependent Variables

Research suggests that the factors associated with one-time participation in preventive screening programs can be different from those associated with regular participation (54, 57, 89, 94). As a result, two outcomes were examined in this study: lifetime screening or having ever had a Pap test and recent or guideline-compliant Pap screening. A list of the CCHS questions from which the analyzed data were obtained can be found in Appendix I.

As discussed earlier, BC Pap screening guidelines recommend women initially be screened at a frequency of once every year, but following three years of screening with no abnormal results, decreasing screening frequency to once every two years is suggested. To allow time for appropriate notification of need for screening and to enable comparisons with the published literature, receipt of a Pap screen within the last three years was classified as recent screening for the purposes of this study.

3.5.2 Independent Variables

Immigration status in Canada was the primary independent variable in the study. Other variables of interest as potential correlates of screening were the *predisposing* variables age, marital status, highest level of personal education, self-reported cultural or racial background, region of birth, length of time in Canada since immigration, age at immigration and fluency in English. *Enabling* factors examined were adjusted household income (a ratio of household income and the low income cut-off corresponding to the number of persons in the household and the size of the community), having a regular doctor, having visited a doctor at least once within the last year, health region of residence and living in an urban versus rural setting. Finally, self-reported health status was included as a measure of perceived *need*. Table 3.1 provides a summary of the study variables.

Table 3.1 Study variables.

Dependent Variables
Lifetime Pap screening
Recent Pap screening (i.e. within the last three years)
Independent Variables
Immigration Status
Age
Marital status
Highest level of personal education
Cultural or racial background
Region of birth*
Length of time in Canada since immigration*
Age at immigration*
Fluency in English*
Adjusted household income
Has a regular doctor
Visited a doctor at least once within the last year
Health region of residence
Living in an urban or rural setting
Self-reported health status

* used only in analyses of immigrant population

Perceived barriers to Pap screening were examined using responses to a series of questions exploring potential reasons for non-participation. These questions were asked only of respondents reporting no Pap screen within the last three years. Potential reasons offered included haven't gotten around to it, didn't think it was necessary, doctor didn't think it was necessary, language problems and fear, to which respondents were able to respond "yes" or "no" that it was a factor for them personally.

3.6 Descriptive Analysis

Frequencies were calculated for each categorical study variable, stratified by immigration status and weighted to represent the household population of BC. Due to the complex sampling strategy employed for the CCHS, Statistics Canada develops weights for each survey respondent that can be used to make the results representative of the general population (109). These weights correspond to the number of households in the population that are represented by the respondent and take into account the survey design (probability of the household and the individual within that household being selected for inclusion), nonresponse adjustments and calibration to match

population projection counts based on the Census (by age and sex for each health region in Canada). By applying these weights to the survey data, estimates produced from them become representative of the covered population and not just the sample itself.

For continuous variables, the mean and standard deviation were determined, again stratified by immigration status and weighted to represent the general population. To address the complex sampling scheme of the CCHS, 95% confidence intervals for all estimates were calculated using bootstrapping methods through the Statistics Canada's program BOOTVAR Version 3.0. Bootstrapping is a method for approximating sampling distributions when theory cannot predict their shape. The variance of the estimates is computed by drawing several subsamples with replacement from the full dataset and calculating the parameter of interest for that subsample. The variability among the subsample estimates is then used to approximate the overall variance estimate (110, 111).

All analyses were conducted using SPSS Statistics version 17.0.

3.7 Analysis of Screening Rates

For both lifetime and regular Pap screening, the weighted overall proportions of immigrant and non-immigrant women participating were calculated. In addition to these overall proportions, age stratified estimates were obtained in order to examine age variations in Pap screen utilization (90). Two-proportion z-tests were used to test for differences in the proportions screened between groups. The 95% confidence intervals for all estimates were determined using bootstrapping methods.

Among immigrant respondents, lifetime and regular Pap screening participation rates were also stratified by length of time in Canada since immigration. Two-proportion z-tests were used to test for differences in the proportions screened between groups. Length of time in Canada since immigration was grouped into three categories: less than 10 years, 10 to 19 years, and 20 or more years. While categories with shorter

timeframes were considered, the small number of respondents in some categories would have precluded their release by Statistics Canada due to an unacceptable risk of disclosure.

A number of studies have questioned the accuracy of self-reported measures of Pap screening participation (69-71). Especially important for this study, the gap between reported and observed screening rates has been found to vary between ethnic groups (72). In order to assess the impact of this potential reporting bias on the participation rates observed in this study, a sensitivity analysis was undertaken. Published sensitivity and specificity pairs from Pap screening self-report validation studies (see Table 2.2) were used to obtain 'corrected' rates of participation and measures of association. The corrected numbers of women screened (B_1) and not screened (B_0) were calculated using the following formulas (84), where Se = sensitivity and Sp = specificity:

B_1* = number of women who self-report being screened
= # true positives + # false positives
= $SeB_1 + (1\text{-}Sp)B_0$

B_0* = number of women who self-report not being screened
= # true negatives + # false negatives
= $SpB_0 + (1\text{-}Se)B_1$

Rearranging these formulas to solve for B_1 and B_0:

$$B_0 = (B_0^* - ((1\text{-}Se)B_1))/Sp$$

$$B_1 = \frac{SpB_1^* - (1\text{-}Sp)B_0^* \quad e}{SeSp - (1\text{-}Sp)(1\text{-}Se)}$$

The self-reported and corrected numbers of immigrant and non-immigrant women screened were then summarized in 2 x 2 contingency tables as follows:

Table 3.2 Summary of self-reported and adjusted numbers of women screened

	Self-Report		Corrected	
	Screened	Not screened	Screened	Not Screened
Immigrant women	B_{i1}*	B_{i0}*	B_{i1}	B_{i0}
Non-immigrant women	B_{n1}*	B_{n0}*	B_{n1}	B_{n0}

The odds ratios for self-reported and corrected screening participation of immigrant women relative to non-immigrant women were calculated using:

$OR_{self\text{-}report} = B_{i1}*B_{n0}*/ B_{i0}* B_1*$

$OR_{adjusted} = B_{i1}B_{n0}/ B_{i0} B_1$

This procedure was repeated for each sensitivity and specificity pair and trends in corrected odds ratios were examined.

3.8 Logistic Regression Modeling for Correlates of Screening

Multivariate logistic regression methods were used to model the relationship between lifetime and recent Pap screening participation and the predisposing, enabling and need factors discussed above to explore the impact of these potential correlates of screening. In addition to immigration status, age, cultural or racial background (categorized dichotomously as White and visible minority), marital status, highest level of personal education, adjusted household income, having a regular doctor, having visited a doctor at least once within the last year, health region of residence, living in an urban or rural setting and self-reported health status were entered as independent variables in the regression model to obtain adjusted effects.

Age, adjusted household income and self-reported health status were entered as continuous variables. These three variables were centred by subtracting the mean value from all data points. This was done to make any interaction terms obtained from the regression model more interpretable (112). For example, in a model with the equation $y = \beta_1X + \beta_2Y + \beta_3XY$ resulting from the use of uncentred variables X & Y, the coefficient β_1 measures the effect of X when Y is zero. But if Y is age, zero is not a meaningful response. The interpretation becomes easier when β_1 gives a measure of the effect of X at the average age of the population, which is accomplished through the mean-centring of the age variable.

Immigration and visible minority status were entered as dichotomous variables. Being an immigrant and visible minority were each coded as 1 and being a non-immigrant and White were coded as 0. The categorical variables marital status, highest level of personal education and health region of residence were represented using dummy variables. Secondary graduation or less served as the reference category for highest level of personal education, with the other two categories being some post-secondary education (including trade diplomas, college diplomas and certificates less than a bachelor's degree) and bachelor's degree or higher. Being single served as the reference group for marital status, with two dummy variables included to represent being married or in a common-law relationship and being widowed, separated or divorced. Vancouver Coastal Health Region was the reference health region and the other four regions, Interior, Fraser, Vancouver Island, and Northern Health, were represented by four dummy variables. Finally, having a regular doctor, having visited a doctor at least once within the last year and living in an urban setting were entered as dichotomous variables, with a positive response scored as 1 and a negative response scored as 0.

A modeling strategy based on that proposed by Hosmer & Lemeshow (113) was used to obtain the final model in this study. Univariate analyses of each variable with lifetime and regular Pap screening participation were performed. For categorical variables, contingency tables were generated and trends explored. Contingency tables were also examined for low cell counts that could be problematic for regression modeling. Univariate logistic regression models were then generated for all variables and odds ratios and their 95% confidence intervals were calculated. Likelihood ratio tests and Wald statistics were used to assess the significance of the associations.

All variables showing at least a moderate level of association in the univariate analyses (p-value < 0.25) were entered into a multivariate logistic regression model. A lower significance level was chosen at this stage since the traditional 0.05 often fails to identify variables known to be important (113). Wald statistics and their associated p-values were examined to assess the significance of each variable and changes in

coefficients between models were noted. Since Wald statistics can sometimes be underestimated due to the inflation of standard errors when regression coefficients are large (114), likelihood ratio tests were also used to assess the significance of individual variables by comparing models with and without the variable of interest. Significance was determined using the G-statistic (G = likelihood $\text{ratio}_{\text{model without variable}}$ – likelihood $\text{ratio}_{\text{model with variable}}$) (113).

Variables found not to contribute significantly to the model as judged by likelihood ratio tests were examined and, in conjunction with what is known about the relationship of each variable with Pap screening behaviour from the literature, a decision was made on whether or not to retain the variable. A model including the final subset of variables deemed important was then fitted to the data.

Jaccard has observed that researchers looking to compare the effects of a variable for two different populations often do so by fitting separate logistic regression models for each group and examining the statistical significance of the variables in each model (115). He points out that this does not constitute a formal statistical test of the difference between the coefficients for the two groups and argues that interaction analysis through the inclusion of product terms in a single model is preferable because it does provide a means of formally testing the difference between coefficients. In order to test for differences in the correlates of screening participation between immigrant and non-immigrant women, interaction terms for immigration status with each of the other variables in the model were examined. Interaction terms were added one variable pair at a time and their significances were assessed using likelihood ratio tests, comparing the model with the interaction term(s) to that without. Interaction terms found to be significant were then added simultaneously to generate the final model.

At this stage the final model was assessed for goodness of fit and to ensure that the assumptions of logistic regression analysis had been satisfied using methods proposed by Field (114). Residuals and deviance statistics were examined to isolate points for which the model fit poorly and those that exerted an undue influence on the

model. The percentages of standardized residuals with an absolute value above 2.58 and 3.29 were calculated. To asses the influence of individual cases on the model, Cook's distance values were examined, with values above 1 noted as a cause for concern. Leverage values above or below three times the expected value (calculated as the number of predictors in the model plus one divided by the number of subjects in the study) were identified, with leverage values gauging the influence of the observed value over the expected value. As a final measure of deviance, DFBetas, which measure the difference between the parameter estimated using all cases and that estimated when one case is excluded, were examined, with values above 1.0 noted. All continuous variables were plotted versus the natural log of that variable. The assumption of linearity was tested by including interaction terms for each continuous variable with its natural log in the model, with significant interaction terms suggesting potential violations of the assumption. Finally, variance inflation factors were examined to check for multilinearity. Variance inflation factors indicate whether a predictor has a strong linear relationship with other predictors, with a value of 10 or greater deemed indicative of potential multilinearity.

From the final model, the regression coefficient for each variable was converted to an odds ratio by calculating the exponent of the coefficient. The significance of the coefficients was indicated by the 95% confidence intervals. As noted by Jaccard, the introduction of interaction terms into a logistic regression model changes the interpretation of the coefficients since variables that form part of a product term in the equation (for example XZ) become conditioned on the values of the other variable in the product term (115). The modifying variable of interest in this study (Z) was immigration status, so the coefficient for the other variable in the interaction term (X) was calculated separately for immigrants and non-immigrants. This was done by isolating all terms in the equation containing the variable X ($\beta_i X + \beta_j XZ$). Since for non-immigrants Z = 0, the coefficient of X for non-immigrants was simply that of the main effect: $\beta_i X + \beta_j X(0) = \beta_i X$. For immigrants (Z = 1), the coefficient for the variable was calculated as: $\beta_i X + \beta_j X(1) = X(\beta_i + \beta_j)$. Odds ratios were calculated by taking the exponent of the coefficient and the 95% confidence intervals were calculated using bootstrapping methods.

A separate multivariate logistic regression model was also fitted for immigrant women alone. This was done only to explore the impact of additional variables specific to this population, including length of time in Canada since immigration, age at immigration and fluency in English. Along with all of the variables identified as significant in the combined immigrant and non-immigrant model, length of time since immigration and age at immigration were entered into the immigrant women-only model as continuous variables and fluency in English was entered as a dichotomous variable. As in the combined immigrant and non-immigrant model, Wald statistics and their associated p-values, in combination with likelihood ratio tests, were used to assess the significance of these additional variables. The regression coefficients were then converted to odds ratios and 95% confidence intervals were calculated using bootstrapping methods.

3.9 Analysis of Screening Rates by Racial Background and Region of Birth

For the immigrant population in this study, the most common ethnicities and regions of birth were identified. For each of these immigrant subgroups, the weighted proportions of women participating in both lifetime and regular Pap screening were calculated. Age stratified estimates were obtained and 95% confidence intervals determined using bootstrapping methods. Two-proportion z-tests were used to test for differences in the proportions screened between ethnic and birth region groups, as well as between each of these groups and the non-immigrant study population.

In order to obtain adjusted odds ratios associated with screening participation for each of the major ethnic and birth region subpopulations relative to the Canadian-born population, modified versions of the final multivariate logistic regression models obtained in the previous analyses were fitted. In these models, the more fine-grained ethnicities and regions of birth were used in place of the dichotomous visible minority category, with non-immigrants comprising the reference group. Assessment of fit and interpretation were done as described above for the full study population.

3.10 Perceived Barriers to Pap Screening

A total of 1,448 study subjects who had not received a Pap test within the last three years responded to the questions pertaining to perceived barriers to screening. The proportion of positive responses was calculated for each potential barrier, stratified by immigration status and weighted to represent the household population of BC. The 95% confidence intervals for all estimates were determined using bootstrapping methods. Ratios for immigrant versus non-immigrant women were calculated for each potential barrier as a measure of their relative importance for these two subpopulations.

CHAPTER 4: Results

4.1 Population Description

A total of 5,891 female respondents to CCHS Cycle 3.1 were between the ages of 18 and 69, living in BC, responded to the Pap test question subset and were therefore included in this study. This comprised 1,756 women who self-identified as immigrants to Canada and 4,135 women who identified as non-immigrants.

A sociodemographic summary of the study population is presented in Table 4.1. As can be seen there, the immigrant population tends to be older than the non-immigrant population (mean age of 44.9 years for the immigrant population compared to 41.9 years for the non-immigrant population), is more likely to be married or in a common-law relationship (71% vs. 63%), less likely to have never been married (14% vs. 25%) and more likely to have a Bachelor's degree or higher level of education (30% vs. 19%). A significantly larger percentage of the immigrant population, as compared to the non-immigrant population, report household income levels in the lowest decile and a significantly smaller percentage of the immigrant population report incomes in the highest deciles. A greater proportion of immigrant women live in the Lower Mainland and 93% live in urban settings, compared to 82% of non-immigrant women.

