BC Cancer Agency
CARE + RESEARCH
An agency of the Provincial Health Services Authority

Cervical Cancer Screening Program

Cervical Cancer Screening Program 2015 Annual Report

Updated: November 2016

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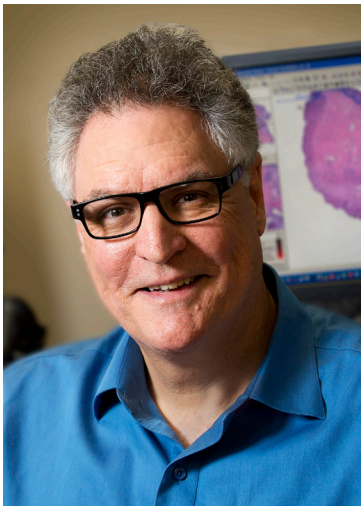
1.0 Message



Message from the Medical Director

We are pleased to present British Columbia's Cervical Cancer Screening Program's (CCSP) 2015 annual report. This report highlights the efforts and dedication of program and laboratory staff, as well as the healthcare providers of British Columbia.

The CCSP works in partnership with healthcare providers, regional health authorities, the Provincial Colposcopy Program and the Cervical Cancer Screening Laboratory to ensure eligible women have access to screening tests and follow up investigation.

The program reminds healthcare providers when their patients are due for screening, tracks adherence to screening recommendations, and monitors system performance and outcomes of cervical screening activities.

As demonstrated in Figure 1, cervical cancer incidence and mortality rates have remained low in British Columbia, clearly demonstrating the value of an organized population-based screening program.

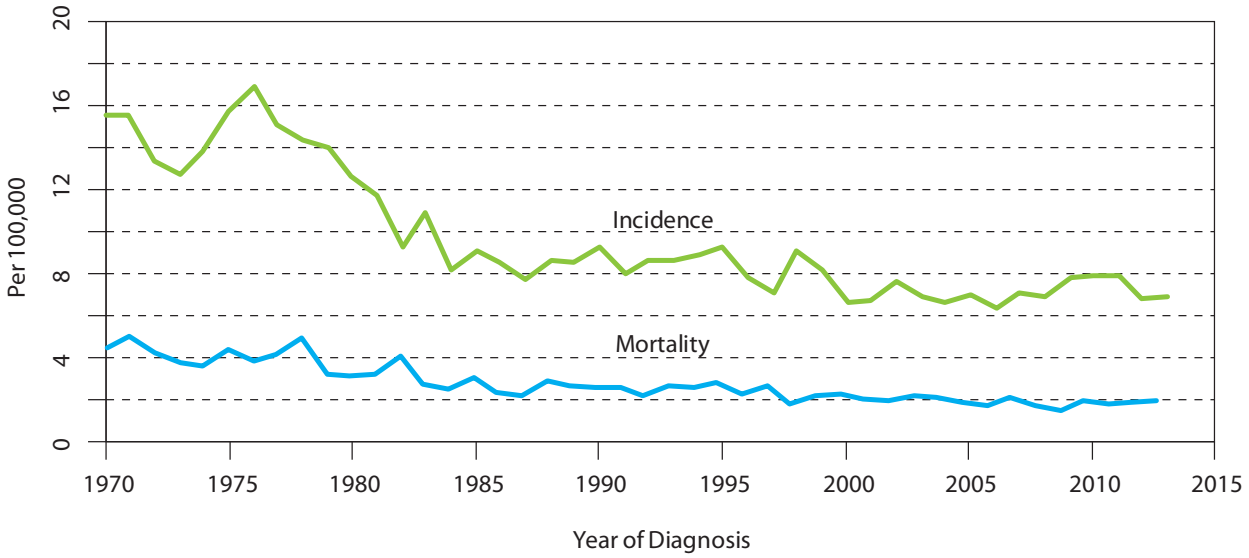
In 2014, a total of 467,754 women received Pap tests and 14,278 women required further follow-up including a repeat Pap test at six months, colposcopy or other investigations. A review of cervical cancers diagnosed in 2013 showed that 58% were 5 or more years overdue for screening or had never been screened.

The hysterectomy corrected cervical screening participation rate for women aged 21-69 years is currently 69.3%. This rate is lower for some regions in BC including urban areas like Richmond, Vancouver and the Fraser Valley. To this, we must continue to build awareness of the benefits of regular Pap tests.

We look forward to continuing to work together to provide screening to all eligible women in the prevention and early detection of cervical cancer in BC.

Dr. Dirk van Niekerk
Medical Director, Cervical Cancer Screening Program

Figure 1: Age Standardized Incidence & Mortality Rate of Invasive Cervical Cancer in BC



Notes:

1. Rates are standardized to the 1991 Canadian Population

Message from Director, Screening Operations

With a focus on decreasing cervical cancer incidence and mortality rates throughout British Columbia, the Cervical Cancer Screening Program (CCSP) plays an integral role in the province's cancer control strategy.

2015 was no exception, as it marked another year of encouraging progress for the program.

The results found in this report are indicative of that progress, as well as the contributions of many. The program's life-saving service and follow-up care could not be delivered to the women of British Columbia without the ongoing support of healthcare providers, community partners and stakeholders as well as the remarkable teamwork of our dedicated team of colposcopists, cytotechnologists, pathologists, laboratory staff and program staff.

In the coming year, the program will continue its exploration and implementation of new and innovative ways to promote regular screening to both healthcare providers and the eligible population we serve. Both audiences remain of utmost importance to us.

We hope you find this report insightful and informative.

On behalf of the Cervical Cancer Screening Program, thank you for your continued support. We look forward to continue demonstrating the value of an organized population-based screening program. Together we will make a difference.

Laura Gentile
Operations Director, Cancer Screening

2.0 Program Overview

The BC Cancer Agency's Cervical Cancer Screening Program (CCSP) holds the responsibility for overseeing cervical cancer screening in BC. In partnership with the Cervical Cancer Screening Laboratory (CCS Lab) of the Provincial Health Services Authority (PHSA) and the Provincial Colposcopy Program, the CCSP works to ensure that appropriate screening tests are available to eligible women. The program reminds healthcare providers when their patients are due for cervical screening, tracks adherence to screening recommendations, and monitors cervical screening system performance and outcomes.

The Screening Process

The Screening Process is illustrated in Figure 2 (Page 9). The process consists of four stages:

1. Identify and invite the target population for screening
2. Conduct screening examinations
3. Investigate abnormalities identified during screening
4. Send screening reminders at the appropriate interval

Evaluation

Data is collected and analyzed on an ongoing basis to monitor the Program's effectiveness and identify areas for improvement. Results of this analysis are presented in the "Program Results" section of this report. Age-specific cervical cancer incidence and mortality rates are tracked in conjunction with the BC Cancer Registry.

Promotion and Education

CCSP takes a proactive approach when promoting the importance of cervical cancer screening to eligible women in British Columbia. Key to this approach is the Screening Programs website (www.screeningbc.ca).

The website, a comprehensive online destination for patients seeking cancer screening-related information, is updated regularly and includes a number of features that allow for better overall accessibility to information for all. Features include a searchable document library, a drop-in clinic locator for unattached patients with Google Maps, and a fully mobile-friendly design.

A healthcare professionals section is also available on the website, aimed at keeping providers updated about current screening recommendations and equipped with the most recent forms and manuals. This section provides easy access to up-to-date resources, such as evidence-based research, fact sheets and promotional items, to encourage and aid cancer screening discussions with patients.

The program's ongoing promotion activities include:

- Production and distribution of promotional tools, such as brochures, instructional videos, posters and promotional giveaways that effectively communicate the benefits of cervical cancer screening;
- A Twitter account (@BCCancer_Agency) that promotes relevant information about cancer screening;
- Regular presence at health fairs and events throughout British Columbia.

Commitment to Quality

Accreditation: The CCS Lab continues to demonstrate an ongoing commitment to providing quality patient care by following internationally recognized standards of excellence in lab practices.

As of 2016, the CCS Lab has participated in its third on-site accreditation inspection by the College of American Pathologists (CAP), an internationally recognized leader in laboratory quality assurance and accreditation programs. In addition, in 2015, the CCS Lab achieved accreditation by the College of Physicians and Surgeons of British Columbia Diagnostic Accreditation Program (DAP). The CCS Lab was unable to be accredited by DAP previously due to DAP's lack of gynecological cytology lab standards. However, DAP recently finalized and incorporated gynecological cytology standards into their accreditation assessments.

To ensure continuous quality improvement, the CCS Lab monitors and evaluates quality indicators and obtains clinician feedback on a regular basis through a variety of methods.

Professional Development: Continuing education is encouraged and expected for all CCS Lab staff. In addition to participating in CAP and American Society for Clinical Pathology (ASCP) educational programs, CCS Lab staff participate in organized internal education forums and cyto-morphological group discussions. Appropriate on-site resources such as cytology text books and the Acta Cytologica journal are available as educational references.

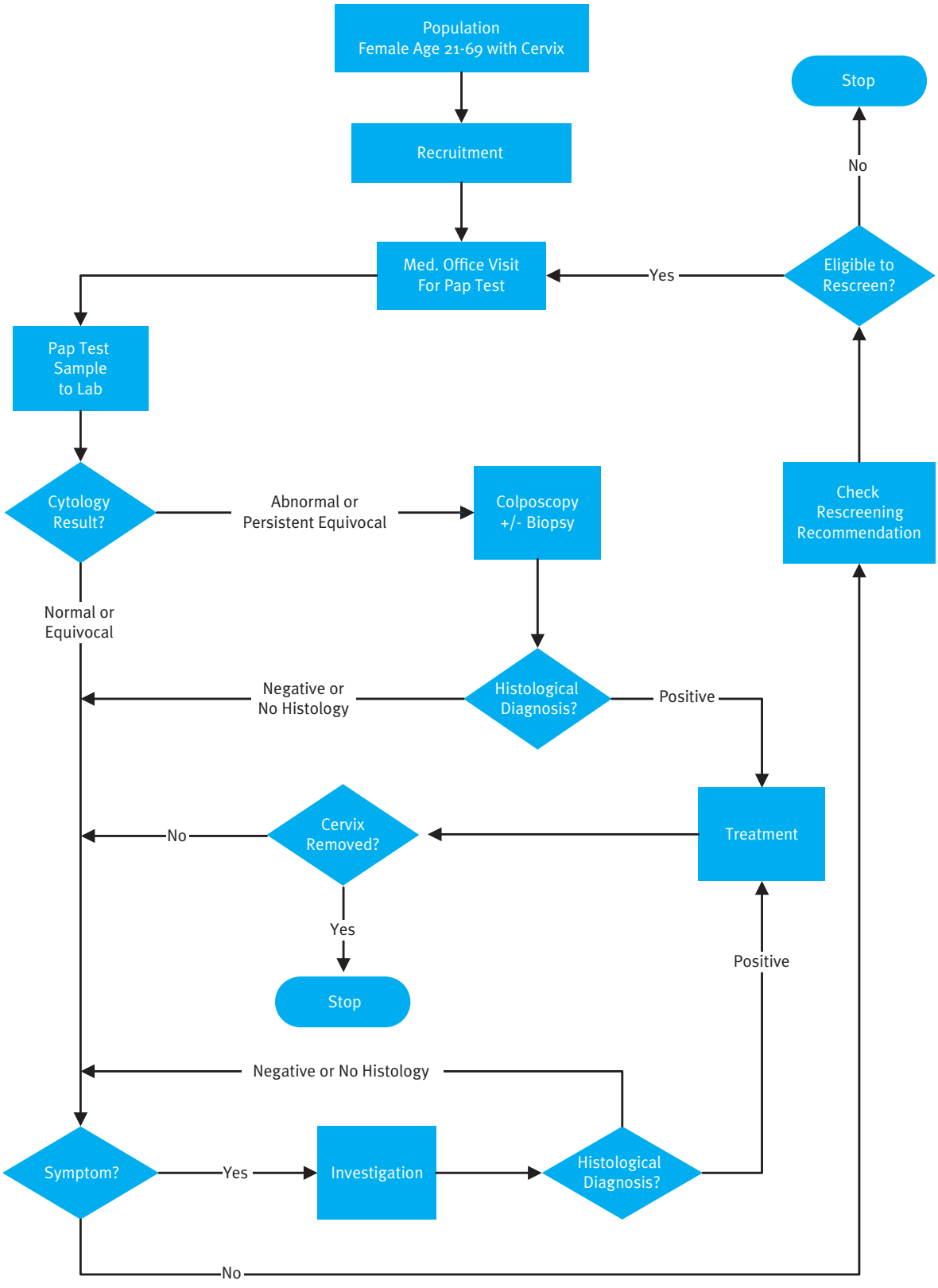
Pathologists associated with the program participate in the Royal College of Physicians and Surgeons certification or equivalent programs.

