

Cervical Cancer and Pap Test Utilisation in Manitoba 1970-1999

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MANITOBA
CERVICAL CANCER
SCREENING PROGRAM

PROGRAMME
MANITOBAIN DE
DÉPISTAGE DU CANCER
DU COL UTÉRIN

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SUMMARY

- Between 1970 and 1999, an average of 64 new cases of invasive cervical cancer was diagnosed annually. This represents an annual average age-standardized incidence rate of 12.3 /100,000 women.
- The age-standardized incidence rate of invasive cervical cancer dropped from 21.6 /100,000 women in 1970 to 8.8 /100,000 women in 1999 which represents a decrease of 0.27 /100,000 women per year.
- Cervical cancer remained one of the most frequently diagnosed invasive cancers in women younger than 50 years of age over the study period.
- On average, 20 women died from invasive cervical cancer annually between 1970 and 1999, which represents an average mortality rate of 3.6 /100,000 women. The mortality rate decreased by 0.09 deaths /100,000 women per year over the study period.
- Cervical cancer was among the five most frequent causes of death due to invasive cancers in women 30-49 years of age, accounting for at least 6.4% of all deaths from cancer between 1970 and 1999.
- Only the Regional Health Authority (RHA) of Burntwood had a significantly higher cervical cancer incidence rate than the average Manitoba one for two consecutive time periods (1990-94 and 1995-99).
- In 1999, Manitoba women had an incidence rate of invasive cervical cancer comparable to the Canadian average (8 /100,000 women) and a higher death rate (3 /100,000 women compared to 2 /100,000 women in Canada)¹.
- Squamous cell carcinoma accounted for approximately 80% of all invasive cervical cancers diagnosed between 1970-74 and 1990-94 and 69% in 1995-99. The percentage of adenocarcinoma increased from 7% to 11% between 1970-74 and 1990-94 and from 11% to 22% between 1990-94 and 1995-99.
- The 5-year cumulative relative survival of invasive cervical cancer increased, but not significantly, between 1985-89 and 1995-99 (0.68 to 0.72 respectively). The 5-year survival decreased with age and was comparable for women diagnosed with squamous cell carcinoma or adenocarcinoma (0.69 versus 0.64).
- An average of 334 new cases of cervical carcinoma *in situ* was diagnosed annually between 1970 and 1999. The age-standardized incidence rate increased from 56.2 /100,000 women in 1970 to 78.0 /100,000 women 1999. The increase occurred mainly after 1992 in women less than 30 years of age.
- Approximately 60% of Manitoba women 15 years of age and older had at least one Pap test in a three-year period between 1984 and 1999.
- The annual age-standardized rate of Pap test increased slightly in women 50 years of age and older and remained stable in the other age groups. The highest utilisation rate was observed in the 20-29 age group and the lowest rate was observed in the 70 year of age and older group.
- Most women with consecutive Pap tests had them performed within a 2-year interval.
- The RHAs of northern Manitoba (Norman, Burntwood and Churchill) had the lowest annual rates of Pap tests between 1984 and 1999.

INTRODUCTION

Cervical cancer is the second most common cancer in women in the world with the majority of cases occurring in developing countries². In Canada, cervical cancer is the 10th most commonly diagnosed cancer among women of all ages³, but ranks third among women aged 20-34 and women aged 35-49⁴. For comparison, the estimated incidence rates for the two most frequently diagnosed cancers in women were 106 /100,000 women for breast cancer and 47 /100,000 for lung cancer in 2002, while it was 7.8 /100,000 women for cervical cancer³.

Western countries have experienced dramatic reductions in the incidence of and the mortality from invasive cancer of the cervix primarily because of screening with the Papanicolaou test (Pap test)⁵⁻¹⁰. As a result, the large proportion of cases that continue to arise is in women who have never been screened, screened inadequately and/or have been followed-up improperly¹¹⁻¹⁴. An organized population-based approach to screening is thought to be the most effective way to screen these women. Unlike opportunistic screening, organized, population-based cervical screening includes the identification of the population to be served, high-quality laboratory services for reading tests with quality control systems, appropriate evaluation and management of abnormal tests, and a method to monitor and evaluate the program. In Manitoba, the Manitoba Cervical Cancer Screening Program (MCCSP) performs these functions. It was developed in response to national recommendations highlighting the importance of organised cervical cancer screening programs in the prevention of the disease.

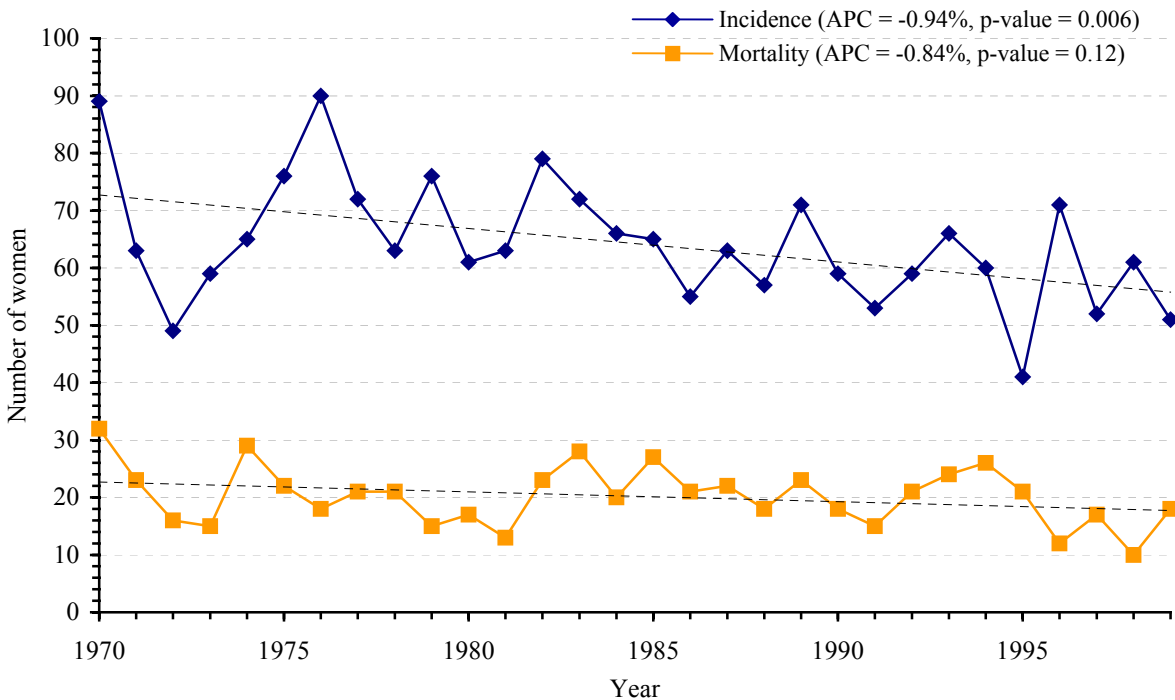
This report presents descriptive statistics on cervical cancer in Manitoba as well as on Pap test utilisation for the time period preceding the implementation of the Manitoba Cervical Cancer Screening Program in 1999. It provides detailed information on the incidence of invasive and *in situ* cervical cancer according to age group, tumour type, and region of residence. Information on mortality, prevalence, and survival are also presented. Statistics on Pap test utilisation, the principal screening tool used to prevent cervical cancer, are provided.

INVASIVE CERVICAL CANCER

Number of incident cases

A total of 75,688 malignancies (ICD9¹ 140 to 208, excluding non-melanoma skin cancer, ICD9 173) were diagnosed in 68,755 women between January 1st 1970 and December 31st 1999. Women diagnosed with more than one tumour on the same diagnosis date or women who eventually developed another cancer accounted for 9% of all cancer cases. Invasive cervical cancer (ICD9 180) accounted for 3.2% (1,927 new cases) of all cancers in women over the 30-year period. None of the cervical cancer cases had a second diagnosis of cervical cancer.

Figure 1. Number of incident cases of and deaths from invasive cervical cancer, 1970-99



The number of cervical cancers dropped from 89 cases (6.5% of all cancers in women) in 1970 to 51 cases (2.0% of all cancers in women) in 1999 (Figure 1). This represents a significant decrease of 0.6 case per year. On average, 64 new cases were recorded annually over the 30-year period. A diagnosis of cervical cancer before 20 years of age was rare; there were only 8 cases (0.4% of women diagnosed with cervical cancer).

Compared to the number of incident tumours for all cancer sites, cervical cancer was the 5th most frequent cancer diagnosed in women in 1970-74 and the 11th most frequent in 1995-99 (Appendix A). However, when ranked by age group, cervical cancer was among the five most frequent malignancies diagnosed in women less than 30 years of age between 1970-74 and 1995-99, accounting for 8.7% to 20.8% of all cancer cases (Table 1). Cervical cancer was the second leading cancer diagnosed in women 30-49 years of age, surpassed only by breast cancer. Cervical

¹ ICD9: International Classification of Diseases, 9th Revision

cancer dropped from the 6th to 11th position for women 50-69 years of age between 1970 and 1999 and from the 14th to 16th position for 70 years of age and older.

Table 1. Rank of the number of invasive cervical cancers relative to other cancers* by time period and age group

1970-74				1975-79			
Age	Rank	Number	% [†]	Age	Rank	Number	%
≤29	3	26	10.0	≤29	1	59	20.8
30-49	2	119	10.4	30-49	2	142	11.5
50-69	6	132	4.1	50-69	7	117	3.1
70+	14	48	2.0	70+	12	59	1.9
1980-84				1985-89			
Age	Rank	Number	%	Age	Rank	Number	%
≤29	1	48	15.8	≤29	2	30	9.7
30-49	2	125	10.0	30-49	2	131	9.3
50-69	8	104	2.6	50-69	9	89	2.1
70+	14	64	1.7	70+	14	61	1.3
1990-94				1995-99			
Age	Rank	Number	%	Age	Rank	Number	%
≤29	4	25	8.7	≤29	5	25	9.0
30-49	2	132	8.4	30-49	2	131	7.2
50-69	10	80	1.8	50-69	11	72	1.6
70+	15	60	1.1	70+	16	48	0.8

* Non-melanoma skin cancer (ICD9 173) and neoplasm without specification of site (ICD9 199) were not included in the analysis

† Percentage of cancers that were cervical cancers

Number of deaths

Between 1970 and 1999, 28,693 women died from cancer in Manitoba. Of these, 606 (2.1%) died from cervical cancer. The reported number of cervical cancer deaths decreased, but not significantly, from 32 in 1970 to 18 in 1999 (Figure 1). On average, 20 women died from cervical cancer annually. No more than 3% of women who died of cervical cancer were younger than 30 years of age.

Relative to other malignancies, the number of deaths from cervical cancer ranked between 10th and 14th between 1970 and 1999 (Appendix A). Death from cervical cancer remained a rare event for women less than 30 years of age (Table 2). Cervical cancer was among the five most frequent causes of death due to cancer in women 30-49 years of age, accounting for at least 6.4% of all cancer deaths over the study period. Breast, colon/rectum, lung or ovarian cancers surpassed cervical cancer depending on the year. Cervical cancer was the 8th to the 13th leading cause of death due to cancer among women 50-69 years of age and ranked 13th to 18th for women 70 years of age and older.

Table 2. Rank of the number of deaths from invasive cervical cancer relative to other cancers* by time period and age group

1970-74				1975-79			
Age	Rank	Number [†]	% [‡]	Age	Rank	Number [†]	%
≤29	11	--	1.9	≤29	5	--	7.1
30-49	5	--	9.0	30-49	4	--	9.4
50-69	8	--	4.2	50-69	13	--	2.1
70+	14	--	1.7	70+	13	--	2.3
1980-84				1985-89			
Age	Rank	Number	%	Age	Rank	Number	%
≤29	3	5	10.4	≤29	3	4	10.0
30-49	4	28	12.2	30-49	3	27	9.9
50-69	12	30	2.2	50-69	8	53	3.5
70+	13	46	2.4	70+	16	42	1.7
1990-94				1995-99			
Age	Rank	Number	%	Age	Rank	Number	%
≤29	10	1	3.0	≤29	5	3	8.8
30-49	3	36	14.0	30-49	5	17	6.4
50-69	12	36	2.6	50-69	12	24	2.0
70+	15	52	1.8	70+	18	26	0.9

* Non-melanoma skin cancer (ICD9 173) and neoplasm without specification of site (ICD9 199) were not included in the analysis

† Cause specific death counts were not presented; see the method section for more details

‡ Percentage of cancers that were cervical cancers

Incidence and mortality rates

Cervical cancer incidence rates in Manitoba dropped from 21.6 /100,000 women in 1970 to 8.8 /100,000 women in 1999, which represents a decrease of 0.27 /100,000 women per year (Figure 2). A comparable reduction was observed for mortality. The death rate dropped from 7.3 /100,000 women in 1970 to 2.8 /100,000 women in 1999, a decrease of 0.09 /100,000 women per year. The average annual incidence rate was 12.3 /100,000 women over the 30 years of follow-up, and the average annual mortality rate was 3.6 /100,000 women.

Women less than 30 years of age had the lowest incidence and mortality rates (Figure 3 and 4). The incidence and mortality rates of this younger age group remained comparable from the beginning to the end of the time frame. Incidence rates decreased at approximately the same pace in the 30-49, 50-69, and 70 and over age groups. Mortality rates decreased slightly in the three older age groups, but more significantly in the 50-69 and 70 and older age groups.

Figure 2. Age-standardised incidence and mortality rates of invasive cervical cancer, 1970-99