In terms of their reported access to health services, equal proportions of immigrant and non-immigrant women report having a regular doctor and consulting a doctor at least once within the past year. Immigrant women are more likely than Canadian-born women to report being in good or fair health, but less likely to report being in very good health. There are no statistically significant differences in the proportions reporting excellent or poor health.

Over 45% of immigrant women in the study population have lived in Canada for more than 20 years, with the remaining women split approximately equally between having spent less than 10 years and 11 to 20 years in the country. The majority of the immigrant population (68%) arrived in Canada before the age of 40 and just 1% was over the age of 60 at the time of immigration. Europe, East Asia and South Asia are the

Table 4.1 Sociodemographic summary of women age 18-69 in Canada, based on data from the Canadian Community Health Survey (CCHS).

Variable	Immigrant Women Percentage (95% CI)	Non-Immigrant Women Percentage (95% CI)
Age (years)		
18 – 29*	14.5% (12.3, 16.8)	26.3% (25.1, 27.3)
30 – 49*	48.4% (45.4, 51.4)	42.6% (41.1, 44.0)
50 – 69*	37.1% (34.3, 40.0)	31.1% (29.8, 32.6)
Marital Status		
Married/Common-Law*	70.8% (67.8, 73.8)	63.0% (61.3, 64.7)
Widowed/Separated/Divorced	14.9% (12.7, 17.1)	12.2% (11.1, 13.3)
Single/Never Married*	14.1% (11.8, 16.5)	24.6% (23.1, 26.1)
Highest Level of Education		
Secondary Graduation or Less*	25.7% (22.7, 28.6)	37.0% (35.2, 38.9)
Trade Diploma, College Diploma, Certificate Less Than Bachelor's Degree	35.0% (31.4, 38.7)	38.2% (36.3, 40.1)
Bachelor's Degree or Higher*	30.4% (27.1, 33.7)	19.4% (17.9, 20.9)
Household Income Distribution		
Decile 1*	13.1% (10.9, 15.3)	7.5% (6.5, 8.6)
Decile 2	9.1% (7.0, 11.3)	6.2% (5.2, 7.2)
Decile 3	10.0 (8.1, 11.9)	7.5% (6.5, 8.6)
Decile 4	9.2% (7.2, 11.2)	8.4% (7.4, 9.4)
Decile 5	9.3% (7.1, 11.6)	8.5% (7.2, 9.7)
Decile 6*	6.4% (4.8, 7.9)	9.9% (8.7, 11.0)
Decile 7	7.1% (5.3, 9.0)	8.7% (7.7, 9.8)
Decile 8*	5.4% (4.2, 6.7)	9.5% (8.2, 10.7)
Decile 9*	4.5% (3.1, 5.9)	9.6% (8.4, 10.8)
Decile 10*	5.1% (3.8, 6.4)	8.6% (7.6, 9.5)
Has a Regular Doctor		
Yes	90.1% (88.0, 92.2)	90.6% (89.5, 91.8)
No	9.9% (7.8, 12.0)	9.4% (7.6. 9.5)
Visited a Doctor Within the Past Year		
Yes	84.3% (81.6, 87.0)	87.7% (86.3, 89.0)
No	14.9% (12.3, 17.6)	12.2% (10.8, 13.5)
Health Authority of Residence		
Interior*	7.5% (6.0, 9.0)	20.1% (19.3, 20.9)
Fraser*	39.2% (36.4, 42.0)	32.4% (31.1, 33.6)
Vancouver Coastal*	40.4% (37.8, 43.1)	19.4% (18.3, 20.6)
Vancouver Island*	10.2% (8.6, 11.7)	19.9% (19.1, 20.7)
Northern*	2.8% (2.1, 3.5)	8.2% (7.8, 8.6)
Geographic Setting		
Urban*	92.9% (91.6, 94.3)	81.7% (80.1, 83.3)
Rural*	7.1% (5.7, 8.5)	18.3% (16.7, 19.9)
Self-Reported Health Status		
Excellent	20.8% (18.4, 23.2)	23.2% (21.5, 24.9)
Very Good*	33.8% (30.9, 36.8)	41.3% (39.4, 43.2)
Good*	32.5% (29.2, 35.7)	26.5% (24.8, 28.3)
Fair*	9.6% (7.8, 11.5)	6.8% (5.9, 7.7)
Poor	3.2% (1.8, 4.6)	2.2% (1.7, 2.6)

* Significant difference between immigrants and non-immigrants

Variable	Immigrant Women Percentage (95% CI)	Non-Immigrant Women Percentage (95% CI)
Cultural or racial background		
White	39.8% (36.6, 42,9)	89.3% (88.0, 90.5)
Black	1.3% (0.6, 2.0)	
Korean	2.8% (1.6, 4.1)	
Filipino	5.9% (4.3, 7.4)	
Japanese	1.5% (0.8, 2.2)	
Chinese	22.8% (19.8, 25.7)	
South Asian	13.1% (10.7, 15.5)	
South East Asian	4.1% (2.6, 5.6)	
Arab	1.1% (-0.2, 2.4)	
West Asian	2.2% (1.0, 3.5)	
Latin American	2.0% (1.1, 3.0)	
Other	1.7% (0.8, 2.6)	
Multiple Origins	1.4% (0.6, 2.1)	
Region of Birth		
North America	5.3% (3.9, 6.6)	
Latin & South America	4.3% (2.9, 5.7)	
Europe	26.5% (23.8, 29.3)	
East Asia	20.4% (17.7, 23.2)	
South Asia	11.0% (8.4, 13.6)	
South East Asia	10.7% (8.7, 12.7)	
Other	5.7% (3.8, 7.5)	
Length of Time Since Immigration		
Less than 10 years	28.0% (24.6, 31.1)	
11 to 20 years	26.3% (23.2, 29.4)	
More than 20 years	45.7% (43.3, 49.1)	
Age at Time of Immigration (years)		
0 – 9	16.4% (13.9, 19.0)	
10 – 19	15.6% (13.2, 17.9)	
20 – 29	35.6% (32.4, 38.9)	
30 – 39	20.4% (17.6, 23.2)	
40 – 49	8.7% (6.7, 10.8)	
50 – 59	2.2% (1.3, 3.0)	
60 – 69	1.1% (0.2, 2.0)	
Languages Spoken		
English	91.8% (89.7, 93.8)	
No English	8.3% (6.2, 10.3)	

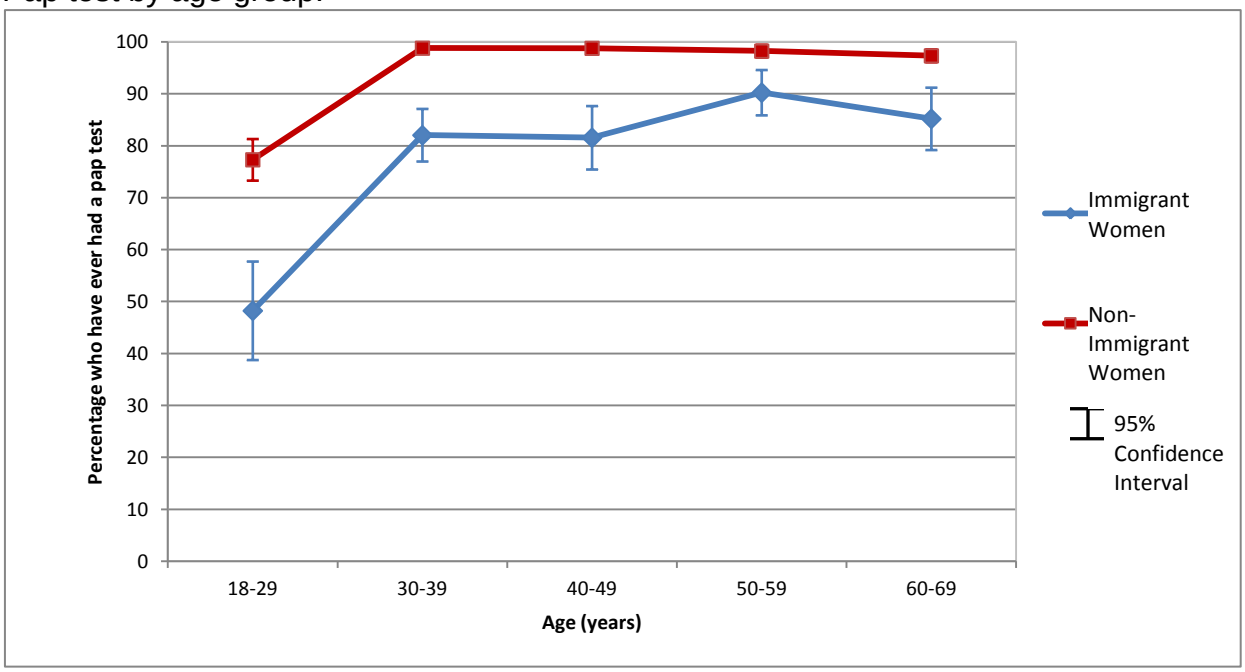
most common regions of birth for this immigrant population and White, Chinese and South Asian are the most common self-reported cultural or racial backgrounds. Nearly 92% of immigrant women report being able to converse in English.

4.2 Study Objective 1a: Age-Specific Pap Screening Rates

The first objective of this study was to compare lifetime and recent age-specific Pap screening rates for immigrant women in BC to those of BC residents born in Canada. Seventy-nine percent of immigrant women report having ever received a Pap screen, which is significantly lower than the participation rate reported by non-immigrant

women of 93% (z = 15.4, p < .01). This gap between the proportions of immigrant and non-immigrant women participating in Pap screening is seen in all age groups (Figure 4.1). For both populations of women participation rates tend to increase with age in the 20s and 30s and then level off in the 40s. Participation rates for non-immigrant women decline very slowly over the 50s and 60s, while rates for immigrant women increase in the 50s and then fall slightly in the 60s.

Figure 4.1 Percentage of immigrant and non-immigrant women who have ever had a Pap test by age group.



The overall unadjusted odds ratio for the reported lifetime screening participation of immigrant women relative to non-immigrant women is 0.29. The results of a sensitivity analysis used to explore the effect of potential differential sensitivities and specificities for self-reported Pap screening for immigrant and non-immigrant women are presented in Table 4.2. As can be seen, the odds of screening participation remain lower for immigrant women than non-immigrant women for all sensitivities and specificities examined, with the exception of the most extreme values (i.e. with the highest specificity used for immigrant women and the lowest specificity used for non-immigrant women). These results suggest that the lower screening rates reported by

immigrant women compared to Canadian-born women are a reflection of a true screening gap between these two populations and not just differences in reporting inaccuracies.

Table 4.2 Corrected lifetime screening participation odds ratios from sensitivity analysis.

Immigrant Women (sensitivity/specificity)	Non-Immigrant Women (sensitivity/specificity)					
	0.98/0.45	0.97/0.35	0.97/0.15	0.96/0.42	0.95/0.47	0.93/0.55
0.98/0.45	0.17	0.19	0.66	0.11	0.07	0.00
0.97/0.35	0.11	0.12	0.41	0.07	0.04	0.00
0.97/0.15	N/A	N/A	N/A	N/A	N/A	0.00
0.96/0.42	0.17	0.18	0.65	0.11	0.07	0.00
0.95/0.47	0.22	0.24	0.85	0.15	0.09	0.00
0.93/0.55	0.33	0.36	1.27	0.22	0.13	0.01

A total of 66% of immigrant women report receiving a Pap test within the last three years, which is significantly lower than the 78% reported by Canadian-born women ($z = 9.8$, $p < .01$). The largest difference in reported participation rates is in the youngest age group, 18-29 years (Figure 4.2). Forty-seven percent of immigrant women 18-29 report having recently received a Pap test, versus 75% of Canadian-born women. Participation rates among immigrant women increase for women in their 30s, level off in the 40s and 50s, and then decline in the 60s. Participation rates among non-immigrant women begin to decline in the 40s. No statistically significant differences are observed between reported screening rates for immigrant and non-immigrant women in their 50s and 60s.

The unadjusted odds ratio for recent screening participation of immigrant women relative to non-immigrant women is 0.55. Sensitivity analysis results can be seen in Table 4.3. As with the lifetime Pap screening, the odds of recent screening participation remain lower for immigrant women than non-immigrant women for all sensitivities and specificities examined, with the exception of the most extreme values and in the case of extremely low specificity for both groups. These results once again suggest that the lower screening rates in immigrant women compared to Canadian-born women reported

Figure 4.2 Percentage of immigrant and non-immigrant women who have had a recent Pap test by age group.

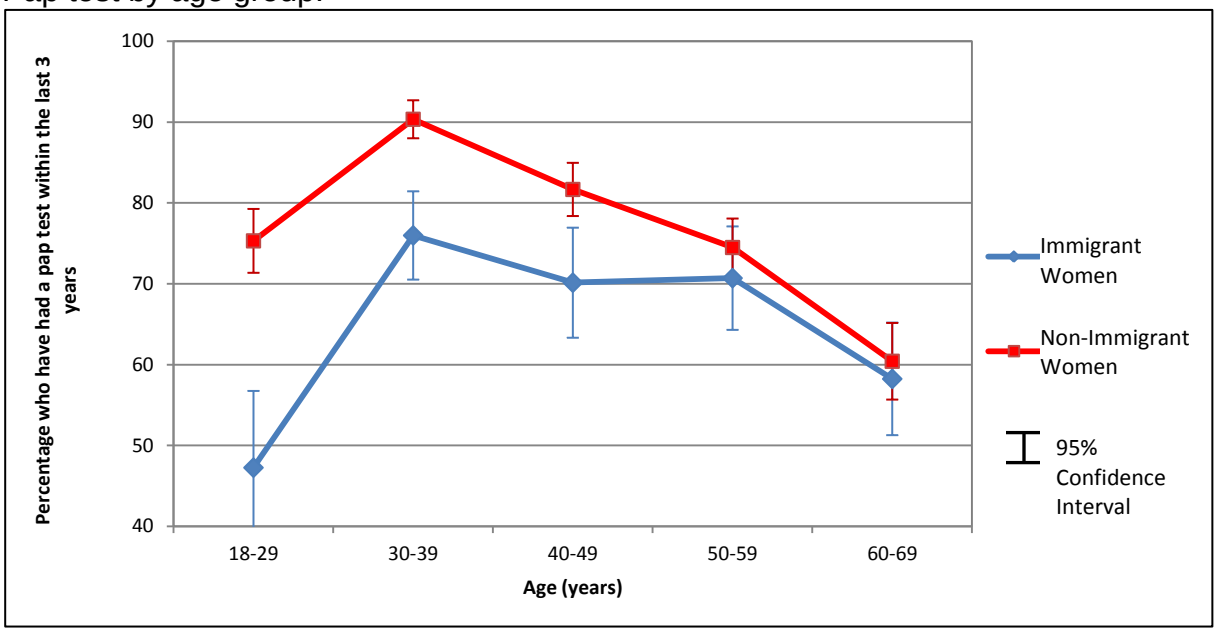


Table 4.3 Corrected recent screening participation odds ratios from sensitivity analysis.