Professional and Academic Activities: Professional staff members of the Cervical Cancer Screening Program (CCSP) are involved in research, professional development, and teaching related to cervical cancer screening.

The HPV FOCAL Study, evaluating primary HPV testing for cervical cancer screening, entered the final phases of trial activity in 2015. Over 25,000 BC women originally consented, and there are now approximately 1,700 BC health care providers who have seen HPV FOCAL participants in their practices.

The investigative team was invited to present trial findings at international scientific meetings in 2015, and preliminary final trial results will be available late 2016. The results of this landmark BC Cancer Agency trial will influence cervical cancer screening program policy throughout Canada in the years to come.

Figure 2: CCSP Screening Process Overview



3.0 Program Results

3.1 Utilization

BC healthcare providers submitted a total of 467,754 gynecological Pap test samples to the Cervical Cancer Screening Laboratory (CCSL) in 2014. An additional 3,725 samples were submitted from the Yukon Territory. The program results in this report include samples from BC only.

Table 1 shows the number of gynecological Pap test samples received by 10-year age groups. The samples received include those from clinically asymptomatic women (routine screening), women with previously detected abnormalities, and a small percentage of symptomatic women. Unlabeled or improperly labeled samples were not processed. Over 98% of the samples received were from the cervix/endocervix.

Table 1: Gynecological Cytology Samples Received / Processed, 2014

	<20	20-29	30-39	40-49	50-59	60-69	70+	All Ages
Number of Samples	8,465	92,545	106,781	99,201	96,627	60,743	3,377	467,754
Number of Samples Processed	8,240	90,550	104,677	97,299	94,895	59,620	3,285	458,577
(%)	97.3	97.8	98.0	98.1	98.2	98.2	97.3	98.0
Samples from Cervix Endocervix	8,219	90,265	104,105	95,702	92,171	57,007	2,665	450,145
(%)	99.7	99.7	99.5	98.4	97.1	95.6	81.1	98.2
Samples from Other Sites	21	285	572	1,597	2,724	2,613	620	8,432
(%)	0.2	0.3	0.5	1.6	2.9	4.4	18.9	1.8

NOTES:

1. CCSP data extraction date: 11/26/2015
2. Age is computed based on sample date

Table 2 shows the number and percentage of women having one, two, and three or more cervical/endocervical Pap tests in the 2014 year. Also shown in Table 2 are the number of women being screened for the first time.

Table 2: Number of Patients with Cervical/Endocervical Pap Test Samples, 2014

	<20	20-29	30-39	40-49	50-59	60-69	70+	All Ages
Number of Patients	7,834	86,086	100,450	93,416	90,845	56,460	2,639	437,732
With 1 Sample	7,555	82,153	96,746	91,152	89,480	55,895	2,606	425,588
(%)	96.4	95.4	96.3	97.6	98.5	99.0	98.7	97.2
With 2 Samples	272	3,837	3,647	2,207	1,341	551	33	11,888
(%)	3.5	4.5	3.6	2.4	1.5	1.0	1.3	2.7
With 3+ Samples	7	96	57	57	24	14		256
(%)	0.1	0.1	0.1	0.1	0.0	0.0		0.1
New Patients	4,101	15,592	7,763	3,499	2,019	1,276	130	34,381
(%)	52.3	18.1	7.7	3.7	2.2	2.3	4.9	7.9

Notes:

1. CCSP data extraction date: 11/26/2015
2. Age is computed on patient's last Pap test

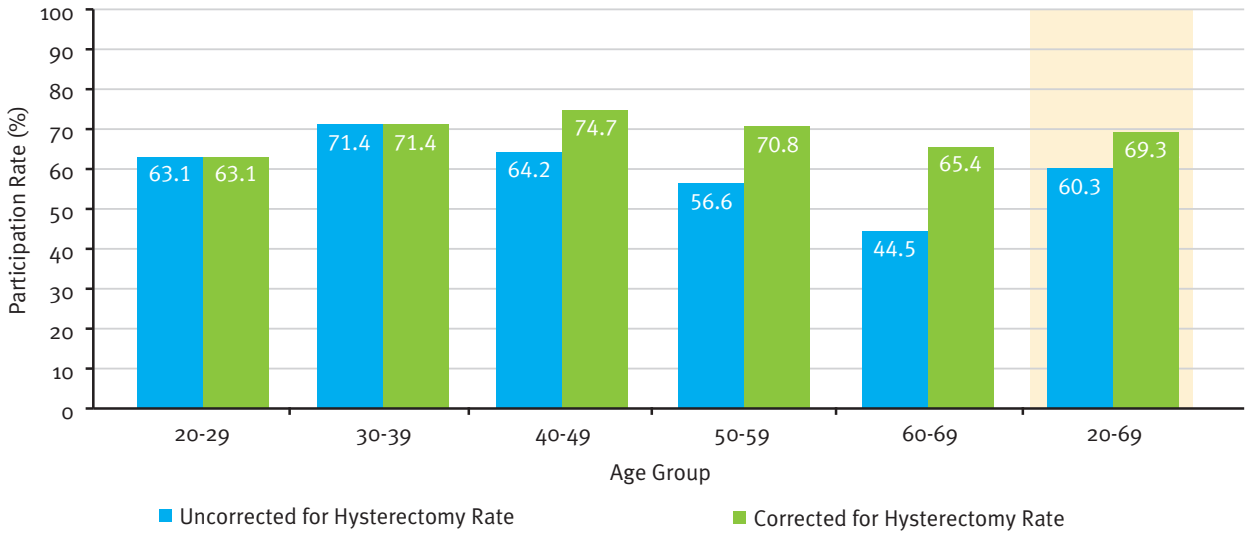
3.2 Participation Rates

The BC cervical cancer screening policy effective during this reporting period (see Appendix 2) advises women to begin screening at age 21 or approximately three years after first sexual contact, whichever occurs first. Women should continue having a Pap test once a year until they have three consecutive normal results. At that point, women should be screened every two years until age 69. At age 69, women can discontinue screening if no significant abnormality has been detected in their screening history.

Participation rate is defined as the percent of eligible women with at least one cervical/endocervical Pap test in a three-year period. The participation rate should exclude women who have had a total hysterectomy, as most of these women do not need routine screening. In 2012, BC started using data from Statistic Canada's Canadian Community Health Survey (CCHS), to correct for hysterectomy rates in BC. However, due to the survey's small sample size, the hysterectomy correction can only be applied in two ways: by 10-year age group for the entire province or by Health Authority for age 20-69 combined.

Figure 3 shows the uncorrected and corrected participation rates by age group. The uncorrected and corrected participation rates for the BC female population ages 20-69 are 60.3% and 69.3% respectively. There is considerably more variation in the uncorrected rates across the age groups, from 71.4% among women ages 30-39 to 44.5% among women ages 60-69. With correction for hysterectomy, participation is highest at 74.7% among women 40-49 years of age, and participation is lowest among women ages 20-29 at 63.1%. This illustrates the importance of correcting for hysterectomy to avoid misdirecting promotional efforts.

Figure 3: Participation Rates by Age Group, 2012–2014



Notes:

1. Based on weighted average of 2012, 2013 and 2014 female population estimates
2. Population data source: P.E.O.P.L.E 2015 (Sept 2015), BC STATS, Service BC, BC Ministry of Citizens' Services
3. Hysterectomy adjustment calculated using 2008 Canadian Community Health Survey
4. CCSP data extraction date: November 26, 2015
5. Age is computed based on patient's age in 2013

Table 3 lists the uncorrected participation rates by Health Service Delivery Area (HSDA) for the younger female population in which hysterectomy is less prevalent. HSDAs with smaller populations are susceptible to year over year participation fluctuation due to population estimate changes from Statistics Canada.

Key highlights include:

- Participation in the 20-29 age group is a challenge in the Lower Mainland - especially in Richmond, Vancouver, and across Fraser Health Authority.
- Participation in the 30-39 age group was the lowest for Fraser East and Fraser South.,
- Although participation is generally higher in the 30-39 age group than in the 20-29 age group, the opposite occurred in some HSDAs in the Interior and Island Health and for all Northern Health HSDAs.