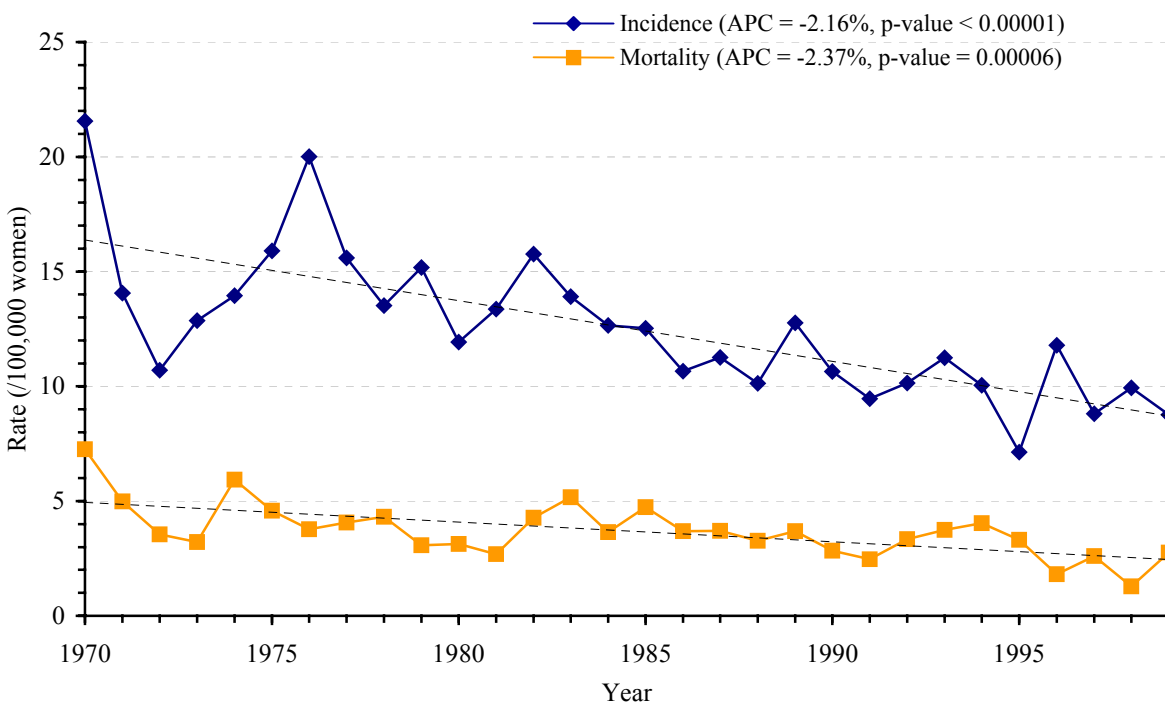


Figure 3. Age-specific incidence rates of invasive cervical cancer, 1970-99

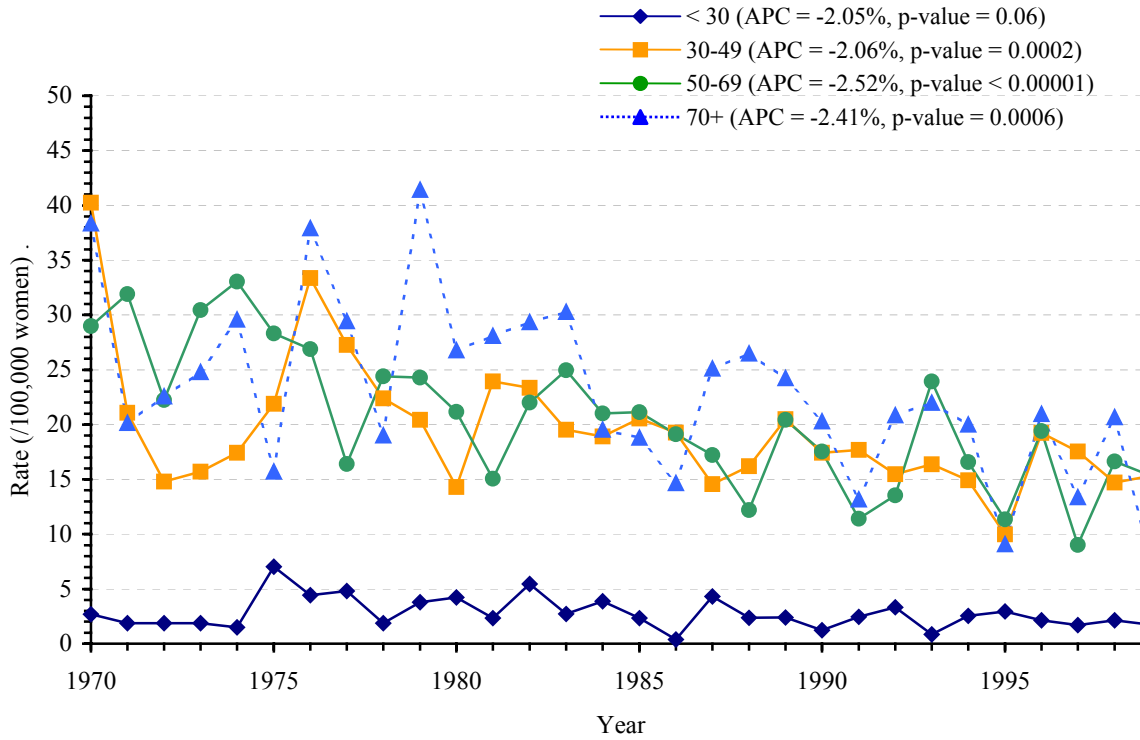
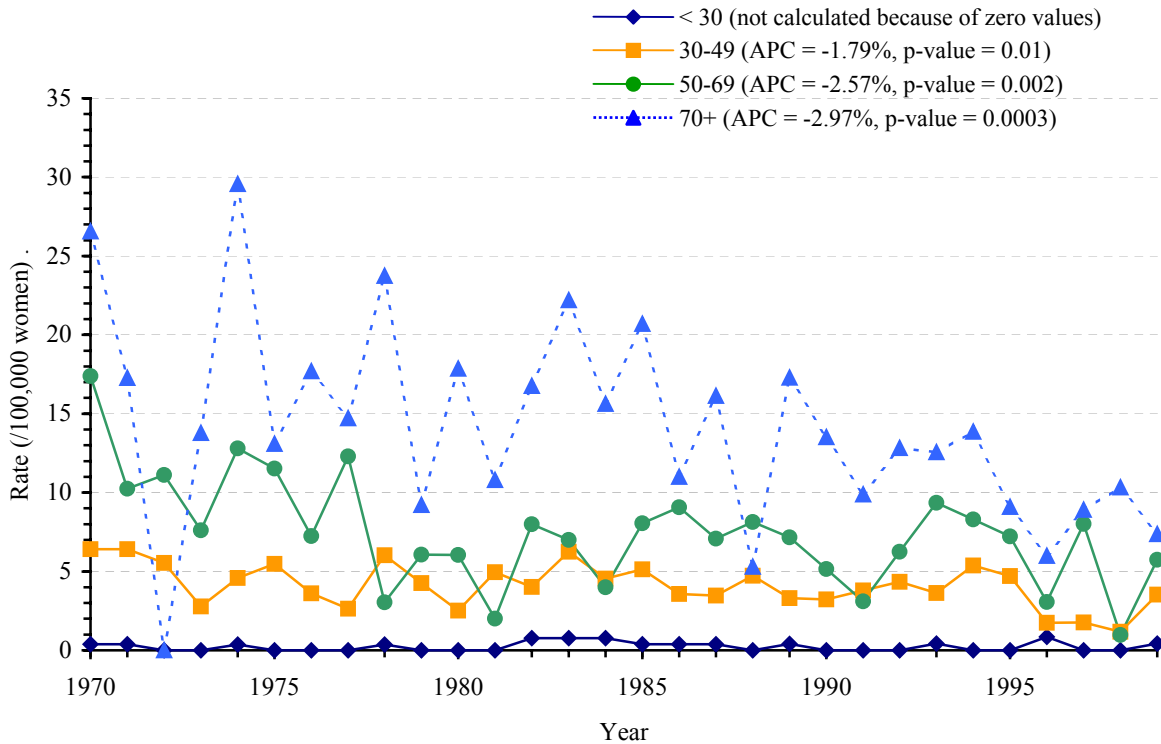


Figure 4. Age-specific mortality rates of invasive cervical cancer, 1970-99



Prevalence

The total number of 5-year prevalent cases of cervical cancer dropped from 245 to 229 between 1989 and 1999 (Table 3). The cumulative number of women diagnosed with cervical cancer between 1985 and 1999 and still alive and living in Manitoba in 1999 was 539.

Table 3. Proportion of prevalent cases of invasive cervical cancer by year and age group

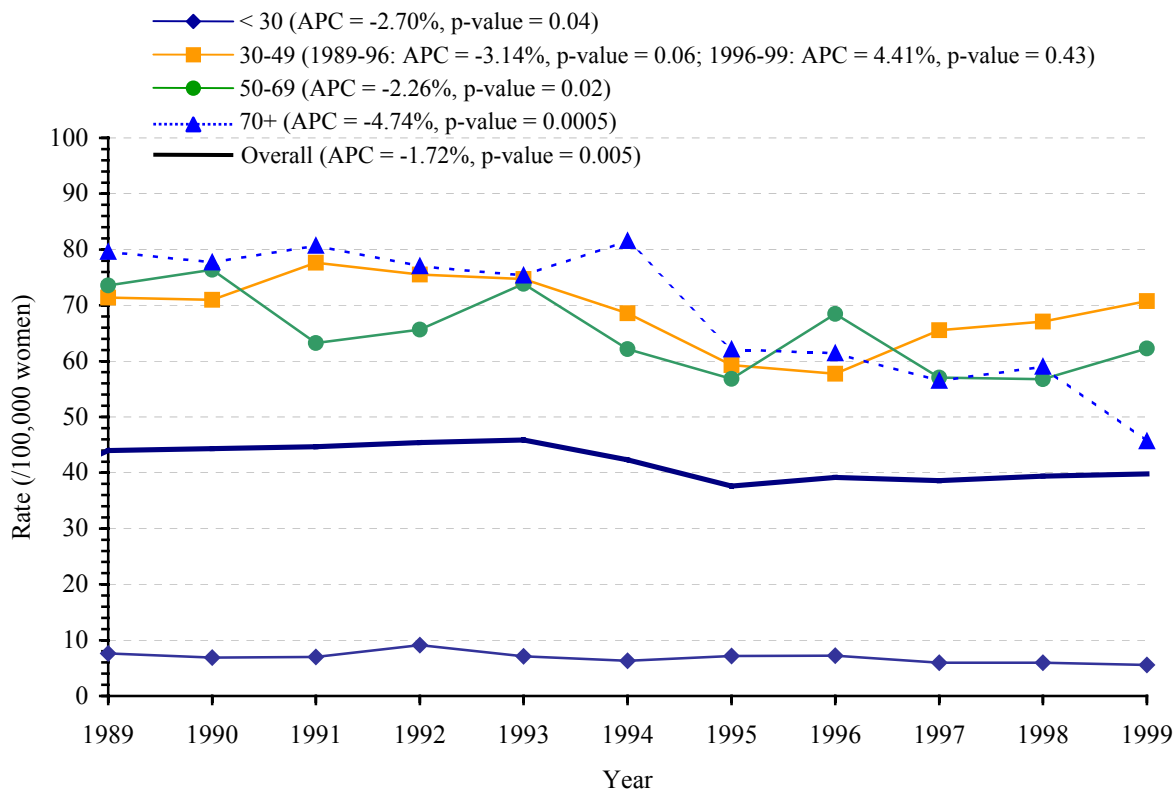
year	5-year prevalence					Total prevalence*				
	Age group				Total <i>N</i> [†]	Age group				Total <i>N</i> [†]
	≤29	30-49	50-69	≥70		≤29	30-49	50-69	≥70	
1989	0.08	0.44	0.29	0.19	245	0.08	0.44	0.29	0.19	245
1994	0.06	0.47	0.25	0.22	243	0.04	0.47	0.28	0.21	418
1999	0.06	0.52	0.28	0.14	229	0.03	0.47	0.31	0.19	539

* Total prevalence is 5-year prevalence in 1989, 10-year prevalence in 1994, and 15-year prevalence in 1999.

† *N*: number of women.

Between 1989 and 1999, the 5-year prevalence rate of cervical cancer decreased from 44.6 /100,000 women to 39.8 /100,000 women (Figure 5). The decrease was primarily observed in the 50-69 and 70 years of age and older age groups. A non-significant increase was observed in the 30-49 age group starting in 1996.

Figure 5. Crude and age-specific 5-year prevalence rates of invasive cervical cancer



Geographic distribution

RHA comparisons

In 1999, Manitoba was divided into 12 Regional Health Authorities (RHAs) (Appendix B). The number of incident cases, deaths, and 5-year prevalent cases of invasive cervical cancer in each RHA, excluding Winnipeg, remained lower or equal to 30 over the six 5-year periods (Table 4).

Since small fluctuations in the number of cases can have a significant impact on rates, the interpretation of the results is limited. Nevertheless, rates and rate ratios are presented for completeness (Table 5). With very few exceptions, RHA incidence, mortality, and 5-year prevalence rates were not different from the Manitoba rate. Significantly higher incidence and 5-year prevalence rates (compared to Manitoba rate) were observed in Burntwood in 1990-94 (1994 for prevalence rate) and 1995-99 (1999 for prevalence rate). Although high incidence and 5-year prevalence rates were observed in Churchill, very few cases were diagnosed within 5-year periods, with less than five cases diagnosed between 1970 and 1999.

Table 4. Number of incident cases, deaths and prevalent cases of invasive cervical cancer by Regional Health Authority (RHA*)

RHA	Incidence											
	1970-74		1975-79		1980-84		1985-89		1990-94		1995-99	
	N	%	N	%	N	%	N	%	N	%	N	%
Brandon	18	5.5	20	5.3	14	4.1	7	2.3	10	3.4	14	5.1
Burntwood	8	2.5	17	4.5	7	2.1	10	3.2	13	4.4	18	6.5
Central	19	5.8	22	5.8	16	4.7	18	5.8	15	5.1	17	6.2
Churchill	--	--	2	0.5	--	--	1	0.3	1	0.3	--	--
Interlake	12	3.7	30	8.0	20	5.9	14	4.5	20	6.7	20	7.2
Marquette	12	3.7	8	2.1	22	6.5	6	1.9	13	4.4	8	2.9
Norman	11	3.4	22	5.8	12	3.5	6	1.9	10	3.4	5	1.8
North Eastman	9	2.8	7	1.9	9	2.6	12	3.9	11	3.7	3	1.1
Parkland	18	5.5	12	3.2	18	5.3	16	5.1	16	5.4	12	4.3
South Eastman	2	0.6	11	2.9	10	2.9	5	1.6	10	3.4	6	2.2
South Westman	13	4.0	14	3.7	9	2.6	7	2.3	10	3.4	7	2.5
Winnipeg	200	61.5	211	56.0	201	58.9	209	67.2	167	56.2	165	59.8
<i>Manitoba</i> [†]	325		377		341		311		297		276	

RHA	Mortality											
	1970-74		1975-79		1980-84		1985-89		1990-94		1995-99	
	N [‡]	%	N [‡]	%	N	%	N	%	N	%	N	%
Brandon	--	3.6	--	5.4	3	3.0	3	2.9	5	5.1	2	3.0
Burntwood	--	1.8	--	5.4	1	1.0	2	1.9	7	7.1	4	6.0
Central	--	5.5	--	3.6	6	6.0	5	4.8	8	8.2	6	9.0
Churchill	--	--	--	--	--	--	--	--	--	--	--	--
Interlake	--	3.6	--	5.4	7	7.0	6	5.7	7	7.1	3	4.5
Marquette	--	3.6	--	5.4	8	8.0	4	3.8	6	6.1	1	1.5
Norman	--	3.6	--	3.6	5	5.0	4	3.8	2	2.0	3	4.5
North Eastman	--	5.5	--	3.6	1	1.0	2	1.9	3	3.1	3	4.5
Parkland	--	7.3	--	0	7	7.0	11	10.5	4	4.1	2	3.0
South Eastman	--	1.8	--	0	1	1.0	2	1.9	2	2.0	3	4.5
South Westman	--	1.8	--	5.4	2	2.0	2	1.9	2	2.0	5	7.5
Winnipeg	--	60.0	--	62.5	56	56.0	64	61.0	52	53.1	35	52.2
<i>Manitoba</i> [†]	--		--		100		105		98		67	

RHA	5-Year prevalence [§]											
	1974 [§]		1979 [§]		1984 [§]		1989		1994		1999	
	N	%	N	%	N	%	N	%	N	%	N	%
Brandon	--	--	--	--	--	--	6	2.4	8	3.3	12	5.2
Burntwood	--	--	--	--	--	--	8	3.3	11	4.5	16	7.0
Central	--	--	--	--	--	--	15	6.1	12	4.9	13	5.7
Churchill	--	--	--	--	--	--	1	0.4	1	0.4	--	--
Interlake	--	--	--	--	--	--	11	4.5	13	5.3	13	5.7
Marquette	--	--	--	--	--	--	6	2.4	7	2.9	7	3.1
Norman	--	--	--	--	--	--	5	2.0	8	3.3	4	1.7
North Eastman	--	--	--	--	--	--	11	4.5	9	3.7	3	1.3
Parkland	--	--	--	--	--	--	9	3.7	12	4.9	8	3.5
South Eastman	--	--	--	--	--	--	5	2.0	10	4.1	4	1.7
South Westman	--	--	--	--	--	--	6	2.4	10	4.1	5	2.2
Winnipeg	--	--	--	--	--	--	162	66.1	141	58.0	143	62.4
<i>Manitoba</i> [†]	--		--		--		245		243		229	

* According to the year 2000 geographic boundaries of RHAs

† Totals include the number of people with missing RHA information

‡ Cause specific death counts were not presented; see the method section for further details

§ Results are not presented because it was not possible to determine accurately if someone had moved outside the province before 1984

|| When the number of death is subtracted from the number of incident cases the result is not the number of prevalent cases; this is because the 5-year prevalence is restricted to the number of incident cases of that 5-year period while the number of deaths is not

Table 5. Age-standardised rates and rate ratios of invasive cervical cancer by Regional Health Authority (RHA)*

RHA	Incidence					
	1985-89		1990-94		1995-99	
	Rate [†]	RR [‡] (95% CI)	Rate [†]	RR [‡] (95% CI)	Rate [†]	RR [‡] (95% CI)
Brandon	5.4	0.52 (0.25-1.12)	7.9	0.79 (0.42-1.48)	10.7	1.19 (0.70-2.04)
Burntwood	17.9	1.37 (0.73-2.58)	19.5	1.84 (1.05-3.21)	22.2	2.43 (1.51-3.93)
Central	8.1	0.71 (0.44-1.15)	6.6	0.63 (0.37-1.06)	6.9	0.77 (0.47-1.26)
Churchill	29.6	3.71 (0.52-26.5)	31.4	4.47 (0.62-31.9)	--	--
Interlake	7.5	0.71 (0.42-1.22)	11.0	1.06 (0.68-1.67)	10.5	1.36 (0.72-1.79)
Marquette	5.3	0.51 (0.22-1.15)	13.5	1.24 (0.71-2.16)	9.3	0.87 (0.43-1.76)
Norman	11.9	1.04 (0.46-2.33)	19.0	1.84 (0.98-3.45)	7.8	0.97 (0.40-2.34)
North Eastman	15.7	1.40 (0.79-2.49)	12.7	1.28 (0.70-2.34)	3.5	0.35 (0.11-1.09)
Parkland	14.2	1.17 (0.71-1.94)	13.3	1.31 (0.79-2.17)	10.4	1.13 (0.63-2.01)
South Eastman	5.4	0.45 (0.19-1.08)	8.8	0.89 (0.47-1.66)	4.6	0.53 (0.24-1.20)
South Westman	5.9	0.63 (0.30-1.34)	9.4	1.01 (0.58-1.90)	6.0	0.81 (0.38-1.72)
Winnipeg	12.9	1.14 (0.96-1.36)	9.5	0.95 (0.78-1.14)	9.2	1.01 (0.83-1.22)
Manitoba	11.2	1.00	10.1	1.00	9.1	1.00