Immigrant Women (sensitivity/specificity)	Non-Immigrant Women (sensitivity/specificity)					
	0.98/0.45	0.97/0.35	0.97/0.15	0.96/0.42	0.95/0.47	0.93/0.55
0.98/0.45	0.31	0.52	N/A	0.32	0.24	0.16
0.97/0.35	0.03	0.05	N/A	0.03	0.02	0.02
0.97/0.15	N/A	N/A	1.65	N/A	N/A	N/A
0.96/0.42	0.24	0.4	N/A	0.25	0.19	0.12
0.95/0.47	0.40	0.67	N/A	0.41	0.31	0.21
0.93/0.55	0.69	1.16	N/A	0.71	0.54	0.36

in this study are a reflection of a true screening gap between these two populations and not just differences in reporting accuracy between the two groups.

Differences in screening participation rates between immigrant groups with varying lengths of time since immigration are also observed (Table 4.4). For lifetime screening participation, the proportion of women screened increases with time, from a low of 61.9% for those living in Canada for less than 10 years to a high of 91.2% for those who have been in Canada for 20 or more years. This means that immigrant women who have been in the country for 20 years or longer display Pap screening participation rates comparable to those of Canadian-born women (92.9%). For recent

screening participation, the proportion of women screened also increases with time, from a low of 57.7% for those living in Canada for less than 10 years to a high of 71.2% for those who have been in Canada for 20 or more years. However, in the case of recent screening participation, the proportion of women who have received a Pap test within the last three years remains lower than that of non-immigrant women (77.9%) regardless of time since immigration.

Table 4.4 Lifetime and recent screening participation rates among immigrant women by time in Canada since immigration.

Time Since Immigration	Lifetime Pap Screening Percentage (95% CI)	Pap Screening Within Last 3 Years Percentage (95% CI)
Less than 10 years	61.9% (55.4, 68.5)*	57.7% (51.0, 64.5)
10 - 19 years	76.6% (70.9, 82.4)*	66.0% (59.6, 72.3)
20 or more years	91.2% (87.7, 94.7)*	71.2% (66.7, 75.7)**

* Statistically significantly different from other time since immigration groups
** Statistically significantly different from immigrant women arriving in Canada less than 10 years ago

4.3 Study Objective 1b: Sociodemographic Correlates of Screening

Based on a review of the literature, ten variables were identified as potentially important for understanding the Pap screening behaviours of immigrant women (Table 3.1). The predisposing variables age, cultural or racial background, marital status and highest level of personal education, enabling variables household income, having a regular doctor, having visited a doctor at least once within the last year, health region of residence and living in an urban or rural setting and the need-based variable self-perceived health status were each explored individually for their relationship with Pap screening participation. A significant relationship with both having ever received a Pap test and having received a recent Pap test is observed for each of these variables, as determined by their odds ratios and associated p-values (see Tables 4.5 and 4.6).

Multivariate logistic regression methods were used to explore the impact of these potential correlates of screening. Looking first at lifetime screening participation, when all ten variables are entered into a multivariate logistic regression model, the Wald statistics and associated p-values for having a regular doctor, health region of residence and living in an urban setting suggest that these variables do not contribute significantly to the model. When removed individually and compared to the full model, the likelihood

ratio tests provide further evidence that these variables are not significant factors in lifetime screening participation.

Examining the effects of the interaction terms between immigration status and each of the remaining factors in the model, likelihood ratio tests suggest a significant interaction between immigration status and: age ($G = 24.91$, $p < .01$), marital status ($G = 28.83$, $p < .01$), highest level of personal education ($G = 16.11$, $p < .01$), relative income ($G = 4.35$, $p = 0.04$), cultural or racial background ($G = 5.67$, $p = 0.02$) and self-perceived health status ($G = 4.21$, $p = 0.04$). This suggests that the effects of these variables on lifetime Pap screening participation are different for immigrant and non-immigrant women. The final model, adjusting for these interaction terms, is presented in Table 4.5.

Table 4.5 Crude and adjusted odds ratios associated with lifetime Pap screening participation.

Variable	Crude OR (95% CI)	Immigrants OR (95% CI)	Non-Immigrants OR (95% CI)
Age *(Continuous)*			
Age	1.06 (1.05, 1.08)	1.03 (0.99, 1.07)	1.06* (1.03, 1.10)
Marital Status *(Ref Group: Single)*			
Married/Common-Law	5.38 (3.99, 7.24)	3.17* (1.34, 7.48)	11.38* (6.19, 20.95)
Widowed/Separated/Divorced	6.30 (3.99, 9.96)	3.75 (0.98, 14.28)	6.99* (2.53, 19.34)
Highest Level of Education *(Ref Group: Secondary Graduation or Less)*			
Other Post-Secondary Education	2.48 (1.80, 3.44)	1.20 (0.46, 3.18)	2.80* (1.49, 5.26)
Bachelor's Degree or Higher	1.40 (0.99, 1.97)	0.83 (0.34, 2.05)	2.23* (1.03, 4.83)
Relative Household Income *(Continuous)*			
Household Income Ratio	1.18 (0.93, 1.50)	1.09 (0.98, 1.21)	1.00 (0.95, 1.05)
Cultural or racial background (*Ref Group: White*)			
Visible Minority	0.15 (0.11, 0.19)	0.26* (0.09, 0.70)	0.45* (0.23, 0.87)
Self-Perceived Health Status *(Continuous)*			
Self-Reported Health	0.89 (0.83, 0.95)	0.79 (0.54, 1.16)	0.94 (0.71, 1.24)
Consulted a Doctor Within the Last Year *(Ref Group: No)*			
Yes	2.19 (1.41, 3.48)	2.52* (1.50, 4.26)	

* Statistically significant at $\alpha = 0.05$

Among both immigrant and non-immigrant women, having visited a doctor within the last year is associated with a higher odds of participation in Pap screening (OR =

2.52). Self-identifying as a visible minority is associated with a much decreased odds of screening participation among both immigrant and non-immigrant women, but a stronger effect is seen among immigrant women (OR = 0.26 vs. 0.45). Being married or in a common-law relationship is associated with increased Pap screening participation among both groups, but the relationship seems to be stronger for non-immigrant women (OR = 3.17 vs. 11.38). Relative household income and self-reported health are not significantly associated with Pap screening participation in either group. Finally, among non-immigrant women only, the odds of participating in Pap screening are significant higher among women who are older, widowed, separated or divorced and have higher than high school education. The greater number of significant findings in the non-immigrant group may be a result of the larger sample size and increased statistical power for this group.

To explore the impact of age at the time of immigration, length of time in Canada since immigration and fluency in English on lifetime Pap screening participation, a logistic regression model including these three variables, along with the seven variables identified above, was fitted for the immigrant population alone. Both age at immigration and time since immigration contribute significantly to the model, but fluency in English does not. The odds of screening participation decrease by 0.05 for each one year increase in age at the time of immigration (95% CI: 0.03, 0.09) and by 0.05 for each one year increase in time since immigration (95% CI: 0.03, 0.09).

For recent Pap screening participation, all ten variables are found to contribute significantly to the fitted multivariate logistic regression model, as determined by their Wald statistics and associated p-values. Examining the effects of the interaction terms between immigration status and each of the other nine factors in the model, likelihood ratio tests suggest a significant interaction between immigration status and: age ($G = 7.12$, $p = 0.01$), highest level of personal education ($G = 14.51$, $p < .01$) and health region of residence ($G = 11.80$, $p = 0.02$). This suggests that the effects of these factors on recent Pap screening participation are different for immigrant and non-immigrant

women. The results of the logistic regression model fitted with these variables are presented in Table 4.6.

Table 4.6 Crude and adjusted odds ratios associated with recent Pap screening participation.

Variable	Crude OR (95% CI)	Immigrants OR (95% CI)	Non-Immigrants OR (95% CI)
Age *(Continuous)*			
Age	0.99 (0.98, 1.0)	0.98 (0.96, 1.00)	0.96* (0.95, 0.97)
Highest Level of Education *(Ref Group: Secondary Graduation or Less)*			
Other Post-Secondary Education	1.43 (1.25, 1.65)	1.17 (0.67, 2.04)	1.57* (1.18, 2.08)
Bachelor's Degree or Higher	1.60 (1.36, 1.89)	1.01 (0.56, 1.83)	2.16* (1.44, 3.22)
Health Authority *(Ref Group: Vancouver Coastal)*			
Interior	0.77 (0.64, 0.93)	0.69 (0.38, 1.26)	0.38* (0.24, 0.60)
Fraser	0.72 (0.62, 0.84)	0.65 (0.30, 1.40)	0.47* (0.30, 0.74)
Vancouver Island	1.13 (0.93, 1.37)	0.93 (0.53, 1.64)	0.54* (0.34, 0.85)
Northern	0.88 (0.68, 1.14)	1.07 (0.49, 2.34)	0.40* (0.25, 0.64)
Marital Status *(Ref Group: Single)*			
Married/Common-Law	1.85 (1.61, 2.12)	3.49* (2.67, 4.58)	
Widowed/Separated/Divorced	1.43 (1.18, 1.74)	3.30* (2.41, 4.53)	
Relative Household Income *(Continuous)*			
Household Income Ratio	1.06 (1.04, 1.06)	1.01 (0.99, 1.03)	
Setting *(Ref Group: Rural)*			
Urban	1.11 (0.94, 1.30)	1.34* (1.01, 1.77)	
Cultural or racial background (*Ref Group: White*)			
Visible Minority	0.51 (0.45, 0.58)	0.60* (0.42, 0.85)	
Regular Source of Care *(Ref Group: No)*			
Has a Family Doctor	2.00 (1.67, 2.40)	1.41* (1.01, 1.98)	
Consulted a Doctor Within the Last Year *(Ref Group: No)*			
Yes	2.36 (2.02, 2.76)	2.64* (1.95, 3.56)	
Self-Perceived Health Status *(Continuous)*			
Self-Reported Health	0.79 (0.75, 0.84)	0.82* (0.72, 0.93)	

* Statistically significant at $\alpha = 0.05$

Among both immigrant and non-immigrant women, being married or in a common law relationship (OR = 3.49), being widowed, separated or divorced (OR = 3.30), living in an urban setting (OR = 1.34), having a regular doctor (OR = 1.41) and having consulted a doctor within the past year (OR = 2.64) are associated with increased odds of Pap screening participation. Belonging to a cultural or racial group other than White (OR = 0.60) and reporting higher levels of health status (OR = 0.82) are associated with decreased odds of screening participation in both groups. For non-

immigrant women only, living in a health region other than Vancouver Coastal (ORs = 0.38 – 0.54) and increasing age (OR = 0.96) is associated with significantly lower odds of participation, while having a level of education higher than high school graduation is associated with increased odds (OR = 1.57 – 2.16). Weaker trends in a similar direction are observed for the immigration population, but none of these are statistically significant. Relative household income is not significantly associated with Pap screening participation in either group.

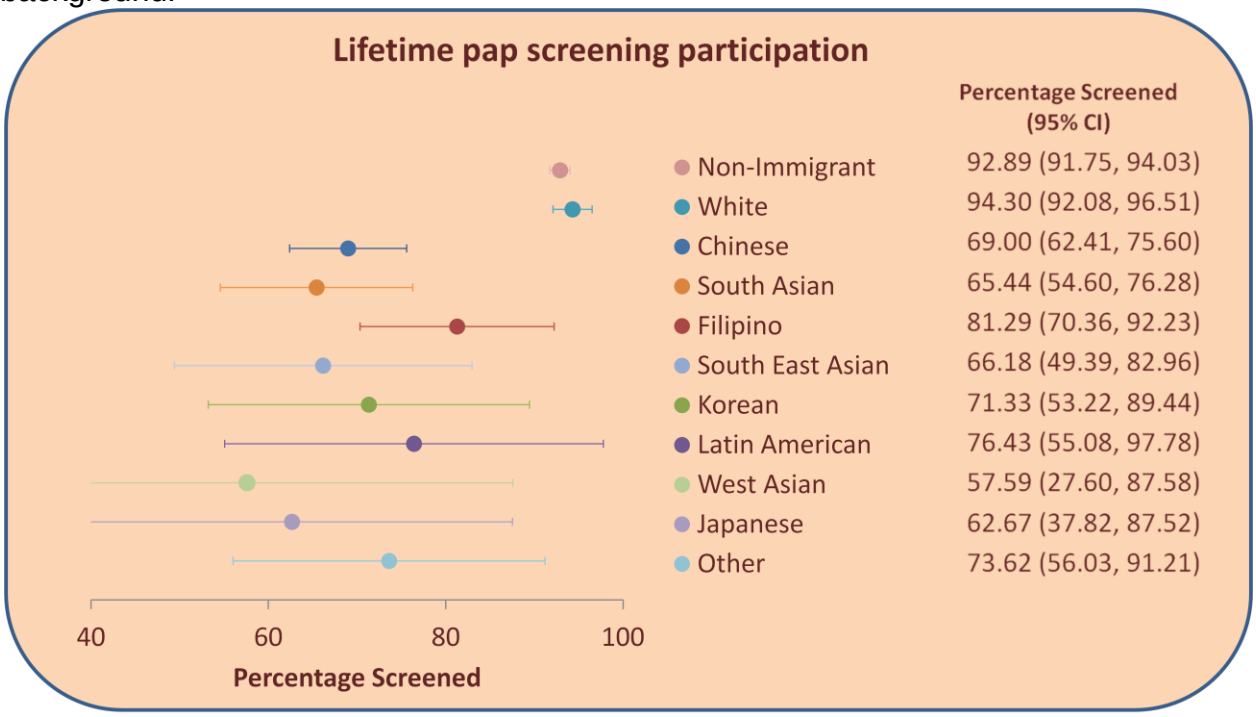
To explore the impact of age at the time of immigration, length of time in Canada since immigration and fluency in English on recent Pap screening participation, a logistic regression model including these three variables, along with the ten variables identified above, was fitted for the immigrant population alone. None of these additional variables were found to contribute significantly to the model.

4.4 Study Objective 2: Pap Screening Participation Among Immigrant Subgroups

4.4.1 Cultural or Racial Background

The second objective of this study was to explore differences in Pap screening participation rates among subgroups of immigrant women based on self-reported cultural or racial background and country of birth. Lifetime Pap screening participation rates broken down by self-reported cultural or racial background are presented in Figure 4.3. White (40%), Chinese (23%), South Asian (13%) and Filipino (6%) are the most commonly reported cultural or racial backgrounds among immigrant women in BC. The proportion of White immigrant women reporting having ever had a Pap test is comparable to that of non-immigrant women (94% vs. 93%), while Chinese (69%), South Asian (65%) and South East Asian (66%) women report rates significantly lower than that of non-immigrant women ($z = 15.8$, $z = 14.5$ and $z= 8.5$ respectively, and $p < .01$ for each). Participation rates for Filipino women are higher than these other groups and do not differ significantly from that of non-immigrant women, although due to the relatively small number of women in this group, the confidence interval is large (70% to 92%).

Figure 4.3 Reported lifetime Pap screening participation by cultural or racial background.



