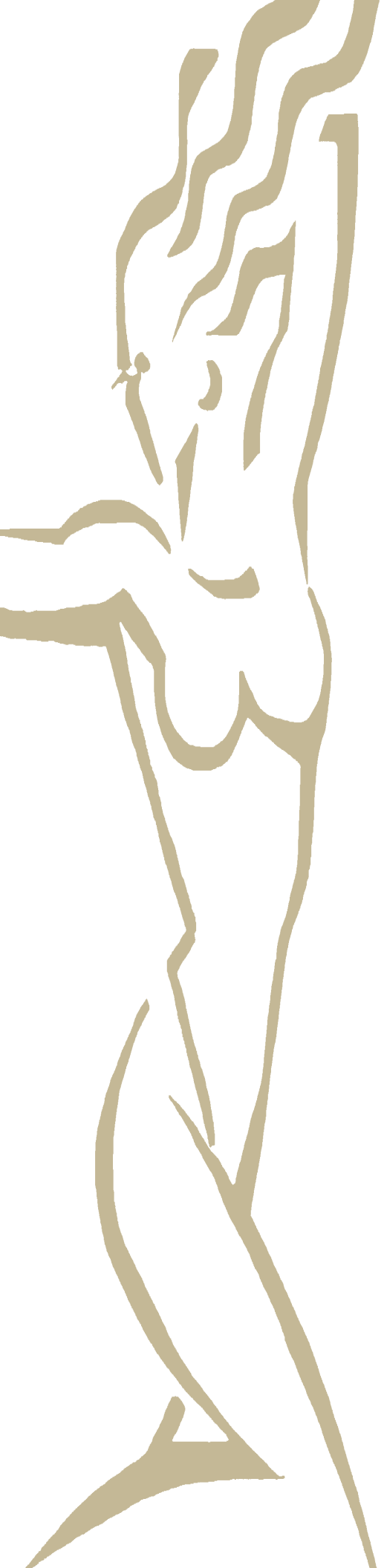

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Cervical Cancer Screening in Canada: 1998 Surveillance Report

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Cervical Cancer Screening in Canada: 1998 Surveillance Report

PAP SCREENING for Life.

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Preface

Cervical Cancer Screening in Canada: 1998 Surveillance Report is the first national surveillance report on cervical cancer screening activities in six provinces across Canada. The report provides information on key areas of program performance, including participation in cervical cancer screening, specimen adequacy, cytology results, and incidence and mortality of cervical cancer. Development of cervical cancer screening has been guided by the Cervical Cancer Prevention Network since 1995 in response to national recommendations highlighting the need for comprehensive cervical cancer screening programs. Such programs aim to provide screening to Canadian women at appropriate intervals, with information systems in place to monitor overall quality assurance of screening procedures, including follow-up of all women found to have abnormal screen results. Effectively organized programs ensure wise use of health resources, and at the same time minimize the burden of cervical cancer on the Canadian population.

Managers and staff working in cervical cancer programs, health policy makers and members of the general public with an interest in cervical cancer are the intended audience for this report. Planning and managing cervical cancer screening programs requires surveillance information not only on indicators of screening participation and quality of the screening process, but also knowledge of trends in cervical cancer incidence and mortality, and of its risk factors. By synthesizing evidence from published research and new analyses of Canadian data, this report demonstrates how epidemiologic analyses can identify areas for further development of program interventions and policies for cervical cancer screening.

Our success in this work has been achieved through strong collaboration with Health Canada's Cancer Division and the Information Systems Working Group of the Cervical Cancer Prevention Network. These, in turn, rely on a larger network of national and international agencies that have contributed to development of various data sources and research studies that are essential to our understanding of how to control this largely preventable disease.

This document serves as the basis for regular reporting on cervical cancer screening activities in Canada.

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- Cancer incidence data used in this project were provided to Health Canada from the Canadian Cancer Registry, formerly the National Cancer Incidence Reporting System, at Statistics Canada. The cooperation of the provincial and territorial cancer registries that supply the data to Statistics Canada is gratefully acknowledged.
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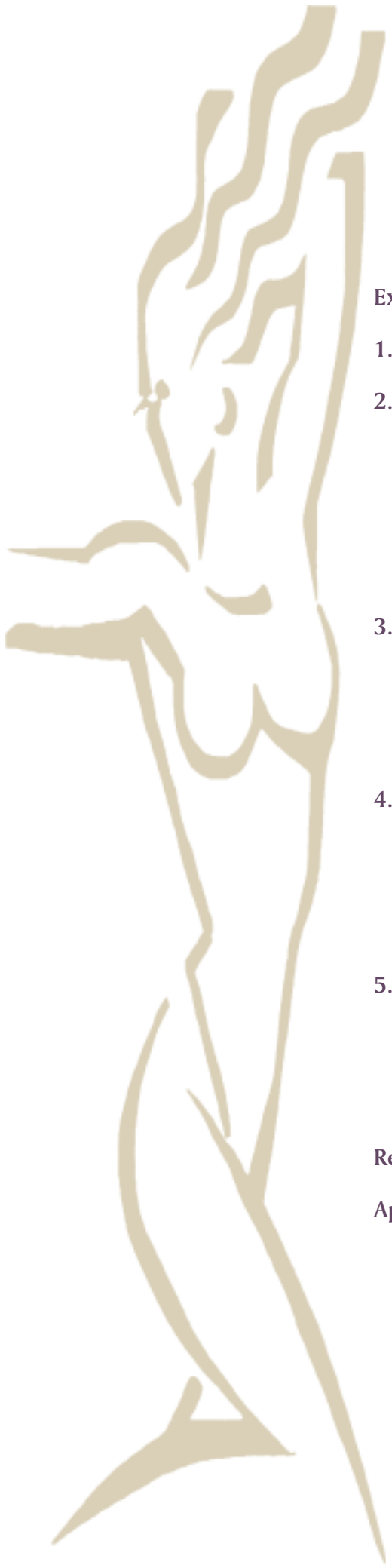

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Executive Summary

The majority of deaths from cervical cancer are avoidable. In most women, the Papanicolaou (Pap) smear test can successfully detect lesions before they become cancerous or, if they are cancerous, when the disease is at a stage when treatment can be effective. As a result, cytological screening for the early detection of precursors of cancer of the uterine cervix has been one of the most successful public health measures introduced so far for the prevention of cancer.

Cervical cancer is now the 12th most commonly diagnosed cancer among women of all ages in Canada; however, it ranks third among women aged 20-34 and women aged 35-49. Since the introduction of the Pap test in Canada, the rate of mortality from cervical cancer has steadily declined, with an almost 50% drop over the past 25 years. The incidence of invasive cervical cancer has also fallen considerably as a result of declining rates of squamous cell carcinoma, the form of cervical cancer most amenable to control through the Pap test. Overall, close to 1,000 deaths due to cervical cancer have been prevented each year as a result of improved control measures.

Despite these advances, an estimated 1,400 women in Canada will receive a diagnosis of invasive cervical cancer and approximately 410 women will die from the disease in the year 2002. Women who are older, immigrant or Aboriginal, or who have a lower socio-economic status are at higher risk of developing cervical cancer, as these groups show lower compliance with regular screening schedules. The increasing rate of adenocarcinomas and adenosquamous carcinomas, which account for 20% of all cervical carcinomas, is of concern, as these forms of cervical cancer arise further in the endocervical canal and are less effectively detected by the Pap test. It is now known that the combination of a brush and spatula with an extended tip is more efficient in collecting these cells than the spatula used alone.

In Canada, numerous recommendations have been made over the past 25 years to develop comprehensive cervical cancer screening programs that include population-based recruitment and a quality management component, supported by a computerized information system. Effective organization can eventually reduce the cost of screening programs, while retaining, if not improving their

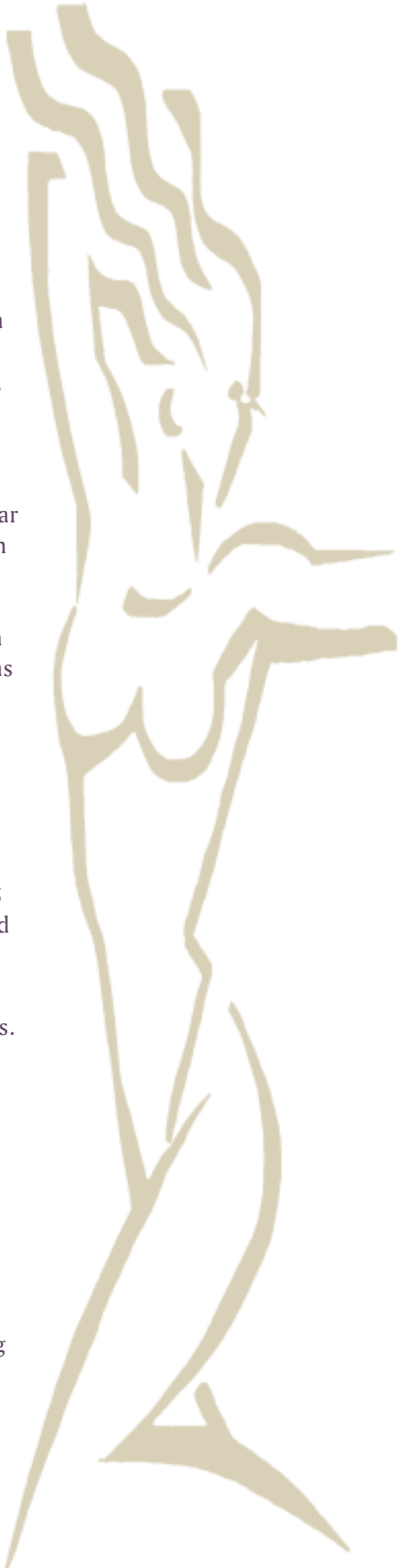
effectiveness. As many jurisdictions have not fully adopted these recommendations, opportunistic screening continues to be the predominant way in which most women receive screening services. Guidelines for screening frequency have varied over time. The 1989 National Workshop on Cervical Cancer Screening has recommended a yearly Pap test for women who are sexually active and, after two consecutive satisfactory smears that show no significant abnormality, continued screening every 3 years to age 69.

Data from provincial departments of health and established cervical cancer screening programs are presented in this report. Overall, 3-year participation rates do not vary greatly among provinces, ranging from 67% to 74%, although rates are sub-optimal and are also lower than those reported from national surveys. To increase participation rates would require targeting sub-groups of the population that are known to have lower compliance. Although population-based recruitment has the potential to increase overall participation rates, no province or territory in Canada practises this.

