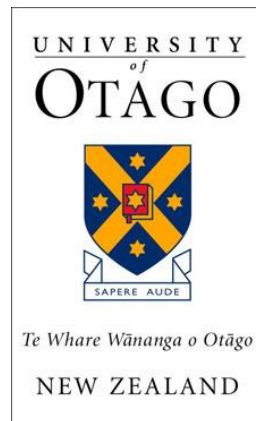


Review of Cervical Cancer Occurrences in relation to Screening History in New Zealand for the years 2013-2017

Prepared for the National Cervical Screening Programme



Final Report 29 August 2019

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Disclaimer

This document represents the advice and recommendations made to the Ministry of Health regarding the National Cervical Screening Programme by the independent review team based at the University of Otago, Christchurch.

The Review Team

This report was prepared by staff at the University of Otago, Christchurch, as part of an independent review with funding from the Ministry of Health.

The conduct of this review, data analysis and reporting of results has been undertaken solely by the review team.

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Contents

Disclaimer	2
The Review Team	3
List of Figures	7
List of Tables.....	8
Acknowledgments	10
Executive Summary	11
Recommendations from the Review	14
Introduction	16
Aims of the 2013-2017 Cervical Cancer Review	19
Methods	19
Sample Selection.....	19
Inclusion and exclusion criteria.....	19
Data	20
Collection and management.....	20
Data quality.....	20
Definitions.....	22
Date of diagnosis.....	22
Ethnicity	22
Deprivation and rurality.....	22
Screening history	23
Analysis	25
Results	26
Population.....	26
Review of available pathology information.....	26
Comparison of information in the NZCR and NCSP-R following review	26
Application of inclusion and exclusion criteria.....	27
Demographics of women with cancer	27
Incidence of cervical cancer.....	28
Age at diagnosis of cervical cancer	28
Histological type.....	28

FIGO staging.....	28
Ethnicity	29
Deprivation index.....	30
Residence at Time of Diagnosis	30
Rurality.....	30
Cancer Network Residence at diagnosis	31
Review of cervical screening adequacy.....	31
The accuracy of cervical cytology	32
Patients with prior screen detected abnormalities.....	33
Screening history in women with adenocarcinoma.....	33
Special Populations (women aged under 30 and over 70).....	34
Women aged under 25 years.....	34
Women 25-29 years.....	34
Women aged over 70 years	34
Women aged between 70-79 years.....	35
Women aged over 80 years	35
Comparison of results from cervical screening programme reviews 2008-2012 and 2013-2017.....	36
Below is a summary of the main differences in the current review (2013-2017) compared with the previous review (2008-2012). Note: all numbers are presented as current review versus previous review.	36
Among women with confirmed cervical cancer:.....	36
Among women eligible for screening review.....	36
Number of women identified	37
Annual incidence.....	37
Annual incidence by year and ethnicity	37
Stage at diagnosis	38
Demographics for all cervical cancer diagnoses	38
Demographics among women eligible for screening history review	38
Age as a proportion of Māori and non-Māori women	38
Incidence rates by age and ethnicity	39
Incidence rates by deprivation and ethnicity.....	39
Diagnoses by rurality and ethnicity.....	39
Diagnoses by Cancer Network and ethnicity	39
Screening adequacy by demographics.....	39
Screening adequacy by histological type and stage.....	39

Review of Cervical Cancer Occurrences 2013-2017 – FINAL REPORT

Screening adequacy and ethnicity	40
Screening history in 6-84 months period to diagnosis.....	40
Discussion.....	41
Tables and Figures for the 2013-2017 review of Cervical Cancer Occurrences.....	51
Appendix 1: Comparison of key results with previous review and audits	87
References.....	91
Supplementary Data	93

List of Figures

Figure 1-1 Application of inclusion and exclusion criteria to the full dataset as supplied by the NZCR and NCSP-R for selection of women eligible for the screening review	51
Figure 3-1 Annual age-standardised (WHO 2000-2025) incidence of cervical cancer cases per 100,000 female population by year	56
Figure 3-2 Age standardised (to Māori 2001 census) incidence of cervical cancer cases per 100,000 person-years by year of diagnosis (2008-2017) for Māori and non-Māori	58
Figure 3-3 Age specific incidence of cervical cancer cases per 100,000 person-years by age for Māori and non-Māori.....	63
Figure 3-4 Age-standardised (to Māori 2001 census) incidence of cervical cancer per 100,000 persons-years by aggregated deprivation decile for Māori and non-Māori ...	64
Figure 3-5 Age standardised (to Māori 2001 census) incidence of cervical cancer cases per 100,000 person-years by rurality for Māori and non-Māori.....	66
Figure 3-6 Age standardised (to Māori 2001 census) incidence of cervical cancer cases per 100,000 person-years by Cancer Network for Māori and non-Māori.....	68
Figure 3-7 Differences in histological type, stage by ethnicity for all women diagnosed with cervical cancer included in the review.	70
Figure 3-8 Deprivation index data expressed as aggregated deciles for cervical cancer cases by histological type and stage	73
Figure 4-1 Proportion of cervical cytology samples taken per month and associated cytological findings in the 60 months prior to diagnosis.	77
Figure 4-2 Screening adequacy by age at diagnosis	78