Age-stratified lifetime Pap screening participation rates were also examined for the three most common immigrant racial groups: White, Chinese and South Asian (Table 4.7). Chinese and South Asian immigrants report lower screening participation rates than do non-immigrant women in all age groups. The screening rates among women 18-29 in these two groups are especially striking, with just 28% of South Asian women and 42% of Chinese women reporting having been screened, compared to 77% of non-immigrant women.

Table 4.7 Age-stratified lifetime Pap screening rates by cultural or racial background.

Ages	Non-Immigrants N = 4135	White N = 699	Chinese N = 400	South Asian N = 229
18-29	77.33 (73.33, 81.34)	82.92 (68.15, 97.69)	42.39* (27.35, 57.42)	28.1* (5.70, 50.51)
30-49	98.81 (98.26, 99.35)	91.79* (87.03, 96.55)	75.36* (65.36, 85.37)	75.49* (63.38, 87.60)
50-69	97.91 (97.01, 98.81)	97.55 (95.95, 99.14)	72.64* (60.96, 84.33)	66.87* (46.40, 87.34)

* Statistically different from non-immigrants at $\alpha = 0.05$

To obtain adjusted odds ratios associated with screening participation for immigrant women belonging to these racial groups, a modified version of the overall regression model (Table 4.5) was fitted that used these more detailed racial or cultural background groups (White, Chinese, South Asian, Filipino, South East Asian and other) in place of the dichotomous visible minority category and used non-immigrant women as the reference group. The results reveal that all of the racial groups examined have lower adjusted odds of screening participation than non-immigrant groups, with the exception of White immigrant women (OR = 0.46, 95% CI: 0.20, 1.07). Chinese immigrant women have the lowest odds relative to Canadian-born women at 0.07 (95% CI: 0.04, 0.12), followed by South Asian immigrant women at 0.09 (95% CI: 0.05, 0.19) and Filipino immigrant women at 0.11 (0.03, 0.34).

Recent Pap screening participation rates broken down by self-reported cultural or racial background can be seen in Figure 4.4. The proportion of White immigrant women reporting having had a Pap test within the last three years is comparable to that of non-immigrant women (73% vs. 78%). Chinese (62%) and South Asian (56%) women report rates significantly lower than that of non-immigrant women ($z = 7.29$ and 7.89 respectively, $p < .01$ for both), but participation rates among Filipino (73%) women are not significantly different from that of non-immigrant women.

Age-stratified recent Pap screening participation rates were also examined for the three most common immigrant ethnic groups discussed above and are presented in Table 4.8. South Asian immigrants report lower screening participation rates than non-immigrant women at all age groups. Screening participation rates for Chinese women 18-29 and 30-49 are also significantly lower than those of Canadian-born women. Recent screening rates in these ethnic groups range from a low of 26% for South Asian women 18-29 years of age to a high of 71% for Chinese women aged 30-49 years.

Figure 4.4 Reported recent Pap screening participation by cultural or racial background.

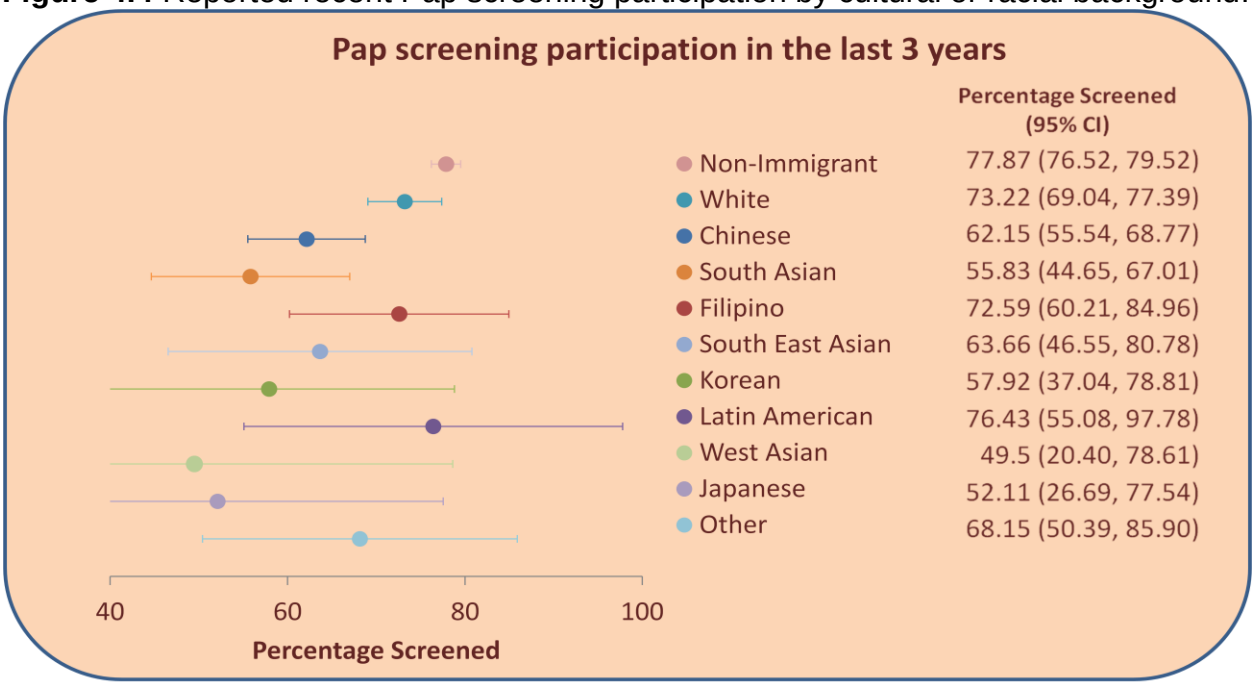


Table 4.8 Age-stratified recent Pap screening rates by cultural or racial background.

Ages	Non-Immigrants N = 4135	White N = 698	Chinese N = 397	South Asian N = 228
18-29	75.32 (71.37, 79.27)	82.92 (68.15, 97.69)	42.39* (27.35, 57.42)	26.09* (4.62, 47.55)
30-49	86.21 (83.72, 87.90)	75.45* (67.51, 83.39)	71.07* (60.76, 81.37)	68.02* (55.00, 81.03)
50-69	69.93 (66.34, 72.00)	70.38 (64.76, 75.99)	58.74 (46.25, 71.22)	42.21* (20.98, 63.43)

* Statistically different from non-immigrants at α = 0.05

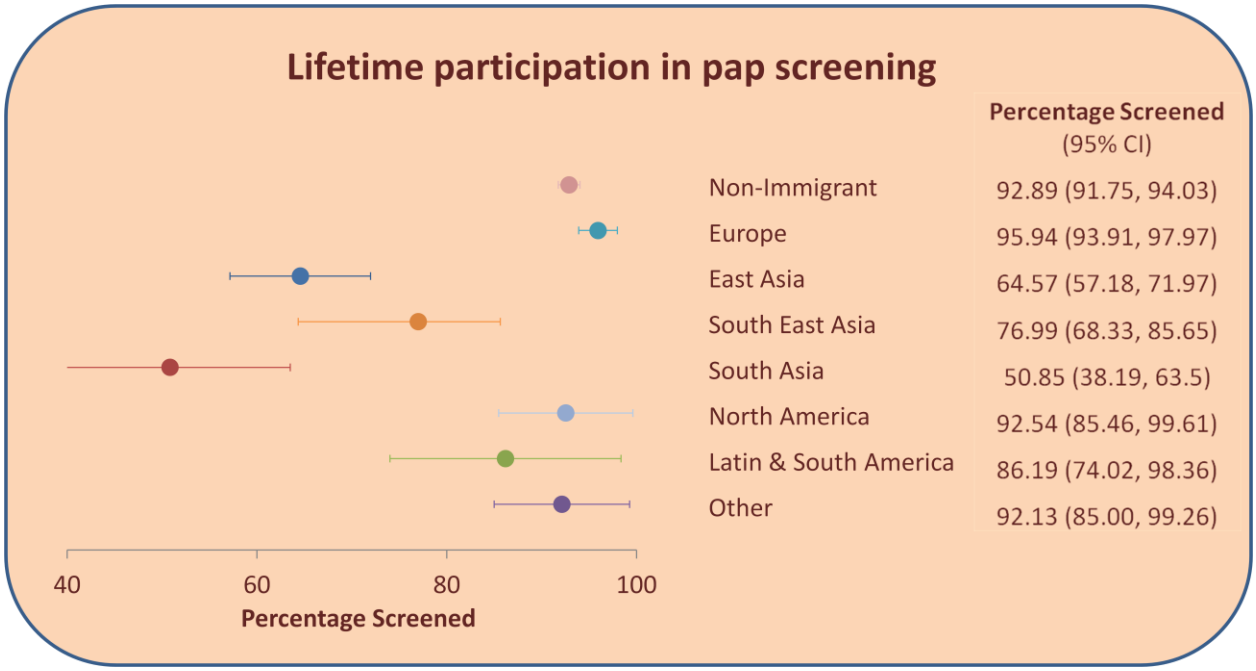
To obtain adjusted odds ratios associated with recent screening participation for women belonging to these cultural or racial groups, a modified version of the overall regression model (Table 4.6) was fitted, once again using these more detailed cultural or racial groups in place of the dichotomous visible minority category and with non-immigrant women as the reference group. All of the groups examined report significantly lower odds of screening participation than non-immigrant women, with the exception of immigrant Filipino women (OR = 0.38, 95% CI: 0.17, 1.09). Chinese immigrant women again have the lowest odds ratio relative to Canadian-born women at 0.32 (95% CI:

0.20, 0.49), followed by South Asian immigrant women at 0.36 (95% CI: 0.18, 0.71) and White immigrant women at 0.70 (95% CI: 0.48, 0.93).

4.4.2 Region of Birth

Lifetime Pap screening participation rates broken down by self-reported region of birth are presented in Figure 4.5. Europe (26%), East Asia (20%), South Asia (11%) and South East Asia (11%) are the most commonly reported birth regions among immigrant women in BC. The proportion of immigrant women born in Europe reporting having ever had a Pap test is comparable to that of non-immigrant women (96% vs. 93%), while women born in East Asia (65%), South East Asia (77%) and South Asia (51%) report rates significantly lower than that of non-immigrant women ($z = 17.6$, $z = 7.9$ and $z = 19.9$ respectively, and $p < .01$ for each).

Figure 4.5 Lifetime Pap screening participation among immigrant women by region of birth.



Age-stratified lifetime Pap screening participation rates were also examined for the three most common regions of birth and are presented in Table 4.9. East Asian and South Asian immigrants report significantly lower screening participation rates than non-

immigrant women in all age ranges. South East Asian women under 50 also report lower participation rates than non-immigrant women.

Table 4.9 Age-stratified lifetime Pap screening rates by region of birth.

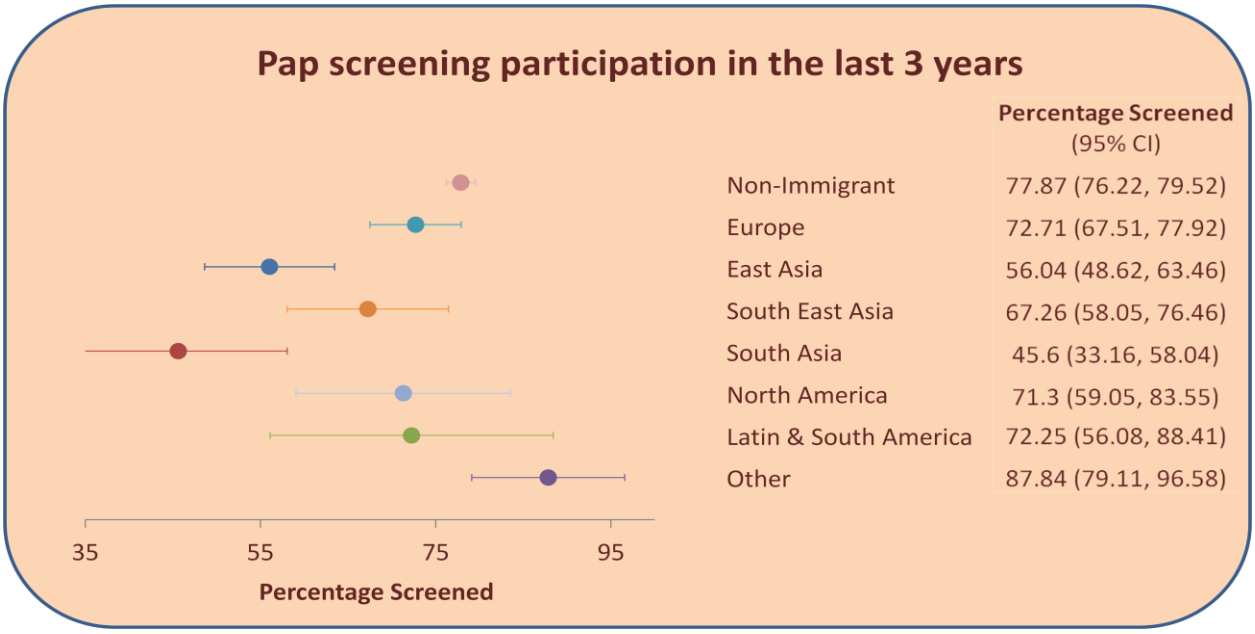
Ages	Non-Immigrants N = 4135	Europe N = 466	East Asia N = 358	South East Asia N = 193	South Asia N = 187
18-29	77.33 (73.33, 81.34)	81.54 (61.07, 102.01)	34.96* (21.17, 48.75)	46.16* (25.49, 66.84)	20.11* (-0.24, 40.47)
30-49	98.81 (98.26, 99.35)	96.24 (92.72, 99.77)	66.83* (55.04, 78.62)	82.75* (73.38, 92.11)	66.95* (50.97, 82.94)
50-69	97.91 (97.01, 98.81)	97.22 (95.25, 99.19)	76.43* (65.32, 87.54)	91.19 (76.27, 106.1)	44.46* (21.11, 67.81)

* Statistically different from non-immigrants at $\alpha = 0.05$

To obtain adjusted odds ratios associated with lifetime screening participation for women born in these regions, a modified version of the overall regression model (Table 4.5) was fitted, using these more detailed birth regions (Europe, East Asia, South East Asia, South Asia and other) in place of the dichotomous visible minority category and using non-immigrant women as the reference group. Immigrant women born in East Asia, South East Asia and South Asia have lower odds of screening participation than non-immigrant groups. East Asian women have the lowest odds ratio relative to Canadian-born women at 0.10 (95% CI: 0.05, 0.18), followed by South Asian women at 0.11 (95% CI: 0.05, 0.25) and South East Asian at 0.17 (0.08, 0.36). Immigrant women born in Europe do not display significantly different odds of screening participation than non-immigrant women (OR = 0.76, 95% CI: 0.26, 2.25).

Recent Pap screening participation rates broken down by region of birth are presented in Figure 4.6. The proportion of immigrant women born in Europe reporting having had a recent Pap test is comparable to that of non-immigrant women (73% vs. 78%). Immigrant women born in East Asia (56%) and South Asia (46%) report rates significantly lower than that of non-immigrant women ($z = 9.3$ and $z = 3.4$ respectively, and $p < .01$ for both). Participation rates for immigrant women born in South East Asia (67%, 95% CI: 58, 76) do not differ significantly from that of Canadian-born women (95% CI: 76, 80), although the confidence interval is large.