Table 3: Participation Rates (%) of Women 20-29 and 30-39 Years of Age by HSDA, 2012–2014

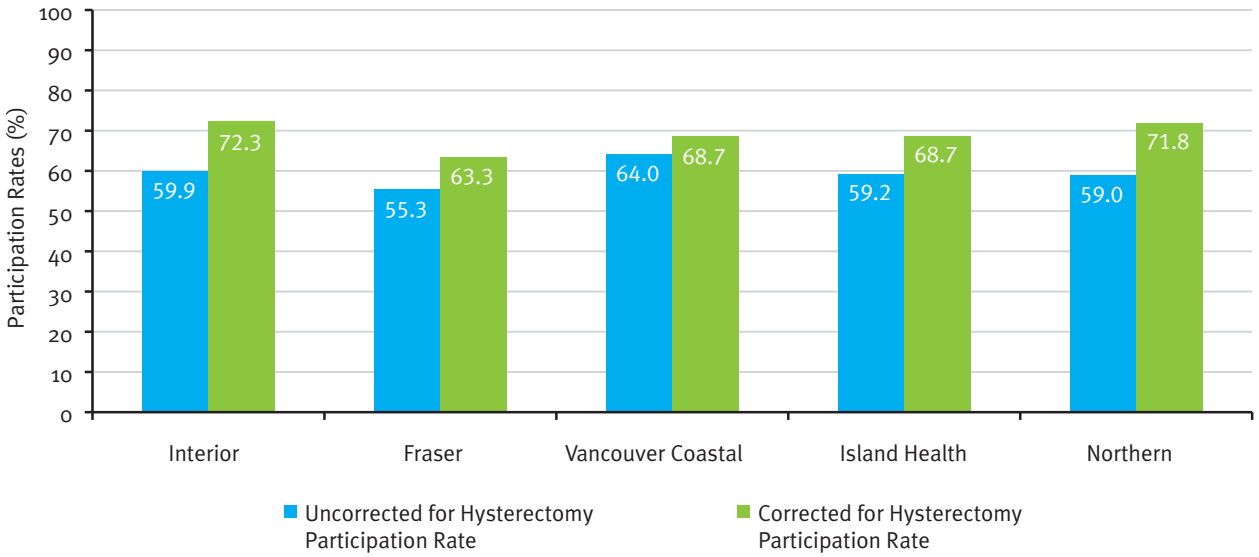
Health Authority	Health Service Delivery Area	20-29	30-39
Interior	East Kootenay	84.4	79.3
	Kootenay Boundary	83.4	73.6
	Okanagan	72.4	75.2
	Thompson Cariboo Shuswap	74.1	68.4
Fraser	Fraser East	58.4	64.1
	Fraser North	50.8	67.1
	Fraser South	53.2	64.5
Vancouver Coastal	Richmond	47.4	67.5
	Vancouver	55.2	73.3
	North Shore/Coast Garibaldi	70.8	82.3
Vancouver Island	South Vancouver Island	62.5	72.5
	Central Vancouver Island	70.4	68.6
	North Vancouver Island	76.0	69.3
Northern	Northwest	78.7	74.0
	Northern Interior	74.4	70.5
	Northeast	72.0	67.0
BC		63.1	71.4

Notes:

1. Based on weighted average of 2012, 2013 and 2014 female population estimates
2. Population data source: P.E.O.P.L.E. 2015 (Sept 2015), BC STATS, Service BC, BC Ministry of Citizen's Services
3. HSDA data acquired from Research Data Access Services, BC Ministry of Health
4. CCSP data extraction date: 11/26/2015
5. Age is computed based on patient's age in 2013

Figure 4 compares the hysterectomy corrected participation rate against the uncorrected rate by Health Authority. Interior Health Authority has the highest overall corrected participation (72.3%), while Fraser Health Authority has the lowest (63.3%). Using the uncorrected rates would provide a different impression.

Figure 4: Participation Rates by Health Authority, 2012–2014



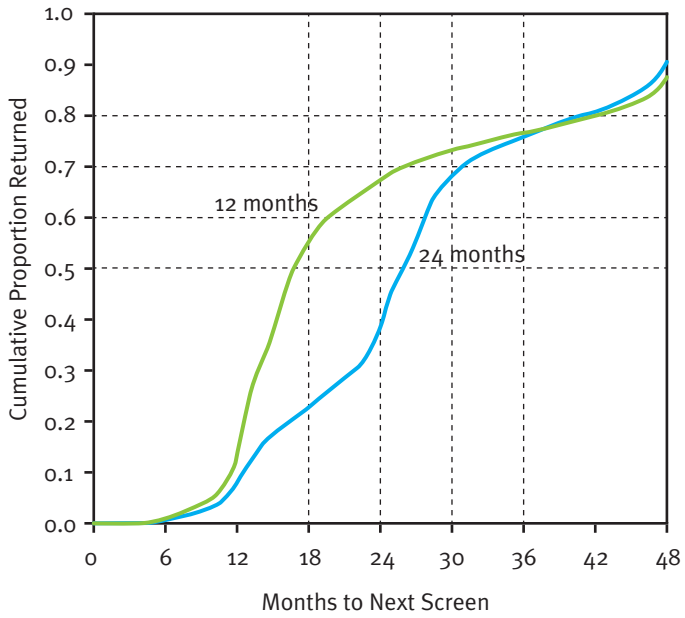
Notes:

1. Based on weighted average of 2012, 2013 and 2014 female population estimates
2. Population data source: P.E.O.P.L.E. 2015 (Sept 2015), BC STATS, Service BC, BC Ministry of Citizen's Services
3. Hysterectomy adjustment calculated using 2008 Canadian Community Health Survey
4. HA data acquired from Research Data Access Services, BC Ministry of Health
5. CCSP data extraction date: 11/26/2015
6. Age is computed based on patient's age in 2013

3.3 Retention Rate

Retention is the percentage of eligible women re-screened after a negative Pap test. Figure 5 shows the retention rate by the actual recommended screening interval. For patients with a 12-month interval recommendation, 56% returned by 18 months, and 69% of those with a 24-month recommendation returned by 30 months. The percentage of women who did not return by 48 months is 12% and 10% respectively for the 12-month and 24-month groups.

Figure 5: Retention Rates by Screening Interval Recommendation, 2011



Notes:

1. CCSP data extraction date: 11/26/2015

Table 4 summarizes the retention rates for women last screened in 2011 by 10-year age groups. It shows that more women in their 20's are returning by 18 months, which is consistent with the recommendation to have three negative annual screens before extending to biennial screening. About 76% of women with a negative Pap test return within 36 months.

Table 4: Retention Rates (%) by Age Group, 2011

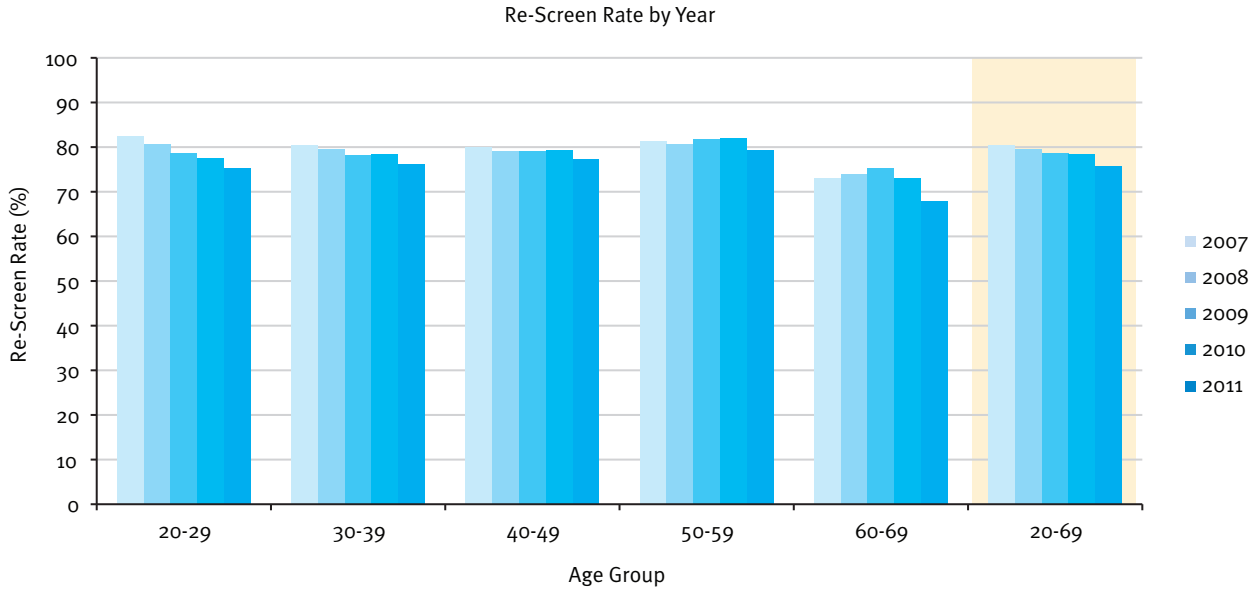
Timelist	20-29	30-39	40-49	50-59	60-69	20-69
Number of Patients	90,777	97,262	99,784	87,984	50,029	425,836
Re-screened by						
18 Months	44.6	39.8	36.3	34.8	29.6	37.8
24 Months	58.4	54.3	51	50.2	44.1	52.4
30 Months	70.4	70.3	71	73.2	64	70.3
36 Months	75.5	76.1	77.1	78.9	68.4	75.9

Notes:

1. CCSP data extraction date: 11/26/2015
2. Age is computed based on patient's age on report date of the index Pap test

Figure 6 shows the 36-month retention rate of women ages 20-69 by 10-year age groups for calendar years 2007-2011. The retention rate has been declining in every age group. The decline is largest in the 20-29 age group – 7%. CCSP has been working to identify enablers and challenges in retaining participants. Work is ongoing in this area to reverse the decline seen in the last few years.

Figure 6: 36-Month Retention Rate by Age Group over Time, 2007–2011



Notes:

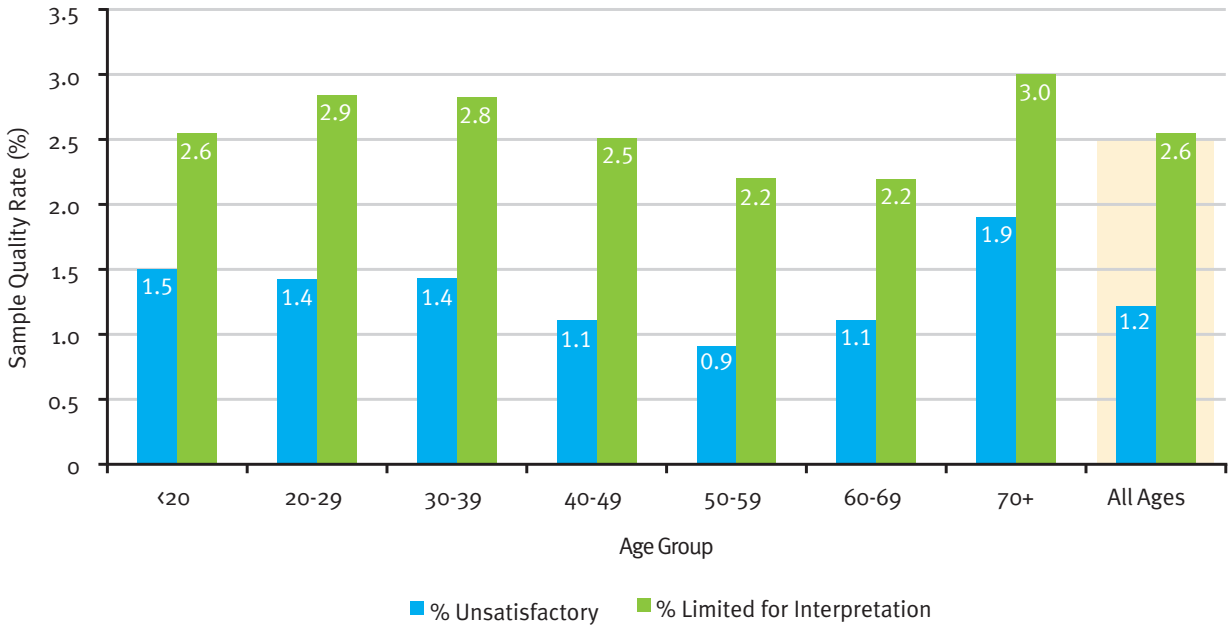
1. CCSP data extraction date: 11/26/2015
2. Age is computed on patient's age on report date of the index Pap test

3.4 Quality of Pap Test Samples

Figure 7 summarizes Pap test sample quality by 10-year age groups for cervical/endocervical samples. The percentage of samples reported as unsatisfactory or limited for interpretation are 1.2% and 2.6% respectively. The unsatisfactory samples have improved over 2013, and the samples reported limited for interpretation have remained the same.