Monitoring specimen adequacy is important in measuring quality of smear-taking techniques. The percentage of "unsatisfactory" smears varied from 0.3% to 3.8% of smears taken in 1 year; the percentage of "satisfactory but limited for interpretation" smears varied from 16.3% to 25.5%. Some of the variation is due to the differing thresholds used for reporting specimen inadequacy.

Cytology outcomes were measured as high grade or low grade lesions. The percentage of high grade lesions (most severe findings) varied from 0.5% to 1.4% of "satisfactory" smears in 1 year. Low grade abnormalities differed greatly among provinces, likely because of diverse reporting thresholds and recommendations for follow-up. Greater standardization in reporting is an ongoing goal.

Most women who develop cervical cancer remain unscreened or underscreened. Canadian studies show that about 60% of cervical cancers occur in women who have not been screened in the previous 3 years. Lack of organization has contributed to this failure, including an inability to reach high-risk women, inadequate quality control, or ineffective follow-up procedures. A small number of women will have unfavourable and rapidly progressing abnormalities that will escape



detection through screening. As organized programs continue to develop, cervical cancer screening will reach more women at risk and thereby further reduce mortality from this disease.

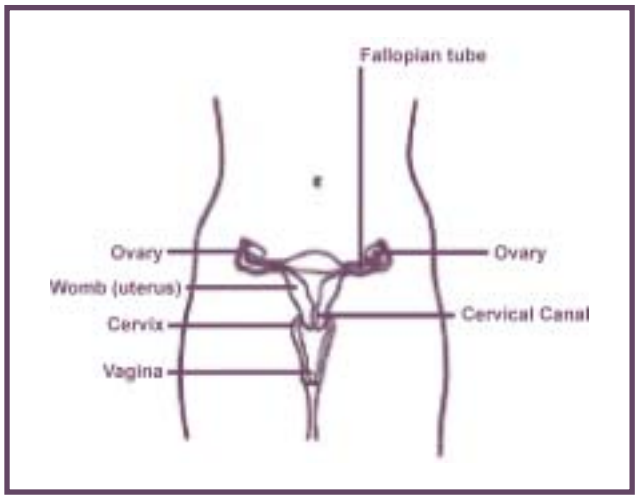
The introduction of Pap screening practice into the health care system in Canada has contributed to a significant drop in the incidence and mortality of cervical cancer. Lack of pertinent information on screening practices across this country reinforces the need for information systems to monitor screening activity, cytology outcomes and, subsequently, the effects on incidence and mortality.

1. Introduction

The cervix is the lower portion of the uterus leading into the vagina (Figure 1). It is lined with two main types of cell: squamous and glandular mucus-secreting cells. The junction between the two types of cell is called the transformation zone (or squamo-columnar junction) and is an area of rapid cell turnover where benign and malignant cellular changes are most likely to occur.

Cervical cancer is a malignancy of the cells lining the surface of the cervix. It begins as asymptomatic pre-cancerous lesions and usually develops gradually over many years. The intraepithelial lesions are limited to the cervical epithelium, and as invasion occurs the neoplastic cells penetrate the underlying membrane with potential for widespread dissemination. Depending on their severity, lesions can resolve on their own or can progress to cancer. Cervical cancers most commonly arise from the squamous cells (70%), and 18% to 20% arise from the glandular cells (adenocarcinomas). Adenosquamous carcinomas (5%) share features of squamous cell carcinomas as well as adenocarcinomas, but rarely occur. Other unspecified type of cervical cancer account for the remaining 5%[1].

Figure 1: Female Reproductive System

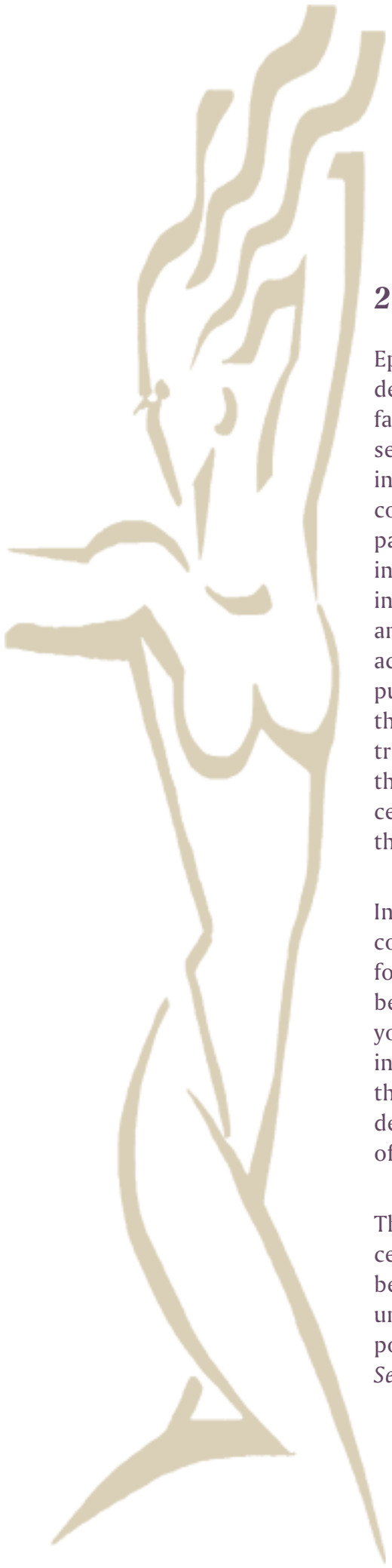


Cervical cancer affects women of all age ranges, but the highest incidence is found among women aged 40-59[1]. Women with cervical cancer show a relatively good prognosis: the ratio of deaths to cases is 0.29, and the 5-year relative survival rate is 74%[2]. Effective treatments for cervical cancer are readily available.

Because of the natural history of cervical cancer, specifically the presence of pre-cancerous stages that can be easily detected and treated, the disease lends itself well to screening programs. The Papanicolaou (Pap) test is an established method used to examine cells obtained from the cervix in order to determine whether they show any signs of pre-cancerous changes. A spatula and/or brush is used to sample cells from the transformation zone (squamo-columnar junction), which are then smeared onto a glass slide and examined under the microscope by a cytotechnologist for any type of pre-cancerous changes. The cytopathologists and cytotechnologists classify the cells according to a spectrum from normal to carcinoma.

Several different classification schemes have evolved over the years for characterizing Pap test results. The CIN (cervical intraepithelial neoplasia) grading system has been gradually replaced by the Bethesda System (introduced in 1989)[3], although some provinces in Canada continue to use the CIN grading system. Appendix B provides a comparison between the various nomenclature used to classify cell abnormalities seen on Pap tests.

In Canada, opportunistic screening has occurred since the introduction of the Pap test and is by far the most frequent way in which women receive screening services. Pap smears are taken by general practitioners, gynecological specialists and, in some circumstances, nurses in doctors' offices, community health clinics and hospitals.



2. Epidemiology of Cervical Cancer

2.1 Risk Factors

Important Risk Factors for Cervical Cancer

Inadequate screening
Human papillomavirus (HPV)
Multiple sexual partners
Young age at intercourse
Male sexual behaviour
Tobacco

Epidemiologic evidence has demonstrated that in terms of risk factors cervical cancer behaves as a sexually transmitted disease[4]. Several indicators, the most convincing and consistent being multiple sexual partners and young age at first intercourse, have been shown to increase the risk of cervical cancer among women[5]. Early onset of sexual activity is thought to be associated with high risk because, during puberty, cervical tissue undergoes a variety of changes that may make the area more vulnerable to damage. Further support for the sexually transmitted etiology of this disease can be found in several studies that indicate the importance of a "male factor": male partners of cervical cancer patients report considerably more sexual partners than those of unaffected women[6,7].

Infection with certain types of the human papillomavirus (HPV) is now considered to be a causal agent for cervical cancer[8]: the relative risks for the association between HPV and cervical neoplasia are high, between 20 and100 times. HPV is widely prevalent, especially among younger women. However, this may reflect the transient nature of HPV infections, in that older women will have had the opportunity to clear the infection[9]. A recent survey conducted in the province of Ontario demonstrated that women aged 20 to 24 had the highest prevalence of HPV (24%)[10].

The overwhelming majority of women today with a diagnosis of cervical cancer have either not had regular Pap tests or they have not been followed up after detection of an abnormal smear. Not undergoing regular Pap tests is the single greatest risk factor for a poor outcome in women who develop cervical cancer[11,12]. *(see also Section 5 of this report).*

Cigarette smoking has also been found in a few studies to increase the risk of cervical cancer, especially among long-term smokers[13]. Smoking constituents have been found in cervical mucus, but the biologic mechanisms underlying the smoking–cervical cancer relation have not been identified[14].

Choice of contraceptive methods appears to affect the risk of acquiring cervical cancer. Barrier mechanisms have been associated with reduced risk, whereas the use of oral contraceptives has been associated with an increased risk[15]. The risk associated with oral contraceptives has been found to be stronger for adenocarcinomas than for squamous cell carcinomas, even after adjustment for a variety of socio-economic and sexual factors[16,17]. Assessing the effect of oral contraceptive use is difficult because this variable is highly associated with factors such as sexual activity and history of Pap smear screening[18].