Figure 4.6 Recent Pap screening participation among immigrant women by region of birth.



Age-stratified recent Pap screening participation rates were also examined for the most common birth regions and are presented in Table 4.10. South East Asian immigrants report lower screening participation rates than non-immigrant women in all age groups. Screening participation rates for immigrant women born in East Asia who are under the age of 50 and South Asian women who are under the age of 30 are also significantly lower than those of Canadian-born women.

Table 4.10 Age-stratified recent Pap screening rates by region of birth.

Ages	Non-Immigrants N = 4135	Europe N = 466	East Asia N = 358	South Asia N = 193	South East Asia N = 187
18-29	75.32 (71.37, 79.27)	81.54 (61.07, 102.01)	34.96* (21.17, 48.75)	20.11* (-0.24, 40.47)	46.16* (25.49, 66.84)
30-49	86.21 (83.72, 87.90)	80.66 (70.83, 90.49)	62.55* (50.72, 74.37)	63.04* (46.52, 79.57)	72.83 (61.32, 84.33)
50-69	69.93 (66.34, 72.00)	67.76 (60.90, 74.63)	58.11 (45.61, 70.61)	31.87* (11.52, 52.22)	70.94 (47.61, 94.26)

* Statistically different from non-immigrants at α = 0.05

To obtain adjusted odds ratios associated with these birth regions, a modified version of the overall regression model (Table 4.6) was fitted, once again using these

more detailed birth regions in place of the dichotomous visible minority category and using non-immigrant women as the reference group. Immigrant women born in East Asia, South Asia and South East Asia have lower odds of screening participation than non-immigrant groups. Women born in East Asia again have the lowest odds relative to Canadian-born women at 0.31 (95% CI: 0.20. 0.49), followed by those born in South Asia at 0.37 (95% CI: 0.17, 0.79) and South East Asia at 0.40 (95% CI: 0.22, 0.73). Immigrant women born in Europe do not display odds of recent Pap screening participation that are significantly different from non-immigrant women (OR = 0.72, 95% CI: 0.49, 1.05).

4.5 Study Objective 3: Perceived Barriers to Pap Screening

The final objective of this study was to assess differences in reported barriers of use for Pap screening between immigrant and non-immigrant women in BC. A total of 1,448 study subjects who had not received a Pap test within the last three years responded to the CCHS questions pertaining to reasons for non-participation in screening. The results are summarized in Table 4.11.

Table 4.11 Reported barriers to Pap screening participation by immigrant and non-immigrant women.

Reason	Immigrant Women Percentage (95% CI)	Non-Immigrant Women Percentage (95% CI)	Ratio
Didn't think it was necessary*	43.2% (37.2, 49.1)	28.5% (24.8, 32.3)	1.5
Haven't gotten around to it**	17.8% (13.3, 22.2)	29.4% (25.5, 33.3)	0.6
Hysterectomy**	12.2% (7.7, 16.6)	21.0% (17.6, 24.4)	0.6
Doctor didn't think it necessary	12.1% (8.0, 16.1)	12.7% (9.9, 15.6)	0.9
Fear*	6.5% (3.0, 9.9)	2.9% (1.7, 4.1)	2.2
Didn't know where to go*	3.9% (0.9, 6.8)	0.3% (0.0, 0.6)	11.7
Hate/dislike having one done	3.5% (1.3, 5.7)	6.9% (4.9, 8.9)	0.5
Other	10.4% (6.2, 14.7)	11.6% (8.7, 14.4)	0.9

* Immigrants more likely to report
** Immigrants less likely to report

The most common reasons given by immigrant women for not having had a recent Pap test are: 1) not believing a Pap test is necessary (43.2%); 2) not having gotten around to it (17.8%); 3) having had a hysterectomy (12.2%); and 4) believing their doctor doesn’t think it is necessary (12.1%). The most common reasons reported

by non-immigrant women are similar, with 29.4% reporting they haven't had a recent Pap test because they haven't gotten around to it, 28.5% because they don't think it is necessary, 21.0% because they have had a hysterectomy, and 12.7% because their doctor doesn't think it is necessary. Transportation problems, being unable to leave the house, not having a Pap test available when required, personal or family responsibilities, cost, language problems, waiting times that are too long, and not having Pap testing available in their area are not reported as significant barriers for either immigrant or non-immigrant women.[2]

The relative proportions of immigrant and non-immigrant women reporting each of the reasons for non-participation were also examined. Immigrant women are 11.7 times more likely to report not knowing where to go for a Pap test than Canadian-born women. Immigrant women are also 2.2 times more likely to cite fear as a reason for not having had a recent Pap test and 1.5 times more likely to not believe a Pap test is necessary. Not having gotten around to it and having had a hysterectomy are reasons more commonly reported by Canadian-born women.

[2] Cell counts were below the minimum required by Statistics Canada for release from the RDC.

CHAPTER 5: Discussion

5.1 Summary of Major Findings

Regular, population-wide Pap screening represents an accessible, relatively low cost means to drastically reduce the incidence and mortality associated with cervical cancer (29, 35), and British Columbia's Cervical Cancer Screening Program is evidence of this. However it is believed that inequitable use of Pap screening services, notably underutilization by the province's immigrant population, has resulted in an unequal distribution of the burden associated with this disease. Using data from the Canadian Community Health Survey, this study explored the Pap screening practices, sociodemographic correlates of use and reported barriers to access of immigrant women in BC relative to those of native-born Canadians in the province, information necessary for the development of culturally-appropriate programs and policies designed to improve screening participation in this population.

Immigrant women were found to participate in Pap screening, both over the lifetime and within the last three years, at rates significantly below those of non-immigrant women. Many of the sociodemographic factors associated with Pap screening and the perceived barriers reported by women in accessing Pap screening services are similar in the immigrant and non-immigrant populations, but often with different impacts on screening participation between the two groups. Within the immigrant population, subgroup analyses reveal differences in rates of screening participation based on self-reported cultural or racial background and country of birth, results that highlight the highly heterogeneous nature of the province's immigrant population. Each of these results, as well as a consideration of their implications, will be considered in more detail in the following sections, followed by a review of the strengths and limitations associated with the study methodology, directions for future research and concluding remarks.

5.1.1 Pap Screening Participation

Just 79% of immigrant women in BC report having had a Pap test during their lifetime, compared to 93% of non-immigrant women in the province. A slightly smaller gap is observed for recent screening participation, with 66% of immigrant women reporting having had a Pap test within the last three years compared to 78% of non-immigrant women. These gaps are consistent with previous studies comparing the Pap screening practices of immigrant and non-immigrant women within the larger Canadian population. Using data from the National Population Health and Canadian Community Health Surveys conducted between 1996 and 2003, McDonald et al. (57) found that 93% of native-born Canadians 18 years and older reported having ever had a Pap test, compared to 80% of foreign-born Canadians. For Pap screens within the previous three years, 72% of foreign-born Canadians reported participating, less than the 81% reported by native-born Canadians. These three year screening rates reported in the McDonald et al. study are higher than those observed in the current study, which may reflect differences between the BC and broader Canadian populations or national decreases in screening participation over the intervening time period.

Also consistent with previous Canadian studies (54), reported lifetime Pap screening among BC women tends to increase with age. This finding is generally true for both immigrant and non-immigrant women in the province, although there is a slight decline in participation among immigrant women in their 60s. Reports of recent Pap screening participation, however, are seen to peak among women in their 30s for both the immigrant and non-immigrant populations and then decline through to the 60s. Pap tests are routinely performed as part of good prenatal care (91). Since the average age of mothers at childbirth in BC has been around 30 for the last several years, this peak may be partially explained by the increasing number of women seeking prenatal care during this age decade. Pregnancy is also often the first exposure to the health care system for immigrant women (116), which may help to explain the lessening gap in screening rates between immigrant and non-immigrant women that begins during this age decade.

Concerns have been raised in the literature about the validity of self-reported measures of Pap screening participation, such as those used in this study. The self-reported participation rates for women in this study are higher than those reported by the BC CCSP for this same time period based on the program's screening records (117). While these two measures are not directly comparable and the responses regarding Pap screening participation in the CCHS are not limited to tests conducted in BC, this apparent inflation of the self-reported measures is consistent published studies (70, 73-78). It is also interesting to note that the trends in age-stratified recent Pap screening rates observed in the CCSP data are similar to those seen among non-immigrant women in this study, peaking in the 30s and then declining steadily throughout the 40s, 50s and 60s.

Of particular concern for this study was the possibility of differential reporting between immigrant and non-immigrant women. Sensitivity analyses were used to explore the effect this would have on observed measures of association. While this methodology does not appear to have been used in previous studies of self-reported Pap screening, it has been used in studies involving self-report of body mass index (118) and pharmaceutical use (119). In almost all sensitivity and specificity scenarios explored for self-reported measures of Pap screening participation in the current study, immigrant women remain less likely than non-immigrant women to participate. Only at extreme values (i.e. when the specificity for one or both groups is very low) does the direction of this relationship change. These results suggest that the lower screening participation rates observed among immigrant women in this study reflect genuine participation differences, rather than gaps in reporting accuracy.

Also consistent with previous studies examining the Pap screening practices of immigrant women in Canada (56, 57, 89), differences in screening participation were observed among BC immigrants based on time since immigration. Reporting of both lifetime and recent Pap screening participation increases along with time spent in Canada. Lifetime screening rates range from a low of 62% among immigrant women who have been living in Canada for less than ten years to a high of 91% for women who

have been living in the country for 20 years of more, a rate comparable to that of non-immigrant women in the province. Recent screening rates range from 58% for women who have been living in Canada for less than ten years to 71% for those who have been in Canada for 20 or more years, rates consistently below those observed among non-immigrant women. These increases over time likely reflect a growing acceptance of and familiarity with BC's health care system and the Pap screening program offered in the province, as well as increased opportunities for screening, since the number of encounters with the health care system is also likely to increase over time.

5.1.2 Sociodemographic Correlates of Use

The current study identified a number of sociodemographic variables related to lifetime Pap screening participation among BC women. The results of the logistic regression analysis suggest that women who have visited a doctor within the last year are more likely to have ever had a Pap test (OR = 2.52). Frequency of physician visits has received little attention in previous studies of lifetime Pap screening, but this finding is consistent with the notion that a recent doctor visit may be indicative of a greater familiarity with the health care system, as well as increased opportunities for screening, both of which have been found to be associated with increased Pap screening participation (66, 96).

Logistic regression analysis also suggests that associations exist between lifetime Pap screening participation and age, marital status, highest level of personal education and self-identifying as a visible minority, but that the impact of these variables is different for immigrant and non-immigrant women. The idea that the sociodemographic correlates of Pap screening participation may be different for immigrant and non-immigrant populations has been proposed previously and the factors important for specific subgroups of immigrant women have been explored in earlier studies (10, 94, 96), but often without direct comparisons to those of non-immigrant women. The use of interaction analysis in this study provided a formal means of testing for statistical differences between these two groups (115).

Self-identifying as a visible minority is associated with a much decreased odds of participation in Pap screening over the lifetime, a result that is consistent with the findings of previous studies (97). A stronger effect on Pap screening participation is seen among immigrant (OR = 0.26) than non-immigrant (OR = 0.45) women, suggesting that immigrant women self-identifying as visual minorities are less likely to participate in screening than visual minority women born in Canada. Tu et al. (66) observed a similar phenomenon among Chinese women in BC, with those reporting a place of birth in Asia displaying lower rates of screening participation than those born in North America. This supports the idea that there is an independent effect associated with immigration status that goes beyond racial or ethnic background.

Also consistent with the available literature, being married or in a common law relationship is associated with increased Pap screening participation, with previous studies in Canada reporting odds ratios ranging from 1.4 to 4.5 (10, 57). This study's finding that this association is stronger among the non-immigrant (OR = 11.38) than the immigrant (OR = 3.17) population has not been previously reported in the literature. Other study results suggest that screening participation is higher among non-immigrant women who are older (OR = 1.06) or widowed, separated or divorced (OR = 6.99), with non-significant trends in the same direction also seen among immigrant women. Given the much smaller sample size for the immigrant population, it is possible that these differences in significance are the result of decreased statistical power in that group. Finally, having a higher than high school education is associated with increased Pap screening participation among non-immigrant women (OR = 2.23-2.80), but not immigrant women, a finding that is inconsistent with previous studies, which have found higher levels of education to be important for all women (OR = 1.2-1.7) (97).

Health region of residence, living in an urban as opposed to a rural setting, having a regular doctor, relative household income and self-reported health status do not have a significant impact on lifetime Pap screening participation. This may be due to the often transitory nature of these variables. Since each of these variables is likely to have changed over the course of the lifetime, associations based on current status may

not reflect the impact these variables have had on Pap screening participation during discrete time intervals over the life course.

Of the additional variables theorized to be relevant for immigrant women, lower age at the time of immigration and longer time since immigration are associated with higher levels of Pap screening participation. These relationships have also been observed in previous studies examining immigrant women's participation in Pap screening (57, 89, 94). However, unlike in previous studies (68, 89), fluency in English was found not to be significantly associated with increased participation. Since the number of study participants unable to converse in English is relatively small (less than 9% of the immigrant women), this lack of significance may be the result of a lack of statistical power to detect differences of this magnitude. A study by Latif (97) has also suggested that English language ability may be a particularly important factor for recent immigrants, but that immigrants may overcome this barrier over time, with language ability playing a less important role among longer-term immigrants. Since this study looks at BC immigrants as a whole, the effect of this variable on screening participation among recent immigrants may be masked by the large number of longer-term immigrants in the study population. Finally, given the large number of immigrants in the lower mainland, which is the primary destination of BC's immigrants, and the concentration of immigrants of particular ethnicities within specific communities across the region, fluency in English may not be as essential in this region as it is in others. Many services are available within certain ethnic communities across the lower mainland where the dominant language is often one other than English. For example, a large proportion of BC's Chinese immigrant population reports seeing a Chinese physician (89), which would make fluency in English less essential for accessing health services than it would be in other regions.

A similar set of sociodemographic variables was found to be associated with recent Pap screening among BC women. Interestingly, fewer differences in the sociodemographic correlates of screening were found between immigrants and non-immigrants for recent screening than for lifetime screening. Logistic regression analysis

suggests that being married or in a common-law relationship (OR = 3.49), being widowed, separated or divorced (OR = 3.30), living in an urban setting (OR = 1.34), having a regular doctor (OR = 1.41) and having consulted a doctor within the past year (OR = 2.64) are all associated with increased odds of recent Pap screening participation among both immigrants and non-immigrants and that belonging to a cultural or racial group other than White (OR = 0.60) and reporting higher levels of health status (OR – 0.82) are associated with decreased odds of screening participation in both groups. These results are consistent with those of previous studies examining the Pap screening behaviours of immigrant women in North America (10, 56, 57, 97). For non-immigrant women only, living in a health region other than Vancouver Coastal (OR = 0.38-0.54), having a level of education higher than high school graduation (OR = 1.57-2.16) and being of older age (OR = 0.96) are all associated with significantly lower odds of participation. Weaker trends in a similar direction are observed for the immigrant population, but none of these are statistically significant, possibly due to decreased statistical power resulting from the smaller sample size in this group.