The most commonly cited factor for inadequate sample is scanty sample material (89% of unsatisfactory samples and 72% of samples that are limited for interpretation). Scanty sample material is especially common in the older age groups. The next most cited reason is inflammatory exudates (9% in unsatisfactory samples and 18% in limited for interpretation samples). Multiple factors may be cited.

Figure 7: Cervical Sample Quality Rates by Age Group, 2014



Notes:

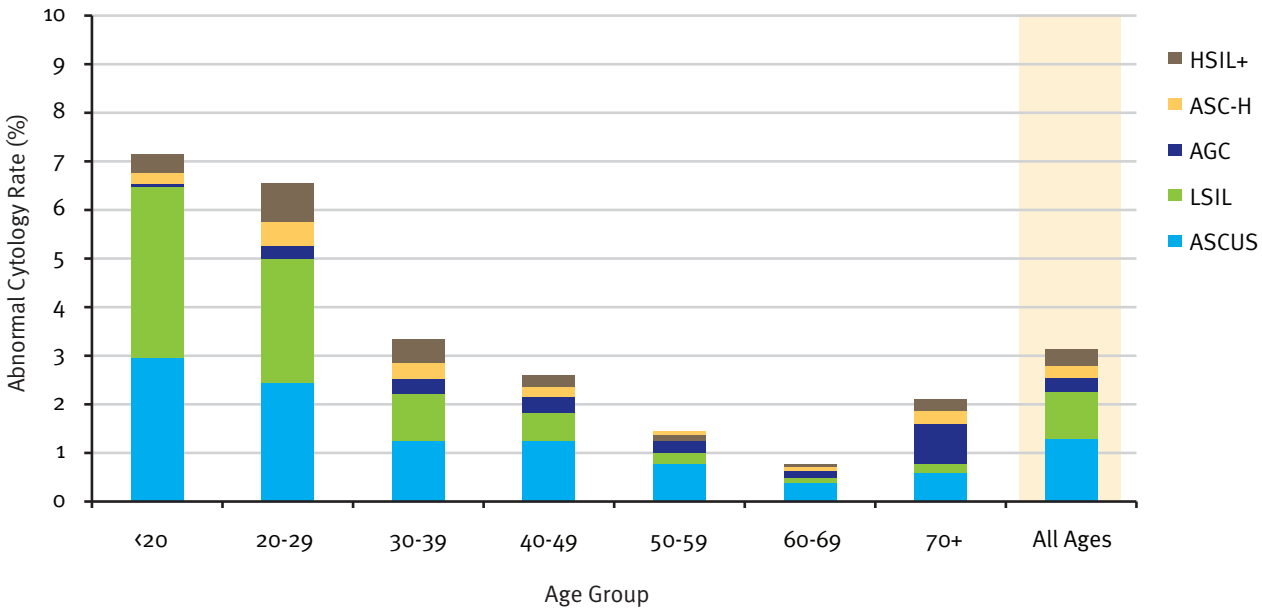
1. CCSP data extraction date: 11/26/2015
2. Age is computed based on sample date

3.5 Screening Test Results

Cytology turnaround time is the average number of days from the date the sample is received in the CCS Lab to the date the finalized report is issued. The average turnaround time was 16 days in 2014, well below the target of 20 working days for Pap test reporting. This is an increase from an average of 10 days in 2013.

The CCS Lab uses the international standardized Bethesda nomenclature to report Pap test results. The most severe abnormal screening test results for patients are summarized in Figure 8 and Table 5. Overall, 2.3% of Pap tests were reported as ASCUS/LSIL, 0.3% AGC, 0.3% ASC-H, and 0.3% HSIL+.

Figure 8: Abnormal Screening Test Result Distribution by Age Group, 2014



Notes:

1. CCSP data extraction date: 11/26/2015
2. Age is computed based on sample date

3.6 Follow-up of Abnormal Pap Test Results

Follow-up Recommendation

The current screening guideline is to follow ASCUS/LSIL results with a repeat Pap test at six-month intervals for up to two years. Colposcopy is recommended for either persistent ASCUS/LSIL or an initial interpretation of an abnormality more severe than ASCUS/LSIL. Other procedures may be recommended on the basis of a patient's clinical condition and cytology history.

Table 5 summarizes follow-up recommendations for patients by their screening test results. Compared to the previous annual report there were almost 23% fewer ASCUS/LSIL diagnoses and 21% fewer High Grade or AGC cases. This is partially explained by a decrease in number of screening samples of 13% and partially by a lower proportion of abnormal results. A slightly larger proportion of women with abnormal screening test results received a recommendation for colposcopy. There has been no change in follow up recommendation during this period.

Table 5: Follow-up Recommendations by Age Group, 2014

	<20	20-29	30-39	40-49	50-59	60-69	70+	all ages
Patients with ASCUS/LSIL	507	4,356	2,287	1,764	971	308	23	10,216
Repeat in 6 months	486	3,838	1,993	1,561	870	264	15	9,027
(%)	95.9	88.1	87.1	88.5	89.6	85.7	65.2	88.4
Other Investigation	21	518	294	203	101	44	8	1,189
(%)	4.1	11.9	12.9	11.5	10.4	14.3	34.8	11.6
Patients with High Grade or AGC	50	1,382	1,180	783	449	172	46	4,062
Colposcopy and/or ECC	47	1,346	1,138	673	337	118	23	3,682
(%)	94.0	97.4	96.4	86.0	75.1	68.6	50.0	90.7
Other Investigation	3	36	42	110	112	54	23	380
(%)	6.0	2.6	3.6	14.1	24.9	31.4	50.0	9.4

Notes:

1. CCSP data extraction date: 11/26/2015
2. Age is computed based on the date of the patient's most severe Pap test in the year
3. ECC: Endocervical Curettage

Colposcopy Follow-up Rate

The colposcopy follow-up rate is the percentage of women recommended to have a colposcopy examination that had the follow-up procedure within 12 months of the Pap test. Colposcopies performed within one week of the Pap test are excluded, as the Pap test is unlikely to be the reason for the colposcopy referral. Figures 9 and 10 show the colposcopy follow-up rate by age and their Pap test result. The 12-month follow-up rate was 86.7% for women with persistent ASCUS/LSIL Pap test results; and 85.4% for women with high grade or AGC Pap test results. Compared to the previous year, the overall follow-up rate increased slightly, by 1.5%.

Figure 9: Colposcopy Follow-up Rates for Women with Persistent ASCUS/LSIL Pap Test Result by Age Group, 2014

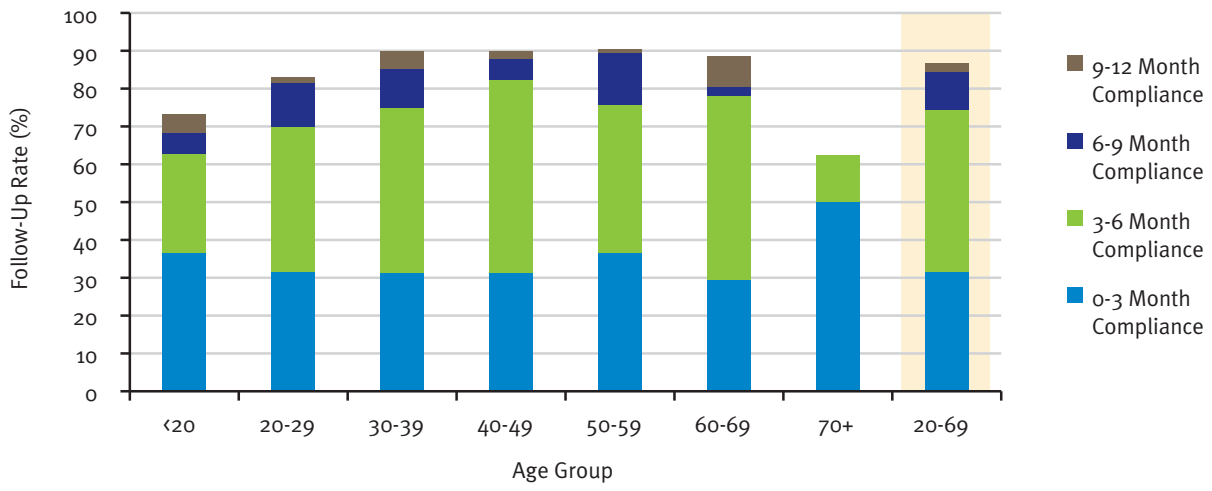
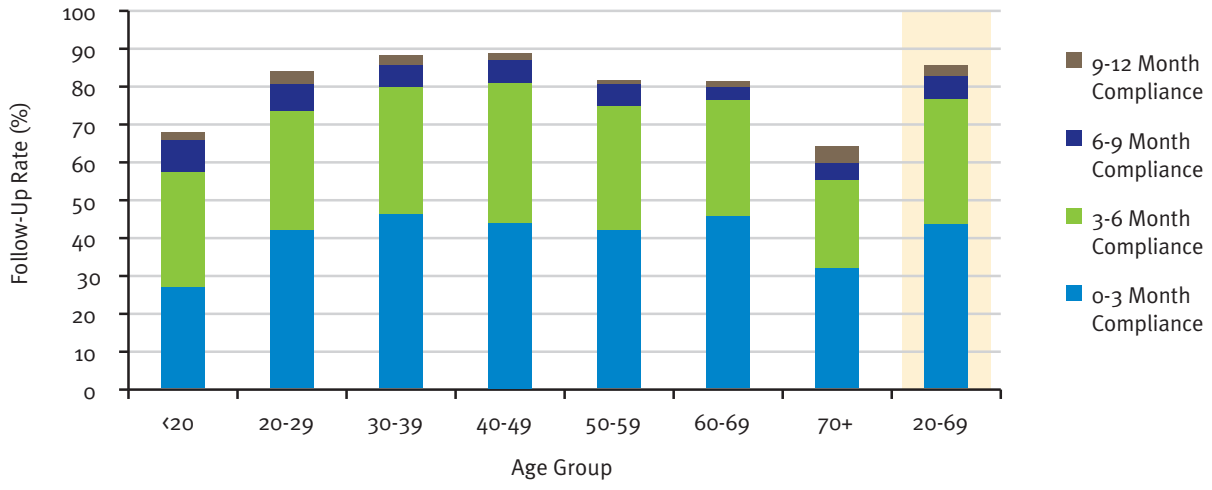


Figure 10: Colposcopy Follow-up Rates for Women with High Grade or AGC Pap Test Result by Age Group, 2014



Notes for figure 9 and 10:

1. CCSP data extraction date: 11/26/2015
2. Age is computed based on patient's age on report date of the index Pap test

Cytology-Histology Agreement

The cytology-histology agreement or positive predictive value (PPV) of cytology is the percentage of positive Pap tests that have had histological confirmation of significant cervical dysplasia. This measure is an indicator of the predictive validity of a positive test. However, it is important to note the limitations of cytology and histology, i.e. specimen sampling may not be representative of the lesion, and interpretation is subject to observer variability for cytology, and to lesser extent for histology. Furthermore, there may be progression or regression of the lesion in the period between cytology and histology, particularly with mildly abnormal lesions. Histological diagnosis was based on the most severe histological diagnosis from cervical pathology reported up to one year after the Pap test. Cervical intraepithelial neoplasia (CIN) result reporting terminology is used.