RHA	Mortality					
	1985-89		1990-94		1995-99	
	Rate [†]	RR [‡] (95% CI)	Rate [†]	RR [‡] (95% CI)	Rate [†]	RR [‡] (95% CI)
Other RHAs	3.5	0.95 (0.66-1.36)	3.5	1.16 (0.81-1.64)	2.4	1.17 (0.77-1.79)
Winnipeg	3.7	1.04 (0.76-1.42)	2.8	0.89 (0.64-1.25)	1.8	0.88 (0.59-1.33)
Manitoba	3.6	1.00	3.1	1.00	2.0	1.00

RHA	5-Year prevalence					
	1989		1994		1999	
	Rate [§]	RR [‡] (95% CI)	Rate [§]	RR [‡] (95% CI)	Rate [§]	RR [‡] (95% CI)
Brandon	24.3	0.57 (0.25-1.29)	32.4	0.78 (0.38-1.57)	48.5	1.25 (0.70-2.24)
Burntwood	39.8	1.39 (0.69-2.82)	52.8	1.91 (1.04-3.50)	73.6	2.55 (1.53-4.24)
Central	31.7	0.76 (0.45-1.28)	25.2	0.62 (0.35-1.11)	26.7	0.72 (0.41-1.26)
Churchill	163.7	5.20 (0.73-37.1)	194.6	5.81 (0.81-41.1)	--	--
Interlake	30.6	0.70 (0.38-1.28)	36.2	0.85 (0.49-1.49)	35.4	0.88 (0.50-1.54)
Marquette	31.6	0.67 (0.30-1.51)	37.5	0.83 (0.39-1.76)	37.8	0.95 (0.45-2.02)
Norman	39.5	1.10 (0.45-2.67)	65.1	1.83 (0.90-3.70)	32.2	0.93 (0.35-2.50)
North Eastman	65.8	1.60 (0.87-2.92)	50.9	1.26 (0.65-2.45)	15.9	0.41 (0.13-1.27)
Parkland	39.7	0.87 (0.44-1.68)	54.5	1.23 (0.69-2.20)	36.8	0.94 (0.46-1.90)
South Eastman	21.5	0.56 (0.23-1.35)	40.7	1.07 (0.57-2.01)	15.5	0.42 (0.16-1.13)
South Westman	33.3	0.71 (0.32-1.60)	56.8	1.26 (0.67-2.36)	29.3	0.73 (0.30-1.77)
Winnipeg	49.2	1.12 (0.92-1.36)	42.8	0.98 (0.79-1.20)	42.9	1.06 (0.86-1.30)
Manitoba	42.9	1.00	42.1	1.00	39.4	1.00

* According to the year 2000 geographic boundaries of RHAs

† Standardised to the 1991 Canadian population

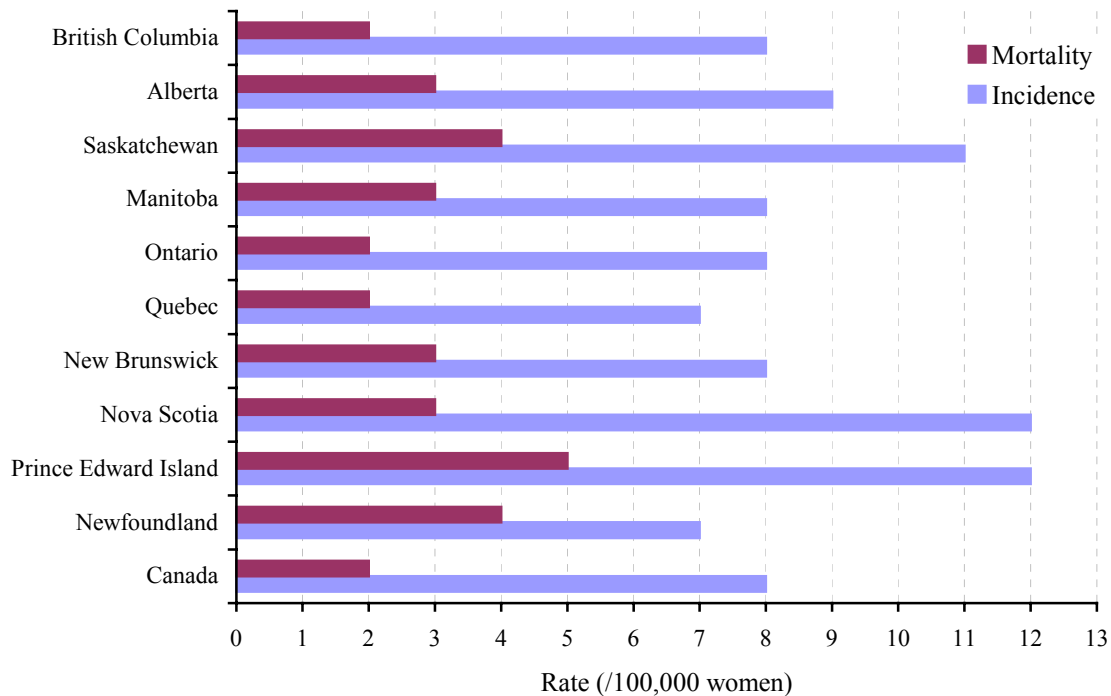
‡ RR: age-adjusted risk ratio; CI: confidence interval; a RR with a 95% CI not including the value 1.00 is not significantly different than the reference group (Manitoba); for example, in 1985-89 the RR comparing the incidence rate of Winnipeg to that of Manitoba is 1.14 (0.96-1.36); the value 1.00 is included in the 95% CI and consequently the rate of Winnipeg is not significantly different than the Manitoba rate

§ Crude rate (not adjusted for age)

Inter-provincial comparisons

The Manitoba age-standardised incidence rate of cervical cancer for 1999 (8 /100,000 women) was the same as the Canadian incidence rate (8 /100,000 women)¹ (Figure 6). The 1999 Manitoba mortality rate (3 /100,000 women) was higher than the Canadian rate (2 /100,000 women). Manitoba's incidence rate was lower than the rate observed in P.E.I., Nova Scotia, Saskatchewan and Alberta and comparable to that seen in Ontario and British Columbia. Manitoba's mortality rate was comparable to Alberta, Nova Scotia, and New Brunswick, but higher than the Canadian average. Cervical cancer screening activities and hysterectomy practice may partly be responsible for the differences in incidence and mortality rates observed between provinces.

Figure 6. Age-standardised incidence and mortality rates of invasive cervical cancer by province (1999)¹



Types of invasive cervical cancer

Squamous cell carcinoma (Appendix C) was the most frequently diagnosed type of invasive cervical cancer in Manitoba women over the study period. It represented approximately 80% of newly diagnosed cervical cancers between 1970-74 and 1990-94 and 69% in 1995-99 (Table 6).

The proportion of women diagnosed with adenocarcinoma increased from 7% to 11% between 1970-74 and 1990-94 and from 11% to 22% between 1990-94 and 1995-99. The increase reported between 1990-94 and 1995-99 was observed in all age groups, but to a lesser extent in the 70 years of age and older age group. Because of the small sample size, it is impossible to tell if the increase represents a random fluctuation or a real change.

The other types of cervical cancer represented approximately 10% of all invasive cervical cancers diagnosed in the province.

Table 6. Distribution of invasive cervical cancer by morphological type, year of diagnosis and age group* (number of cases (proportion))

Type of carcinoma	1970-74					1975-79				
	≤29	30-49	50-69	70+	Total	≤29	30-49	50-69	70+	Total
Squamous cell	21 (0.81)	98 (0.82)	112 (0.85)	35 (0.73)	266 (0.82)	42 (0.71)	113 (0.80)	98 (0.84)	43 (0.73)	296 (0.79)
Adenocarcinoma	--	5 (0.04)	11 (0.08)	6 (0.13)	22 (0.07)	5 (0.08)	12 (0.08)	8 (0.07)	9 (0.15)	34 (0.09)
Adenosquamous	1 (0.04)	1 (0.01)	1 (0.01)	1 (0.02)	4 (0.01)	2 (0.03)	1 (0.01)	1 (0.01)	--	4 (0.01)
Others	4 (0.15)	15 (0.13)	8 (0.06)	6 (0.13)	33 (0.10)	10 (0.17)	16 (0.11)	10 (0.09)	7 (0.12)	43 (0.11)
<i>Total</i>	<i>26</i>	<i>119</i>	<i>132</i>	<i>48</i>	<i>325</i>	<i>59</i>	<i>142</i>	<i>117</i>	<i>59</i>	<i>377</i>
Type of carcinoma	1980-84					1985-89				
	≤29	30-49	50-69	70+	Total	≤29	30-49	50-69	70+	Total
Squamous cell	40 (0.83)	109 (0.87)	81 (0.78)	49 (0.77)	279 (0.82)	24 (0.80)	106 (0.81)	76 (0.85)	49 (0.79)	255 (0.82)
Adenocarcinoma	1 (0.02)	8 (0.06)	17 (0.16)	9 (0.14)	35 (0.10)	5 (0.17)	16 (0.12)	11 (0.12)	8 (0.13)	40 (0.13)
Adenosquamous	3 (0.06)	1 (0.01)	3 (0.03)	1 (0.02)	8 (0.02)	1 (0.03)	6 (0.05)	2 (0.02)	2 (0.03)	11 (0.04)
Others	4 (0.08)	7 (0.06)	3 (0.03)	5 (0.08)	19 (0.06)	--	3 (0.02)	--	3 (0.05)	5 (0.02)
<i>Total</i>	<i>48</i>	<i>125</i>	<i>104</i>	<i>64</i>	<i>341</i>	<i>30</i>	<i>131</i>	<i>89</i>	<i>62</i>	<i>312</i>
Type of carcinoma	1990-94					1995-99				
	≤29	30-49	50-69	70+	Total	≤29	30-49	50-69	70+	Total
Squamous cell	23 (0.92)	100 (0.76)	64 (0.80)	47 (0.80)	234 (0.79)	19 (0.76)	90 (0.69)	50 (0.69)	32 (0.67)	191 (0.69)
Adenocarcinoma	2 (0.08)	15 (0.11)	8 (0.10)	9 (0.15)	34 (0.11)	4 (0.16)	29 (0.22)	19 (0.26)	9 (0.19)	61 (0.22)
Adenosquamous	--	15 (0.11)	7 (0.09)	--	22 (0.07)	2 (0.08)	8 (0.06)	1 (0.01)	2 (0.04)	13 (0.05)
Others	--	2 (0.02)	1 (0.01)	3 (0.05)	6 (0.02)	--	4 (0.03)	2 (0.03)	5 (0.10)	11 (0.04)
<i>Total</i>	<i>25</i>	<i>132</i>	<i>80</i>	<i>59</i>	<i>296</i>	<i>25</i>	<i>131</i>	<i>72</i>	<i>48</i>	<i>276</i>

* Information on cervical cancer morphology was missing for 12 cases (totals include those with missing type)

The age-standardised incidence rates of adenocarcinoma and squamous cell carcinoma followed different patterns between 1970 and 1999 (Figure 7). The rate of squamous cell carcinoma decreased significantly, while the rate of adenocarcinoma increased slightly but significantly. The incidence rate of squamous cell carcinoma decreased 2.56% per year and the rate of adenocarcinoma increased 1.67% per year.

The rate of squamous cell carcinoma decreased after the mid-1980s in the 30-49 and 70 years of age and older age groups and decreased steadily from 1970 for the 50-69 age group (Figure 8).

Non-significant changes were observed in women less than 30 years of age and the variations in this group were small on an absolute scale in comparison to other age groups.

Trends were not as homogenous for adenocarcinomas as for squamous cell carcinomas, although two age groups show sustained trends (Figure 9). The incidence rate of adenocarcinoma increased significantly in the 30-49 age group and decreased in the 70 years of age and older age group. Rates in the 50-69 and less than 30 age groups were erratic although trends were detected.

Figure 7. Age-standardised incidence rates of invasive cervical cancer by morphological type

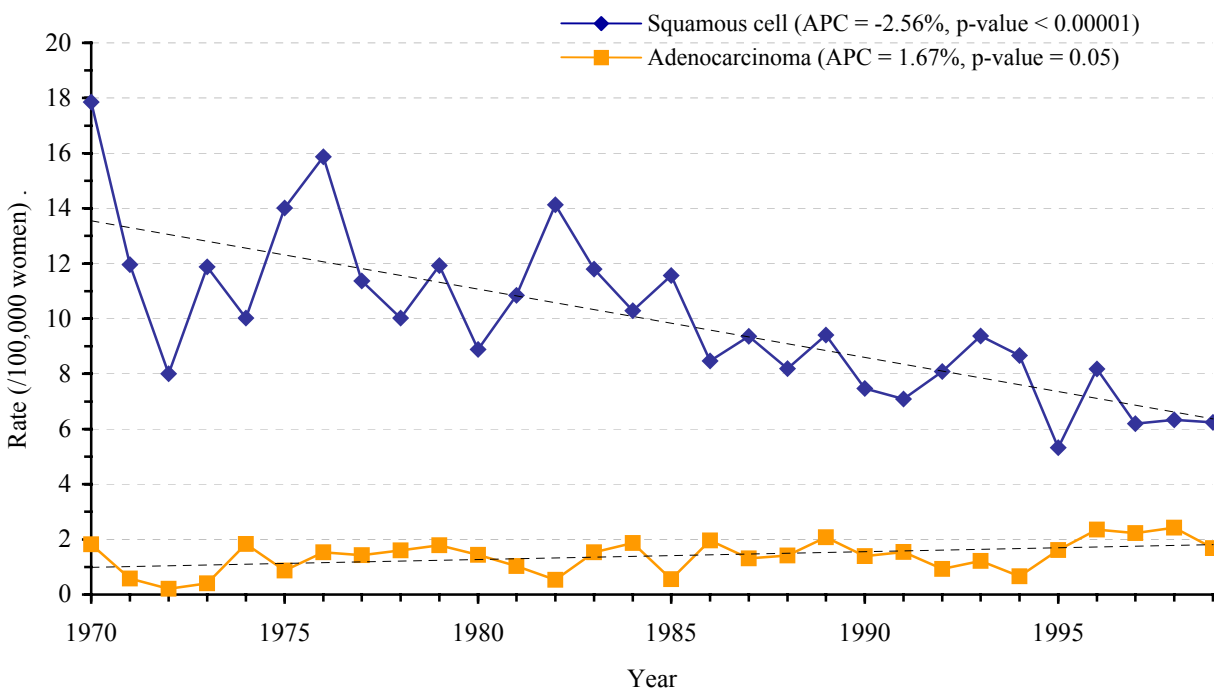


Figure 8. Age-specific incidence rates of invasive squamous cell carcinoma (5-year moving average)