2.2 Trends in Incidence and Mortality in Canada

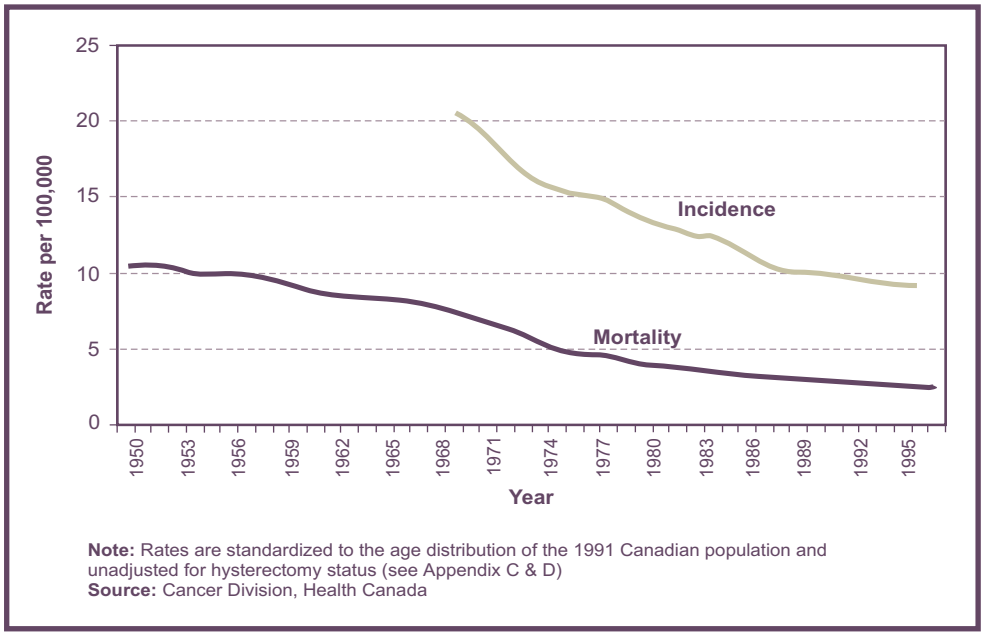
Cervical cancer is the 12th most common cancer diagnosed in women in Canada. Among women aged 20 to 34 and women 35 to 49, it ranks third in incidence[1]. In the year 2002, it is estimated that there will be approximately 1,400 new cases and 410 deaths due to the disease[19]. Both incidence and mortality rates have declined substantially in Canada (Figure 2), age-standardized incidence rates by 50% over a period of 25 years and mortality rates by 73% over 50 years (which coincides with the introduction of the Pap smear).

More recently, there has been an attenuation in the decrease of overall incidence and mortality rates, and this attenuation is apparent in all age groups. The incidence of cervical cancer varies by age group, the highest incidence occurring between the fifth and seventh decades of life[1].

Cervical cancer incidence in Canada varies substantially by region (Figure 3). Age-standardized incidence rates for two 5-year periods, 1982-86 and 1992-96, were highest in the Atlantic provinces. The lowest rate between 1982 and 1986, in British Columbia, likely reflects the influence of that province's well-established screening program;

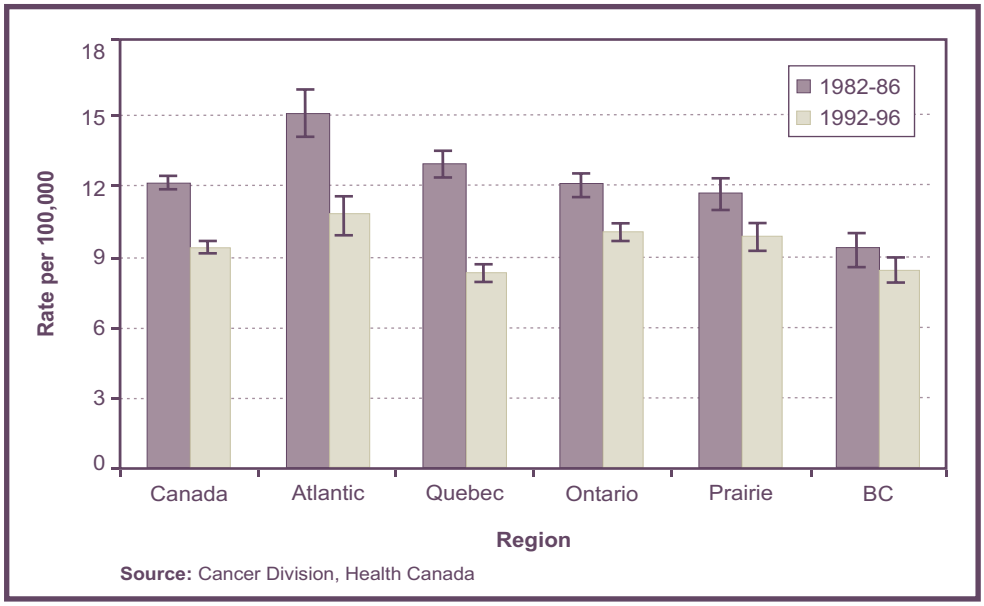
the low rate between 1992 and 1996 in Quebec may reflect, in part, under-reporting. Overall, incidence rates have declined across all regions.

Figure 2: Age-standardized Incidence (1969-96) and Mortality (1950-97) Rates for Cervical Cancer, Canada (3-year moving average)



Note: Rates are standardized to the age distribution of the 1991 Canadian population and unadjusted for hysterectomy status (see Appendix C & D)
Source: Cancer Division, Health Canada

Figure 3: Comparison of Age-Standardized Incidence Rates of Cervical Cancer by Region, 1982-86 and 1992-96



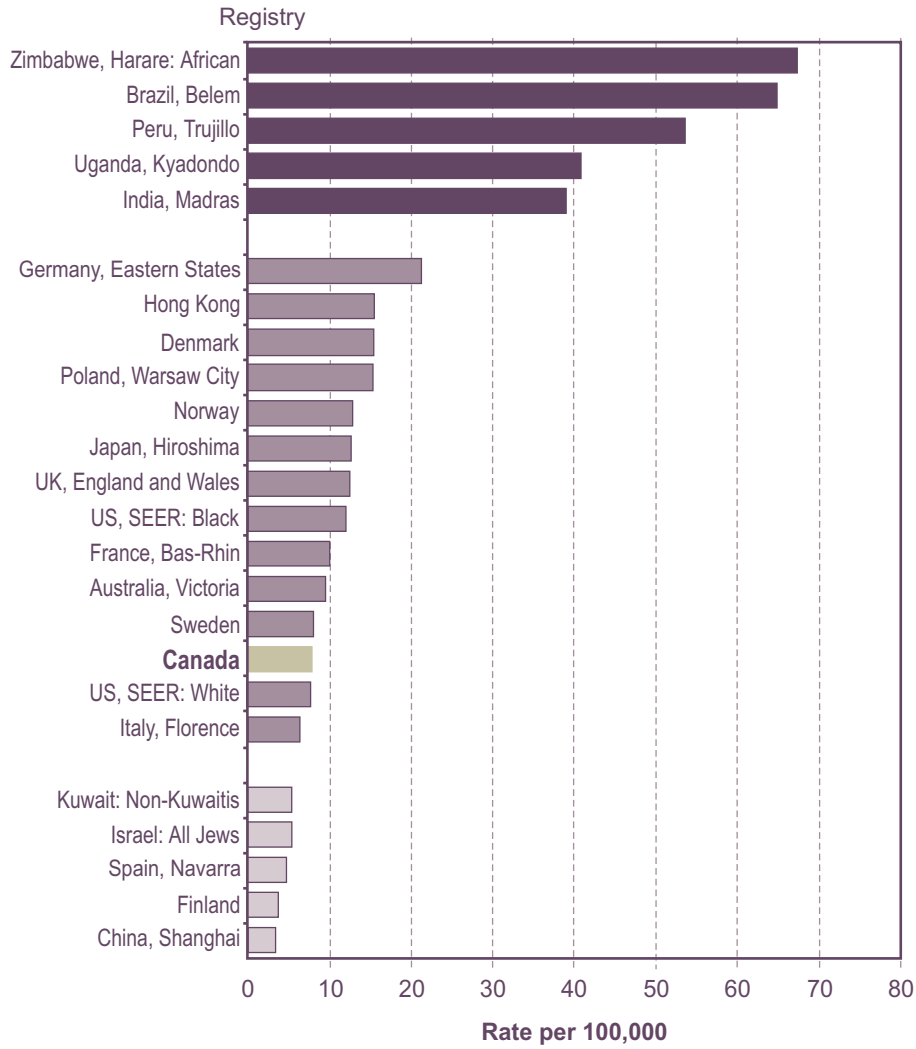
Source: Cancer Division, Health Canada

In North America cervical cancer rates in Aboriginal populations are generally high[20]. Among Canadian Inuit, cervical cancer accounts for approximately 15% of all cancers in women, and age-standardized rates are three times higher than the national average[9,21]. Among First Nations, elevated incidence rates of from two to six times higher have been reported in Saskatchewan[22], Manitoba[23] and Ontario[24]. Similarly, elevated mortality rates from cervical cancer have been reported among First Nations in British Columbia[25]. These results are often linked to lower rates of Pap screening[26] but may also be due, in part, to differences in underlying risk factors.

2.3 International Comparisons

Canada compares favourably in terms of incidence rates internationally (Figure 4). Cervical cancer ranks third worldwide and accounts for 10% of all cancers worldwide; in developing countries it ranks second, accounting for 15% of all cancers[27]. The highest risk areas are in South America, east and south Africa, and India, where rates are five to eight times higher than in Canada. Among the lowest risk areas are Shanghai (China), Finland, Navarra (Spain) and Israel. Canada's incidence rate is similar to rates in other developed countries but is still about twice as high as in the countries with the lowest rates, suggesting that there is room for improvement. These comparisons should be interpreted with some caution, as incidence rates may be influenced by differences in hysterectomy rates and there may be some under-reporting of cervical cancers that are identified as uterus, not otherwise specified.

Figure 4: Age-standardized Incidence Rates for Cervical Cancer, Canada and Selected Cancer Registries 1988-1992

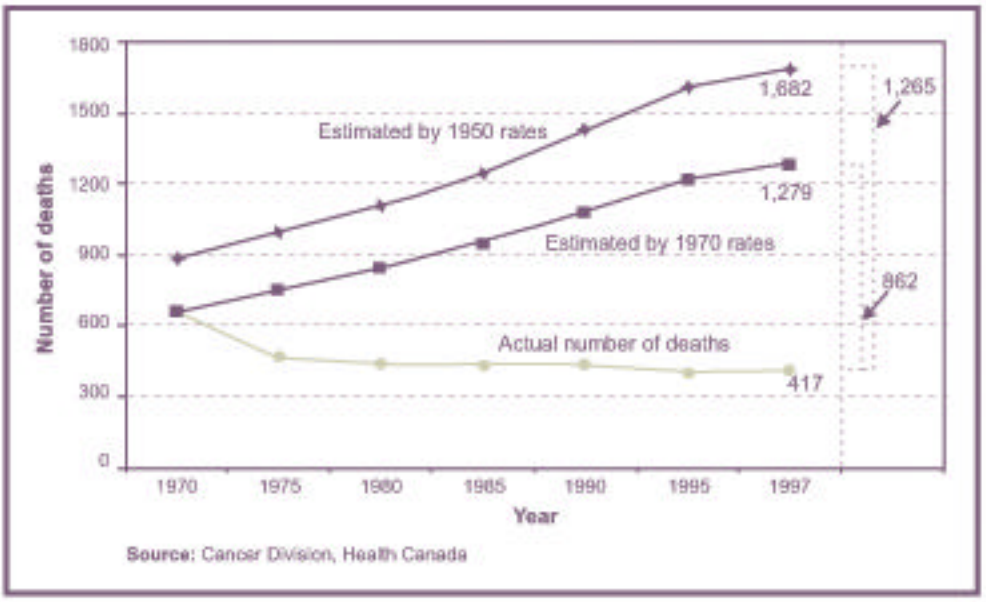


Note: Rates are standardized to the age distribution of the World Standard Population. Figure includes registries with the five highest and lowest rates, plus selected registries with intermediate rates.
Source: Cancer Incidence in Five Continents, Vol. VII, International Agency for Research on Cancer.