85% of women with high-grade or ACG Pap test results had a histological diagnosis in the following 12 months. For those women with persistent ASCUS/LSIL that were referred for further investigation, 84% had a subsequent histological investigation. Table 6 shows the level of cytology-histology agreement or PPV for different cytology and histology results. The PPV for CIN II or higher is 60% for high-grade or AGC, and is 27% for those ASCUS/LSIL referred for further investigation. The data for this annual report shows a slight increase in PPV over the previous period.

Table 6: Cytology-Histology Agreement, 2014

	ASCUS/LSIL	Rate %	High Grade or AGC	Rate %
Samples With Pathological Diagnosis:	1,050	83.6	3,520	84.6
CIN II or Higher	288	27.4	2,129	60.5
CIN III or Higher	128	12.2	1,406	39.9
Other Histology Findings	0	0	0	0
Glandular Sever	5	0.5	79	2.2
Glandular in Situ	0	0	27	0.8
Glandular Invasive	0	0	1	0.03

Notes:

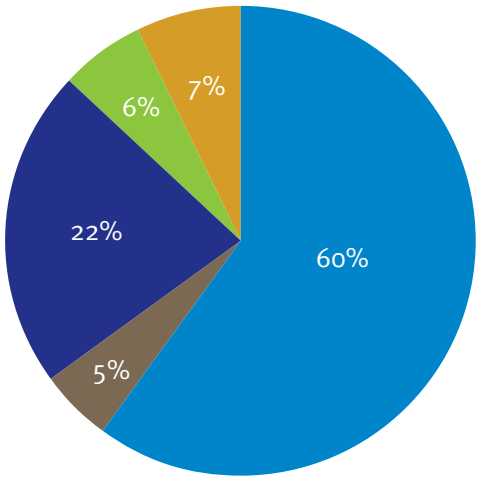
1. CCSP data extraction date: 11/26/2015

3.7 Provincial Colposcopy Program

The Provincial Colposcopy Program consists of 27 hospital-based clinics located throughout the province. It is estimated that 97% of all colposcopy procedures performed in BC are done through the Provincial Colposcopy Program. Colposcopists affiliated with the Provincial Colposcopy Program, are certified and have agreed to use a uniform reporting system with standardized terminology. Copies of this form are sent to both the referring physician and to CCSP for incorporation into the provincial database. The data are summarized for the annual continuing medical education workshop in colposcopy, held by the Provincial Colposcopy Program.

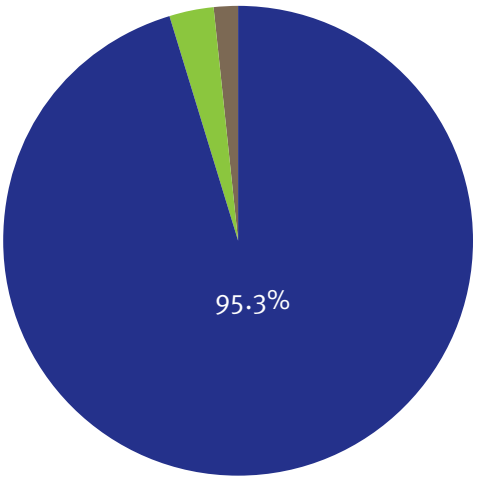
In 2014, 16,085 colposcopy examinations were performed. A cytological abnormality was the most common reason for the colposcopy referral (see Figure 11) and the primary site of investigation was the cervix (see Figure 12). Compared to the previous annual report, overall numbers of colposcopy are down by 0.5%. A larger proportion of colposcopy visits are performed for treatment and follow up (20% previously versus 22% in the current report).

Figure 11:
Reason for Referral to Colposcopy Clinic, 2014



60% Abnormal Cytology
5% Abnormality of Cervix
22% Treatment Follow-Up
6% Other
7% No Information

Figure 12:
Site of Colposcopic Investigation, 2014



0.0% Vulva
1.4% Vagina
95.3% Cervix
3.2% Combination

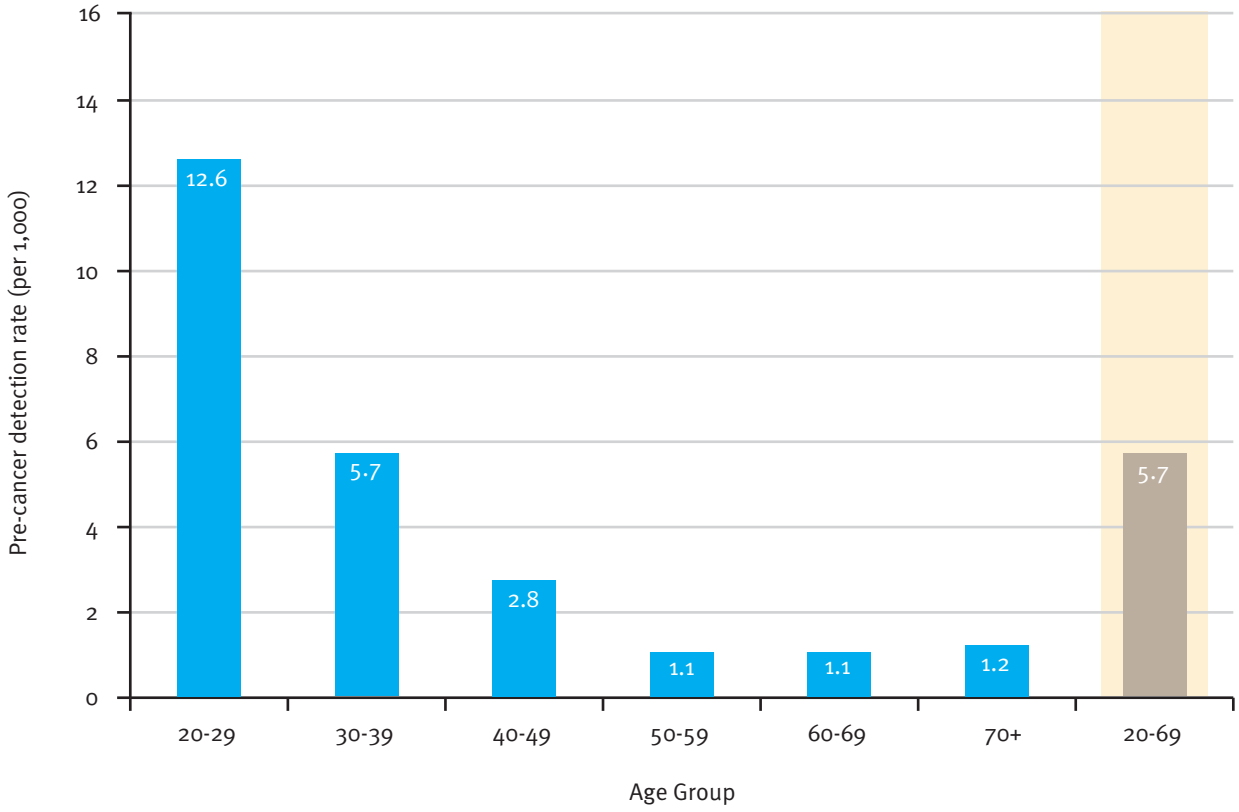
Notes for figures 11 and 12: 1. CCSP data extraction date: 11/26/2015

3.8 Pre-Cancer Detection Rate

Pap tests can identify pre-cancerous lesions where treatment is more likely to be effective in preventing the development of cervical cancer and, thus, reducing the morbidity of treating more advanced disease. Pre-cancerous lesions are histological confirmed CIN II or III lesions. The pre-cancer detection rate is influenced by a number of factors, such as the screening test, the population's risk profile, and the screening coverage.

Figure 13 shows the pre-cancer detection rate for women ages 20-69 by 10-year age groups. The pre-cancer detection rate in 2014 for women ages 20-69 in BC is 5.7 per 1,000. This is an important indicator to monitor over time as the environment changes in screening participation, HPV vaccination, and screening policies. 2013 and 2014 pre-cancer detection rates were 6.9 and 6.2 per 1,000 respectively.

Figure 13: Pre-Cancer Detection per 1,000 Women Screened by Age Group, 2014



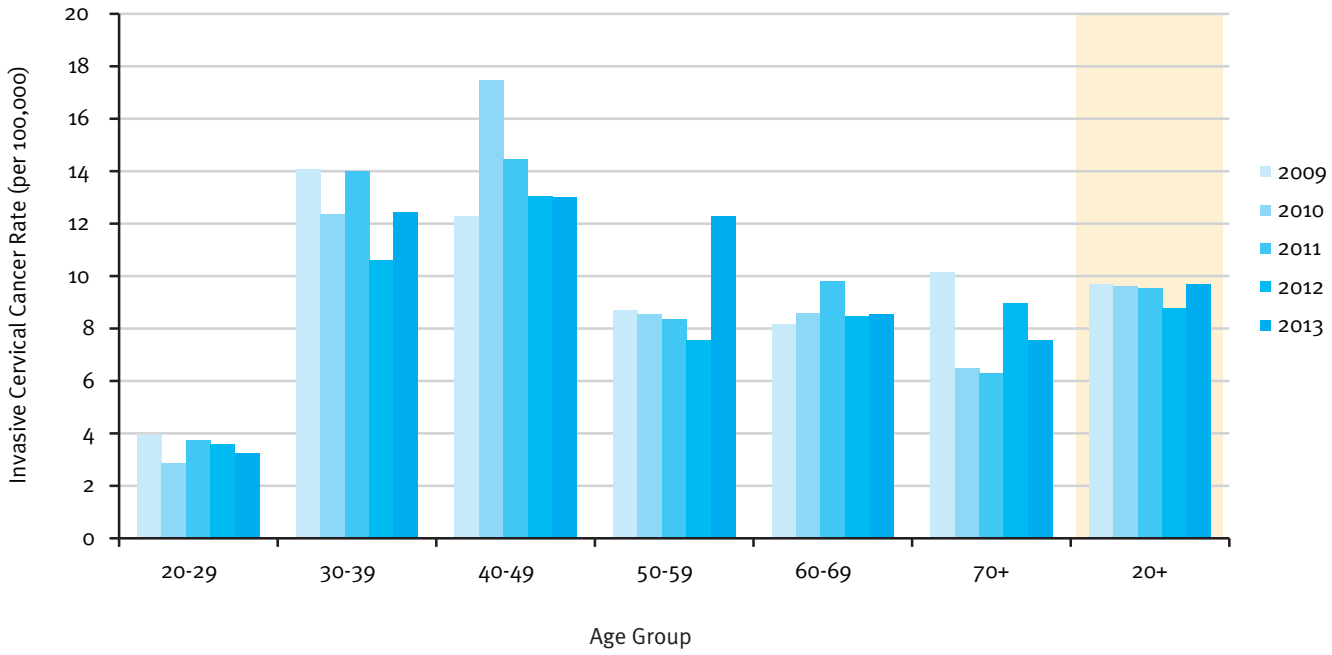
Notes:

1. CCSP data extraction date: 11/26/2015
2. Age is computed based on the date of the patient's severe Pap result in the year

3.9 Cancer Incidence

New invasive cervical cancers diagnosed in 2009 to 2013 were identified from the British Columbia Cancer Registry and the data collected by the CCSP. The age-specific cancer incidence rates for 2009-2013 are presented in Figure 14, and the cancer counts are shown in Table 7. Compared to historical incidence rates, there has been a significant increase in cancer rates in women between the ages 50 and 59. The reason for this is unknown but a similar order of magnitude increase was seen in the 40 to 49 year age group in 2010, hinting at a cohort effect Invasive cervical cancers are rare in women ages 20-29.

Figure 14: Invasive Cervical Cancer Incidence per 100,000 by Age Group, 2009 – 2013



Notes:

1. Population data source: P.E.O.P.L.E. 2015 (Sept 2015), BC STATS, Service BC, BC Ministry of Citizens' Services
2. CCSP data extraction date: 11/26/2015
3. Age is computed based on date of diagnosis

Table 7: Number of Invasive Cervical Cancers by Age Group, 2009 – 2013

	20-29	30-39	40-49	50-59	60-69	70+	20+
2013 Number of cases							
All cell types	10	38	43	43	23	21	178
Squamous cell only	9	26	25	31	17	11	119
Incidence rate (per 100,000)							
All cell types	3.3	12.4	13.0	12.3	8.5	7.5	9.7
Squamous cell only	2.9	8.5	7.6	8.8	6.3	4.0	6.5
2012 Number of cases							
All cell types	11	32	44	26	22	24	159
Squamous cell only	6	25	30	19	17	19	116
Incidence rate (per 100,000)							
All cell types	3.6	10.6	13.1	7.6	8.5	8.9	8.7
Squamous cell only	1.9	8.3	8.9	5.5	6.5	7.1	6.4
2011 Number of cases							
All cell types	12	42	50	29	25	17	176
Squamous cell only	9	30	33	21	20	14	127
Incidence rate (per 100,000)							
All cell types	3.8	14.0	14.5	8.3	9.8	6.3	9.6
Squamous cell only	2.8	10.0	9.5	6.0	7.8	5.2	6.9
2010 Number of cases							
All cell types	9	37	61	29	21	17	174
Squamous cell only	5	24	44	22	14	12	121
Incidence rate (per 100,000)							
All cell types	2.9	12.3	17.5	8.5	8.6	6.5	9.6
Squamous cell only	1.6	8.0	12.6	6.5	5.7	4.6	6.7
2009 Number of cases							
All cell types	12	42	43	29	19	26	172
Squamous cell only	11	27	25	22	12	25	122
Incidence rate (per 100,000)							
All cell types	3.9	14.1	12.3	8.7	8.2	10.2	9.7
Squamous cell only	3.6	9.1	7.1	6.6	5.2	9.8	6.9

Notes:

1. Population data source: P.E.O.P.L.E. 2015(Sept 2015), BC STATS, Service BC, BC Ministry of Citizens' Services
2. CCSP data extraction date: 11/26/2015
3. Age is computed based on date of diagnosis

3.10 Screening History in Cases of Invasive Cancer

Screening history of women diagnosed with invasive cancer is summarized in Figure 15 and 16 for squamous cell carcinomas and adenocarcinoma respectively. As Pap tests performed within six months prior to the invasive cancer diagnosis are less likely to be done for screening purpose, these Pap samples are considered to be diagnostic tests and disregarded in the categorization of screening history.

Figure 15 shows that 67% of patients with squamous cell carcinoma are "inactive" screening participants (›5 years or no screening history with CCSP), 10% are "under screened" (›3 to 5 years), and 22% are "active" screening participants (0.5 to 3 years). Figure 16 shows that 33% of patients with adenocarcinoma are "inactive" screening participants (›5 years or no screening history with CCSP), 20% are "under screened" (›3 to 5 years), and 47% are "active" screening participants (0.5 to 3 years). Although the number of invasive cancers is not significantly different in the 20-29 age group, the proportion screened in the last 5 years is increased.

In total, about 58% of the 178 patients diagnosed with invasive cervical cancer in 2013 were screened more than 5 years ago, or did not have a screening history.

Figure 15: Screening History of Women Diagnosed with Squamous Cell Carcinoma, 2013

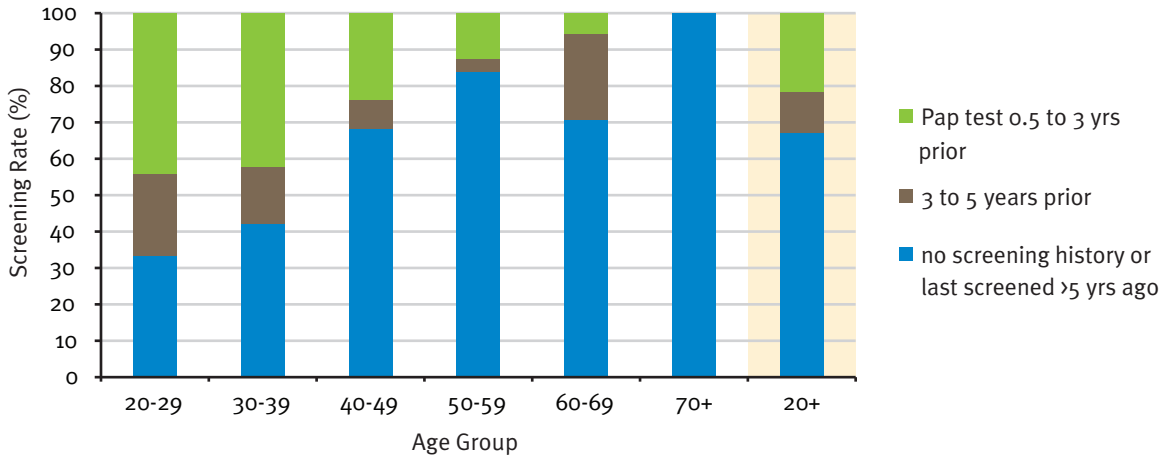
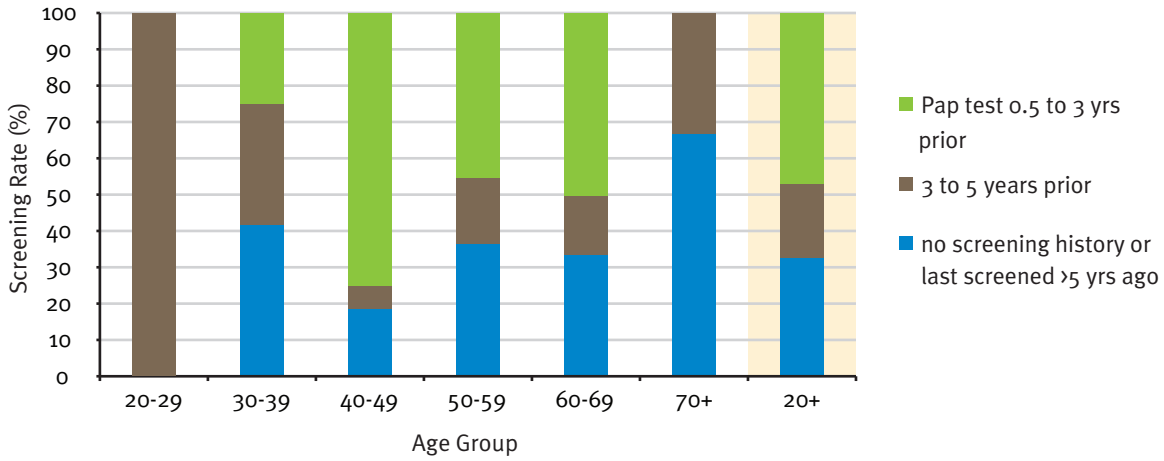


Figure 16: Screening History of Women Diagnosed with Adenocarcinoma, 2013



Notes for figures 15 and 16: 1. CCSP data extraction date: 11/15/2015 2. Age is computed based on date of diagnosis

Appendix 1 — General Cancer Screening Program Overview

Definition of Screening

Screening is a prevention strategy. Primary cancer prevention strategies involve changes of behavior or habits that reduce a risk, for example, stopping smoking, fat reduction in the diet, etc. Screening for cancer is a secondary prevention strategy. Secondary cancer prevention strategies target disease in process.[1] A secondary prevention can reduce cancer morbidity and mortality by diagnosing invasive disease at an earlier prognostic stage; and, detecting precursor lesions associated with some cancers that once eliminated, prevent progression to invasive disease. Screening is "*the application of various tests to apparently healthy individuals to sort out those who probably have risk factors or are in the early stages of specified conditions.*"[2]

Limitations of Screening

The decision to screen an at-risk population for pre-clinical signs of cancer is based on well-established criteria related to cancer and the screening tests that we use to identify individuals who may have occult disease.[3,4,5]

The overall objective of an organized screening program is to reduce morbidity and mortality from cancer. The goal of screening is to "apply a relatively simple, inexpensive test to a large number of persons in order to classify them as likely or unlikely to have the cancer". The emphasis on likelihood underscores the limits of what should be expected from screening (i.e., screening tests are not diagnostic tests).

A person with an abnormal screening test does not have a definitive diagnosis until additional, more sophisticated diagnostic tests are completed. The emphasis on likelihood is also important because screening tests are inherently limited in their accuracy, which varies by test, cancer site, and individual characteristics. Although most of screening interpretations are accurate, it is inevitable that some individuals are identified as possibly having cancer when they do not, and screening tests fail to identify some individuals who do not have the disease.

The comparative evaluation of accuracy versus error cannot be considered in absolute terms, but rather should be evaluated in terms of the relative consequences of one or the other kind of error.

Organized Screening Program

To reduce morbidity and mortality from cancer in a population by screening, there must be coordinated and effective strategies to ensure acceptance and utilization of the established screening test. Since screening is targeted at asymptomatic individuals, the fine balance between maximizing benefits and minimizing undesirable effects must be maintained.