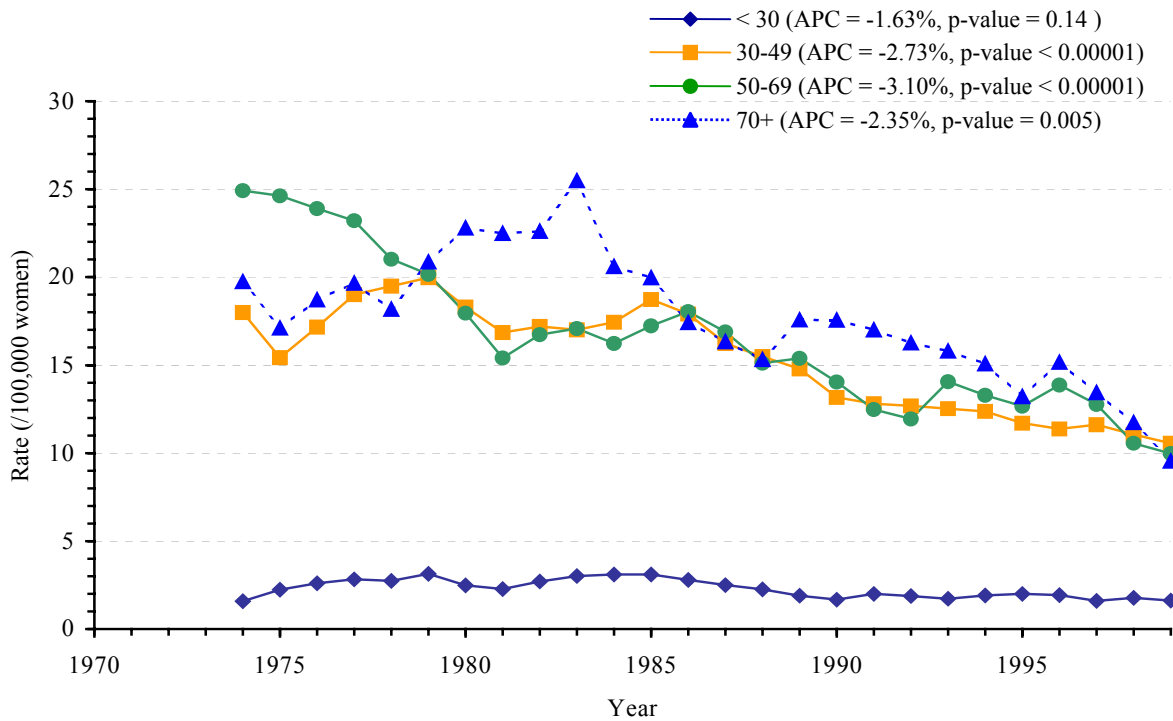
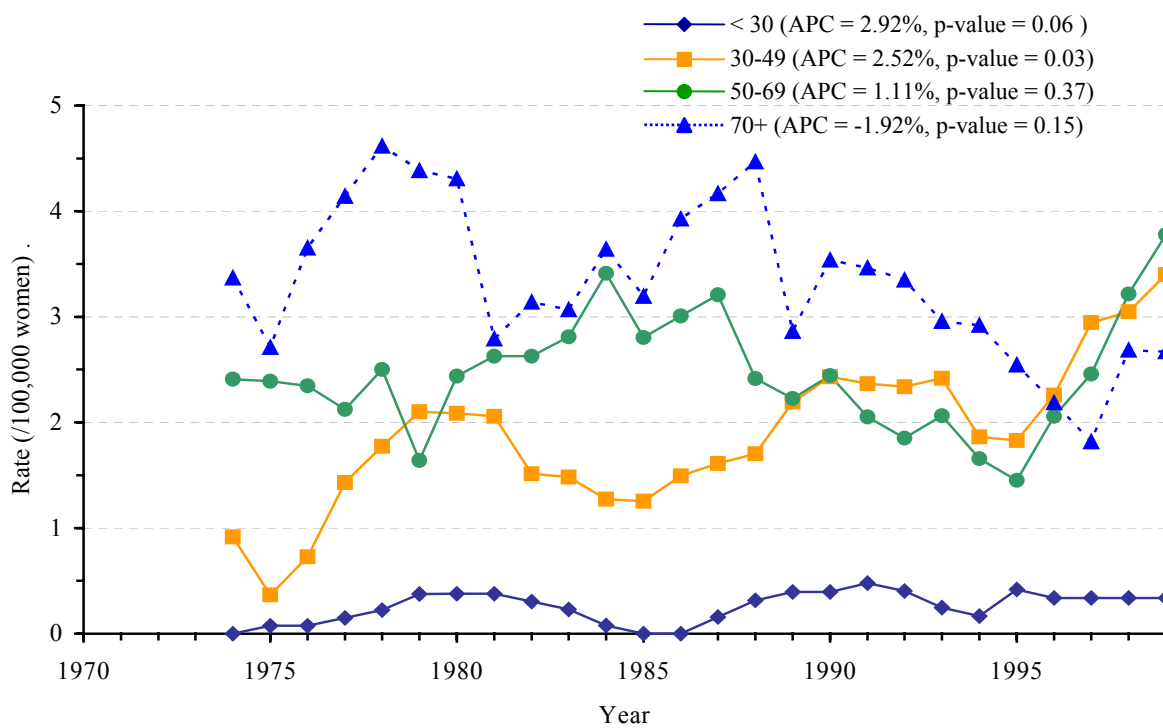


Figure 9. Age-specific incidence rates of invasive adenocarcinoma (5-year moving average)



Survival

The 5-year cumulative relative survival rate for women diagnosed with invasive cervical cancer increased but not significantly between 1985-89 and 1995-99 (Table 7). Women 40 years of age and older experienced a higher excess risk of death compared to younger women. This was especially noticeable for women 70 years of age and older. Women diagnosed with adenocarcinoma had the same risk of death as women diagnosed with squamous cell carcinoma.

Table 7. 5-year cumulative relative survival and excess risk of death from invasive cervical cancer by age group, tumour type and diagnosis period

Group	5-year survival rate	RR* (95% CI)	P-value
<i>Period</i>			
1985-89 (reference)	0.68	1.00	
1990-94	0.65	1.12 (0.83-1.51)	0.47
1995-99	0.72	0.99 (0.70-1.40)	0.96
<i>Age</i>			
20-29 (reference)	0.88	1.00	
30-39	0.84	1.29 (0.61-2.76)	0.51
40-49	0.64	3.03 (1.48-6.20)	0.002
50-59	0.66	3.26 (1.54-6.90)	0.002
60-69	0.63	3.70 (1.78-7.68)	<0.001
70+	0.42	5.57 (2.74-11.4)	<0.001
<i>Tumour type</i>			
Squamous cell (reference)	0.68	1.00	
Adenocarcinoma	0.65	1.17 (0.81-1.69)	0.41

* RR: risk ratio (excess risk of death), CI: confidence interval, models are adjusted for period, age, and tumour type. A lower 5-year survival rate is interpreted as an increase of the excess risk of death. For example women 70 years of age and older have a lower 5-year survival rate than the 20-29 years old women (0.42 compared to 0.88); accordingly they have an excess risk of death (5.57 (2.74-11.4)); the rate in the 70+ age group is significantly higher than the rate in the 20-29 age group since the 95% CI doesn't include the value 1.00

CERVICAL CARCINOMA *IN SITU*²

Number of incident cases

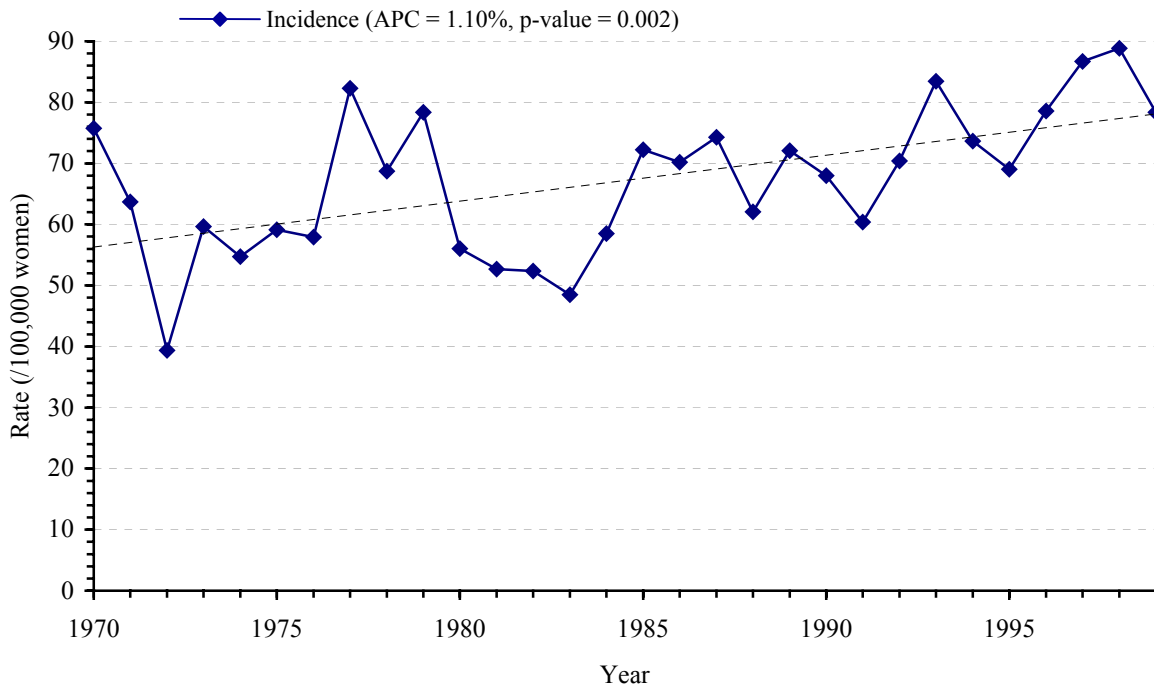
Cervical carcinoma *in situ*, based either on cytology or morphology, is reportable to the Manitoba Cancer Registry, while lesser degrees of dysplasia are not. A total of 10,006 diagnoses of carcinoma *in situ* were reported between 1970 and 1999. Nine women had two diagnoses of cervical cancer *in situ*; all others had only one. Most cancers (98.7%) were *in situ* squamous cell carcinoma while 1.1% were *in situ* adenocarcinoma. On average, 334 new cases of *in situ* cervical cancer were diagnosed annually. The number of new cases increased over time with approximately 78% more cases diagnosed in 1995-99 (2,163 cases) than in 1970-74 (1,214 cases).

Incidence rates

The incidence rate of carcinoma *in situ* has increased steadily between 1970 and 1999, although fluctuations were observed, especially before 1984 (Figure 10). On average, the rate increased by 0.75 /100,000 women per year.

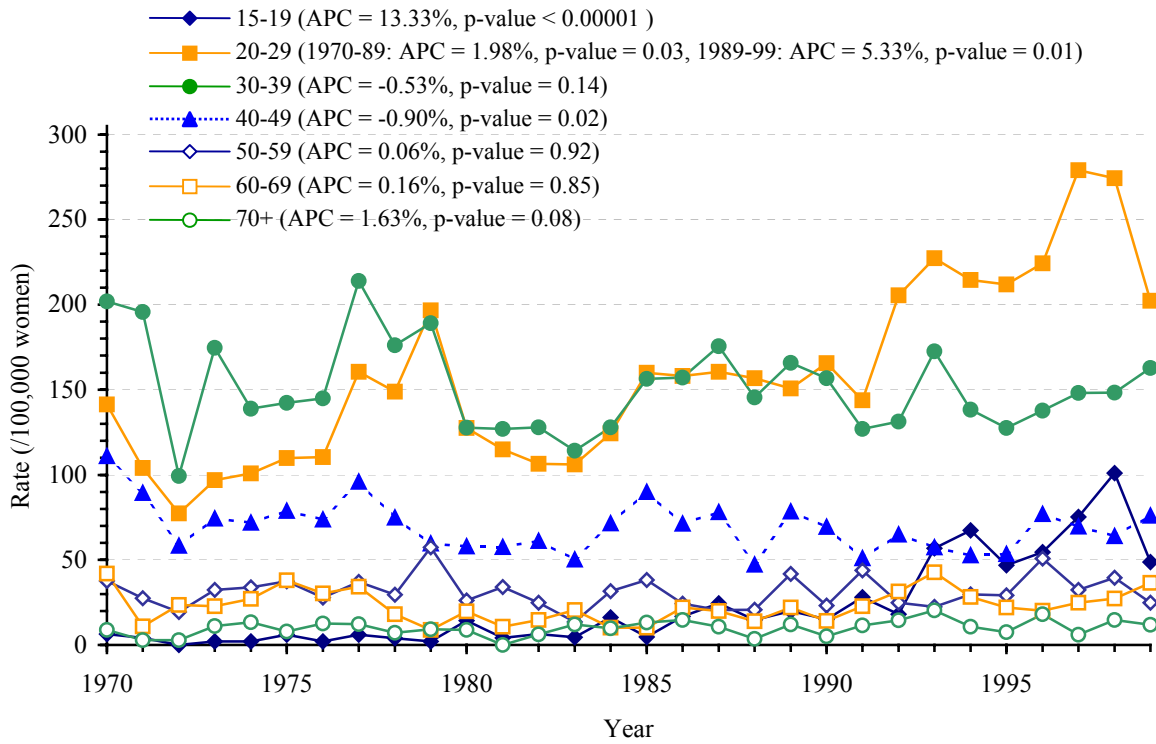
The incidence rate of carcinoma *in situ* has remained relatively stable among women 30 years of age and older over the study period but increased in women less than 30 years of age (Figure 11). The increase appears to have started in the early 1980s for the 15-19 age group.

Figure 10. Age-standardised incidence rates of cervical cancer *in situ*



² ICD-9 2332 - International Classification of Diseases, 9th revision

Figure 11. Age-specific incidence rates of cervical cancer *in situ*



Geographic distribution

RHA comparisons

Nine out of 12 RHAs had a higher rate of cervical carcinoma *in situ* in 1995-99 than in 1985-89 and 1990-94 (Table 8). However, only the RHA of Burntwood showed an incidence rate of carcinoma *in situ* significantly higher than Manitoba over two consecutive 5-year periods (1990-94 and 1995-99). Incidence rates were also significantly higher in Winnipeg in 1985-89 and in Brandon in 1990-94.

The RHAs of Central and South Eastman showed incidence rates significantly lower than Manitoba for the three 5-year time periods. Significantly lower rates were also observed in South Westman (1985-89 and 1990-94) and Parkland (1990-94). The small population of Churchill caused rates to fluctuate more than in other RHAs and consequently, the 1990-94 rates should not be considered abnormal.

Table 8. Age-standardised incidence rates (/100,000 women) and rate ratios of cervical cancer *in situ* by Regional Health Authorities (RHA)

RHA	1985-89		1990-94		1995-99	
	Rate*	RR† (95% CI)	Rate*	RR† (95% CI)	Rate*	RR† (95% CI)
Brandon	70.6	1.04 (0.83-1.30)	93.0	1.34 (1.10-1.62)	91.4	1.15 (0.95-1.40)
Burntwood	72.9	1.01 (0.80-1.28)	92.0	1.27 (1.03-1.55)	125.5	1.58 (1.34-1.87)
Central	33.7	0.51 (0.40-0.64)	50.3	0.73 (0.60-0.88)	65.1	0.82 (0.70-0.97)
Churchill	173.4	2.01 (0.84-4.84)	198.3	3.22 (1.53-6.76)	76.5	0.91 (0.23-3.65)
Interlake	67.4	1.00 (0.82-1.20)	60.6	0.88 (0.72-1.07)	74.0	0.93 (0.77-1.11)
Marquette	63.4	0.91 (0.69-1.20)	75.8	1.09 (0.85-1.41)	79.3	1.02 (0.79-1.30)
Norman	65.2	1.03 (0.77-1.39)	64.2	0.92 (0.67-1.25)	130.2	1.68 (1.35-2.08)
North Eastman	56.3	0.81 (0.60-1.09)	58.5	0.83 (0.63-1.11)	70.8	0.89 (0.70-1.15)
Parkland	60.0	0.90 (0.69-1.16)	50.0	0.72 (0.54-0.95)	73.8	0.90 (0.70-1.14)
South Eastman	36.9	0.55 (0.40-0.75)	51.6	0.72 (0.56-0.93)	43.2	0.54 (0.41-0.71)
South Westman	42.0	0.63 (0.45-0.89)	48.2	0.68 (0.49-0.95)	80.0	1.01 (0.78-1.30)
Winnipeg	76.8	1.13 (1.05-1.21)	73.1	1.06 (0.98-1.13)	78.5	0.99 (0.93-1.07)
Manitoba	68.1	1.00	69.2	1.00	79.0	1.00

* Standardised to the 1991 Canadian population

† RR: risk ratio; CI: confidence interval; adjusted for age

PAP TEST UTILISATION

A total of 472,959 women 15 years of age and older had at least one Pap test between 1984 and 1999. These women had 2,888,512 Pap tests (6.4 per women on average), although some women were frequent users while others had only one. Since all Pap tests reported on different dates were included in the analysis, some tests were performed in order to confirm results or to re-evaluate unsatisfactory tests. Therefore, two subsequent tests are not necessarily independent. This is reflected in Figure 12, where 39% of consecutive Pap tests were performed in less than 1 year. A total of 396,392 women had more than one Pap test over the study period and 76,567 women had only one. The 396,392 women had 2,811,945 Pap tests (2,415,553 Pap test intervals). The number of Pap test intervals was used as the denominator to calculate the percentages in Figure 12. Women 15-19 years old were more likely than other age groups to have had two consecutive Pap tests within one year (Table 9).