2.4 Expected Deaths from Cervical Cancer

Most deaths from cervical cancer are considered to be avoidable. Figure 5 shows the actual and expected number of deaths from cervical cancer that would have occurred if 1950 and 1970 age-specific mortality rates had prevailed. Screening activity in Canada contributed to a saving of between 862 and 1,265 lives in 1997, but there are several hundred more cervical cancer deaths in Canada that are still potentially preventable.

Figure 5: Actual and Expected Number of Deaths from Cervical Cancer, Canada (1970 to 1997), Estimated by 1950 and 1970 Mortality Rates



Source: Cancer Division, Health Canada

3 Cervical Cancer Screening in Canada

3.1 History of Cervical Cancer Screening

In Canada, the history of cervical cancer screening dates back to 1960, when the province of British Columbia introduced a provincial cervical cancer screening program. In 1973, the Conference of Deputy Ministers of Health identified the need for comprehensive cervical cancer screening programs, and the ensuing Walton Report recommended that health authorities support the development of these programs[28]. A 1980 survey concluded that the recommendations of the Task Force had not been implemented at the provincial level[29]. The Walton Task Force was reconvened in 1980 in response to the lack of implementation and to concerns about changing sociosexual patterns[30]. Recommendations at this meeting related to frequency of screening, laboratory quality control and follow-up mechanisms. In addition, the 1980 task force also concluded that improving the quality and sensitivity of screening and including women who had never been screened would reduce mortality more effectively than attempts to increase screening frequency.

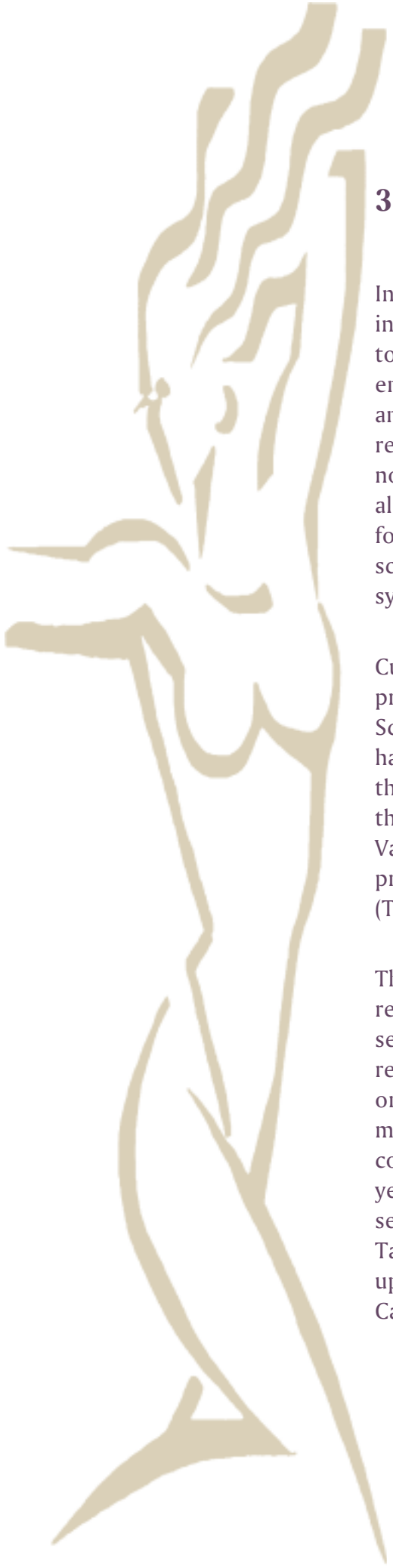
In a National Workshop on Screening for Cancer of the Cervix (1989)[31], previous recommendations on screening were reviewed and it was recognized that programs in Canada were not as effective as they could be. Not only were some women at risk not being screened but also smears were not being taken adequately and women with abnormalities were not receiving appropriate follow-up and management. Conversely, some women were being screened too frequently, resulting in inappropriate use of resources. Participants at the workshop concluded that the following issues needed to be addressed:

- the frequency of screening;
- the management of abnormalities;
- information systems;
- training and quality control requirements for laboratories and programs.

The need for an organized approach to screening was emphasized. In November 1990 the recommendations from this workshop were accepted by the Deputy Ministers of Health, who requested that a regular review of developments be made to them.

In 1995, Health Canada supported a workshop entitled *Interchange '95* to review the situation within the provinces, identify factors affecting the implementation of comprehensive cervical cancer screening programs and determine whether previous recommendations were still appropriate. The participants outlined three specific but interrelated components required of a comprehensive cervical cancer screening program: information systems, quality management and recruitment. It was at *Interchange '95* that participants felt the need to have a forum for the exchange of information. Thus the provinces and territories were invited to participate in a Cervical Cancer Prevention Network (CCPN), an informal association of federal, provincial and territorial representatives together with representation from professional societies and the community. The purpose of the CCPN is to continue to reduce the morbidity and mortality associated with cervical cancer and its precursors in Canada by facilitating the implementation of organized screening programs. Three working groups were formed to focus on the development of the three components of organized screening programs: effective recruitment, information systems and quality management. Since the formation of the CCPN in 1995, Health Canada has continued to sponsor meetings for information exchange and to foster collaboration on components of organized screening programs among jurisdictions.

With the formation of the CCPN in 1995, considerable progress has been made towards information exchange on resources and materials that support planning and implementation of organized cervical cancer screening programs in the provinces and territories. Meetings of the CCPN were held in 1998 and, most recently, in January 2001.



3.2 Recommended Guidelines and Current Provincial Status

In Canada, opportunistic screening, which has occurred since the introduction of the Pap test, is by far the most frequent method used to screen women. Opportunistic screening, however, tends to encourage overscreening of women at all ages, especially the young, and the overtreatment of abnormalities that otherwise would have regressed spontaneously. Recognizing that effective organization will not only reduce the cost of screening programs in the long run but also improve their effectiveness, recommendations have been put forward numerous times in Canada for the development of organized screening programs that incorporate a computerized information system, population-based recruitment and quality management.

Currently, two provinces in Canada have well-established, organized programs for cervical cancer screening: British Columbia and Nova Scotia. Recently, Alberta, Manitoba, Ontario, and Prince Edward Island have also launched programs. Provincial programs target all women in their population in a specified age range (usually 18-69); however, at this time no province encompasses population-based recruitment. Variation among provinces in their implementation of screening program components reflects maturity of program development (Table 1).

The Canadian Task Force on Preventive Health Care (1991)[32] recommends annual screening with the Pap smear after initiation of sexual activity or at age 18. The annual screening frequency may be reduced to every 3 years, until age 69, after two normal tests and if an organized program is in place with appropriate quality control measures and information systems. More frequent testing may be considered for women at high risk (first intercourse at less than18 years of age, multiple sexual partners, partner who has had multiple sexual partners, smoking, low socio-economic status). The Canadian Task Force on Preventive Health Care recommendations are based upon the recommendations from the National Workshop on Cervical Cancer Screening, held in 1989[31].

Table 1: Cervical Cancer Screening Programs and Practices, Canada, 2001

Province	Program	Year of Inception	Computerized Information System*	Target Age Group	Screening Frequency
Newfoundland	No	–	✓	18+	Annual
Nova Scotia	Yes	1991	✓	18+	Annual
Prince Edward Island	Yes	2001	✓	20-69	After three normal annual Pap smears, screening should be continued at least every 2 years.
New Brunswick	No	–	–	–	–
Quebec	No	–	–	18-69	Annual
Ontario	Yes	2000	✓	20-69	After three normal annual Pap smears, screening should be continued every 2 years.
Manitoba	Yes	1999	✓	18-69	After three normal annual Pap smears, screening should be continued every 2 years.
Saskatchewan	No	–	–	–	–

*Has a provincial computerized information system for cytology, which may have been implemented before inception of full program.

Table 1: Cervical Cancer Screening Programs and Practices, Canada, 2001 (continued)

Province	Program	Year of Inception	Computerized Information System*	Target Age Group	Screening Frequency
Alberta	Yes	2000	Under development	18-69	Annual (to be reviewed when all components of program in place)
British Columbia	Yes	1960	✓	18-69	After three normal annual Pap smears, screening should be continued every 2 years. If high risk, continue annually.
Northwest Territories	No	–	–	18+	After three normal annual Pap smears, screening should be continued every 2 years.
Yukon	No	–	–	18+	After three normal annual Pap smears, screening should be continued every 2 years.
Nunavut	No	–	–	18+	After three normal annual Pap smears, screening should be continued every 2 years. If high risk, continue annually.

*Has a provincial computerized information system for cytology, which may have been implemented before inception of full program.

Summary Recommendations from the National Workshop on Cervical Cancer Screening, 1989

Highlights of the recommendations from the 1989 National Workshop on Screening for Cancer of the Cervix[31] are as follows :

- Pap screening to start at age 18 or at initiation of sexual activity.
- A second smear should, in general, be taken after 1 year, especially for women who begin screening after age 20.
- If the first two smears are satisfactory and show no significant epithelial abnormality, women should, in general, be advised to be rescreened every 3 years to age 69.
- Screening should occur at this frequency in areas where a population-based information system exists for identifying women and allowing notification and recall. In the absence of such a system, it is advisable to repeat Pap smears annually.
- Women over the age of 69 who have had at least two satisfactory smears and no significant epithelial abnormality in the last 9 years and who have never had biopsy-confirmed severe dysplasia or carcinoma in situ can be dropped from the cervical cytology screening program.
- If mild dysplasia (cytologic equivalent of cervical intraepithelial neoplasia [CIN] grade 1, or low-grade squamous intraepithelial lesion [LSIL]) is found, the smear is to be repeated every 6 months for 2 years.
- If the lesion persists or progresses to moderate or severe dysplasia (CIN grades 2 and 3, or high-grade SIL), the patient must be referred for colposcopy.
- Women do not need to be screened if they have never had sexual intercourse or have had a hysterectomy for benign conditions with adequate pathological documentation that the cervical epithelium has been totally removed and previous smears have been normal.