Relative household income is not significantly associated with regular Pap screening participation in either immigrant or non-immigrant women. One potential explanation for this is that lower income may be acting as a proxy for lower levels of education, which would explain why the association between income and Pap screening is no longer significant when education is entered into the model. Some previous studies have reported associations between regular Pap screening participation and income among Canadian women, even after adjusting for level of education (56, 66), but that is not true of all of them (98). The use of gross household income in many of these studies rather than the relative measure of income used in the current study may provide a partial explanation for this apparent inconsistency.

Logistic regression analyses also suggest that none of the additional variables theorized to be relevant for immigrant women, specifically age at the time of immigration, time in Canada since immigration and fluency in English, are associated recent Pap screening participation. Previous studies have regularly noted associations

between these variables and recent Pap screening participation among BC and Canadian women (10, 57, 97).

5.1.3 Pap Screening Participation Among Immigrant Subgroups

The findings discussed thus-far have examined the Pap screening practices of BC's immigrant population as a whole, but it was hypothesized that such summary measures are likely to hide a significant amount of heterogeneity within this multiethnic population. Subgroup analyses reveal this to be true, with participation rates varying widely by self-reported cultural or racial background and region of birth. Both of these variables are commonly used measures of ethnicity in survey-based studies of immigrant populations. Some have suggested that self-reported ethnicity may suffer from reporting bias (57). Region of birth is likely to be less susceptible to reporting bias but, while highly correlated with ethnicity, does not account for those individuals who were born in one region but spent most of their lives in another. The results obtained from these two measures in this study were comparable, suggesting that despite these limitations, for the most part these two variables appear to be capturing similar Pap screening trends within BC's population of immigrants.

White represents the most common racial background reported by BC's immigrants, with the vast majority of those women reporting Europe (the most common region of birth for BC immigrants) or, as a distant second, North America, to be their region of birth. The rates of lifetime and recent Pap screening participation for both immigrant women who self-identify as White and immigrant women born in Europe are not significantly different from those of non-immigrant women. Since many European nations have health care systems similar to BC, this is consistent with the theorized prediction that women from countries with similarly organized health care systems and health beliefs will have Pap screening practices similar to non-immigrant women. Many Western European nations also have established cervical cancer screening programs, making the transition to BC's program relatively easy. However, it is important to note that there is still likely to be a significant amount of heterogeneity within these broad classifications. Women coming from portions of Eastern Europe are likely to have had

health care experiences that are quite different from those of BC-born women and may benefit from services and supports designed to ease their transition. Unfortunately the small numbers of survey participants from these regions did not allow for more detailed analyses of their screening behaviours in this study.

East Asia is the second most common region of birth for BC immigrants, with China being by far the most common country of birth within that region, followed by Korea. The measures of screening participation calculated using region of birth and self-reported cultural or racial background are comparable for these groups as well. Both women who report an ethnicity of Chinese and those who report East Asia as their region of birth display lifetime and recent Pap screening participation rates below those of non-immigrant women. The adjusted odds ratio for recent Pap screening participation of immigrant women born in East Asia relative to non-immigrant women is 0.31, while that for immigrant women who self-identify as Chinese is 0.32. Women self-identifying as Korean show lifetime and recent Pap screening participation rates comparable to those of Chinese women, although the small sample size results in large confidence intervals for this group.

Hislop et al. (89) found that belief in the value of Pap testing in preventing cancer and general knowledge about the Pap test itself are associated with higher levels of cervical cancer screening participation among Chinese women in BC. Unlike many Western European countries, few East Asian countries have organized Pap screening programs, so learning about and becoming comfortable with BC's CCSP may take more time for immigrants from Eastern Asia than those from Europe. A lack of exposure to or knowledge about the Pap test among East Asian immigrants in BC may partially explain the observed low rates of participation in this study. Another potential factor is a cultural belief in the ability of discussions about a cancer diagnosis to cause more symptoms and speed up the dying process (64), which could dissuade some immigrants of East Asian background from participating in Pap screening.

Women born in South East Asia report lifetime, but not recent, Pap screening participation rates that are lower than those of non-immigrant women. The largest source of immigrants from this region for BC is the Philippines, and the screening participation of women self-identifying as Filipino shows signs of being quite different from that of women who identify as being of other South East Asian background. Other South East Asian, but not Filipino, women report lifetime Pap screening rates lower than that of non-immigrant women. While not statistically significant, a similar trend for lower screening participation among other South East Asian women compared to Filipino women is observed for recent Pap screening as well. One explanation for this difference between Filipino and other South East Asian women comes from looking at the background of these immigrant groups. A large number of immigrant women from the Philippines, especially those immigrating in the last several decades, have an educational background in health care, particularly nursing (120). While many are forced to downgrade their qualifications to work as caregivers in the absence of access to employment in the nursing field, this education is likely to make them different from other immigrant groups in terms of their health beliefs, attention to health-related concerns and messages, and ability to adapt to a new health care system, which may explain the greater similarity of their Pap screening behaviours to those of non-immigrant populations in the country. These results suggest that caution should be used when grouping together all immigrant women born in South East Asia, since this may mask significant subgroup differences among immigrants from this region.

The final group examined in-depth in this study was South Asian women. Whether defined by region of birth or self-reported ethnic or racial background, immigrant women from South Asia report both lifetime and recent Pap screening participation lower than that of non-immigrant women. The adjusted odds ratio for recent Pap screening participation of immigrant women born in South Asia relative to non-immigrant women is 0.37 while that for women who self-identify as South Asian is 0.36. This is a group that has received a fair amount of attention in the BC Pap screening literature. Previous studies have suggested that low participation in Pap screening programs among South Asian women is believed to be influenced by limited

experience with and knowledge of Pap testing and cervical cancer, as well as health beliefs that discourage screening in the absence of symptoms (12). The establishment of a South Asian Pap test clinic in Vancouver in 1995 was designed to address the specific needs of this community, but the results of this study suggest that this group remains underserved.

Much of the published BC-based research to-date has focussed on the Pap screening practices of East Asian (specifically Chinese), South East Asian and South Asian women. The identification of these groups as underserved by Pap screening programs in the province is consistent with the findings of this study. Adjusting for the sociodemographic variables discussed above, women born in East Asia have an odds ratio of recent screening participation of 0.31, South Asia of 0.37 and South East Asia of 0.40, all relative to non-immigrant women. Gaining a more in-depth understanding of the specific barriers faced by these groups of women in accessing Pap screening services, as well as exploring subgroup differences within them, will be essential to increasing their participation in screening and lessening the burden of cervical cancer currently borne by these populations.

5.1.4 Perceived Barriers to Use

The final objective of this study was to compare the self-reported barriers to Pap screening service access for immigrant women to those of non-immigrant women in BC. Analyses suggest that the perceived barriers are similar for both groups, with not believing a Pap test is necessary, not having gotten around to it, having had a hysterectomy and believing their doctor doesn't think it is necessary being the most common for both. Immigrant women are more likely to report not knowing where to go for a Pap test, to report fear as a reason for non-participation and to report not believing a Pap test is necessary than are Canadian-born women, while hating having one done, not having gotten around to it and having had a hysterectomy are reasons more commonly given by non-immigrant women. All of these barriers have been previously reported in the literature and, with the exception of hysterectomy history, represent potential targets for educational intervention. Some, such as failure to receive a

recommendation from a physician, may be better directed at health care providers than the population at large, and support the idea that health care provider factors play a significant role in Pap screening participation among both immigrant and non-immigrant women.

Language difficulties is one barrier frequently mentioned in the literature (12, 89), but is not one reported by many women in this study. This finding is internally consistent with the logistic regression analyses discussed earlier, which suggest that English language fluency is not a significant sociodemographic correlate of screening for the BC population. As was mentioned above, the number of immigrant survey participants unable to communicate in English was small, which will serve to decrease the study's statistical power and ability to detect differences in the effects of this variable. It may also be the case that this barrier is most disruptive for very recent immigrants (97), but the small number of such immigrants in the study population did not allow for an in-depth analysis of its effects on that subgroup.

5.2 Study Strengths and Limitations

This study has several strengths. First is the large sample size, which allowed for precise measures of association and increased the statistical power of the analyses conducted. The CCHS also had good representation from all health regions within BC, increasing the generalizability of the results to the BC population. The availability of the CCHS in multiple languages was also beneficial for this study, minimizing the language barriers that some immigrant women may have faced in participating in the survey. Finally, the CCHS Cycle 3.1 had a response rate of 77%, which is quite high and once again allows for increased generalizability to the overall BC population.

There are several limitations to this study that need to be acknowledged. First is the possibility for response bias, with women from particular cultural backgrounds or with language barriers not participating in the CCHS at different rates. While the survey was made available in multiple languages and with translators available as required in order to minimize this bias, some women still may have experienced barriers to

participation. This would serve to distort the study results, making them no longer representative of the overall population. This could be especially problematic for the immigrant population, where cultural and/or language barriers are more likely.

A second limitation has to do with the age cut-off for study participants. Current BC Pap screening guidelines call for screening to commence following the onset of sexual activity. A lower cut-off of 18 years of age for participants in this study will have resulted in the exclusion of some young women for whom Pap screening is recommended and inclusion of some for whom screening is not recommended, but was chosen for this study because a large majority of the population has become sexually active by age 18. However, given the natural history of cervical cancer, the development of cancers of the cervix in women under 18 is very rare (38), making screening in this age group less essential than at older ages.

A third limitation of this study is that we were unable to exclude individuals who are ineligible for screening, such as women who have had complete hysterectomies. No reliable indicator was collected as part of the CCHS questionnaire that would have enabled such an adjustment to be made for screening eligibility. Since hysterectomy rates increase with age, this limitation would be expected to result in an increasing underestimation of calculated screening rates in older age groups (16).

A fourth limitation is the inability to distinguish refugees from immigrants within the study population. Refugees come to Canada under different circumstances than other types of immigrants to the country and are likely to display different patterns of behaviour during their settlement in BC. Their Pap screening behaviours are likely to be different from those of other immigrants, as are their sociodemographic correlates of screening and perceived barriers. Further work examining the cervical cancer screening practices of this unique population will be required. Given the small numbers of refugees in BC, it is likely to have had a small impact on the results observed in this study.

A fifth limitations is the inability to determine from the available dataset whether immigrant women display lower rates of participation in preventive programs generally, or whether their non-participation is limited to the Pap test. The CCHS does collect information about participation in other preventive screening programs, including high blood pressure, physical exams and clinical breast exams, but the inclusion of questions related to these is determined provincially. Unfortunately, the BC questionnaire subset only includes questions about mammography participation and the different age of participants for this type of screening does not make this a useful measure of participation in other preventive screening programs for the age group of interest in this study. Inclusion of these additional questions in an extended questionnaire subset for BC in future cycles would allow for such analyses to be undertaken.

Finally, a sixth limitation relates to the use of self-reported measures of Pap screening participation. As discussed above, the accuracy of such measures has been called into question, with most of the literature suggesting that they are likely to overestimate true screening participation. This limitation would be expected to impact the participation rates calculated for both immigrant and non-immigrant women in this study, however, the sensitivity analysis conducted as part of this study suggests that the odds ratios calculated are robust and that the differences in screening participation observed between immigrant and non-immigrant women are likely to reflect true gaps in screening. Unfortunately, as far as we know, no validation studies of self-reported Pap screening measures have been published based on BC or Canadian populations, making it difficult to determine the precise sensitivity and specificity of these measures in this context and requiring the use of approximations from other culturally-diverse Western nations.

5.3 Implications for Future Research

The Pap screening participation rates obtained in this study are based on self-reported data which, as discussed as above, have often been shown to be overestimates of true participation rates. Future research should look to examine how accurately the self-reports of BC women reflect true screening participation in the

province. This could be accomplished through validation studies exploring the sensitivity and specificity of self-report among BC's diverse population by comparing them to screening or medical records. Additionally, studies that make use of the BC CCSP's screening database and potential linkages to other databases containing sociodemographic information, such as that regarding immigration status and country of birth, would add to our understanding of the Pap screening practices in the province and enable better targeting of programs to those shown to be under-utilizing existing services.

The current research also highlights the differing Pap screening participation rates that exist among BC's highly heterogeneous immigrant population. Further work looking specifically at those immigrant groups with reported participation rates significantly lower than those of non-immigrant women, including East Asian and South Asian women, should aim to gain a better understanding of the specific factors at play and barriers experienced by these populations. Some work has already been done in this area (11-13, 66, 89), but often without attention given to the role that immigration-related factors can play. A more in-depth exploration of the beliefs about cervical cancer and Pap screening, as well as the obstacles to accessing Pap screening services, would help to identify specific intervention targets and/or methods.

Finally, interventions designed to address identified barriers ought to be piloted and their effects on screening participation monitored. The results of this study suggest that predisposing, enabling and needs-based variables all have an impact on screening participation, so interventions targeting each of these factor types should be explored. Client reminders, direct mail campaigns and in-home educational sessions are methods that have been shown to be effective in increasing participation among minority women in communities within North America (121-123). These types of interventions have been used most often to address predisposing and need-based barriers, such as health beliefs, knowledge of Pap screening and language barriers, however as Taylor et al. (67) demonstrated, in-home sessions can also be used effectively to address enabling factors. They examined the effectiveness of one-on-one counselling sessions that also

included logistic assistance, which was provided during home visits by trilingual, bicultural outreach workers to Chinese women in Vancouver. This type of intervention was found to increase participation in Pap screening, over and above the effects seen with a direct-mail campaign of Chinese language educational materials about Pap screening. Similarly structured pilots among other cultural groups in BC should be explored, with efforts made to scale-up those interventions shown to be most effective. The inclusion of women from these communities in the development of the interventions would likely go a long way towards ensuring the inclusion of culturally-appropriate messages and thereby increasing the chances of their success.

Another method used to address the predisposing and enabling barriers experienced by specific cultural groups in North America is culture matching through community-based clinics. Such clinics typically recruit health care providers and staff who share a similar culture and/or language with the women of the community being served. Within the lower mainland of BC two such clinics exist: the Asian Women's Health Clinic provides health services, including Pap testing, to local Chinese women, while the South Asian Pap Clinic targets women from the local South Asian community. Community-based clinics have been shown to be effective in other areas of North America (124) and there is some evidence to suggest the effectiveness of the BC-based clinics as well (12). However, this method is only likely to be feasible for the larger cultural groups within any given region, leaving the needs of less populous groups unmet. Finding culturally-sensitive ways to provide screening within existing health clinics and networks may be a more effective way of addressing the needs of BC's diverse immigrant population.

5.4 Conclusions

Immigrant women in British Columbia report Pap screening participation rates, both over the lifetime and within the last three years, that are significantly lower than those of non-immigrant women in the province. Sociodemographic factors, including age, marital status, level of education, location of residence, self-perceived health status and cultural or racial background, play an important role in Pap screening participation,

with the effect of many of these variables being different for immigrant and non-immigrant women. Additionally, Pap screening participation rates are not consistent across all immigrant groups, and East Asian and South Asian immigrant women in particular appear to be under-served by existing services.