Figure 12. Time interval between two consecutive Pap tests, 1984-99

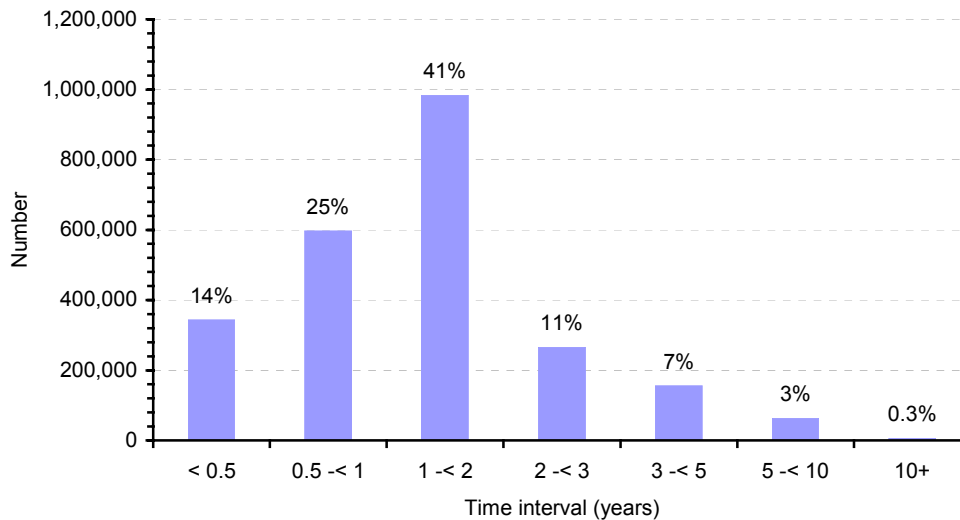


Table 9. Time interval between two consecutive Pap tests by age group (number (proportion))*

Time (years)	Age groups [†]						
	15-19	20-29	30-39	40-49	50-59	60-69	70+
< 0.5	28,354 (0.27)	134,473 (0.18)	85,730 (0.13)	44,036 (0.11)	24,859 (0.10)	15,472 (0.09)	10,741 (0.11)
0.5-< 1	33,590 (0.32)	233,839 (0.32)	162,113 (0.26)	75,144 (0.18)	46,628 (0.18)	28,930 (0.17)	16,330 (0.17)
1-< 2	36,669 (0.35)	275,929 (0.38)	259,565 (0.41)	182,190 (0.44)	119,267 (0.46)	73,581 (0.43)	36,534 (0.37)
2-<3	5,332 (0.05)	55,792 (0.08)	71,824 (0.11)	58,104 (0.14)	35,573 (0.14)	25,055 (0.15)	14,007 (0.14)
3-< 5	1,176 (0.01)	26,400 (0.04)	40,726 (0.06)	36,570 (0.09)	22,069 (0.08)	17,388 (0.10)	11,662 (0.12)
5-< 10	--	6,556 (0.01)	14,604 (0.02)	16,080 (0.04)	10,218 (0.04)	8,566 (0.05)	7,589 (0.08)
10+	--	123 (0.00)	1,134 (0.00)	1,648 (0.00)	1,217 (0.00)	1,028 (0.01)	1,138 (0.01)
Total	105,121	733,112	635,696	413,772	259,831	170,020	98,001

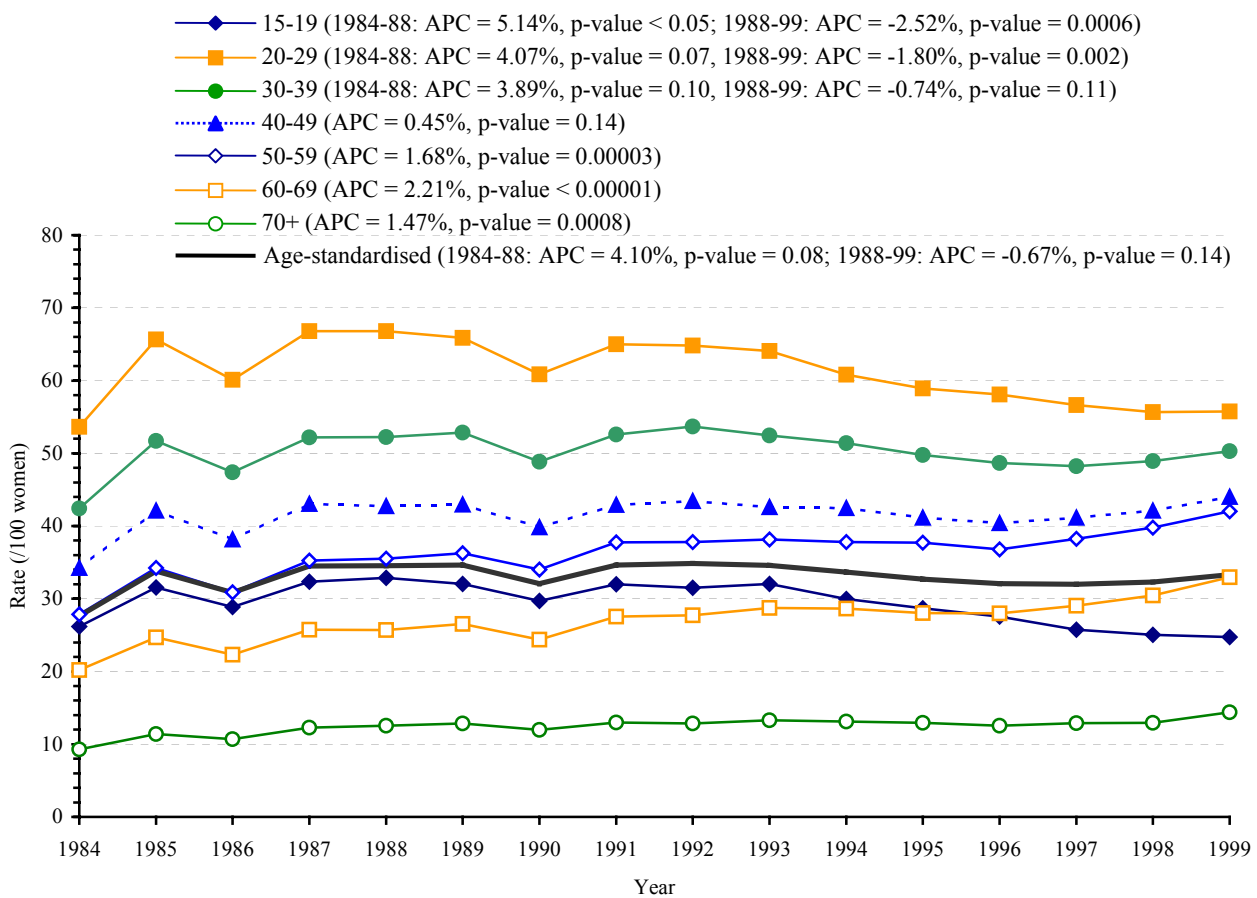
* For women who had at least two Pap tests between 1984 and 1999

† A woman might be counted several times within and over age groups if she had more than two Pap tests

Rate of utilisation

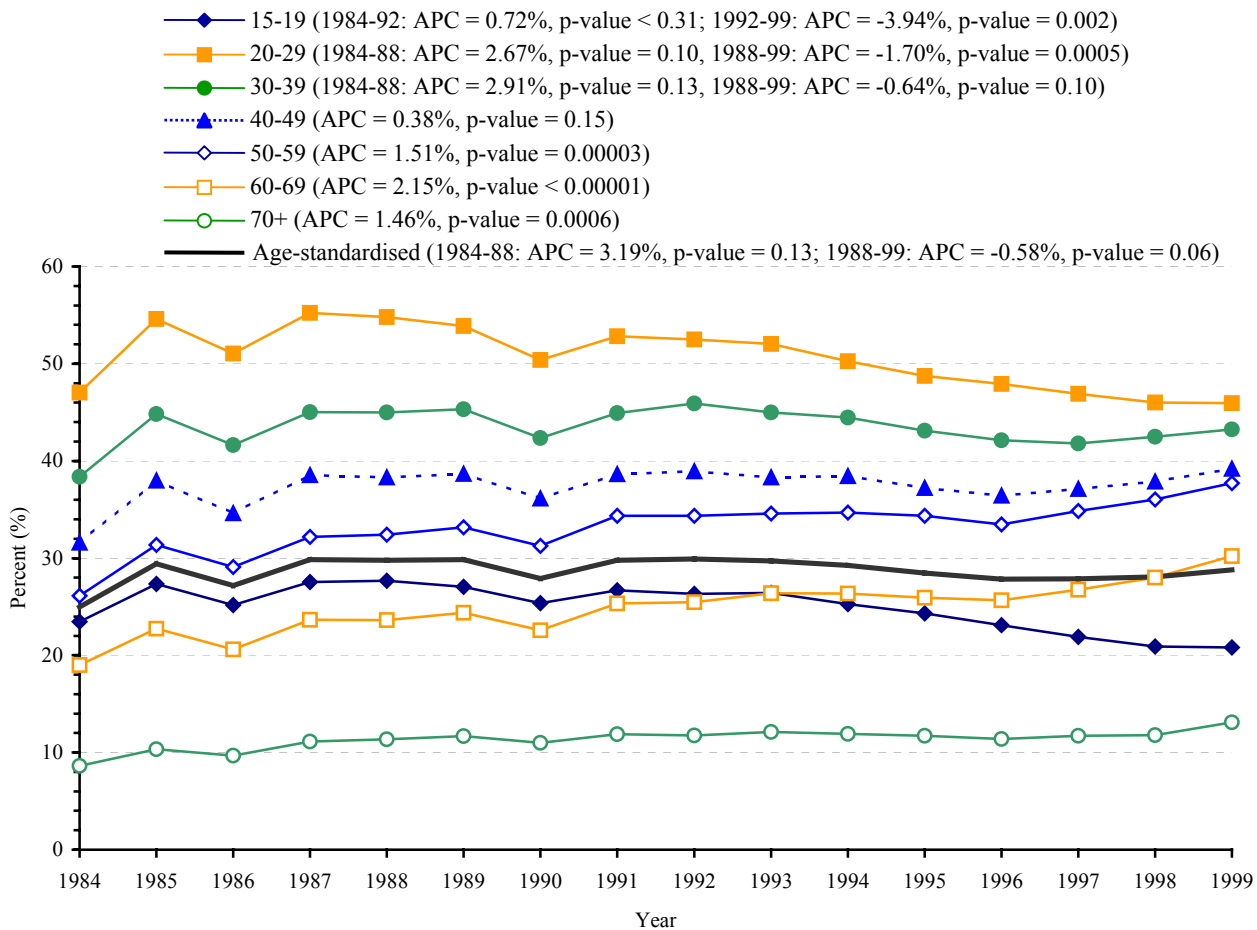
The age-standardised Pap test rate remained stable over the follow-up period at an average of 33.0 /100 women 15 years of age and older per year, although some age-specific rates changed significantly (Figure 13). Rates decreased in the 15-19 and 20-29 age groups from 66.8 and 52.2 respectively in 1988 to 55.8 and 50.3 in 1999. The Pap test utilisation rate increased over the whole follow-up period for the 50-59, 60-69 and 70+ age groups from 27.9, 20.2, and 9.3 respectively in 1984 to 42.0, 33.0 and 14.1 in 1999. The rates remained stable for the 30-39 and 40-49 age groups. Women 20-29 years of age had the highest utilisation rate (average of 61.4/100 women) followed by women 30-39 years of age (50.3/100 women), and women 40-49 years of age (41.6/100 women).

Figure 13. Age-standardised and age-specific annual rates of Pap test utilisation, 1984-99



The Pap test utilisation rate reflects the total number of tests occurring in a population. It is also of interest to look at the percentage of women having at least one Pap test (Figure 14). On average, 28.7% of women 15 years of age and older had at least one Pap test annually. This percentage remained stable over the 16 years of follow-up. The percentage of women 15-19 and 20-29 years of age who had at least one Pap test decreased between 1988 and 1999. It went from 27.7 and 54.8 respectively in 1988 to 20.8 and 45.9 in 1999. The percentage of women 50-59, 60-69 and 70 years of age and older that had at least one Pap test annually increased over the study period, from 26.1, 19.0 and 8.6 respectively in 1984 to 37.7, 30.2 and 13.1 in 1999.

Figure 14. Age-standardised and age-specific annual rates (percent) of women who had at least one Pap test, 1984-99



Number and timing of Pap tests

Approximately 45% of Manitoba women had one or two Pap tests over the three 3-year periods examined and approximately 39% had none (Table 10). The percentage of women who had three or more Pap tests within a three-year period was 16%. It is not possible to say, however, if these frequent Pap tests are a consequence of over-screening, repeats for unsatisfactory tests, or diagnosis confirmation. On a yearly basis, approximately one third of Manitoba women 15 years of age and older had a Pap test. Most of these women had only one Pap test.

Table 10. Number (proportion) of women 15 years of age and older who had a Pap test within a 1-year and 3-year period

Number of Pap Tests	1-Year periods			3-Year periods		
	1990	1995	1999	1988-90	1993-95	1997-99
0	297,086 (0.66)	300,715 (0.66)	302,344 (0.65)	171,950 (0.38)	179,927 (0.39)	185,552 (0.40)
1	134,376 (0.30)	137,493 (0.30)	139,934 (0.30)	114,619 (0.26)	115,029 (0.25)	118,624 (0.26)
2	15,640 (0.03)	15,480 (0.03)	16,635 (0.04)	87,196 (0.19)	86,107 (0.19)	86,019 (0.19)
3	2,716 (0.01)	2,663 (0.01)	2,859 (0.01)	51,432 (0.11)	51,877 (0.11)	48,060 (0.10)
4	434 (0.00)	525 (0.00)	450 (0.00)	14,555 (0.03)	13,870 (0.03)	12,915 (0.03)
5-<10	91 (0.00)	83 (0.00)	72 (0.00)	9,237 (0.02)	9,019 (0.02)	8,585 (0.02)
10+	0 (0.00)	0 (0.00)	0 (0.00)	133 (0.00)	147 (0.00)	99 (0.00)
Total*	450,343	456,959	462,294	449,122	455,376	459,854

* Manitoba population on July 1st 1990, 1995, 1999, 1989, 1994 and 1998 respectively

Between 1997 and 1999, women in the 15-19, 60-69 and 70 years of age and older age groups were the most likely to not have had a Pap test (Table 11). At least 49% of the women in these age groups did not have a Pap test over the three-year period. Alternatively, less than one third of women in the 20-29, 30-39 and 40-49 age groups did not have a Pap test, while at least 50% had one or two. Thirty eight percent of women 50-59 years of age did not have a Pap test and 48% had one or two.

Table 11. Number (proportion) of women 15 years of age and older who had a Pap test between 1997 and 1999 by age group

Number of Pap tests	Age groups*						
	15-19	20-29	30-39	40-49	50-59	60-69	70+
0	20,655 (0.54)	17,643 (0.23)	24,386 (0.27)	26,947 (0.32)	22,570 (0.38)	21,600 (0.49)	51,751 (0.76)
1	7,782 (0.20)	19,769 (0.26)	25,896 (0.29)	26,031 (0.31)	16,586 (0.28)	11,894 (0.27)	10,666 (0.16)
2	5,197 (0.13)	18,750 (0.24)	21,278 (0.24)	18,571 (0.22)	11,757 (0.20)	6,686 (0.15)	3,780 (0.06)
3	2,955 (0.08)	12,917 (0.17)	12,194 (0.14)	9,096 (0.11)	6,115 (0.10)	3,251 (0.07)	1,532 (0.02)
4	1,117 (0.03)	4,399 (0.06)	3,419 (0.04)	2,014 (0.02)	1,132 (0.02)	566 (0.01)	268 (0.00)
5-<10	889 (0.02)	3,046 (0.04)	1,942 (0.02)	1,318 (0.02)	745 (0.01)	379 (0.01)	266 (0.00)
10+	5 (0.00)	20 (0.00)	18 (0.00)	16 (0.00)	16 (0.00)	10 (0.00)	14 (0.00)
Total†	38,600	76,544	89,133	83,993	58,921	44,386	68,277

* Age at last Pap test

† Manitoba population on July 1st 1998

Women who had their last Pap test in 1999 were most likely to have had a previous test within two years (Table 12). This was observed for all age groups. The proportion of women who had two consecutive Pap tests within a year decreased with age falling from 55% in the 15-19 age group to 20% in the 70+ age group. However, the proportion of women who had two consecutive Pap tests within two to five years increased with age, as did the proportion of women who had two consecutive Pap tests in more than five years.

Table 12. Time span between the last Pap test performed in 1999 and the previous one*

Time (year)	Age groups (number of women (proportion)) [†]							All ages
	15-19	20-29	30-39	40-49	50-59	60-69	70+	
<0.5	997 (0.24)	4,650 (0.15)	3,839 (0.10)	2,915 (0.09)	1,864 (0.08)	821 (0.06)	631 (0.07)	15,718 (0.10)
0.5-<1	1,299 (0.31)	9,029 (0.28)	8,358 (0.23)	5,113 (0.16)	3,551 (0.16)	1,913 (0.15)	1,136 (0.13)	30,400 (0.20)
1-<2	1,491 (0.36)	12,466 (0.39)	15,212 (0.41)	14,173 (0.43)	10,284 (0.45)	5,527 (0.43)	2,944 (0.35)	62,099 (0.41)
2-<3	291 (0.07)	3,120 (0.10)	4,505 (0.12)	4,572 (0.14)	3,127 (0.14)	1,895 (0.15)	1,196 (0.14)	18,707 (0.12)
3-<5	81 (0.02)	1,923 (0.06)	3,056 (0.08)	3,422 (0.10)	2,154 (0.09)	1,428 (0.11)	1,150 (0.14)	13,214 (0.09)
5-<10	0 (0.00)	708 (0.02)	1,657 (0.04)	2,070 (0.06)	1,378 (0.06)	1,042 (0.08)	1,074 (0.13)	7,929 (0.05)
10+	0 (0.00)	32 (0.00)	298 (0.01)	450 (0.01)	372 (0.02)	295 (0.02)	364 (0.04)	1,811 (0.01)
Total	4,159	31,928	36,925	32,715	22,730	12,921	8,495	149,879

* This table shows the time interval between the last Pap test in 1999 and the previous Pap test in either 1999 or before; 10,077 women had their first and only Pap test in 1999 and therefore are not included in this analysis

† Age at last Pap test

The probability of having a Pap test did not change markedly over the three time periods examined although differences were significant because of the large number of Pap tests included in the analysis (Table 13). Manitoba women were slightly more likely to have had a Pap test between 1990-94 than between 1984-89. The 20-29 age group was the most likely to have had a Pap test over the study period, while the 70+ age group was the least likely.