4. Cervical Cancer Screening Activities in Canada

4.1 Participation, by Age Group and Province (provincial data and self-reported survey data)

The best national data currently available from certain provinces in Canada are shown in Table 2 (details are provided in Appendix E). One year participation rates do not vary greatly among provinces, ranging from 37% in British Columbia and Ontario to 44% in Nova Scotia. These participation rates vary, however, by age group: the lowest rate is among women in the 15-19 age group and the highest rate among women aged 20-39.

Table 2: One-Year Pap Test Rates, by Age Group and Province, 1998

	British Columbia	Manitoba[a]	Ontario[b]	Nova Scotia[c]	Prince Edward Island	Newfoundland[c]
Age Group	**% of ♀**	**% of ♀**	**% of ♀**	**% of ♀**	**% of ♀**	**% of ♀**
15-19	20	20	21	28	14	27
20-29	47	46	47	60	49	57
30-39	47	43	44	51	46	47
40-49	39	39	37	43	41	39
50-59	30	37	34	38	41	32
60-69	21	29	24	26	32	17
Totals (15-69)	37	38	37	44	40	40
Total Number of Women Screened	***536,452***	***147,257***	***684,567***	***147,867***	***18,848***	***81,195***

[a] Frequencies are based on physician billing data.
[b] As data capture in Ontario includes only 45% of all smears, rates presented have been adjusted to represent the entire province.
[c] Most recent data available are for 1997.
Note: Only British Columbia and Nova Scotia had implemented cervical cancer screening programs by 1998.
Source: Numerator data provided by provincial programs and departments of health. Denominator data: 1998 post-censal population estimates from Statistics Canada.

Figure 6: Proportion of Women Screened Within the Last 3 Years, Self Report, NPHS 1998/99

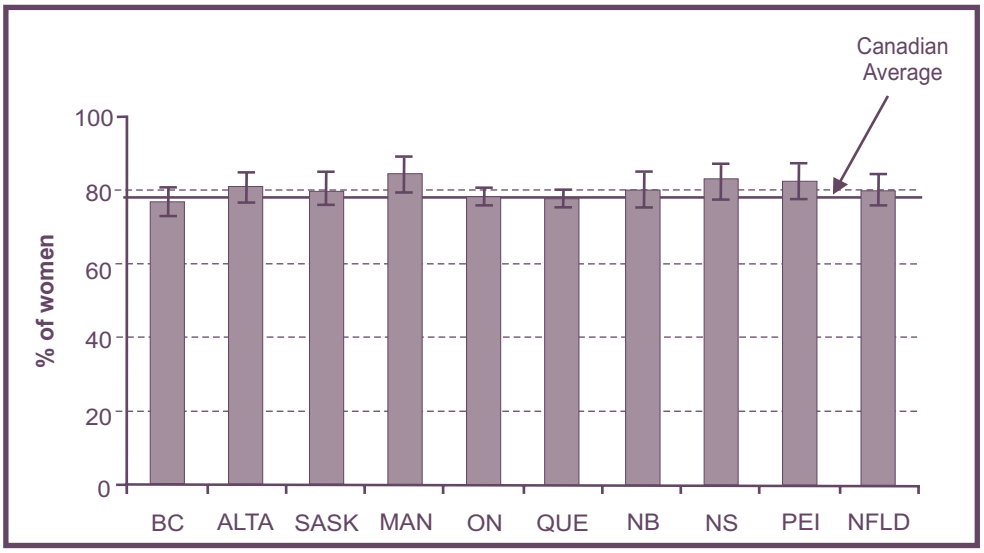


Figure 6 shows Canadian women's self reports of Pap tests, by province, reported in the 1998-1999 National Population Health Survey (NPHS). Overall, 79% of Canadian women aged 20-69 reported having had a Pap test within the previous 3 years (detailed data shown in Appendix E). This percentage varied only slightly among provinces, ranging from 77% in British Columbia to 85% in Manitoba. Three-year self reports did vary considerably by age group, ranging from a low of 60% among women aged 60-69 to a high of 86% among women aged 30-39. Population estimates of screening practices can be influenced by a variety of factors, such as self-reporting biases. Socially desirable responses tend to be reported more often in surveys. Studies have shown that women tend to over-report screening[33].

Table 3 presents the 3-year participation rate of women in the four provinces that collected data between 1996 and 1998 (details are provided in Appendix E). Among the women in the 20-69 year age group participation rates were similar in each province, ranging from 67% to 74%. However, rates varied according to age group, from a peak of 91% among women aged 20-29 in Nova Scotia to a low of 40% to 45% in British Columbia and Nova Scotia among women aged 60-69. A comparison of Table 3 with Figure 6 shows that in their self reports women may somewhat overestimate the occurrence or recency of their Pap tests. (Such differences between self-reported and administrative data occur for various reasons, including the desire to give a socially acceptable answer, the higher participation in health

surveys of women who are also more likely to engage in health-promoting behaviour, the telescoping of the time frame such that events are remembered as occurring more recently than was actually the case, or the fact that not all administrative events may have been included as a result of block funding or migration[34].)

For a similar time period, the 3-year participation rate in Canada (about 70%) was similar to the rate for the NHS Cervical Screening Programme in the United Kingdom[35]. However, the target age group in that country is 25-64. The National Cervical Screening Program in Australia reported a 2-year participation rate of 63.9% in its target age group, of 20-69[36].

Table 3: Three-Year Pap Test Rates, by Age Group and Province, 1996-1998

	British Columbia	Manitoba[a]	Nova Scotia[b]	Prince Edward Island
Age Group	**% of ♀**	**% of ♀**	**% of ♀**	**% of ♀**
20-29	79	76	91	75
30-39	78	75	82	75
40-49	70	69	72	71
50-59	54	66	65	71
60-69	40	53	45	55
Totals (20-69)	67	69	74	71
Number of Women Screened	***864,299***	***241,393***	***224,231***	***30,244***

[a] Frequencies are based on physician billing data.
[b] Most recent data available are for 1995-1997
Note: Only British Columbia and Nova Scotia had implemented cervical cancer screening programs by 1998.
Source: Numerator data provided by provincial programs and departments of health
Denominator data: 1998 post-censal population estimates from Statistics Canada

4.2 Specimen Adequacy

Cervical cancer screening programs classify smears on the basis of their perceived adequacy for interpretation: satisfactory for interpretation, satisfactory but limited for interpretation, and unsatisfactory. The “satisfactory but limited for interpretation" category is used when the specimen provides useful information, but interpretation may be compromised. Limiting factors may include lack of pertinent clinical patient information (age and date of last menstrual period, as minimum; additional information as appropriate), partially obscuring blood, inflammation, thick areas, poor fixation, air-drying artifact, contaminant, and absence of an endocervical/ transformation zone component. The “unsatisfactory”category is used when the smear quality is inadequate for an interpretation.

Three provinces reported on specimen adequacy for smears taken in 1998 (Table 4). The percentage of unsatisfactory smears varied from 0.3% to 3.8%, and the percentage of satisfactory but limited smears from 16.3% to 25.5%. Overall, the British Columbia program reported the lowest level of satisfactory smears (70.8%), indicating that a higher threshold for “satisfactory” may be in use.

Table 4: Specimen Adequacy, by Province, 1998

Specimen Adequacy	British Columbia	Ontario[a]	Prince Edward Island
Satisfactory	70.8%	78.0%	83.4%
Satisfactory but limited	25.5%	21.3%	16.3%
Unsatisfactory	3.8%	0.7%	0.3%
Total Number of Smears	*627,690*	*756,550*	***21,823***

[a]As data capture in Ontario includes only 45% of all smears, percentages presented have been adjusted to represent the entire province.
Source: Data provided by provincial programs and departments of health

The level of unsatisfactory smears was similar between age groups < 50 and 50+ within each of the three provincial programs. However, the level of "satisfactory but limited" smears was noticeably higher in the younger age group for British Columbia and Prince Edward Island programs. The age disparity may be an artifact of physiological changes with age, or an adjustment in the reporting threshold to accommodate expected physiological changes with age.

4.3 Cytology Results

The results of all cervical smears interpreted in one reference year by four provincial programs are shown in Table 5. Unsatisfactory smears were excluded. Because recommendations for repeat smears may differ among provincial programs and there is no mechanism in place to prevent over-screening, the extent to which multiple smears from the same patients may affect the resulting distributions is unknown, but should not be discounted.

The percentage of high grade or more severe findings varied, from 0.5% in Nova Scotia to 1.4% in British Columbia. This likely reflects differences in reporting thresholds. The greatest difference among provincial programs is in their reporting of low grade abnormalities (including atypical squamous cells of undetermined significance [ASCUS] and LSIL). Nova Scotia and Prince Edward Island reported low grade abnormalities at a rate of 2.1% and 2.2% respectively; Ontario reported a rate of 4.5%; and British Columbia reported the highest rate of 13.7%. There are likely differences in reporting thresholds, as mentioned in Section 4.2. Regional variations in the follow-up of low grade abnormalities, which ranges from repeat Pap test at 6 month intervals for up to 2 years to immediate colposcopic examinations, further contribute to the differences.