REFERENCES

1. Parkin DM, Bray F. Chapter 2: The burden of HPV-related cancers. Vaccine. 2006;24(S3):S11 - 25.
2. Brown ML, Lipscomb J, Snyder C. The Burden of Illness of Cancer: Economic Cost and Quality of Life. Annu Rev Public Health. 2001;22:91-113.
3. Herzog T, Wright J. The impact of cervical cancer on quality of life—The components and means for management. Gynecologic Oncology. 2007;107:572–7.
4. Ashing-Giwa KT, Kagawa-Singer M, Padilla GV, Tejero JS, Hsiao E, Chhabra R, et al. The Impact of Cervical Cancer and Dysplasia: A Qualitative, Multiethnic Study. Psycho-Oncology. 2004;13:709–28.
5. BC Cancer Agency. Cervical Cancer Screening Program 2006 Annual Report. WinnipegMarch 2007.
6. Duarte-Franco E, France EL. Cancer of the Uterine Cervix. BMC Women's Health. 2004;2004(4):Suppl 1.
7. 2006 Canadian Census [database on the Internet]. Statistics Canada. 2006 [cited April 13, 2009].
8. Ip F. 2006 Census Fast Facts. Victoria: BC Stats2008.
9. BC Stats. Special Feature: B.C. Immigrant Population. Victoria2003.
10. Hislop T, Inrig K, Bajdik C, Deschamps M, Tu S-P, Taylor V. Health Care Services and Pap Testing Behavior for Chinese Women in British Columbia. Journal of Immigrant Health. 2003;5(4):143-52.
11. Hislop T, Teh C, Lai A, Ralston J, Shu J, Taylor V. Pap Screening and Knowledge of Risk Factors for Cervical Cancer in Chinese Women in British Columbia, Canada. Ethnicity & Health. 2004;9(3):267-81.
12. Grewal S, Bottorff J, Balneaves L. A Pap Test Screening Clinic in a South Asian Community of Vancouver, British Columbia: Challenges to Maintaining Utilization. Public Health Nursing. 2004;21(5):412–8.
13. Donnelly T. The Health-Care Practices of Vietnamese-Canadian Women: Cultural Influences on Breast and Cervical Cancer Screening. CJNR. 2006;38(1):82–101.
14. Jackson S. Service to Oncology. Radiation as a cure for cancer: the history of radiation treatment in British Columbia. Vancouver: BC Cancer Agency; 2002.
15. Anderson GH, Boyes DA, Benedet JL, Le Riche JC, Matisic JP, Suen KC, et al. Organization and results of the cervical cytology screening programme in British Columbia, 1955-85. British Medical Journal. 1988;296:975-8.
16. BC Cancer Agency. Cervical Cancer Screening Program 2009 Annual Report. Vancouver2010.
17. Canadian Cancer Society/National Cancer Institute of Canada. Canadian Cancer Statistics 2008. Toronto2008.
18. Wright T. Cervical Cancer Screening in the 21st Century: Is it Time to Retire the PAP Smear. Clinical Obstetrics and Gynecology. 2007;50(2):313-23.
19. Moscicki A. Human Papilloma Virus, Papanicolaou and the College Female. Pediatr Clin N Am. 2005;52:163-77.
20. Gordis L. Epidemiology. Third ed. Pennsylvania: Elsevier Saunders; 2004.

21. Oleckno WA. Screening for disease detection. Essential Epidemiolgy: Principles and Applications. Prospect Heights, Illinois: Waveland Press, Inc.; 2002. p. 159-79.
22. Abulafia O, Pezzullo JC, Sherer DM. Performance of ThinPrep liquid-based cervical cytology in comparison with conventionally prepared Papanicolaou smears: a quantiative survey. Gynecologic Oncology. 2003;90:137-44.
23. Aziz S, Chiarelli A, Gaudette L, Kan L, Shearer-Hood B, van Til L. Cervical Cancer Screening in Canada: 1998 Surveillance Report. Ottawa2002.
24. Fahey MT, Irwig L, Macaskill P. Meta-analysis of pap test accuracy. American Journal of Epidemiology. 1995;141(7):680-9.
25. Kulasingam SL, Hughes JP, Kiviat NB, Mao C, Weiss NS, Kuypers JM, et al. Evaluation of Human Papillomavirus Testing in Primary Screening for Cervical Abnormalities: Comparison of Sensitivity, Specificity, and Frequency of Referral. JAMA. 2002;288(14):1749-57.
26. Mayrand M-H, Duarte-Franco E, Rodriguez I, Walter S, Hanley J, Ferenczy A, et al. Human Papillomavirus DNA versus Papanicolaou Screening Tests for Cervical Cancer. The New England Journal of Medicine. 2007;357(16):1579-88.
27. Breslow L, Wilner D, History of Cancer Control Project. A history of scientific and technical advances in cancer control: UCLA School of Public Health1979.
28. Parkin DM. The global health burden of infection-associated cancers in the year 2002. Int J Cancer. 2006;118:3030-44.
29. Waxman A. Guidelines for Cervical Cancer Screening: History and Scientific Rationale. Clinical Obstetrics and Gynecology. 2005;48(1):77-97.
30. Wilson JMG, Jungner G. Principles and Practice of Screening for Disease. Geneva: World Health Organization; 1968.
31. BC Cancer Agency. A Population Based HPV Immunization Program in British Columbia: Background Paper. Vancouver: BC Cancer Agency2006 January 17, 2006.
32. Melnikow J, McGahan C, Sawaya GF, Ehlen T, Coldman A. Cervical intraepithelial neoplasia outcomes after treatment: long-term follow-up from the British Columbia Cohort Study. Journal of the National Cancer Institute. 2009;101(10):721-8.
33. Long H, Laack N, Gostout B. Prevention, Diagnosis, and Treatment of Cervical Cancer. Mayo Clin Proc. 2007;82(12):1566-74.
34. Richardson H, Kelsall G, Tellier P, al. e. The natural history of type-specific human papillomavirus infections in female university students. Cancer Epidemiol Biomarkers Prev. 2003;12:485-90.
35. Schiffman M, Castle P, Jeronimo J, Rodriguez A, Wacholder S. Human papillomavirus and cervical cancer. Lancet. 2007;370:890-907.
36. Tiffen J, Mahon S. Cancer: What Should We Tell Women About Screening? Clinical Journal of Oncology Nursing. 2006;10(4):527-31.
37. Health Canada. Progress report on cancer control in Canada. Ottawa: Health Canada, Population and Public Health Branch, Centre for Chronic Disease Prevention and Control2004.
38. BC Cancer Agency. Cervical Cancer Screening Program 2007 Annual Report. Vancouver2008.

39. Decker K, Demers A, Chateua D, Musto G, Nugent Z, Lotocki R, et al. Papanicolaou test utilization and frequency of screening opportunities among women diagnosed with cervical cancer. Open Medicine. 2009;3(3):140-7.
40. Austin R. New Cervical Cancer Screening Guidelines: The Other Side of Group Health Care “Rights”. Diagnostic Cytopathology. 2004;30(3):208-10.
41. Sawaya GF, Iwaoka-Scott AY, Kim S, Wong ST, Huang AJ, Washington E, et al. Ending cervical cancer screening: attitudes and beliefs from ethnically diverse older women. Am J Obstet Gynecol. 2009;200:40.e1-.e7.
42. Strander B. At what age should cervical screening stop? Negative tests are no reason to stop screening earlier. BMJ. 2009;338:1022 - 3.
43. Rothman SM, Rothman DJ. Marketing HPV vaccine: Implications for adolescent health and medical professionalism. JAMA. 2009;302(7):781-6.
44. Tiro J, Meissner H, Kobrin S, Chollette V. What Do Women in the U.S. Know about Human Papillomavirus and Cervical Cancer? Cancer Epidemiol Biomarkers Prev. 2007;16(2):288-94.
45. Gerend M, Magloire Z. Awareness, Knowledge, and Beliefs about Human Papillomavirus in a Racially Diverse Sample of Young Adults. Journal of Adolescent Health. 2008;42:237-42.
46. National Advisory Committee on Immunization. Canada Communicable Disease Report: Statement on human papillomavirus vaccineFeb 2007.
47. Canadian Immunization Committee. Recommendations on a Human Papillomavirus Immunization ProgramDec 2007.
48. Dyer O. HPV vaccine campaign struggles. National Review of Medicine. 2007;4(20).
49. Lexchin J, Arya N, Singh S. Gardasil - The New HPV Vaccine: The Right Product, the Right Time? A Commentary. Healthcare Policy. 2010;5(4):26-36.
50. Canadian Women's Health Network. HPV, Vaccines, and Gender: Policy Considerations. Winnipeg: Canadian Women’s Health Network2007.
51. Epidemiology Services BCfDC. Grade 6 and 9 Female Students Who Received the First Dose of Human Papillomavirus (HPV) Vaccine, 2008-9, British Columbia. Vancouver2009.
52. Raffle A. Challenges of implementing human papillomavirus (HPV) vaccination policy. BMJ. 2007;335:375-7.
53. Braveman P, Grushin S. Defining quity in health. J Epidemiol Community Health. 2003;57:254-8.
54. Maxwell CJ, Bancej CM, Snider J, Vik SA. Factors important in promoting cervical cancer screening among Canadian women: Findings from the 1996-97 National Population Health Survey (NPHS). Canadian Journal of Public Health. 2001;92(2):127-33.
55. Blackwell D, Martinez M, Gentleman J. Women's compliance with public health guidelines for mammograms and pap tests in Canada and the United States: An analysis of data from the Joint Canada/United States Survey of Health. Women's Health Issues. 2008;18:85-9.
56. Lofters A, Glazier R, Agha M, Creatore M, Moineddin R. Inadequacy of cervical cancer screening among urban recent immigrants: A population-based study of

physician and laboratory claims in Toronto, Canada. Preventive Medicine. 2007;44:536-42.
57. McDonald J, Kennedy S. Cervical Cancer Screening by Immigrant and Minority Women in Canada. J Immigrant Minority Health. 2007;9:323-34.
58. BC Stats. Profile of Immigrants: British Columbia. Victoria: BC Stats2006.
59. McDonald JT, Kennedy S. Insights into the 'healthy immigrant effect': Health status and health service use of immigrants to Canada. Social Science & Medicine. 2004;59:1613-27.
60. Newbold KB, Danforth J. Health status and Canada's immigrant population. Social Science & Medicine. 2003;57:1981-95.
61. Vissandjee B, Desmeules M, Cao Z, Abdool S, Kazanjian A. Integrating Ethnicity and Migration as Determinants of Canadian Women's Health. BMC Women's Health. 2004;4(Suppl 1):S32 - 43.
62. Gushulak B. Healthier on arrival? Further insight into the "healthy immigrant effect". CMAJ. 2007;176(10):1439-40.
63. Fennelly K. Health and well-being of immigrants: The health migrant phenomenon. In: Walker PF, Barnett ED, editors. Immigrant Medicine. Philadelphia: Saunders Elsevier; 2007. p. 19-26.
64. Walker PF. Preventative healthcare and management of chronic diseases in adults. In: Walker PF, Barnett ED, editors. Immigrant Medicine. Philadelphia: Saunders Elsevier; 2007. p. 537-66.
65. Vissandjee B, Weinfeld M, Dupere S, Abdool S. Sex, gender, ethnicity, and access to health care services: Research and policy challenges for immigrant women in Canada. Journal of International Migration and Integration. 2001;2(1):55-75.
66. Tu S-P, Jackson S, Yasui Y, Deschamps M, Hislop T, Taylor V. Cancer preventive screening: A cross-border comparison of United States and Canadian Chinese women. Preventive Medicine. 2005;41:36-46.
67. Taylor VM, Hislop TG, Jackson JC, Tu S-P, Yasui Y, Schwartz SM, et al. A Randomized Controlled Trial of Interventions to Promote Cervical Cancer Screening Among Chinese Women in North America. J Natl Cancer Inst. 2002;94:670–7.
68. Ponce N, Chawla N, Babey S, Gatchell M, Etzioni D, Spencer B, et al. Is there a Language Divide in Pap Test Use? Medical Care. 2006;44(11):998-1004.
69. Tremblay M. The Need for Directly Measured Health Data in Canada. Canadian Journal of Public Health. May/June 2004;95(3):165-6.
70. Newell S, Girgis A, Sanson-Fisher R, Ireland M. Accuracy of Patients' Recall of Pap and Cholesterol Screening. Am J Public Health. 2000;90:1431–5.
71. Mamoon H, Taylor R, Morrell S, Wain G, Moore H. Cervical screening: population-based comparisons between self-reported survey and registry-derived Pap test rates. Austalian and New Zealand Journal of Public Health. 2001;26(6):505-10.
72. McPhee S, Nguyen T, Shema S, Nguyen B, Somkin C, Vo P, et al. Validation of Recall of Breast and Cervical Cancer Screening by Women in an Ethnically Diverse Population. Preventive Medicine. 2002;35:463-73.

73. Bowman J, Redman S, Dickinson J, Gibberd R, Sanson-Fisher R. The Accuracy of Pap Smear Utilization Self-Report: A Methodological Consideration in Cervical Screening Research. Health Services Research. 1991;26(1):97-107.
74. Bowman J, Sanson-Fisher R, Redman S. The accuracy of self-reported Pap smear utilisation. Soc Sci Med. 1997;44(7):969-76.
75. Gordon N, Hiatt R, Lampert D. Concordance of Self-reported Data and Medical Record Audit for Six Cancer Screening Procedures. Journal of the National Cancer Institute. 1993;85(7):566-70.
76. McGovern P, Lurie N, Margolis K, Slater J. Accuracy of Self-Report of Mammography and Pap Smear in a Low-Income Urban Population. Am J Prev Med. 1998;14:201-8.
77. Paskett E, Tatum C, Mack D, Hoen H, Case L, Velez R. Validation of self-reported breast and cervical cancer screening tests among low-income minority women. Cancer Epidemiology, Biomarkers & Prevention. 1996;5:721-6.
78. Sawyer J, Earp J, Fletcher R, Daye F, Wynn T. Accuracy of Women's Self-Report of Their Last Pap Smear. American Journal of Public Health. 1989;79(8):8-9.
79. Bradburn NM, Rips LJ, Shevell SK. Answering Autobiographical Questions: The Impact of Memory and Inference on Surveys. Science. 1987;236:157-61.
80. Furnham A. Response Bias, Social Desirability and Dissimulation. Personality and Individual Differences. 2986;7(3):385-400.
81. Colgan TJ, Marshall R, Austin A, Davey DD. The Annual Papanicolaou Test: Women's Safety and Public Policy. Cancer. 2001;93(2):81-5.
82. Suarez L, Goldman DA, Weiss NS. Validity of Pap smear and mammogram self-reports in a low-income Hispanic population. Am J Prev Med. 1995;11(2):94-8.
83. Kleinman JC, Kopstein A. Who Is Being Screened for Cervical Cancer? American Journal of Public Health. 1981;71(1):73-6.
84. Greenland S. Basic methods for sensitivity analysis of biases. International Journal of Epidemiology. 1996;25(6):1107-16.
85. Andersen RM. Revisiting the Behavioral Model and Access to Care: Does it Matter? Journal of Health and Social Behavior. 1995;36(1):1-10.
86. Andersen R. National Health Surveys and the Behavioral Model of Health Services Use. Medical Care. 2008;46(7):647-53.
87. Gelberg L, Andersen RM, Leake BD. The Behavioral Model for Vulnerable Populations: Application to Medical Care Use and Outcomes for Homeless People. Health Services Research. 2000;34(6):1273-302.
88. Andersen RM, Newman JF. Societal and Individual Determinants of Medical Care Utilization in the United States Milbank Memorial Fund Quarterly. 1973;51(1):95-124.
89. Hislop T, Deschamps M, Teh C, Jackson C, Tu S-P, Yasui Y, et al. Facilitators and barriers to cervical cancer screening among Chinese Canadian Women. Canadian Journal of Public Health. 2003;94(1):68-73.
90. BC Cancer Agency. Cervical Cancer Screening Program 2008 Annual Report. Vancouver2009.