Table 13. Age-standardised* Pap test utilisation rates (/100 women) and rate ratios by period and age group

	Rate	RR [†]
<i>Period</i>		
1995-99 (reference)	61.4	1.000 (0.998-1.002)
1990-94	62.9	1.039 (1.037-1.040)
1984-89	58.0	1.000
<i>Age group</i>		
15-19	29.5	0.484 (0.483-0.486)
20-29 (reference)	61.4	1.000
30-39	50.3	0.818 (0.816-0.820)
40-49	41.6	0.677 (0.675-0.679)
50-59	36.4	0.593 (0.591-0.595)
60-69	26.8	0.436 (0.435-0.438)
70+	12.5	0.204 (0.203-0.205)

* Standardised to the 1991 Canada population

† RR: risk ratio (adjusted age, period and region of residence)

Geographic distribution

RHA comparisons

The average age-standardised annual rate of Pap test utilization in Manitoba RHAs ranged from approximately 23/100 women in the northern RHAs to 35/100 women in Winnipeg over the follow-up period (Table 14). The RHAs of Churchill, Burntwood and Norman had a lower rate than the Manitoba. However, some Pap tests performed by nurses in northern nursing stations (Churchill or Burntwood) and analysed in hospital labs may not have been captured in the Manitoba Health Physician Claims database.

Pap test utilisation changed significantly in only two RHAs between 1984 and 1999 (Figure 15). The annual utilisation rate decreased in Norman and increased in North Eastman. The differences between the 1984 and 1999 rates in these two RHAs were 0.6 Pap test /100 women in Norman and 7.7 Pap tests /100 women in North Eastman.

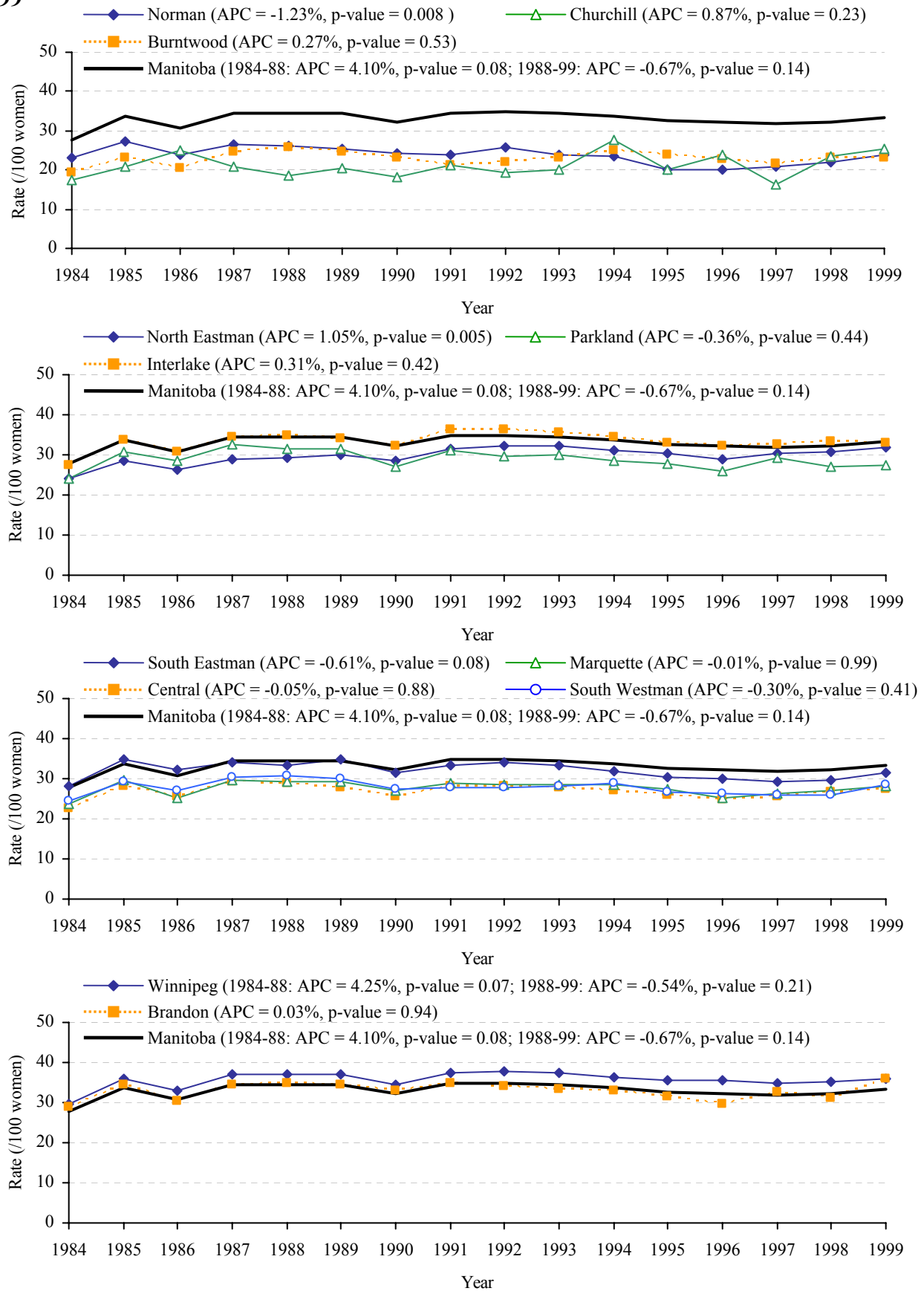
Table 14. Age-standardised* Pap test utilisation rates (/100 women) and rate ratios† by Regional Health Authority (RHA), 1984-99

RHA	Rate	RR†
Brandon	33.0	1.002 (0.996-1.007)
Burntwood	23.0	0.735 (0.730-0.741)
Central	27.0	0.806 (0.802-0.810)
Churchill	21.2	0.684 (0.656-0.713)
Interlake	33.4	1.012 (1.008-1.017)
Marquette	27.7	0.833 (0.827-0.840)
Norman	23.8	0.729 (0.722-0.736)
North Eastman	29.7	0.901 (0.894-0.907)
Parkland	28.9	0.882 (0.876-0.888)
South Eastman	32.0	0.963 (0.957-0.968)
South Westman	27.8	0.842 (0.836-0.848)
Winnipeg	35.7	1.079 (1.077-1.081)
Manitoba	33.1	1.000

* Standardised to the 1991 Canada population

† RR: risk ratio (adjusted for age and period)

Figure 15. Pap test utilisation rates among women aged 15 years and older by RHA, 1984-99



METHODS

Manitoba population

Two population files were used to calculate rates. When data were not reported by RHAs, the number of Manitoba residents was obtained from the Canadian Socioeconomic Information and Management System (CANSIM) web site (<http://datacentre.chass.utoronto.ca:5680/cansim/cansim.html>) which is a repository site for Statistics Canada data. For RHA specific analyses, population estimates were based on the mid year (July 1st) population from the Manitoba Health Population Registry (MHPR). Postal codes, which have been included on the MHPR since 1984, were used to determine RHA populations and cases' residence area. Because two population files were used, rates calculated with both files may be slightly different.

Cervical cancer cases

The Manitoba Cancer Registry (MCR) was used to identify incident cases of cervical cancer. The MCR records all new cancer patients who were residents of Manitoba at the time of diagnosis, as well as non-residents who were diagnosed in Manitoba or received treatment in Manitoba. The MCR has been population-based since 1956. Only women diagnosed with an invasive cervical cancer or carcinoma *in situ* (ICD-9 180 and 2331) and who were Manitoba residents at date of diagnosis were included in the study. All primary cancers were accounted for.

Although information on the specific cause of death in the MCR is complete after 1980, it is underreported before that date. Therefore, cervical cancer deaths provided by Statistics Canada were used for Figures 1, 2, and 4, as well as for Tables 17, 18 and 19 in Appendix A. For Tables 2, 4 and 16, death counts from the Cancer Registry were used, but only percentages were reported before 1980.

The 5-year prevalent cases of cervical cancer were defined as those who had been diagnosed with cervical cancer in Manitoba in the previous five years, as of the fifth year, and who were alive for at least one day on the fifth year. Women that moved out of the province were no longer considered prevalent cases unless they moved back within the 5-year time frame. To be considered a prevalent case in a specific year, a woman had to be registered in the MHPR for at least one day during that year. Both the MCR and the MHPR were used to determine prevalent cases. Linkage between the databases was done using a unique identifier (Personal Health Insurance Number, PHIN). Since the PHIN was introduced in 1984 in Manitoba, 5-year prevalence was calculated starting in 1985.

We did not exclude women who had a hysterectomy from the analyses. The Canadian National Workshop on Screening for Cancer of the Cervix recommends that women having a hysterectomy for benign conditions do not need screening as long as there is adequate pathological documentation, the cervical epithelium has been totally removed and previous tests have been normal¹⁵. However, many physicians advocate continuing Pap tests in these women because the test can also pick up vaginal cancer. Roos et al. found that a considerable number of Pap test testing occurred after hysterectomy in Manitoba; 21.4% of women aged 18 to 69 who had a total hysterectomy had one or more Pap tests in the year after surgery¹⁶. Further, these authors estimated that removing women who have had a hysterectomy from the denominator might increase the Pap test rate by no more than 4%.

Tumour morphology

Information on tumour morphology was extracted from the MCR. Detailed morphologic data have been coded using the Systematised Nomenclature of Pathology (SNOP)¹⁷ between 1970 and 1981 and the International Classification of Diseases for Oncology (ICD-O)¹⁸ between 1982 and 1999. Tumour morphology was grouped under squamous cell carcinoma, adenocarcinoma, adeno-squamous carcinoma, and other (Appendix C).

Pap test utilisation

Information on Pap test utilisation was abstracted from the Manitoba Physician Claims database, which includes claims for fee-for-services, as well as claims for statistical purposes (*i.e.* claims by salaried physicians in community health centres, hospitals, and emergency units). All practitioners in Manitoba are required to submit claims regarding their health care services even if they are salaried. Some Pap tests carried out in northern nursing stations and tested in hospital labs may not have been captured in the Physician Claims database.

Women fifteen years of age and older were retained for the analyses. In order to obtain the number of Manitoba women that never had a Pap test, the total number of women 15 years of age and older on July 1st of the year of interest was subtracted from the number of women who had Pap tests.

Statistics

Rates, trends and rate ratios

Rates were defined as the number of cases or deaths, identified over a time period divided by the number of women registered in Manitoba on July 1st (mid point) of the same time period. Rates were expressed per 100,000 women over the time period¹⁹. Both incidence and mortality rates were standardised to the 1991 Canadian population²⁰ using the direct method of standardisation²¹. Five-year prevalence rates were defined as the number of women diagnosed with cervical cancer in the last five years as of the fifth year, divided by the number of women registered in Manitoba on the fifth year. Prevalence rates were expressed per 100,000 women and were not standardised²².

Linear trends and inflections in linear trends were determined using Joinpoint v2.7²³. The statistical method involves choosing the best change-points at which the slope of the regression line changes significantly. In Figure 8 and 9, moving averages were used in order to lessen the variability that was present in data, however, trends analyses used annual rates. Poisson regression models were used to test the rate differences between age groups and RHAs. Data management and statistical analyses, other than linear regression, were performed using SASTM version 8.2.

Trends were tested in order to determine if the slopes were significantly different than zero²³. Additionally, the amount of change in the regression line (log-linear mode: $\ln Y(x) = mx + b$) was reported in annual percent change (APC), calculated by $100 * (e^m - 1)$, where m is the estimated slope of the regression line. For example, $APC = -0.18\%$ means that, on average, the rate decreased by 0.18% annually over the segment of time of interest.

Relative survival

Survival was calculated from the date of the first invasive cervical cancer diagnosis. Women who were diagnosed with other malignancies within 6 months of the cervical cancer diagnosis date were kept in the analysis. The censor status of cancer cases was determined using emigration and death date information of the MHPR. The censor status could be determined only from 1984 to 1999 and consequently, relative survival analyses were performed from 1985 onward rather than from 1970. The five-year cumulative relative survival was computed using SAS™ codes developed by Paul Dickman (<http://www.pauldickman.com/teaching/toronto2002/index.html>) from the Department of Medical Epidemiology at Karolinska Institute in Stockholm. Cancer cases confirmed by death certificate only or with an unofficial death source of information were not included in the analyses.

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APPENDIX A. DETAILED TABLES

Table 15. Incident numbers of invasive cancers* by time period

1970-74				1975-79			
Rank	Cancer site	Number	%	Rank	Cancer site	Number	%
1	Breast	2007	28.7	1	Breast	2251	27.0
2	Colon/rectum	1059	15.2	2	Colon/rectum	1359	16.3
3	Uterus body	479	6.9	3	Uterus body	629	7.5
4	Ovary	337	4.8	4	Lung	493	5.9
5	Cervix	325	4.7	5	Cervix	377	4.5
	All other sites	2779	39.8		All other sites	3223	38.7
1980-84				1985-89			
Rank	Cancer site	Number	%	Rank	Cancer site	Number	%
1	Breast	2585	27.4	1	Breast	2890	27.1
2	Colon/rectum	1436	15.2	2	Colon/rectum	1587	14.9
3	Lung	779	8.2	3	Lung	1095	10.3
4	Uterus body	656	6.9	4	Uterus body	674	6.3
5	Ovary	436	4.6	5	Lymphoma†	442	4.1
6	Lymphoma†	380	4.0	6	Ovary	428	4.0
7	Cervix	341	3.6	7	Cervix	311	2.9
	All other sites	2837	30.0		All other sites	3251	30.4
1990-94				1995-99			
Rank	Cancer site	Number	%	Rank	Cancer site	Number	%
1	Breast	3366	28.9	1	Breast	3686	29.1
2	Colon/rectum	1555	13.3	2	Colon/rectum	1693	13.4
3	Lung	1329	11.4	3	Lung	1624	12.8
4	Uterus body	697	6.0	4	Uterus body	766	6.0
5	Ovary	478	4.1	5	Lymphoma†	543	4.3
6	Lymphoma†	476	4.1	6	Ovary	505	4.0
7	Pancreas	311	2.7	7	Leukaemia	329	2.6
8	Cervix	297	2.5	8	Pancreas	325	2.6
	All other sites	3144	27.0	9	Skin	282	2.2
				10	Kidney	280	2.2
				11	Cervix	276	2.2
					All other sites	2629	21.1

* Non-melanoma skin cancer was excluded

† Non-Hodgkin's lymphoma

Table 16. Number of deaths from cancers by time period

1970-74				1975-79			
Rank	Cancer site	Number [†]	%	Rank	Cancer site	Number [†]	%
1	Colon/rectum	--	15.9	1	Colon/rectum	--	15.7
2	Breast	--	13.8	2	Breast	--	15.6
3	Lung	--	8.8	3	Lung	--	10.6
4	Stomach	--	7.8	4	Pancreas	--	6.4
5	Pancreas	--	7.2	5	Stomach	--	5.0
6	Ovary	--	6.6	6	Ovary	--	5.0
7	Liver	--	4.6	7	Leukaemia	--	3.3
8	Leukaemia	--	3.3	8	Liver	--	3.0
9	lymphoma*	--	2.9	9	lymphoma*	--	3.0
10	Brain	--	2.8	10	Brain	--	2.6
11	Cervix	--	2.7	11	Uterus body	--	2.5
	All other sites	--	23.6	12	Cervix	--	2.3
					All other sites	--	25.0

1980-84				1985-89			
Rank	Cancer site	Number	%	Rank	Cancer site	Number	%
1	Breast	877	19.1	1	Breast	1054	19.5
2	Colon/rectum	745	16.3	2	Lung	859	15.9
3	Lung	583	12.7	3	Colon/rectum	807	14.9
4	Pancreas	300	6.5	4	Pancreas	290	5.4
5	Ovary	250	5.5	5	Ovary	279	5.2
6	Stomach	214	4.7	6	Stomach	226	4.2
7	lymphoma*	200	4.4	7	lymphoma*	216	4.0
8	Leukaemia	133	2.9	8	Leukaemia	171	3.2
9	Uterus body	116	2.5	9	Liver	153	2.8
10	Liver	115	2.5	10	Cervix	126	2.3
11	Brain	113	2.5	11	Uterus body	126	2.3
12	Cervix	109	2.4		All other sites	1101	20.3
	All other sites	829	18.0				