List of Tables

Table 1-1 Description of NZCR records Popn: 807	52
Table 1-2 ICD10 cancer codes for all NZCR records Popn: 807	52
Table 1-3 Women excluded from the review following review of histology reports Popn: 64	53
Table 1-4 Women excluded from the review for other reasons Popn: 119.....	53
Table 1-5 Mode of confirmation of cases included in the screening review Popn: 628	53
Table 2-1 Number of cases of cervical cancer as reported by NZCR, NCSP-R and following histological review by the review team.....	54
Table 2-2 Concordance of histology and date of diagnosis data between the NZCR and NCSP Popn: 747.....	54
Table 3-1 Annual incidence of confirmed cervical cancer per 100,000 female population across the review period, unadjusted or age-standardised to world standards (Segi, European, and WHO 2000-2025)	55
Table 3-2 Annual incidence of confirmed cervical cancer cases per 100,000 female population by year and ethnicity Popn: 747.....	57
Table 3-3 Demographics for all cervical cancer diagnoses by year (2013-2017) Popn: 747	59
Table 3-4 Tumour characteristics for all cervical cancer diagnoses by year (2013-2017 Popn: 747	60
Table 3-5 Age at diagnosis by ethnicity	60
Table 3-6 Demographics for all cervical cancer diagnoses eligible for the screening history review by year (2013-2017) Popn: 628.....	61
Table 3-7 Tumour characteristics for all cervical cancer diagnoses eligible for the screening history review by year (2013-2017) Popn: 628.....	62
Table 3-8 Women with cervical cancer by age and deprivation index, as a proportion of Māori and non-Māori populations Popn: 747	62
Table 3-9 Cervical cancer diagnoses by rurality and ethnicity Popn: 747.....	65
Table 3-10 Cancer Network regions by ethnicity Popn: 747	67
Table 3-11 Histological type and stage by ethnicity Popn: 747.....	69

Table 3-12	Histological type and stage by age at diagnosis	Popn: 747.....	70
Table 3-13	Histological type and stage by ethnicity and age at diagnosis	Popn: 747..	71
Table 3-14	Histological type and aggregated NZ Deprivation Index decile	Popn: 747	72
Table 3-15	Type and stage by rurality	Popn: 747.....	74
Table 3-16	Type and stage by Regional Cancer Network	Popn: 747	74
Table 4-1	Screening adequacy by patient demographics	Popn: 628	76
Table 4-2	Screening adequacy by histological type and stage	Popn: 628	79
Table 4-3	Screening adequacy by age and ethnicity	Popn: 628	80
Table 4-4	Screening adequacy by year of diagnosis	Popn: 628.....	81
Table 4-5	Screening adequacy by Regional Cancer Network	Popn: 628	82
Table 4-6	Screening adequacy by rurality and ethnicity	Popn: 628.....	83
Table 4-7	Screening history in the 6 to 84 months prior to diagnosis for all patients included in the Review	Popn: 628.....	84
Table 4-8	Screening history in the 6 to 84 months prior to diagnosis by histological type and stage at diagnosis	Popn: 628.....	85
Table 4-9	Cytological interpretation of high grade cervical cytology samples taken in the 0-36 months prior to the diagnosis of adenocarcinoma.....		86
Table 5-1	Description of NZCR records comparing 2008-2012 and 2013-2017		87
Table 5-2	ICD10 cancer codes for all NZCR records comparing 2008-2012 and 2013-2017		87
Table 6-1	Number of cases of cervical cancer as reported by NZCR, NCSP-R comparing 2008-2012 and 2013-2017.....		88
Table 6-2	Number of cases of cervical cancer following histological review by the review team comparing 2008-2012 and 2013-2017		88
Table 6-3	Annual incidence of confirmed cervical cancer cases per 100,000 female population by year, unadjusted or age-standardised to world standards (Segi, European, and WHO 2000-2025) comparing 2008-2012 and 2013-2017		89
Table 6-4	Annual incidence of confirmed cervical cancer cases per 100,000 female population, age-standardised to the WHO 2000-2025 Standard Population (all ages) as reported in the NCSP Annual report 2015 ²¹		89
Table 6-5	Key comparisons between the current review and previous audits and review		90

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The National Kaitiaki Group – the group appointed by the Minister of Health to protect Māori women's cervical screening data.

Executive Summary

Summary of the University of Otago review of cervical cancer occurrences for the period between 1 January 2013 and 31 December 2017. This report was prepared for The National Cervical Screening Programme (NCSP).