91. Bazargan M, Bazargan S, Farooq M, Baker R. Correlates of cervical cancer screening among underserved Hispanic and African-American women. Preventive Medicine. 2004;39:465-73.
92. Ackerson K, Pohl J, Low LK. Personal Influencing Factors Associated with Pap Smear Testing and Cervical Cancer. Policy, Politics, & Nursing Practice. 2008;9(1):50-60.
93. Ho IK, Dinh KT. Cervical Cancer Screening Among Southeast Asian American Women. J Immigrant Minority Health. 2011;13:49-60.
94. Juon H-S, Seung-Lee C, Klassen A. Predictors of regular Pap smears among Korean-American women. Preventive Medicine. 2003;37:585-92.
95. Oelke N, Vollman A. “Inside and Outside”: Sikh Women’s Perspectives on Cervical Cancer Screening. CJNR. 2007;39(1):174-89.
96. Johnson C, Mues K, Mayne S, Kiblawi A. Cervical Cancer Screening Among Immigrants and Ethnic Minorities: A Systematic Review Using the Health Belief Model. Journal of Lower Genital Tract Disease. 2008;12(3):232-41.
97. Latif E. Recent Immigrants and the Use of Cervical Cancer Screening Test in Canada. J Immigrant Minority Health. 2010;12:1-17.
98. Leach CR, Schoenberg NE. The Vicious Cycle of Inadequate Early Detection: A Complementary Study on Barriers to Cervical Cancer Screening Among Middle-Aged and Older Women. Prev Chronic Dis. 2007;4(4):1-12.
99. Wyke S, Ford G. Competing explanations for associations between marital status and health. Soc Sci Med. 1992;34(5):523-32.
100. BC Stats. Age, Family and Marital Characteristics of B.C. Immigrants Victoria2006.
101. Panzenboeck E. Mother Tongue and Home Language. Victoria: BC Stats2008 January 2008.
102. Harlan LC, Bernstein AH, Kessler LG. Cervical Cancer Screening: Who is Not Screened and Why? American Journal of Public Health. 1991;81(7):885-90.
103. Ackerson K, Gretebeck K. Factors influencing cancer screening practices of underserved women. Journal of the American Academy of Nurse Practitioners. 2007;19:591-601.
104. Talbot Y, Fuller-Thomson E, Tudiver F, Habib Y, McIsaac WJ. Canadians without regular medical doctors: Who are they? Canadian Family Physician. 2001;47(1):58-64.
105. Watson DE, Black C, Peterson S, Mooney D, Reid R. Who are the primary health care physicians in British Columbia? 1996/97-2004/052006: Available from: http://www.chspr.ubc.ca/files/publications/2006/chspr06-13.pdf.
106. Thurston WE, Vissandjee B. An ecological model for understanding culture as a determinant of women's health. Critical Public Health. 2005;15(3):229-42.
107. Donnelly TT. Challenges in providing breast and cervical cancer screening services to Vietnamese Canadian women: the healthcare providers’ perspective. Nursing Inquiry. 2008;15(2):158–68.
108. BC Stats. Special Feature: Earnings of Recent Canadian Immigrants. Victoria2004.
109. Brisebois F, Thivierge S. The weighting strategy of the Canadian Community Health Survey. Ottawa.

110. Statistics Canada. Estimation of the Variance Using Bootstrap Weights - User's Guide for the BOOTVARE_V30.sps Program. Ottawa2004.
111. Moore DS, McCabe GP. Introduction to the practice of statistics. Third ed. New York: W. H. Freeman anc Company; 1999.
112. Vittinghoff E, Glideen DV, Shiboski SC, McCulloch CE. Regression methods in biostatistics: Linear, logistic, survival, and repeated measures models. Gail M, Krickeberg K, Samet J, Tsiatis A, Wong W, editors. New York: Springer Science+Business Media, Inc.; 2005.
113. Hosmer DW, Lemeshow S. Applied Logistic Regression. 2nd Edition ed. New York: John Wiley & Sons, Inc.; 2000.
114. Field A. Discovering Statistics Using SPSS. Third ed. Los Angeles: Sage Publications Ltd.; 2009.
115. Jaccard J. Interaction Effects in Logistic Regression. Thousand Oaks: Sage Publications; 2001.
116. Bruce H. Women's Health Issues. In: Walker PF, Barnett ED, editors. Immigrant Medicine. Philadelphia: Saunders Elsevier; 2007. p. 567-83.
117. BC Cancer Agency. Cervical Cancer Screening Program 2005 Annual Report. Vancouver2006.
118. Rauscher GH, Mayne ST, Janerich DT. Relation between body mass index and lung cancer risk in men and women never and former smokers. Am J Epidemiol. 2000;152(6):506-13.
119. Hernandez-Diaz S, Garcia Rodriguez LA. Nonsteroidal anti-inflammatory drugs and risk of lung cancer. Int J Cancer. 2007;120:1565-72.
120. Barber PG. The ideal immigrant? Gendered class subjects in Philippine-Canada migration. Third World Quarterly. 2008;29(7):1265-85.
121. Black MEA, Frisina A, Hack T, Carpio B. Improving early detection of breast and cervical cancer in Chinese and Vietnamese immigrant women. Oncology Nursing Forum. 2006;33(5):873-6.
122. Baron RC, Rimer BK, Breslow RA, Coates RJ, Kerner J, Melillo S, et al. Client-directed interventions to increase community demand for breast, cervical, and colorectal cancer screening: A systematic review. Am J Prev Med. 2008;35(1S):S34-S55.
123. McAvoy BR, Raza R. Can health education increase uptake of cervical smear testing among Asian women? BMJ. 1991;302:833-6.
124. Kagawa-Singer M, Wong L, Shostak S, Walsh CR, Lew R. Breast and cervical cancer screening practices for low-income Asian American women in ethnic-specific clinics. Californian Journal of Health Promotion. 2005;3(3):180-92.

Appendix A: CCHS Cycle 3.1 Questions

Table A.1 CCHS Cycle 3.1 questions.

Variable	CCHS Question(s)	Variable Categorization Used in this Study
Lifetime Pap screening	PAPE_020: *Have you ever had a PAP smear test?* 1 Yes 2 No	Dichotomous variable
Recent Pap screening	PAP_022: *When was the last time?* 1 Less than 6 months ago 2 6 months to less than 1 year ago 3 1 year to less than 3 years ago 4 3 years to less than 5 years ago 5 5 or more years ago	Collapsed into a dichotomous variable: Pap test less than 3 years ago vs. Pap test 3 or more years ago
Perceived barriers to Pap screening	PAP_026 *What are the reasons that you have not had a PAP smear test in the past 3 years?* (Mark all that apply) Have not gotten around to it Respondent - did not think it was necessary Doctor - did not think it was necessary Personal or family responsibilities Not available - at time required Not available - at all in the area Waiting time was too long Transportation - problems Language - problem Cost Did not know where to go / uninformed Fear (e.g., painful, embarrassing, find something wrong) Have had a hysterectomy Hate / dislike having one done Unable to leave the house because of a health	All dichotomous variables

Variable	CCHS Question(s)		Variable Categorization Used in this Study
		problem Other - Specify	
Immigration Status	SDCE_2	*Were you born a Canadian citizen?* 1 Yes 2 No	Dichotomous variable
Age	ANC_03	*What is your age?*	Continuous variable
Marital Status	DHHEGMS	*What is your marital status?*	Used the categorical variable created by Statistics Canada, collapsing married and common-law into a single category
Highest Level of Personal Education	EDU_02	*Did you graduate from high school (secondary school)?* 1 Yes 2 No	Collapsed into a 3 categories: secondary graduation or less, some post secondary education (including trade diploma, college diploma, certificate less than bachelor's degree) and bachelor's degree or higher
	EDU_03	*Have you received any other education that could be counted towards a degree, certificate or diploma from an educational institution?* 1 Yes 2 No	
	EDU_04	*What is the highest degree, certificate or diploma you have obtained?* 1 No post-secondary degree, certificate or diploma 2 Trade certificate or diploma from a vocational school or apprenticeship training 3 Non-university certificate or diploma from a community college, CEGEP, school of nursing, etc. 4 University certificate below bachelor's level	

Variable	CCHS Question(s)		Variable Categorization Used in this Study
		5 Bachelor's degree 6 University degree or certificate above bachelor's degree	
Cultural or Racial Background	SDC_Q7	*People living in Canada come from many different cultural and racial backgrounds. Are you:* (Mark all that apply) White? Chinese? South Asian (e.g., East Indian, Pakistani, Sri Lankan)? Black? Filipino? Latin American? Southeast Asian (e.g., Cambodian, Indonesian, Laotian, Vietnamese)? Arab? West Asian (e.g., Afghan, Iranian)? Japanese? Korean? Aboriginal (North American Indian, Métis or Inuit)? Other – Specify	Used as a dichotomous variable (White vs. visible minority) and categorical variable (White, Chinese, South Asian, Filipino, South East Asian, Korean, Latin American, West Asian, Japanese, Other)
Region of Birth	SDC_Q1	*In what country were you born?* 1 Canada 11 Jamaica 2 China 12 Netherlands / Holland 3 France 13 Philippines 4 Germany 14 Poland 5 Greece 15 Portugal 6 Guyana 16 United Kingdom 7 Hong Kong 17 United States 8 Hungary 18 Viet Nam 9 India 19 Sri Lanka	Collapsed into regions of birth based on United Nations groupings: Europe: Austria, Belgium, France, Germany, Hungary, Italy, Netherlands, Poland, Portugal, UK, Greece, Switzerland, Bulgaria, Czechoslovakia, Czech Republic, Romania, Slovakia, USSR, Russia, Ukraine, Ireland,

Variable	CCHS Question(s)	Variable Categorization Used in this Study
	10 Italy 20 Other - Specify	Denmark, Finland, Sweden, Croatia, Serbia, Spain, Yugoslav East Asia: China, Hong Kong, Japan, South Korea, Korea, Mongolia, Taiwan South East Asia: Philippines, Vietnam, Brunei, Indonesia, Kampuchea, Laos, Malaysia, Thailand South Asia: India, Sri Lanka, Afghanistan, Iran, Bangladesh, Pakistan North America: United States, Latin and South America: Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Panama, Antigua, Bahamas, Barbados, Bermuda, Cuba, Grenada, Jamaica, Trinidad & Tobago, Argentina, Bolivia, Brazil Chile, Columbia, Guyana, Paraguay, Peru, Venezuela Other
Age at Immigration, Length of Time in Canada Since Immigration	SDC_Q3 *In what year did you first come to Canada to live?*	Continuous variables (calculated by Statistics Canada)
Fluency in English	SDC_Q5 *In what languages can you conduct a conversation?* (Mark all that apply)	Collapsed into a categorical variable (can converse in

Variable	CCHS Question(s)		Variable Categorization Used in this Study
		English French Arabic Chinese Cree German Greek Hungarian Italian Korean Persian (Farsi) Polish Portuguese Punjabi Spanish Tagalog (Pilipino) Ukrainian Vietnamese Dutch Hindi Russian Tamil Other – Specify	English vs. not)
Adjusted Household Income	INC_Q3	*What is your best estimate of the total income, before taxes and deductions, of all household members from all sources in the past 12 months?*	Used adjusted household income, which is calculated by Statistics Canada as a ratio between the respondent's household income and the low-income cut-off corresponding to the number of persons in the household and the size of the community in which the respondent lives, multiplied by 100. The low income cut-off is the threshold at which a family would typically spend a larger portion of its income on the necessities of food, shelter and clothing than the average family.

Variable	CCHS Question(s)		Variable Categorization Used in this Study
Has a Regular Doctor	HCU_01	*Do you have a regular medical doctor?* 1 Yes 2 No	Dichotomous variable
Regular Physician Contact	HCU_02	*[Not counting when you were an overnight patient, in the past 12 months/In the past 12 months], how many times have you seen, or talked on the telephone, about you physical, emotional or mental health with:* *… a family doctor or general practitioner?*	Collapsed into a dichotomous variable (consulted a doctor within the past year vs. not)
Self-Perceived Health Status	GEN_01	*To start, in general, would you say your health is:* 1 excellent? 2 very good? 3 good? 4 fair? 5 poor?	Categorical variable
Health Region of Residence	N/A – Determined by Statistics Canada and used to determine survey eligibility.		Categorical variable
Geographic Setting	N/A – Determined by Statistics Canada and used to determine survey eligibility.		Dichotomous variable (urban vs. rural)

Appendix B: Assessing Model Fit

Table B.1 Multivariate logistic regression model with lifetime Pap screening participation assessment of fit.

Measure	Results	Conclusions/Notes
Standardized Residuals	2.3% of standardized residuals have an absolute value above 2.58 and 1.5% of standardized residuals have an absolute value above 3.29	Suggests there are a number of individuals for which the model fits poorly
Cook's Distance	All < 1.0	Indicates no individual cases with significant influence on the model
Leverage Values	Large number outside expected range of ± 3 x 0.0042	Suggests there are a number of individual cases which have a large effect on the outcome of fitting the model
DFBetas	All < 1.0	Indicates no individual cases with significant influence on the model parameters
Log Interaction Terms	Interaction terms for age and health status with their natural logarithms are significant	Suggests assumption of linearity may have been violated
Variance Inflation Factors	All < 10	Suggests assumption of non-multilinearity is satisfied

Table B.2 Multivariate logistic regression model with regular Pap screening participation assessment of fit.

Measure	Results	Conclusions/Notes
Standardized Residuals	2.7% of standardized residuals have an absolute value above 2.58 and 1.4% of standardized residuals have an absolute value above 3.29	Suggests there are a number of individuals for which the model fits poorly
Cook's Distance	All < 1.0	Indicates no individual cases with significant influence on the model
Leverage Values	Large number outside expected range of ± 3 x 0.0053	Suggests there are a number of individual cases which have a large effect on the outcome of fitting the model
DFBetas	All < 1.0	Indicates no individual cases with significant influence on the model parameters
Log Interaction Terms	Interaction term for age with its natural logarithm is significant	Suggests assumption of linearity may have been violated
Variance Inflation Factors	All < 10	Suggests assumption of non-multilinearity is satisfied