1990-94				1995-99			
Rank	Cancer site	Number	%	Rank	Cancer site	Number	%
1	Lung	1113	19.3	1	Lung	1214	21.3
2	Breast	1004	17.5	2	Breast	1010	17.7
3	Colon/rectum	768	13.3	3	Colon/rectum	647	11.3
4	Pancreas	310	5.4	4	lymphoma*	291	5.1
5	Ovary	270	4.7	5	Ovary	283	5.0
6	lymphoma*	268	4.7	6	Pancreas	276	4.8
7	Stomach	211	3.7	7	Leukaemia	174	3.0
8	Leukaemia	165	2.9	8	Liver	171	3.0
9	Kidney	142	2.5	9	Stomach	140	2.5
10	Liver	138	2.4	10	Kidney	127	2.2
11	Brain	130	2.3	11	Uterus body	90	1.6
12	Cervix	125	2.2	12	Multiple myeloma	90	1.6
	All other sites	1109	19.1	13	Brain	83	1.5
				13	Bladder	73	1.3
				14	Cervix	70	1.2
					All other sites	968	16.9

* Non-Hodgkin's lymphoma

† See the method section for details on missing numbers

Table 17. Number of new cases of and deaths from invasive cervical cancer

Year	Incident cases								Deaths							
	Age groups							Total	Age groups							Total
	<30	30-39	40-49	50-59	60-69	70-79	80+		<30	30-39	40-49	50-59	60-69	70-79	80+	
1970	7	18	26	9	16	7	6	89	1	2	5	4	11	7	2	32
1971	5	8	15	19	9	6	1	63	1	1	6	5	4	2	4	23
1972	5	5	11	13	7	6	2	49	0	2	4	6	4	0	0	16
1973	5	7	10	12	16	6	3	59	0	2	1	4	3	2	3	15
1974	4	6	13	10	21	5	6	65	1	1	4	6	6	6	5	29
1975	19	11	13	16	11	4	2	76	0	2	4	6	5	1	4	22
1976	12	24	13	9	17	7	8	90	0	2	2	2	5	6	1	18
1977	13	13	18	5	11	5	7	72	0	1	2	2	10	2	4	21
1978	5	10	16	12	12	8	0	63	1	3	4	2	1	5	5	21
1979	10	13	11	17	7	5	13	76	0	1	4	2	4	2	2	15
1980	11	10	7	13	8	5	7	61	0	0	3	5	1	2	6	17
1981	6	12	17	9	6	11	2	63	0	2	4	0	2	1	4	13
1982	14	13	16	8	14	8	6	79	2	2	3	3	5	6	2	23
1983	7	13	12	15	10	7	8	72	2	4	4	2	5	7	4	28
1984	10	16	9	11	10	5	5	66	2	2	4	2	2	4	4	20
1985	6	15	13	7	14	9	1	65	1	3	4	4	4	6	5	27
1986	1	11	16	6	13	5	3	55	1	1	4	3	6	3	3	21
1987	11	14	7	7	10	11	3	63	1	0	5	2	5	5	4	22
1988	6	17	7	5	7	10	5	57	0	3	4	3	5	2	1	18
1989	6	18	13	8	12	10	4	71	1	1	4	2	5	5	5	23
1990	3	18	9	10	7	11	1	59	0	4	1	2	3	3	5	18
1991	6	14	14	3	8	4	4	53	0	2	4	0	3	5	1	15
1992	8	10	15	5	8	8	5	59	0	2	5	2	4	4	4	21
1993	2	13	14	11	12	9	5	66	1	2	4	2	7	2	6	24
1994	6	13	12	8	8	6	7	60	0	4	5	2	6	3	6	26
1995	7	11	6	9	2	5	1	41	0	1	7	4	3	3	3	21
1996	5	13	20	8	11	9	5	71	2	0	3	2	1	1	3	12
1997	4	17	13	3	6	4	5	52	0	1	2	6	2	5	1	17
1998	5	12	13	10	7	9	5	61	0	1	1	0	1	3	4	10
1999	4	12	14	8	8	4	1	51	1	1	5	2	4	2	3	18

Table 18. Age distribution of incident cases of and deaths from invasive cervical cancer by time period (proportions)

year	Incident cases								Deaths							
	Age groups							Total	Age groups							Total
	≤29	30-39	40-49	50-59	60-69	70-79	≥80		≤29	30-39	40-49	50-59	60-69	70-79	≥80	
1970-74	0.08	0.14	0.23	0.19	0.21	0.09	0.06	325	0.03	0.07	0.17	0.22	0.24	0.15	0.12	115
1975-79	0.16	0.19	0.19	0.16	0.15	0.08	0.08	377	0.01	0.09	0.16	0.14	0.26	0.16	0.16	97
1980-84	0.14	0.19	0.18	0.16	0.14	0.11	0.08	341	0.06	0.10	0.18	0.12	0.15	0.20	0.20	101
1985-89	0.10	0.24	0.18	0.11	0.18	0.14	0.05	311	0.04	0.07	0.19	0.13	0.23	0.19	0.16	111
1990-94	0.08	0.23	0.22	0.12	0.14	0.13	0.07	297	0.01	0.13	0.18	0.08	0.22	0.16	0.21	104
1995-99	0.09	0.24	0.24	0.14	0.12	0.11	0.06	276	0.04	0.05	0.23	0.18	0.14	0.18	0.18	78

* N: number of women

Table 19. Age-specific and age-standardised incidence and mortality rates (/100,000 women) of invasive cervical cancer

Year	Incident cases					Deaths				
	Age groups				Overall	Age groups				Overall
	<30	30-49	50-69	70+		<30	30-49	50-69	70+	
1970	2.7	40.3	29.0	38.4	21.6	0.4	6.4	17.4	26.6	7.3
1971	1.9	21.1	31.9	20.1	14.1	0.4	6.4	10.3	17.3	5.0
1972	1.9	14.8	22.2	22.6	10.7	0.0	5.5	11.1	0.0	3.6
1973	1.9	15.7	30.4	24.8	12.9	0.0	2.8	7.6	13.8	3.2
1974	1.5	17.4	33.1	29.6	13.9	0.4	4.6	12.8	29.6	5.9
1975	7.0	21.9	28.3	15.7	15.9	0.0	5.5	11.5	13.1	4.6
1976	4.4	33.4	26.9	37.9	20.0	0.0	3.6	7.2	17.7	3.8
1977	4.8	27.3	16.4	29.4	15.6	0.0	2.6	12.3	14.7	4.1
1978	1.9	22.4	24.4	19.0	13.5	0.4	6.0	3.0	23.7	4.3
1979	3.8	20.4	24.3	41.4	15.2	0.0	4.3	6.1	9.2	3.1
1980	4.2	14.3	21.2	26.8	11.9	0.0	2.5	6.0	17.9	3.1
1981	2.3	23.9	15.1	28.1	13.4	0.0	5.0	2.0	10.8	2.7
1982	5.4	23.4	22.0	29.3	15.8	0.8	4.0	8.0	16.8	4.3
1983	2.7	19.5	25.0	30.3	13.9	0.8	6.3	7.0	22.2	5.2
1984	3.9	18.9	21.0	19.5	12.6	0.8	4.5	4.0	15.6	3.7
1985	2.3	20.5	21.1	18.8	12.5	0.4	5.1	8.0	20.7	4.7
1986	0.4	19.3	19.1	14.7	10.7	0.4	3.6	9.1	11.0	3.7
1987	4.3	14.6	17.2	25.1	11.3	0.4	3.5	7.1	16.1	3.7
1988	2.4	16.2	12.2	26.5	10.1	0.0	4.7	8.1	5.3	3.3
1989	2.4	20.5	20.4	24.2	12.8	0.4	3.3	7.2	17.3	3.7
1990	1.2	17.4	17.5	20.3	10.6	0.0	3.2	5.2	13.5	2.8
1991	2.5	17.7	11.4	13.2	9.5	0.0	3.8	3.1	9.9	2.5
1992	3.3	15.5	13.6	20.8	10.1	0.0	4.3	6.3	12.8	3.3
1993	0.8	16.4	23.9	22.0	11.2	0.4	3.6	9.4	12.6	3.7
1994	2.5	14.9	16.6	20.0	10.1	0.0	5.4	8.3	13.8	4.0
1995	3.0	10.0	11.4	9.1	7.1	0.0	4.7	7.2	9.1	3.3
1996	2.1	19.2	19.4	21.0	11.8	0.8	1.7	3.1	6.0	1.8
1997	1.7	17.6	9.0	13.4	8.8	0.0	1.8	8.0	8.9	2.6
1998	2.1	14.7	16.6	20.7	9.9	0.0	1.2	1.0	10.3	1.3
1999	1.7	15.3	15.3	7.4	8.8	0.4	3.5	5.7	7.4	2.8

Table 20. Number of prevalent cases of invasive cervical cancer

Year	2-year					5-year					Total				
	Age groups				Total	Age groups				Total	Age groups				Total
	<30	30-49	50-69	70+		<30	30-49	50-69	70+		<30	30-49	50-69	70+	
1985	--	--	--	--	--	--	--	--	--	--	6	28	21	10	65
1986	7	53	36	17	113	--	--	--	--	--	7	53	36	17	113
1987	12	47	35	22	116	--	--	--	--	--	17	69	49	30	165
1988	11	49	26	27	113	--	--	--	--	--	17	87	56	38	198
1989	12	53	33	26	124	19	108	72	46	245	19	108	72	46	245
1990	9	57	37	25	128	17	110	74	46	247	17	128	87	52	284
1991	8	53	26	23	110	17	123	61	49	250	17	151	89	57	314
1992	14	51	24	19	108	22	122	63	48	255	25	168	98	67	358
1993	9	51	36	24	120	17	123	71	48	259	20	187	112	73	392
1994	8	51	31	28	118	15	115	60	53	243	18	197	116	87	418
1995	12	40	24	19	95	17	101	55	41	214	20	194	120	91	425
1996	11	49	30	18	108	17	99	67	41	224	20	212	131	96	459
1997	8	61	27	20	116	14	112	57	38	221	15	237	134	101	487
1998	8	54	24	21	107	14	114	58	40	226	15	244	145	106	510
1999	9	50	33	15	107	13	120	65	31	229	14	254	166	105	539

Table 21. 5-Year prevalence rates (/100,000 women) of invasive cervical cancer

Year	Age groups				Total
	<30	30-49	50-69	70+	
1989	7.6	71.4	73.6	79.6	44.0
1990	6.9	71.0	76.4	77.7	44.3
1991	7.0	77.6	63.3	80.7	44.7
1992	9.1	75.5	65.7	77.0	45.4
1993	7.1	74.7	73.9	75.3	45.9
1994	6.3	68.6	62.2	81.6	42.3
1995	7.2	59.3	56.8	62.1	37.6
1996	7.2	57.7	68.5	61.4	39.2
1997	6.0	65.5	57.1	56.5	38.6
1998	6.0	67.1	56.8	59.0	39.4
1999	5.6	70.7	62.3	45.6	39.8

Table 22. Distribution of morphological types (number) of invasive cervical cancer by year and age at diagnosis

Year	Squamous cell carcinoma					Adenocarcinoma				
	Age groups				Total	Age groups				Total
	<30	30-49	50-69	70+		<30	30-49	50-69	70+	
1970	6	37	23	8	74	0	4	1	2	7
1971	3	20	24	6	53	0	0	2	1	3
1972	5	10	16	7	38	0	0	1	0	1
1973	4	17	26	7	54	0	0	2	0	2
1974	3	14	23	7	47	0	1	5	3	9
1975	15	23	24	4	66	1	1	1	1	4
1976	8	30	23	10	71	0	2	2	3	7
1977	8	21	14	10	53	1	4	0	1	6
1978	3	21	17	5	46	1	2	4	1	8
1979	8	18	20	14	60	2	3	1	3	9
1980	6	15	14	9	44	1	1	5	1	8
1981	5	24	11	11	51	0	2	3	0	5
1982	13	25	21	12	71	0	1	0	2	3
1983	7	22	19	13	61	0	2	5	1	8
1984	9	23	16	4	52	0	2	4	5	11
1985	6	26	19	9	60	0	1	2	0	3
1986	1	22	15	6	44	0	4	4	2	10
1987	9	17	15	11	52	2	2	1	3	8
1988	4	20	10	12	46	2	3	1	2	8
1989	4	21	17	11	53	1	6	3	1	11
1990	3	17	12	10	42	0	3	3	2	8
1991	5	22	7	5	39	1	4	2	2	9
1992	7	18	12	10	47	1	2	0	3	6
1993	2	21	20	12	55	0	4	2	1	7
1994	6	22	13	10	51	0	2	1	1	4
1995	4	13	9	5	31	3	3	2	1	9
1996	4	21	13	12	50	0	8	5	1	14
1997	3	21	7	5	36	1	8	2	2	13
1998	4	17	10	7	38	0	5	6	4	15
1999	4	18	11	3	36	0	5	4	1	10

Table 23. Age-specific and age-standardised incidence rates (/100,000 women) of invasive cervical cancer by morphological type

Year	Squamous cell carcinoma					Adenocarcinoma				
	Age groups				Overall	Age groups				Overall
	<30	30-49	50-69	70+		<30	30-49	50-69	70+	
1970	2.3	33.9	26.7	23.6	17.9	0.0	3.7	1.2	5.9	1.8
1971	1.1	18.3	27.3	17.3	12.0	0.0	0.0	2.3	2.9	0.6
1972	1.9	9.2	17.8	19.8	8.0	0.0	0.0	1.1	0.0	0.2
1973	1.5	15.7	28.3	19.3	11.9	0.0	0.0	2.2	0.0	0.4
1974	1.1	12.8	24.5	18.8	10.0	0.0	0.9	5.3	8.1	1.8
1975	5.6	21.0	25.2	10.5	14.0	0.4	0.9	1.0	2.6	0.9
1976	3.0	27.0	23.8	25.3	15.9	0.0	1.8	2.1	7.6	1.5
1977	3.0	18.5	14.3	24.5	11.4	0.4	3.5	0.0	2.5	1.4
1978	1.1	18.1	17.3	11.9	10.0	0.4	1.7	4.1	2.4	1.6
1979	3.0	15.3	20.2	32.2	11.9	0.8	2.6	1.0	6.9	1.8
1980	2.3	12.6	14.1	20.1	8.9	0.4	0.8	5.0	2.2	1.4
1981	1.9	19.8	11.0	23.8	10.8	0.0	1.7	3.0	0.0	1.0
1982	5.1	20.1	21.0	25.1	14.1	0.0	0.8	0.0	4.2	0.5
1983	2.7	17.2	19.0	26.2	11.8	0.0	1.6	5.0	2.0	1.5
1984	3.5	17.4	16.0	7.8	10.3	0.0	1.5	4.0	9.8	1.9
1985	2.3	19.1	19.1	16.9	11.6	0.0	0.7	2.0	0.0	0.6
1986	0.4	15.7	15.1	11.0	8.5	0.0	2.9	4.0	3.7	2.0
1987	3.5	11.8	15.2	19.7	9.4	0.8	1.4	1.0	5.4	1.3
1988	1.6	13.5	10.2	21.2	8.2	0.8	2.0	1.0	3.5	1.4
1989	1.6	13.9	17.4	19.0	9.4	0.4	4.0	3.1	1.7	2.1
1990	1.2	11.0	12.4	16.9	7.5	0.0	1.9	3.1	3.4	1.4
1991	2.1	13.9	7.3	8.2	7.1	0.4	2.5	2.1	3.3	1.5
1992	2.9	11.1	12.5	16.0	8.1	0.4	1.2	0.0	4.8	0.9
1993	0.8	12.7	20.8	18.8	9.4	0.0	2.4	2.1	1.6	1.2
1994	2.5	13.1	13.5	15.4	8.7	0.0	1.2	1.0	1.5	0.7
1995	1.7	7.6	9.3	7.6	5.3	1.3	1.8	2.1	1.5	1.6
1996	1.7	12.2	13.3	18.0	8.2	0.0	4.7	5.1	1.5	2.4
1997	1.3	12.3	7.0	7.4	6.2	0.4	4.7	2.0	3.0	2.2
1998	1.7	10.0	9.8	10.3	6.3	0.0	2.9	5.9	5.9	2.4
1999	1.7	10.6	10.5	4.4	6.2	0.0	2.9	3.8	1.5	1.7

Table 24. Cumulative relative survival of women diagnosed with invasive cervical cancer

Variables	Follow-up (years)				
	1	2	3	4	5
<i>Year</i>					
1985-89	0.89	0.78	0.72	0.69	0.68
1990-94	0.85	0.75	0.70	0.66	0.65
1995-99	0.85	0.77	0.72	0.71	0.72
<i>Age</i>					
20-29	0.96	0.91	0.88	0.88	0.88
30-39	0.94	0.89	0.87	0.85	0.84
40-49	0.91	0.79	0.69	0.66	0.64
50-59	0.83	0.72	0.70	0.68	0.66
60-69	0.82	0.70	0.65	0.63	0.63
70+	0.75	0.60	0.49	0.45	0.42
<i>Morphology</i>					
Squamous cell carcinoma	0.88	0.78	0.72	0.70	0.68
Adenocarcinoma	0.85	0.73	0.68	0.66	0.65
Adeno-squamous cell carcinoma	0.99	0.89	0.76	0.73	0.73
Other	0.48	0.38	0.33	0.33	0.34