Table 5: Cytology Outcomes by Province, 1998

Outcomes[a]	British Columbia	Ontario[b]	Nova Scotia[c]	Prince Edward Island
Normal[d]	84.9%	94.5%	97.8%	97.0%
Low grade abnormalities[e]	13.7%[f]	4.5%	2.1%	2.2%
High grade abnormalities[g]	1.4%	1.0%	0.5%	0.7%
Total Number of Smears	***604,058***	***750,687***	***167,331***	***21,740***

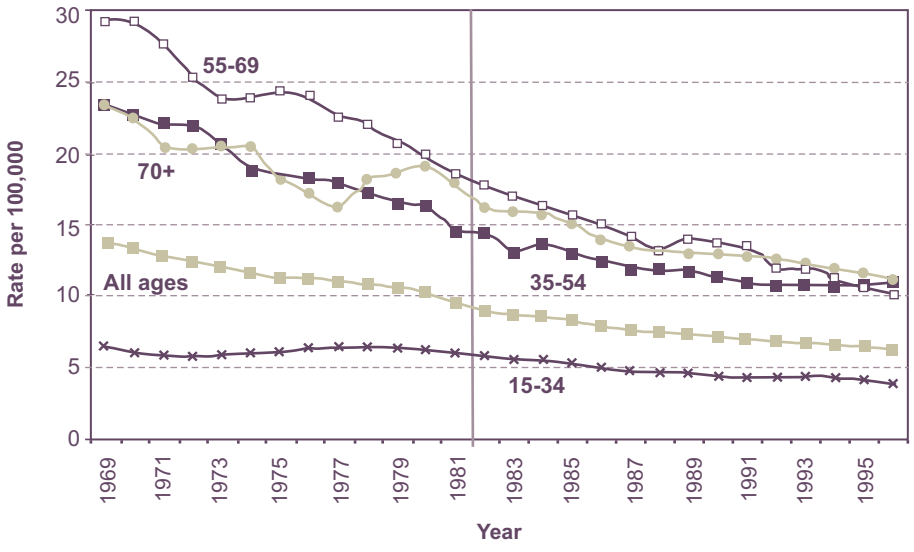
[a]Excludes unsatisfactory smears.
[b]As data capture in Ontario includes only 45% of all smears, percentages presented have been adjusted to represent the entire province.
[c]Most recent data available for Nova Scotia are from 1997.
[d]Normal includes benign cellular changes, and changes within normal limits.
[e]Low grade abnormalities include LSIL, ASCUS and mild dysplasia.
[f]BC low grade includes 5.1% with atypia in the previous 2 years, and 8.6% without significant atypia in the previous 2 years.
[g]High grade abnormalities include high grade squamous intraepithelial lesions (HSIL), atypical glandular cells of undetermined significance (AGUS), moderate to severe dysplasia and carcinoma.
Source: Data provided by provincial programs and departments of health.

5. Special Topic: Examination of Invasive Cervical Cancer

5.1 Morphology of Invasive Cervical Cancer

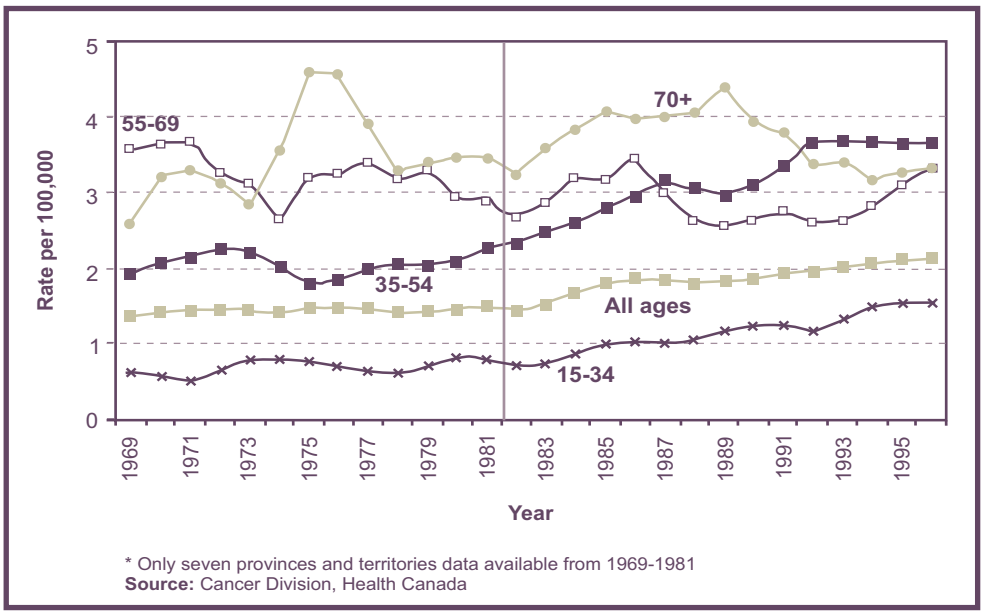
In Canada, squamous cell carcinomas account for about 70% of all types of cervical cancer, and adenocarcinomas and adenosquamous carcinomas for about 25%[1]. These percentages are somewhat higher than the international averages of 75% and 10%-15% respectively. As has been reported in many countries[27], there has been a steady decline over the last 30 years in the incidence of squamous cell carcinoma among all ages (Figure 7). By contrast, the incidence of adenocarcinoma has shown a steady increase in rates over the last two decades, especially among younger women (Figure 8)[37,38]. The Pap test has been shown to be less effective in detecting cervical adenocarcinoma than it is in detecting cervical squamous carcinoma[38-40] because adenocarcinomas arise further in the endocervical canal. Cervical brushes when used in combination with a spatula with an extended tip are now known to be more efficient than spatulas alone in collecting the endocervical cells[41].

Figure 7: Age-standardized Incidence Rates by Age for Cervical Squamous Cell Carcinomas, Canada, 1969-96* (3-year moving average)



* Only seven provinces and territories data available from 1969-1981
Source: Cancer Division, Health Canada

Figure 8: Age-standardized Incidence Rates by Age for Cervical Adenocarcinomas, Canada, 1969-96* (3-year moving average)



* Only seven provinces and territories data available from 1969-1981
Source: Cancer Division, Health Canada

5.2 Screening History

Invasive cervical cancer can be prevented by regular screening. However, not all women are screened regularly, and even if they were it is not likely that cervical cancer would be completely eliminated. Particularly among young women, individuals infected with new oncogenic HPV types may, for some reason, be unduly susceptible and show rapid progression of abnormalities and subsequent disease. Such lesions develop too quickly to be detected by screening and this type of unfavourable natural history, though rare, may explain some of the deaths in women who had negative screens in the previous 3 years[42].

Some Canadian studies have examined the influence of prior screening in patients who have developed invasive cervical cancer (Table 6). Regular screening was defined as laboratory evidence of a Pap test in the province during the 3 years before the histologic diagnosis, excluding tests within 6 months before the diagnosis. Unfortunately, as shown in Table 6, about 40% of cervical cancer cases in these studies were found in women who had been screened within the previous 3 years. Some of these cases were lost to appropriate management after screening revealed an abnormality. Elimination of these cases will require organized screening programs that include

"fail-safe" mechanisms to encourage follow-up of abnormal screening results. Other women had a recent negative cytology report for either sampling or laboratory reasons. Possible causes include diagnosis of adenocarcinoma, difficulty detecting small numbers of abnormal cells, or inadequate sampling of the cervical cells.

Table 6: Review of Screening History for Canadian Women with Invasive Cervical Cancer

Year	Province	Number of Cases	Screened Within 3-Year Interval	Inadequate Screening Interval
1973-82	Ontario[43] (Kingston hospital)	245	29%*	71%
1976-81	Manitoba[44]	141	50%	50%
1981-86	PEI[45]	47	32%	68%
1985-88	BC[46]	437	51%[a]	49%
1990-91	Alberta[47]	246	45%	55%
1993-94	Ontario[48] (Regional Cancer Center)	175	38%	62%
1987-99	PEI[49]	94	38%	62%
1996-98	BC[50]	372	34%	66%[a]

* 5-year interval used

Table 6 also demonstrates that most Canadian women who develop cervical cancer (about 60%) had an inadequate screening interval. These included women with no laboratory evidence of a Pap test during the 3 years before the histologic diagnosis; in some cases there was no evidence of any Pap test. Elimination of these cases will require organized screening programs that actively recruit inadequately screened women. The major risk factor for development of cervical cancer is a lack of screening every 3 years.

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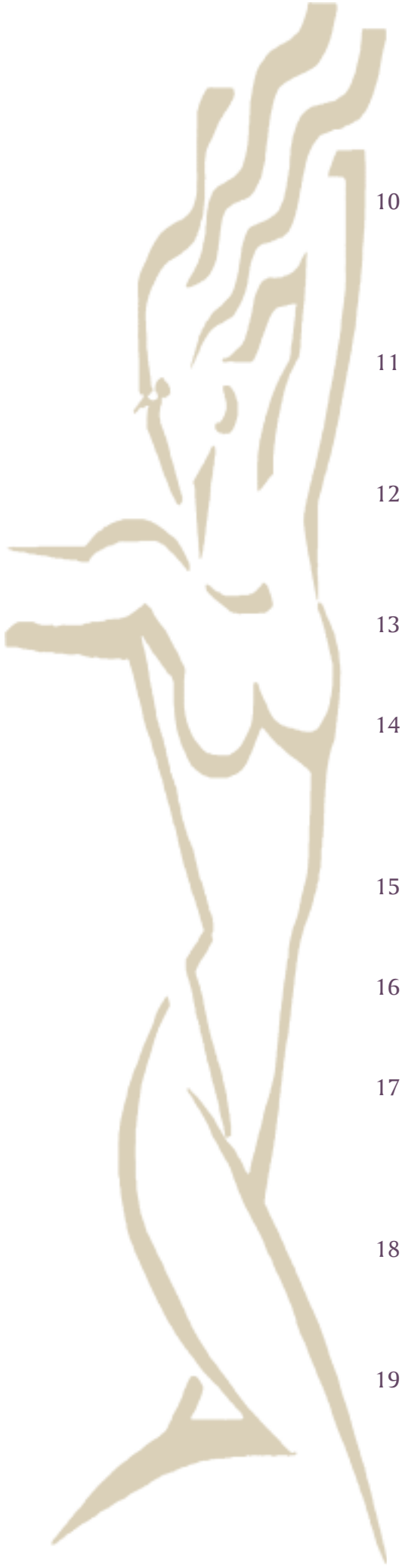