An organized approach to screening ensures that the target population has access to the screening service and that it accepts and uses the services offered. This is achieved by including the following six program components:

1. Health Promotion
2. Professional Development/Education
3. Recruitment & Retention
4. Screening Test & Reporting
5. Follow-up
6. Evaluation/Research Partnerships

The success of screening is a shared responsibility of the team of individuals working together to develop goals, set standards, monitor progress, and continue improvement in each of the six components.

1 US Preventive Services Task Force: Guide to Clinical Preventive Services, Ed 2. Baltimore, Williams & Wilkins, 1996

2 Morrison A: Screening in Chronic Disease. New York, Oxford Press, 1992

3 Cole P, Morrison AS: Basic issues in cancer screening. In Miller AB (ed); Screening in Cancer. Geneva, International Union Against Cancer, 1978, p7

4 Miller AB; Fundamentals of Screening. In Screening for Cancer. Orlando, Academic Press, 1985, p3

5 Wilson JMG, Junger G; Principles and Practice of Screening for Disease. Geneva, World Health Organization, 196

Appendix 2 — Cervical Cancer Screening Guidelines

Cervical Cancer Screening

Clinical Practice Guidelines

BC Cancer Agency
CARE + RESEARCH
An agency of the Provincial Health Services Authority

Screening Initiation

Cervical cancer screening should begin at age 21 or approximately three years after first sexual contact, whichever occurs first. Sexual contact includes intercourse as well as digital or oral sexual contact involving the genital area with a partner of either gender.

The guideline of screening initiation at age 21 provides a way for healthcare providers to offer cervical screening and have a discussion about sexual history. Unfortunately, some women may be reluctant to share information about previous sexual contacts with their healthcare provider. This may be due to a number of reasons, such as embarrassment, fear of disclosing premarital sexual relationship(s), or a history of sexual abuse or assault. A woman's choice to be screened or not should always be respected.

Women who have never had any sexual contact do not need to be screened.

Screening Interval

Repeat Pap tests every 12 months until there are three consecutive negative results, then continue at 24-month intervals.

Discontinue Screening

Women older than 69 years should discontinue screening if they have had at least three negative Pap tests in the past 10 years, with no previous history of biopsy confirmed significant abnormalities (CIN*2 or CIN 3, AIS** or invasive cervical cancer).

Women older than 69 who have never been screened, should be screened with three annual Pap tests. If results are negative, discontinue screening.

HPV vaccination is recommended for females between nine and 26 years of age. For National Advisory Committee on Immunization (NACI) guidelines visit:
www.phac-aspc.gc.ca/publicat/ccdr-rmtc/07vol33/acs-02/index-eng.php

A woman with a visibly abnormal cervix or abnormal bleeding should be referred appropriately, regardless of the Pap test findings

Screening Women with Special Circumstances

- Women should follow regular guidelines for screening if they (1) received the HPV vaccine, (2) are lesbian or (3) are pregnant.
- Women with immunosuppression should be screened annually. This includes women with human immunodeficiency virus (HIV/AIDS), lymphoproliferative disorders, an organ transplant, and women under long-term immunosuppression therapy.
- Women currently being assessed by a colposcopy clinic or being followed by a cancer clinic should not undergo additional Pap testing unless being directed by the treating physician.
- Women who have ever had biopsy confirmed CIN 2, CIN 3, AIS or invasive cervical cancer should be screened annually thereafter.
- Women who have had a hysterectomy with the cervix removed
  - and have a history of invasive cervical cancer, should have a vault smear annually thereafter;
  - and have a history of CIN 2, CIN 3 or AIS, should have a vault smear until there are three consecutive negative results in a three-year period, then discontinue screening;
  - due to benign disease, may discontinue screening if adequate pathological documentation exists that the cervix has been removed completely and there is no history of biopsy confirmed CIN 2, CIN 3, AIS or invasive cervical cancer.
- Women who have undergone subtotal hysterectomy and retained their cervix should continue with screening according to the guidelines.

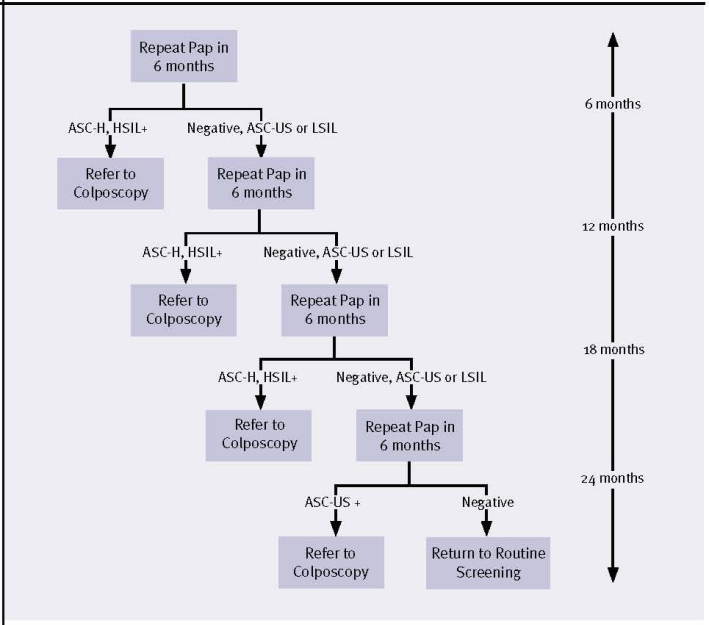
* CIN - cervical intraepithelial neoplasia
** AIS - adenocarcinoma in situ

February 2011

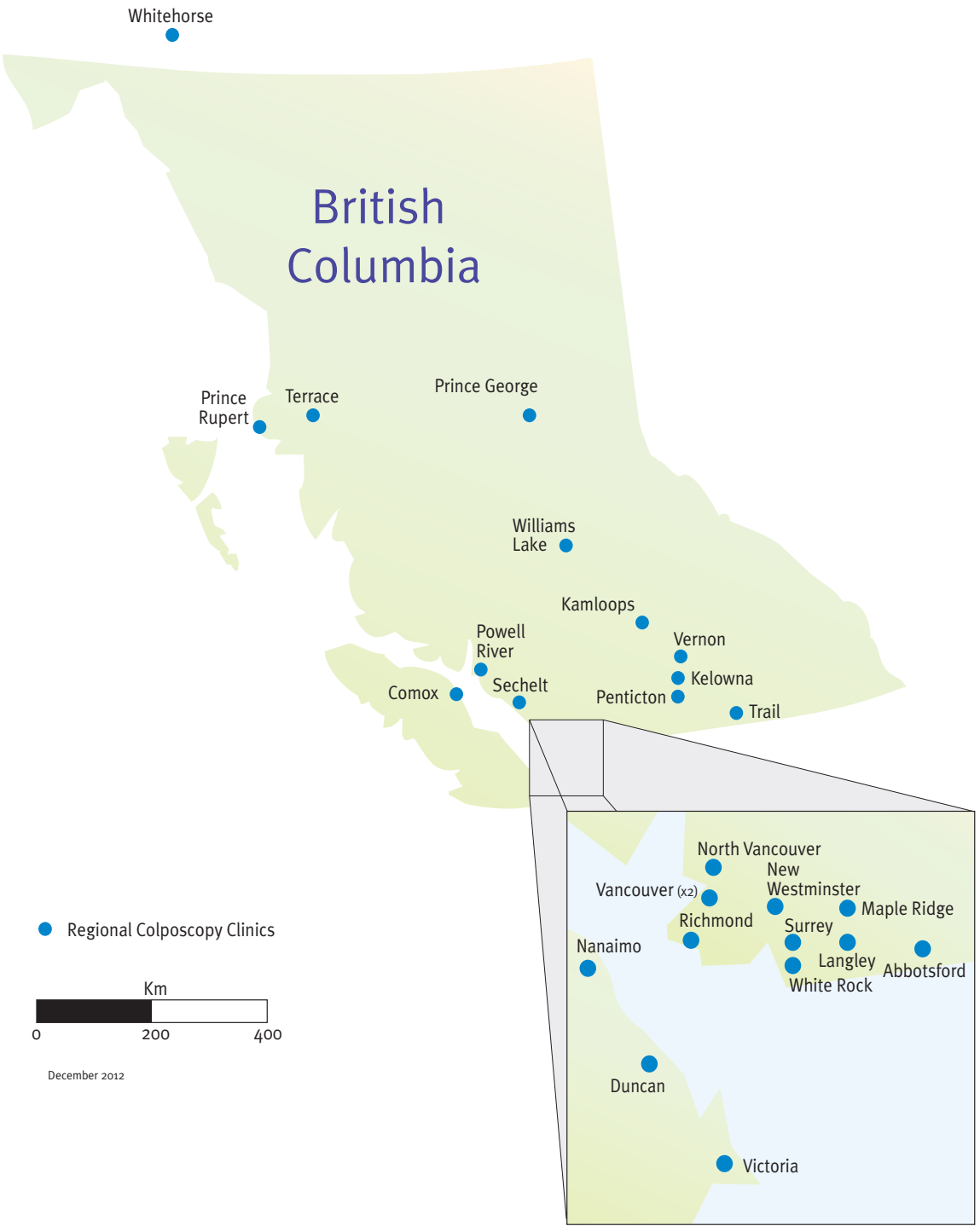
BC Cancer Agency
CARE + RESEARCH
An agency of the Provincial Health Services Authority

Cervical Cancer Screening

Results and Recommended Management

Pap Test Result	Recommended Management
Atypical squamous cells of undetermined significance (ASC-US) Low-grade squamous intraepithelial lesion (LSIL)	 ASC-US in background of atrophy should be repeated after topical estrogen
Atypical squamous cells – cannot exclude HSIL (ASC-H) High-grade squamous intraepithelial lesion (HSIL) Atypical glandular cells (AGC), Adenocarcinoma in situ (AIS)	Refer for colposcopy
Squamous cell carcinoma, adenocarcinoma, other malignancy	Refer to specialist care
After age 40, endometrial cells should be managed as appropriate	

Appendix 3 — Colposcopy Clinic Locations



Appendix 4 — Colposcopy Clinic Contact Information

Abbotsford		604-851-4700
Comox		250-339-2242
Duncan		250-737-2030
Kamloops		250-374-5111
Kelowna		250-862-4000
Langley		604-514-6069
Maple Ridge		604-463-4111
Nanaimo	(Nanaimo Regional Hospital)	250-755-7691 ext 57741
New Westminster		604-520-4253
North Vancouver		604-988-3131
Penticton		250-492-4000
Powell River		604-485-3211
Prince George	(UHNBC Switchboard)	250-565-2000
Prince Rupert		250-624-2171
Richmond		604-278-9711
Sechelt		604-885-2224
Surrey		604-581-2211
Terrace		250-635-2211
Trail		250-368-3311
Vancouver		
St. Paul's Hospital		604-682-2344 ext 62436
Vancouver Hospital & Health Sciences Centre		604-875-5022
Vernon		250-545-2211
Victoria		250-595-9200
White Rock		604-531-5512
Whitehorse		867-393-8915
Williams Lake		250-392-4411

Appendix 5 — Educational Materials

Education materials for health care providers and women are available at no charge from the Cervical Cancer Screening Program.