Table 25. Number of cases of cervical cancer *in situ* by year and age at diagnosis

Year	Age groups							Total
	<30	30-39	40-49	50-59	60-69	70-79	80+	
1970	105	106	63	19	15	3	--	311
1971	82	104	50	14	4	1	--	255
1972	61	53	32	10	9	--	1	166
1973	80	95	40	17	9	3	1	245
1974	87	78	38	18	11	5	--	237
1975	100	82	41	20	16	3	--	262
1976	101	86	38	15	13	5	--	258
1977	150	134	49	20	15	5	--	373
1978	139	115	38	16	8	3	--	319
1979	181	127	30	31	4	3	1	377
1980	124	88	29	14	9	2	2	268
1981	108	90	29	18	5	--	--	250
1982	103	94	31	13	7	1	2	251
1983	104	87	26	7	10	6	--	240
1984	128	101	38	16	5	4	1	293
1985	159	128	49	19	5	5	2	367
1986	162	132	40	12	11	5	3	365
1987	165	150	46	10	10	4	2	387
1988	154	126	29	10	7	--	2	328
1989	146	145	50	20	11	5	2	379
1990	153	139	46	11	7	3	--	359
1991	135	114	35	21	11	6	1	323
1992	179	119	46	12	15	3	6	380
1993	208	158	42	11	20	9	4	452
1994	196	127	40	15	13	5	2	398
1995	184	117	42	15	10	5	--	373
1996	194	125	62	27	9	10	2	429
1997	244	132	57	18	11	3	1	466
1998	250	129	53	23	12	8	2	477
1999	176	139	64	15	16	8	--	418

Table 26. Age-specific and age-standardised incidence rates (/100,000 women) of cervical cancer *in situ* by year

Year	Age groups						Overall
	15-19	20-24	25-29	30-34	35-39	40+	
1970	6.4	73.2	230.7	215.9	187.7	56.5	75.7
1971	4.2	50.5	173.8	205.4	185.3	38.7	63.7
1972	0.0	55.5	103.7	121.8	74.7	28.9	39.3
1973	2.1	52.2	149.4	206.4	138.1	38.4	59.6
1974	2.0	65.5	141.9	174.3	97.1	39.2	54.7
1975	6.1	61.4	165.9	167.6	111.5	43.1	59.1
1976	2.0	60.1	167.9	164.6	120.5	37.8	57.9
1977	6.0	90.4	240.3	278.4	131.1	47.0	82.3
1978	4.0	98.9	204.9	225.6	112.1	34.0	68.7
1979	2.0	144.0	254.6	201.1	173.8	35.8	78.3
1980	14.3	89.9	168.7	151.8	96.7	28.9	56.1
1981	4.2	74.7	159.2	142.7	106.7	26.5	52.7
1982	6.5	51.3	166.0	136.3	117.7	27.2	52.4
1983	4.5	78.2	136.4	136.0	88.6	24.3	48.5
1984	16.2	65.1	188.7	158.1	93.1	31.3	58.5
1985	4.8	102.1	222.5	164.8	146.8	38.7	72.2
1986	16.8	117.4	200.9	179.4	131.9	33.8	70.2
1987	24.4	114.6	205.9	211.2	135.1	33.7	74.3
1988	14.8	102.0	207.0	155.0	134.8	22.2	62.1
1989	19.9	105.7	189.7	190.1	138.9	40.1	72.1
1990	15.1	128.0	197.4	180.4	131.1	30.1	68.0
1991	28.0	129.9	155.7	152.8	99.3	32.8	60.4
1992	18.0	191.9	217.6	152.1	109.2	35.8	70.4
1993	56.9	190.6	261.8	212.7	130.3	36.9	83.5
1994	67.4	207.6	221.2	185.1	89.3	31.6	73.7
1995	46.8	216.6	207.1	142.2	112.7	29.8	69.0
1996	54.5	202.7	245.8	191.2	85.1	44.8	78.6
1997	75.2	256.5	301.4	197.0	102.2	36.1	86.7
1998	101.1	257.6	291.0	197.5	104.4	38.8	88.9
1999	48.8	214.4	190.2	182.9	145.6	40.1	78.4

Table 27. Number of incident cases of cervical cancer *in situ* by Regional Health Authority (RHA^{*}) and time period

RHA [†]	1970-74		1975-79		1980-84		1985-89		1990-94		1995-99	
	N	%	N	%	N	%	N	%	N	%	N	%
Brandon	64	5.3	101	6.4	119	9.1	82	4.5	111	5.8	107	4.9
Burntwood	58	4.8	73	4.6	61	4.7	72	3.9	97	5.1	149	6.9
Central	67	5.5	82	5.2	82	6.3	75	4.1	113	5.9	149	6.9
Churchill	4	0.3	5	0.3	2	0.2	5	0.3	7	0.4	2	0.1
Interlake	58	4.8	83	5.2	65	5.0	114	6.2	103	5.4	125	5.8
Marquette	45	3.7	60	3.8	42	3.2	51	2.8	61	3.2	64	3.0
Norman	42	3.5	56	3.5	41	3.1	45	2.5	41	2.1	85	3.9
North Eastman	25	2.1	43	2.7	26	2.0	44	2.4	49	2.6	63	2.9
Parkland	36	3.0	72	4.5	43	3.3	61	3.3	48	2.5	67	3.1
South Eastman	20	1.6	33	2.1	24	1.8	41	2.2	60	3.1	54	2.5
South Westman	31	2.6	33	2.1	46	3.5	34	1.9	36	1.9	59	2.7
Winnipeg	754	62.1	940	59.2	742	57.0	1191	65.2	1176	61.5	1233	57.0
<i>Manitoba</i>	1214		1589		1302		1826		1912		2163	

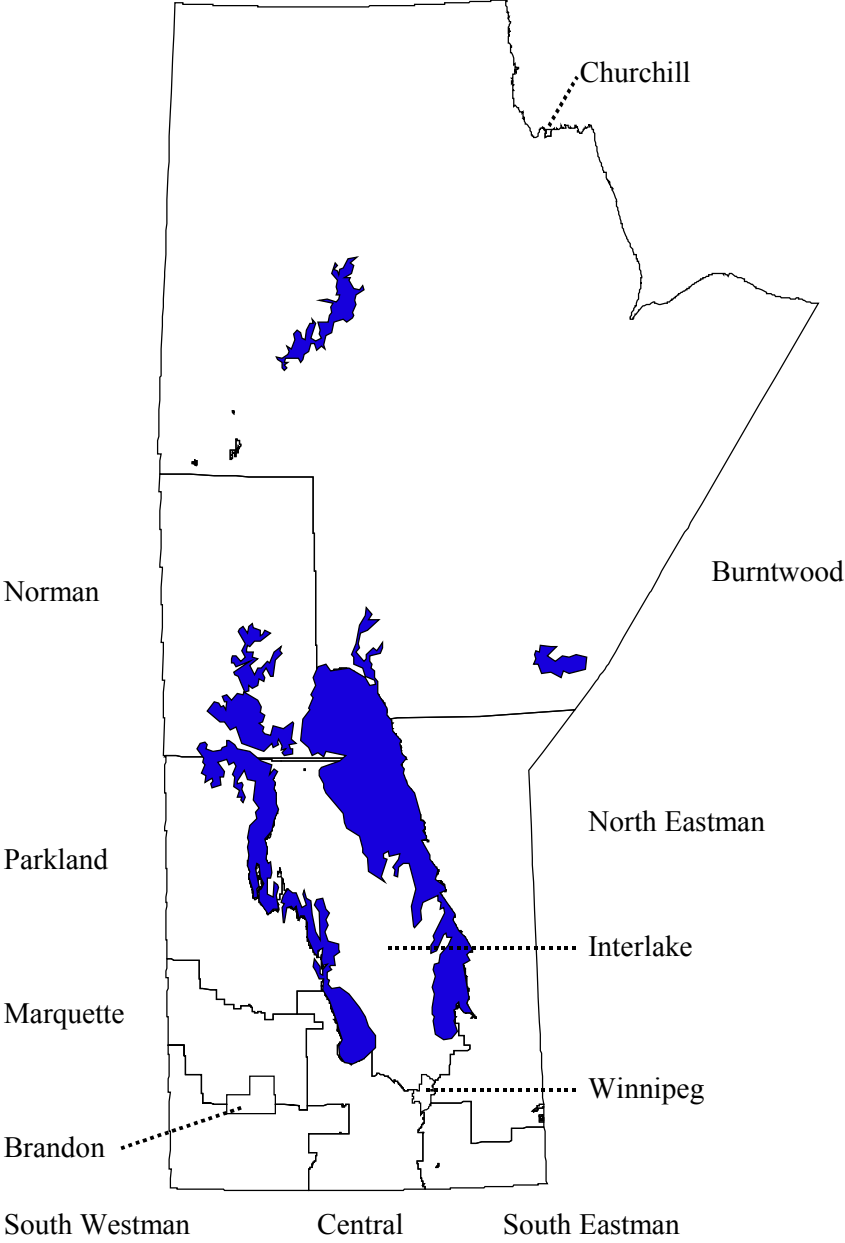
* According to the 2000 administrative delineation of RHAs

† Information was missing for 10 cases in 1970-74, 8 cases in 1974-79, 9 cases in 1980-84, 11 cases in 1985-89, 10 cases in 1990-94, and 6 cases in 1995-99

Table 28. Manitoba female population by year and age

Year	Age groups									Total
	<10	10-19	20-29	30-39	40-49	50-59	60-69	70-79	≥ 80	
1970	92908	96425	72180	52502	56776	50491	35744	22929	10955	490910
1971	91497	97812	76945	53166	55926	50953	36835	23025	11743	497902
1972	89002	98378	78943	53343	54843	51744	38205	23303	12140	499901
1973	86540	98823	81526	54406	53806	52441	39522	23800	12503	503367
1974	84752	99367	85281	56140	52869	53053	40732	24430	12789	509413
1975	83087	98869	88213	57632	52007	53315	42073	25111	13122	513429
1976	81826	97933	90534	59364	51579	53746	42931	25942	13613	517468
1977	81259	96493	91541	62660	51045	53881	43717	26778	14020	521394
1978	80695	94545	91993	65325	50743	54126	44258	27674	14457	523816
1979	79209	92155	91520	67146	50360	53996	44815	28602	14868	522671
1980	77453	90054	91677	68844	50053	53474	45704	29492	15321	522072
1981	76153	88419	92141	70881	50298	52890	46680	30489	15808	523759
1982	76186	86848	93879	73466	50714	52176	47796	31569	16167	528801
1983	76769	85272	96097	76149	51831	51502	48638	32783	16791	535832
1984	77263	83293	97320	78925	53196	50612	49287	33736	17460	541092
1985	77549	81677	98118	81827	54427	49824	49563	34890	18280	546155
1986	77780	80874	98057	84001	56120	49419	49916	35663	18883	550713
1987	78525	79930	96542	85426	58897	48690	50075	36227	19539	553851
1988	78921	79392	94373	86616	61441	48242	50140	36553	20136	555814
1989	79190	78699	91605	87511	63787	47900	49951	37047	20773	556463
1990	79738	77932	88754	88724	66205	47594	49314	37737	21434	557432
1991	80207	77315	86269	89773	68639	47923	48501	38584	22153	559364
1992	80737	76900	83725	90643	70886	48208	47714	39440	22913	561166
1993	80989	76882	81368	91542	73224	49220	46914	39968	23741	563848
1994	81074	77177	79242	91800	75880	50450	46047	40321	24662	566653
1995	81086	77577	77892	91671	78613	51558	45250	40489	25536	569672
1996	80683	78112	77141	90782	80651	53184	44687	40700	26073	572013
1997	79831	78220	76702	89144	81776	55747	44144	40766	26544	572874
1998	78647	78535	76529	86983	82941	58260	43896	40863	26906	573560
1999	77703	79202	76621	85385	84249	60593	43757	40677	27284	575471

APPENDIX B. MAP OF MANITOBA REGIONAL HEALTH AUTHORITIES, 2000



APPENDIX C. MORPHOLOGIC SUBGROUPS FOR CERVICAL CANCER

Type	Morphology	SNOP*	ICD-O†
Squamous cell carcinoma (in situ)	Carcinoma-in-situ, NOS	8012	
	Spindle, giant cell carcinoma, benign	8032	
	Squamous cell carcinoma-in-situ	8072	
	Carcinoma in situ, NOS, intraepithelial carcinoma		8010-2
	Large cell carcinoma, NOS, benign		8012-2
	Squamous cell carcinoma in situ		8070-2
	Squamous cell carcinoma, keratinizing, NOS, benign		8071-2
	Squamous cell carcinoma, large cell, nonkeratinizing, NOS, benign		8072-2
	Squamous cell carcinoma in situ with questionable stroma invasion		8076-2
	Squamous intraepithelial neoplasia, grade III, benign		8077-2
Squamous cell carcinoma (malignant)	Papillary, verrucous carcinoma	8053	
	Squamous cell carcinoma, epidermoid	8073	
	Bowen's disease Queyrat's erythroplasia	8082	
	Undifferentiated squamous cell carcinoma	8083	
	Carcinoma NOS, epithelial tumor, intraepithelial carcinoma		8010-3
	Large cell carcinoma, NOS		8012-3
	Verrucous carcinoma, squamous, epidermoid		8051-3
	Papillary squamous cell carcinoma epidermoid		8052-3
	Squamous cell carcinoma		8070-3
	Squamous cell carcinoma, keratinizing NOS		8071-3
	Squamous Cell Carcinoma large cell nonkeratinizing		8072-3
	Squamous Cell Carcinoma small cell nonkeratinizing		8073-3
	Squamous cell carcinoma, spindle cell		8074-3
	Squamous cell carcinoma microinvasive		8076-3
	Squamous intraepithelial neoplasia, grade III		8077-3
Adenocarcinoma (in situ)	Adenocarcinoma in-situ	8142	
	Adenocarcinoma in situ, NOS		8040-2
	Adenocarcinoma in situ, NOS		8140-2
Adenocarcinoma (malignant)	Adenocarcinoma NOS	8143	
	Papillary adenocarcinoma	8263	
	Mucinous adenocarcinoma	8483	
	Infiltrating duct adenocarcinoma	8503	
	Adenocarcinoma with squamous metaplasia	8573	
	Papillary carcinoma, NOS		8050-3
	Adenocarcinoma NOS		8140-3
	Adenocarcinoma in adenomatous polyp		8210-3
	Papillary adenocarcinoma, NOS		8260-3
	Clear cell adenocarcinoma		8310-3
	Endometrioid carcinoma, adenocarcinoma		8380-3
	Papillary serous cystadenocarcinoma adenocarcinoma		8460-3
	Mucinous adenocarcinoma		8480-3
	Mucin-producing adenocarcinoma		8481-3
	Adenocarcinoma with squamous metaplasia		8570-3
Adeno-squamous carcinoma (in situ)	Adenosquamous carcinoma, in situ	8562	
	Adenosquamous carcinoma, in situ		8560-2
Adeno-squamous carcinoma (malignant)	Adenosquamous carcinoma	8563	
	Adenoid squamous cell carcinoma		8075-3
	Mucoepidermoid carcinoma		8430-3
	Adenosquamous carcinoma		8560-3

Type	Morphology	SNOP*	ICD-O†
Other / Not stated (in situ)	Neoplasm, benign	8002	
	Small cell carcinoma, benign	8042	
	Neoplasm benign		8000-2
	Tumor cells, uncertain whether benign or malignant		8001-2
	Small cell carcinoma, NOS, Reserve cell, Round cell, SC neuroendocrine, benign		8041-2
	Lobular carcinoma in situ, NOS		8520-2
	Other / Not stated (malignant)	Neoplasm, malignant	8003
Carcinoma, epithelial carcinoma malignant		8013	
Undifferentiated carcinoma NOS		8023	
Spindle, giant cell carcinoma		8033	
Small cell carcinoma		8043	
Acinic cell adenocarcinoma		8553	
Leiomyosarcoma		8893	
Hepatoblastoma (this is an error)		8972	
Neoplasm malignant			8000-3
Tumor cells uncertain whether benign or malignant			8001-3
Giant cell carcinoma			8031-3
Small cell carcinoma NOS			8041-3
Lymphoepithelial carcinoma			8082-3
Adenoid cystic carcinoma, adenocarcinoma			8200-3
Neuroendocrine carcinoma			8246-3
Malignant melanoma NOS			8720-3
Sarcoma			8800-3
Leiomyosarcoma NOS			8890-3
Mullerian mixed tumor			8950-3
Carcinosarcoma NOS			8980-3

* SNOP: Systematised Nomenclature of Pathology; effective prior to 1982

† ICD-O: International Classification of Diseases for Oncology second edition (WHO 1976); effective from 1982 to 1999