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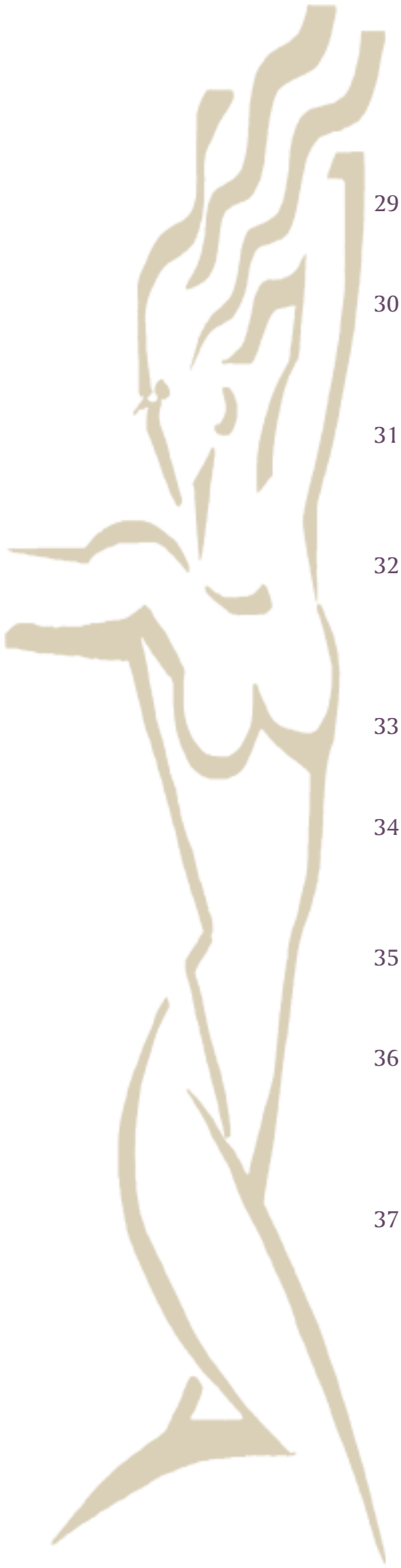

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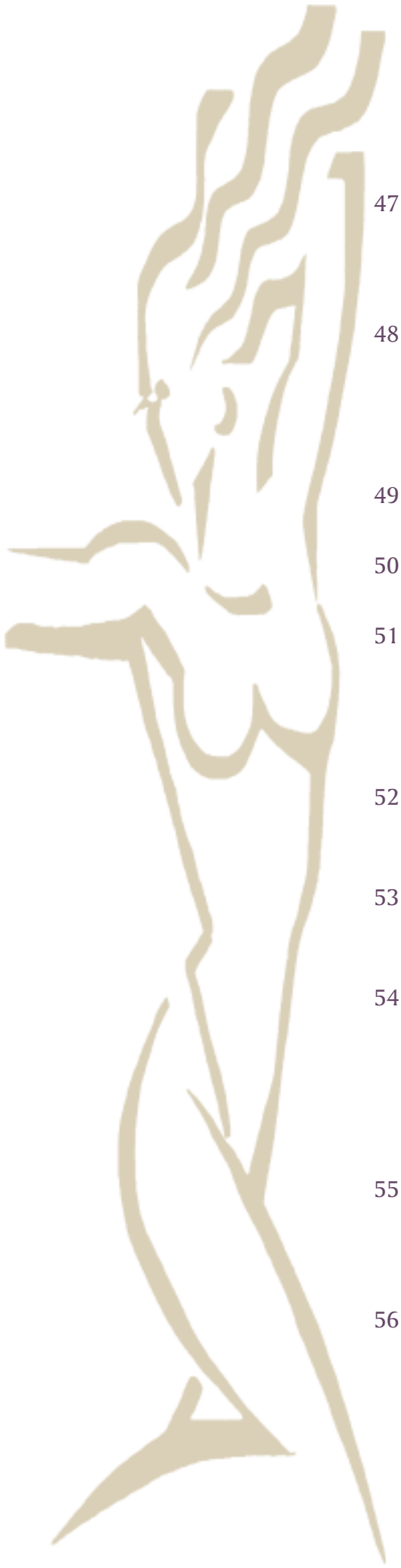

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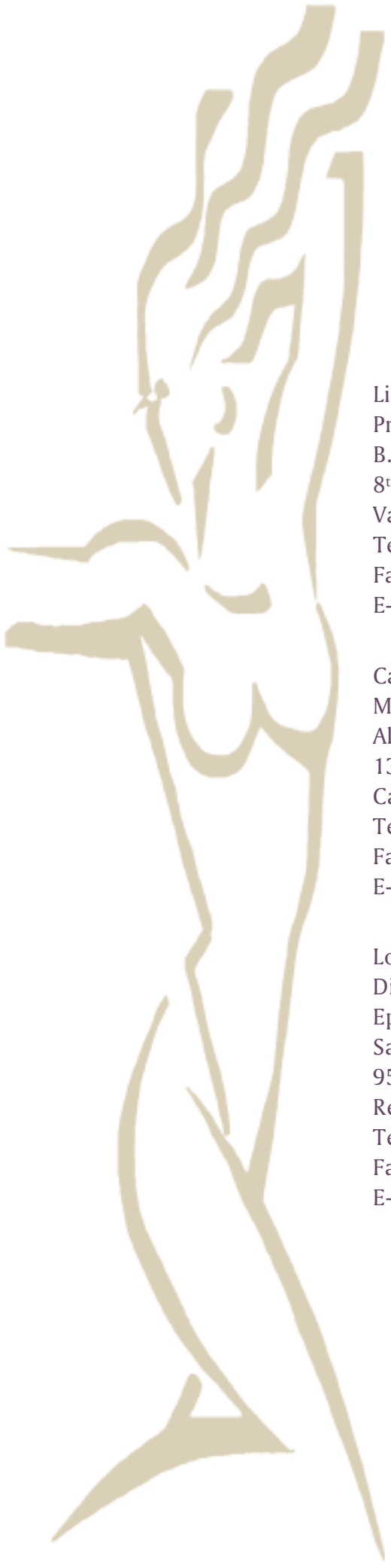

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Appendix B

Classification Systems

Provinces in Canada use various cervical cytology classification systems. To display data for comparison, the various systems were converted to the Bethesda Classification System. Table B1 shows the conversion system used for the data provided. Table B2 shows for each province, the actual categories that were used for conversion of the data provided.

Table B1 : Cervico-vaginal Reporting Terminologies[1]

The Bethesda System	CIN/Modified Walton System
Unsatisfactory: state reason	Unsatisfactory : state reason
Within normal limits	No abnormal cells, metaplasia noted
Benign cellular changes	Abnormal cells consistent with reactive atypia (non-dysplastic)
Trichomonas vaginalis Fungal organisms morphologically consistent with *Candida* spp. Cellular changes associated with herpes simplex virus	*Trichomonas* effect Yeast effect Viral effect (herpes type)
Benign cellular changes	Abnormal cells consistent with reactive atypia (non-dysplastic)
Reactive cellular changes associated with inflammation radiation other	Inflammatory effect Irradiation effect Other
ASCUS*	Abnormal cells consistent with atypia (possibly dysplastic)
	Atypical metaplasia Atypical parakeratosis Other (add comment)

* ASCUS = atypical squamous cells of undetermined significance

1 Adapted from *Programmatic Guidelines For Screening For Cancer of the Cervix in Canada*[51].

Table B1 : Cervico-vaginal Reporting Terminologies[1] (continued)

The Bethesda System	CIN/Modified Walton System
LSIL[**]	Abnormal cells consistent with condyloma (HPV[§] effect)
LSIL	Mild dysplasia/CIN[§§] I
HSIL[***]	Moderate dysplasia/CIN II
HSIL	Severe dysplasia/CIS[§§§]/CIN III
Carcinoma	Abnormal cells consistent with malignancy
Squamous cell carcinoma	Consistent with invasive squamous carcinoma
Adenocarcinoma	Consistent with adenocarcinoma
Unspecified	Type unspecified
AGUS[****]	
Other	Abnormal cells not specifically classified (Add comment)

** LSIL = low grade squamous intraepithelial lesion
*** HSIL = high grade squamous intraepithelial lesion
**** AGUS = atypical glandular cells of undetermined significance
§ HPV = human papillomavirus
§§ CIN = cervical intraepithelial neoplasia
§§§ CIS = carcinoma in situ

1 Adapted from *Programmatic Guidelines For Screening For Cancer of the Cervix in Canada*[51].

Table B2 : Conversion of Provincial Reporting Categories to the Bethesda Reporting System

Province	Within Normal Limits (WNL) and Benign Cellular Changes (BCC)	Low Grade Abnormalities	High Grade Abnormalities	Carcinoma
British Columbia	Negative, reactive changes (squamous, glandular and epithelial cells)	Atypical, NOS (Not Otherwise Specified), mild (squamous, glandular and epithelial cells)	Moderate, marked and suspicious (squamous, glandular and epithelial cells)	Carcinoma
Ontario	WNL and BCC	ASCUS, LSIL	AGUS, HSIL	Carcinoma
Nova Scotia	Negative	Abnormal, mild dysplasia	Moderate, severe dysplasia	Suggestive and positive for malignancy
Prince Edward Island*	Negative/benign	CIN I	CIN II, CIN III	Carcinoma

* After 1996, PEI used terminology similar to Ontario

Appendix C

Data Sources

Data for this report have been derived from multiple sources and are listed as follows:

Description	Data Source
Participation rates	National Population Health Survey (1998/99); Provincial departments of health and cervical cancer screening programs for British Columbia, Nova Scotia, Ontario, Manitoba, Prince Edward Island and Newfoundland
Cytology reporting	Provincial departments of health and cervical cancer screening programs for British Columbia, Nova Scotia, Ontario, Manitoba, and Prince Edward Island
Incidence of cervical cancer	Canadian Cancer Registry
Mortality of cervical cancer	Canadian Vital Statistics Database

National Population Health Survey (NPHS)

This biennial survey, designed and conducted at Statistics Canada since 1994/95, collects information about the health of the Canadian population. It covers household and institutional residents in all provinces and territories, except people living on Indian reserves, on Canadian Forces bases, and in some remote areas, and includes a longitudinal and cross-sectional component. Detailed information on sampling and survey methodology has been published elsewhere[52,53].

The 1998/99 (cycle 3) cross-sectional sample is made up mostly of longitudinal respondents and their cohabitants; most of the interviews were conducted by telephone. Infants born in 1995 or later and immigrants who entered Canada after 1994 were randomly selected and added to keep the sample representative. To replace the sample that was lost to attrition, individuals in dwellings that were part of the original sampling frame but whose household members did not respond in 1994/95 were contacted and asked to participate. In 1998/99, the overall response rate was 88.2% at the household level. The response rate for the randomly selected respondents (aged 0 or older) in these households was 98.5%.

NPHS data are stored in two files. The General file contains socio-demographic and some health information obtained for each member of participating households. The Health file contains in-depth health information, which was collected for one randomly selected household member, as well as the information in the General file pertaining to that individual.