For health care providers

- Fact Sheet: Health Care Provider Fact Sheet
- Fact Sheet: Pap Sampling Technique
- Fact Sheet: Regional Profile: Fraser South
- Fact Sheet: Regional Profile: Richmond
- Office Manual: Screening for Cancer of the Cervix
- Video: A Women-Centred Approach to Cervical Cancer Screening

For women

- Brochure: Is Cervical Cancer Right for You?
  – Available in English, Punjabi, Simplified Chinese, Traditional Chinese
- Brochure: Abnormal Pap Test
  – Available in English, Punjabi, Simplified Chinese, Traditional Chinese
- Postcard: "You Can Get a Pap Test in the Time it Takes to...
- Poster: You Can Get a Pap Test in the Time it Takes to...
- Tear-Off Pad: After Your Pap Test
- Video: Screening for Cervical Cancer-Pap Test

Educational materials online

Educational materials and the order form are available at:
http://www.screeningbc.ca/Cervix/ForHealthProfessionals/Resources.htm

Appendix 6 — Glossary

- **Age-Standardized Incidence Rate**
  Age-standardized incidence rate is the weighted average of the age-range specific incidence rates, where the weights are the proportions of people in the corresponding age groups of the 1991 Canadian population.

$$\text{Age - Standardized Incidence Rate} = \sum_i \left(\frac{\text{Ca}_i}{\text{Pop}_i} \times \text{weight}_i \times 100{,}000 \right)$$

  Where Ca_i is the number of cervical cancers detected in a given year for age group *i*, pop_i is the BC female population in a given year for age group *i*, and weight_i is the proportion of people in age group *i* of the 1991 Canadian population.

- **Age-Standardized Mortality Rate**
  Age-standardized mortality rate is the weighted average of the age-range specific mortality rates, where the weights are the proportions of people in the corresponding age groups of the 1991 Canadian population.

$$\text{Age - Standardized Mortality Rate} = \sum_i \left(\frac{\text{Deaths}_i}{\text{Pop}_i} \times \text{weight}_i \times 100{,}000 \right)$$

  Where $Deaths_i$ is the number of cervical cancer deaths in a given year for age group *i*, pop_i is the BC female population in a given year for age group *i*, and weight_i is the proportion of people in age group *i* of the 1991 Canadian population.

- **Incidence Rate**
  Incidence rate is the proportion of women in the population who develop cervical cancer in a given year, expressed as the number of deaths per 100,000 people.

$$\text{Incidence Rate} = \frac{\text{Number of cervical cancer detected in a given year}}{\text{BC female population in a given year}} \times 100{,}000$$

- **Mortality Rate**
  Mortality rate is the proportion of women in the population who died of cervical cancer in a given year, expressed as the number of deaths per 100,000 people at risk.

$$\text{Mortality Rate} = \frac{\text{Number of cervical cancer deaths in a given year}}{\text{BC female population in a given year}} \times 100{,}000$$

- **Participation Rate**
  BC Overall
  Proportion of women in the BC female population (20-69 years of age) had a Pap test sample taken from the cervix and/or endocervix and processed at least once over a three-year period. Age is calculated in year two of the reporting period.

$$\text{Participation Rate} = \frac{\text{Number of women (age 20 - 69) with at least one Pap test in a 3 - year period}}{\text{Number of women in the BC (age 20 - 69) population at year two}} \times 100$$

  BC Adjusted for Hysterectomy
  Proportion of women out of the target BC female population (20-69 years of age) without hysterectomy had a Pap test sample taken from the cervix and/or endocervix and processed at least once over a three-year period. The BC female population without hysterectomy is computed using the hysterectomy rates estimated from the 2008 Canadian Community Health Survey.

- **Positive Predictive Value**
  Proportions of Pap test samples with significant cytology findings and have histological confirmation of cervical abnormality out of those samples with significant cytology and had follow-up investigation with pathological result. Surveillance with repeat Pap test only is not regarded as follow-up investigation.

$$\text{PPV} = \frac{\text{Number of samples with significant pathology and cytology findings}}{\text{Number of samples with significant cytology findings, investigated and has pathological diagnosis}}$$

- **Pre-Cancer Detection Rate**
  Number of pre-cancerous lesions detected per 1,000 women who had a Pap test in a 12-month period.

$$\text{Pre - Cancer Detection Rate} = \frac{\text{Number of women with histology CIN II and CIN III}}{\text{Number of women who had at least one Pap test}} \times 1{,}000$$

- **Retention Rate**
  Proportion of women with a negative sample returned for Pap test.

$$\text{Rescreen Rate} = \frac{\text{Number of women returned for Pap test after an index sample with negative result}}{\text{Number of women with a negative sample eligible to return for Pap test}}$$

Appendix 7 — Acknowledgments and Contributors

The Cervical Cancer Screening Program would like to thank its partners who have supported and contributed to the Program over the years. The success of the Program depends on an integrated system of:

- Community health professionals taking the cervical Pap test samples
- Dedicated and highly trained staff to process and read the slides
- Community facilities providing space and personnel to support regional colposcopy clinics
- Medical specialists to provide colposcopy follow-up and treatment

We would also like to thank the following organizations for their ongoing support:

- All Hospitals participating in the Provincial Colposcopy Program
- BC Centre for Disease Control
- BC College of Registered Nurses
- BC Medical Association
- BC Naturopathic Association
- BC Women's Hospital and Health Centre
- Canadian Cancer Society
- First Nations Health Council
- SFU Faculty of Health Sciences
- UBC Faculty of Medicine
- Women's Health Bureau

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- Dr. Marette Lee, Program Director, Provincial Colposcopy Program
- Ms. Laurie Smith, Manager, HPV Focal Study
- Dr. Dirk van Niekerk, Medical Director, Cervical Cancer Screening Program

Appendix 8— Publications and Presentations

Publications

1. IPV 2014 Seattle, USA, August 2014
   Incident HPV infection rates at 48 months for HPV negative women in the HPV FOCAL Trial. Oral/Poster
   Ogilvie GS, Smith LW, Cook DA, van Niekerk DJ, Krajden M, Ehlen T, Stuart G, Martin R, Peacock S, Franco EL, Coldman AJ
2. IPV 2014 Seattle, USA, August 2014
   HPV FOCAL: Final round 1 results from a Canadian population based screening trial. Poster
   Ogilvie GS, van Niekerk D, Krajden M, Ceballos K, Cook D, Ehlen TG, Martin RE, Peacock S, Smith LW, Stuart GCE, Franco EL, Coldman AJ
3. IPV 2014 Seattle, USA, August 2014
   Impact of primary HPV testing on demand for colposcopy services in a population screening program.
   Poster, Coldman A, Phillips N, van Niekerk D, Smith L, Peacock S, Krajden M, Cook D, Quinlan D, Ehlen T, Miller D, Stuart G, Martin R, Franco EL, Ogilvie G
4. IPV 2014 Seattle, USA, August 2014
   Assessing women's intentions to self-collect cervical specimens for HPV testing in a Canadian organized cervical cancer screening program.
   Poster, Smith LW, Khurshed F, van Niekerk DJ, Krajden M, Greene SB, Hobbs S, Coldman AJ, Franco EL, Ogilvie GS
5. BMC Public Health, BMC Public Health. 2014; 14: 1060. DOI: 10.1186/1471-2458-14-1060
   Women's intentions to self-collect samples for human papillomavirus testing in an organized cervical cancer screening program.
   Smith LW, Khurshed F, van Niekerk DJ, Krajden M, Greene SB, Hobbs S, Coldman AJ, Franco EL, Ogilvie GS

Presentations

1. Eurogin 2015 Sevilla Spain
   48 month incident HPV infection rates for women negative at baseline: The HPV FOCAL trial.
   Ogilvie GS, Smith LW, Cook DA, van Niekerk DJ, Krajden M, Ehlen T, Stuart G3, Martin R, Peacock S, Franco EL, Coldman AJ
2. Eurogin 2015 Sevilla Spain
   Complete age specific round 1 results from the Canadian population based screening trial: HPV FOCAL
   Ogilvie G, van Niekerk D, Krajden M, Ceballos K, Cook D, Ehlen TG, Martin R, Peacock S, Smith L, Stuart G, Franco E, Coldman A

3. JOGCJ Obstet Gynaecol Can 2015; 37(5): 412-20.
Projected impact of HPV and LBC primary testing on rates of referral for colposcopy in an Canadian cervical cancer screening program.
Coldman AJ, Phillips N, van Niekerk DJ, Smith LW, Krajden M, Cook D, Quinlan D, Ehlen T, Miller D, Stuart G, Peacock S, Martin R, Franco EL, Ogilvie GS

4. IPV 2015 Lisbon Portugal
HPV FOCAL Trial: HPV Infection rates at 48 months for women who are HPV negative at baseline.
Ogilvie G, Smith L, Cook D, Krajden M, van Niekerk D, Ceballos K, Stuart G, Ehlen T, Martin R, Peacock S, Franco E, Coldman A

5. IPV 2015 Lisbon Portugal
Methodological quality control measures of a population based screening trial: HPV FOCAL.
Smith L, Ogilvie G, Krajden M, van Niekerk D, Cook D, Stuart G, Martin R, Peacock S, Franco E, Coldman A

6. IPV 2015 Lisbon Portugal
Roche Cobas 4800 vs. Digene HC2 tests for primary cervical cancer screening in the HPV FOCAL Trial.
Cook D. Mei W, Smith L, van Niekerk D, Ceballos K, Franco E, Coldman A, Ogilvie G

7. IPV 2015 Lisbon Portugal
HPV Vaccination rates in women over the age of 25: Immunization rates in a population based screening trial.
Smith L, Naus M, Krajden M, van Niekerk D, Cook D, Ceballos K, Stuart G, Martin R, Peacock S, Franco E, Coldman A, Ogilvie G

8. IPV 2015 Lisbon Portugal
Results over two rounds of screening in the safety and controls arms of the HPV FOCAL Trial.
Coldman A, van Niekerk D, Krajden M, Smith L, Cook D, Ceballos K, Stuart G, Martin R, Peacock S,
Ehlen T, Franco E, Ogilvie G

9. FIGO 2015 Vancouver Canada
HPV FOCAL Trial: HPV infection rates at 48 month exit for women HPV negative at baseline.
Ogilvie G, Smith L, Cook D, van Niekerk D, Krajden M, Ehlen T, Stuart G, Martin R, Peacock S, Franco E, Coldman A

10. BMC Cancer, BMC Cancer. (2015) 15:968
Comparison of the roche cobas 4800 and Digene Hybrid Capture 2 HPV tests for primary cervical cancer screening in the HPV FOCAL trial.
Cook D, Mei W, Smith L, van Niekerk D, Ceballos K, Franco E, Coldman A, Ogilvie G, Krajden M.

Appendix 9— CCSP/BCCA Contact Information

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