Longitudinal sample: Of the 17,626 randomly selected respondents in 1994/95, 14,786 were eligible members of the NPHS longitudinal panel, along with 468 persons for whom only general information was collected. An additional 2,022 of the 2,383 randomly selected respondents under age 12 were also eligible for the longitudinal panel. Thus, 17,276 respondents were eligible for re-interview in 1996/97, and 16,677 were still alive in 1998/99. A response rate of 88.9%, based on the entire panel, was achieved in 1998/99. Of the 16,168 participants in 1996/97, full information (that is, general and in-depth health information for the first two survey cycles or an outcome of death or institutionalization) was available for 15,670. The corresponding number for 1998/99 was 14,619 respondents. More detailed descriptions of the NPHS design, sample, and interview procedures can be found in published reports[52,53].

The NPHS has included questions on the utilization of Pap smears by women aged 18 and older. For the purposes of this report analyses were restricted to women aged 18-69 (n=6,498). Responses to two survey questions "Have you ever had a Pap smear test?" and if "Yes", "When was the last time you had a Pap smear test?" were used to obtain estimates of 3-year screening rates.

Canadian Cancer Registry (CCR)

The patient-oriented CCR (1992-) and its event-oriented predecessor, the National Cancer Incidence Reporting System (NCIRS) (1969-1991) contain cancer incidence data reported annually by provincial and territorial cancer registries to the Health Statistics Division at Statistics Canada[54,55]. Completeness of registration for invasive cancers is considered to be about 95% or more from 1983 onwards. Statistics Canada annually provides an extract of this data file to Health Canada, where it is loaded into the ORIUS system to facilitate analysis. The NCIRS and CCR contain demographic, diagnostic and residence data for each invasive tumour diagnosed in residents of each province and

territory. Cancer diagnoses are coded using the International Classification of Diseases in Oncology (ICDO), which includes codes for both the tumour topography (T) and morphology (M). For this project, invasive cancers were defined as ICDO-T codes 53.0-53.9. Morphology codes were grouped as follows:

Histological type	ICD-O Morphology Codes
1. Squamous-cell carcinoma	8050-8082
2. Adenocarcinoma	8140-8550, 8560, 8570
3. Other	8800-8932, 8990, 8991, 9040-9044, 9120-9134, 9540 - 9581
4. Unspecified	8000-8004, 8010-8034, 9990

Vital Statistics Mortality Data: Statistics Canada maintains mortality data for Canada as compiled from the vital statistics offices in each province and territory. Underlying cause of death is coded using the International Classification of Diseases, 9th revision. Data for cervical cancer deaths for this study were selected using ICD9 code 180.0-180.9 from a version of this data set supplied annually to Health Canada and stored on the ORIUS system. Cervical cancer deaths may be slightly under-reported in Canada and the degree of under-reporting may vary over time, as the underlying cause of death may be recorded as carcinoma of the uterus, not otherwise specified. However, a study of Alberta deaths due to uterine cancer revealed that most deaths due to unspecified uterine cancer actually occurred in the uterine corpus[56].

Population Data: Population estimates for the female resident and non-permanent resident population were obtained from the Demography Division at Statistics Canada. Incidence and mortality rates for cervical cancer were calculated using the intercensal (1969-1990) and postcensal (1991-1996) estimates. Participation rates for the provinces were calculated using the 1997 and 1998 estimated female population. There may be some variation in published participation rates from the provinces because of varying population data in the denominator.

The age-standardized rates have been calculated using the 1991 Canadian population.

Appendix D

Methods

Age-specific rates

Age-specific rates are calculated by dividing the number of cases occurring in each of the specified age groups by the corresponding population in the same age group.

Age-standardized rates

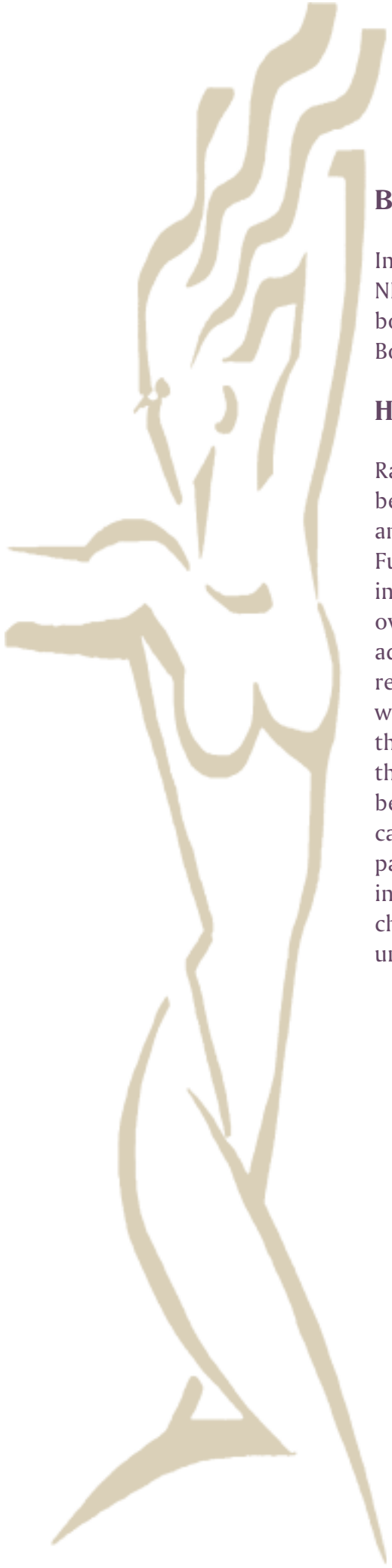
Rates are adjusted for age to facilitate comparisons between populations that have different age structures. This report uses the methods of direct standardization, in which age-specific rates are multiplied by a constant population (Canada, 1991 population). This method was used for both incidence and mortality rates.

Calculation of the expected number of deaths from cervical cancer

Age-specific death rates for cervical cancer in 1950 and 1970 were calculated. This set of age-specific rates was then applied to the corresponding population counts in each age group for each year to obtain the expected number of deaths in each age group in each year. The expected number of deaths in each age group is then summed to derive the expected number of deaths for all ages in a given year had the age-specific death rates in 1950 or 1970 prevailed.

Three-year moving average

The 3-year moving average was calculated by summing the age-specific or age-standardized rates for the 3-year period centred on the year of interest and dividing the total by three. For the first and last years in each series the rates were averaged over 2 years.



Bootstrap variance estimation

In order to account for the stratification and clustering design in the NPHS survey, bootstrap re-sampling methods were used with bootstrap weights to calculate variance and 95% confidence intervals. Bootstrap weights were provided by Statistics Canada.

Hysterectomy

Rates in this report have not been adjusted for hysterectomy status because of lack of reliable data on hysterectomy status by age group and by regions in Canada over the time period used in this report. Further, because an unknown proportion of all hysterectomies do not involve the removal of the cervix, adjustment may lead to an overestimation of rates. One paper that examined the impact of adjusting Pap smear rates among women who had had their uterus removed by hysterectomy reported increased proportions of women with hysterectomies at older ages, as well as regional differences in the hysterectomy rate in 1994. This study was limited as a result of the wide variation due to the small sample[57]. Adjusting the rates has been shown to increase the incidence and mortality rates of cervical cancer as well as participation rates in Pap smear screening, particularly in women aged 45 and older. However, while the overall incidence and mortality rates increase with adjustment, the rate of change and the general trends over time are similar between unadjusted and adjusted data[57,58].

Appendix E

Detailed Participation and Cytology Data

Table E1: Self Reported Pap Smear Usage Within Previous 3 Years, Among Women aged 20-69, Canada and Provinces, by 10 Year Age Group, 1998/99

Age Group	Canada %	BC %	ALTA %	SASK %	MAN %	ON %	QUE %	N B %	NS %	PEI %	NFLD %
20-29	80	76	80	91	86	77	81	84	92	84	92
30-39	86	83	85	85	88	87	82	96	92	89	91
40-49	82	79	89	82	83	80	83	80	90	83	85
50-59	77	79	70	74	90	77	78	73	69	77	67
60-69	60	58	72	64	73	60	56	54	59	68	53
Total (20-69)	**79**	**77**	**81**	**80**	**85**	**78**	**78**	**80**	**83**	**82**	**80**

Source: National Population Health Survey, 1998/99

Table E2: Women Participating in Cervical Cancer Screening by Age Group and Province, 1998

	Number of Women Participating					
Age group	British Columbia 1998	Manitoba 1998	Ontario[a] 1998	Nova Scotia[b] 1997	Prince Edward Island 1998	Newfoundland[b] 1997
15-19	25,053	7,826	34,046	8,665	729	5,761
20-29	129,183	35,035	165,099	38,160	4,395	23,418
30-39	156,888	37,925	193,548	40,866	4,813	21,875
40-49	124,939	32,203	147,212	30,854	4,161	17,383
50-59	66,879	21,663	94,270	19,491	3,041	9,280
60-69	33,510	12,605	50,392	9,831	1,709	3,478
Total (15-69)	**536,452**	**147,257**	**684,567**	**147,867**	**18,848**	**81,195**

[a]As data capture in Ontario includes only 45% of all smears, numbers presented have been adjusted to represent the entire province.
[b]Most recent data available are for 1997.
Source: Data compiled at Health Canada as provided by provincial programs and departments of health.

Table E3: Number of Women in Population by Age Group and Province, 1997-98

Number of Women in Population						
Age group	British Columbia 1998	Manitoba 1998	Ontario 1998	Nova Scotia 1997	Prince Edward Island 1998	Newfoundland 1997
15-19	128,720	38,924	361,024	31,084	5,069	21,736
20-29	275,045	76,127	776,867	64,004	9,023	41,013
30-39	335,846	87,346	984,163	78,959	10,574	46,224
40-49	321,045	82,655	876,454	72,396	10,065	44,436
50-59	220,503	58,252	623,738	50,970	7,494	29,365
60-69	156,696	43,878	464,609	37,946	5,432	20,118
Total (15-69)	**1,437,855**	**387,182**	**4,086,855**	**335,359**	**47,657**	**202,892**

Source: Data compiled at Health Canada as provided by Statistics Canada

Table E4: Women Participating in Cervical Cancer Screening by Age Group and Province, 1996-98

	Number of Women			
Age group	British Columbia 1996-98	Manitoba 1996-98	Nova Scotia[a] 1995-97	Prince Edward Island 1996-98
20-29	216,520	58,104	58,882	6,996
30-39	264,004	66,736	65,871	8,077
40-49	210,234	56,532	51,290	7,198
50-59	111,819	36,729	31,031	5,013
60-69	61,722	23,292	17,157	2,960
Total (20-69)	**864,299**	**241,393**	**224,231**	**30,244**

[a]Most recent data available are for 1995-1997
Source: Data compiled at Health Canada as provided by provincial programs and departments of health