- In this review, we examined information held by the NCSP Register (NCSP-R) and New Zealand Cancer Registry (NZCR), in order to determine the demographics and screening histories of New Zealand women with confirmed cervical cancer. The review did not include patient supplied information, a review of cytology specimens, or a population-based control.
- The Ministry of Health identified 809 records from 807 women from the NZCR as having or possibly having cervical cancer. Two women had two cancer diagnoses with different morphology, in these cases the earlier cancer diagnosis was kept and the later diagnosis excluded. Records were reviewed if they were coded as ICD-10 site code C530 (endocervix) n=0, C539 (cervix) n=776, or C578 (overlapping sites of the female genital tract) n= 31.
- NZCR records for these women were matched with NCSP-R records. An NZCR data extract and copies of the relevant pathology reports were forwarded to the review team.
- All available clinical information and histology reports contained within these records was reviewed by a medical practitioner (Associate Professor Peter Sykes) familiar with the management of women with cervical cancer.
- 64 records were excluded due to either a diagnosis outside the review timeframe (7), non-cervical cancer (35), histology not conclusive for invasive cancer (7), or no diagnostic histology and insufficient clinical information to confirm cervical cancer (15). Four women were added who had been identified in the NZCR during the 2008-2012 review but excluded from the earlier review due to their date of diagnosis being in 2013. Thus, 747 women were confirmed to have cancer of the cervix diagnosed within the review timeframe.
- As the NZCR may form the basis of future NCSP-R cervical cancer audits and reviews, it was noted that all confirmed cervical cancer cases in this review were coded in the NZCR as ICD10 C539.

- Of the 747 women, 75% of cervical cancers were squamous cell carcinoma (SCC), 18% were adenocarcinoma of endocervical type or not otherwise specified, 4% were adenosquamous carcinoma, and 4% were cervical cancers of other histological types.
- On average, there were 149 diagnoses of cervical cancer per year, resulting in a crude incidence of 6.37 per 100,000 female population per year and a standardised rate of 5.70 per 100,000 female population per year (using the World [WHO 2000-2025] Standard).
- Māori have a higher incidence of cervical cancer compared with non-Māori. The overall age-standardised (2001 Māori population) rates per 100,000 female population were 8.1 among Māori and 4.4 among non-Māori.
- Only 25% of records had FIGO stage recorded on the NZCR, however, following review of available pathology reports, it was determined that 26% of the 747 women had superficially invasive (microinvasive) cancers. For the 561 women with SCC, the proportion with superficially invasive cancers was higher (35%).
- Ethnicity data was retrieved from the NZCR and reported as total response ethnicity. Of the 747 women, 162 (22%) women identified as Māori, 49 (7%) women identified as Pacific island, and 91 (12%) women identified as Asian.
- 107 (14%) of the 747 women with confirmed cervical cancer were outside the 25-69 year screening age group at the date of their diagnosis and a further 12 (2%) had rare or non-HPV related cancer types.
- A review of screening history was performed on the remaining 628 women aged 25-69 years with HPV-related cancer types. Cervical cytology samples in the 6 months prior to diagnosis were considered to be part of the diagnostic process and therefore excluded. Of women with cervical cancer, eligible for screening history review, 74% had ever been screened, 50% had been screened in the 5 year interval prior to their diagnosis and 37% had been screened in the 3 year interval prior to their diagnosis.
- Using the definition of at least two cervical cytology samples, no more than 3 years apart, in the 6-84 months prior to diagnosis, only 12% of women aged 25-69 with cervical cancer had been adequately screened and only 23% had undergone five-yearly screens.

- For women with SCC, 70% had ever been screened, 45% had been screened in the 5 years prior to diagnosis, and 34% in the 3 years prior to diagnosis. Only 10% had been adequately screened.
- Of the 346 women who had been screened 6-84 months prior to diagnosis, 34% had had an abnormal screening test in that time period. Therefore, an opportunity for prevention or earlier diagnosis of cancer may have been missed. It is important to note that Māori and Pacific women were over-represented in this group of women. In particular, where a high grade abnormality was present prior to their diagnosis of cancer, the discrepancy was at its greatest – 40% of Māori women and 53% of Pacific women who were screened in the 6-84 months prior to diagnosis had had a high grade cervical cytology sample as opposed to 16% of European women who had been similarly screened.
- Compared with the 2008-2012 review:
 - There were fewer women in this review. While overall incidence rates, both unadjusted and age-standardised, were lower in absolute numbers, there was no evidence of a statistical decrease over time (2008 – 2017). There were more women in the 20-35 year age group (158 women in 2008-2012 review versus 182 women in the 2013-2017 review).
 - There was a decrease in the absolute numbers and incidence of adenocarcinoma and other non-squamous cancers, however, there was no decrease in the numbers or incidence of SCC or adenosquamous cancers.
 - Screening history by any definition of adequacy measured was lower among women 25-29 years.
 - There was less difference in the screening histories of Māori vs non-Māori women. However, Māori women still appear to have less access to regular and adequate cervical screening.

Recommendations from the Review

We recommend that:

- i. The NCSP continue to aim to reduce the incidence of all cervical cancers, including superficially invasive tumours.
- ii. Emphasis continue to be placed on both enrolling (from the recommended age of commencement) and increasing regular participation in the screening programme.
- iii. Resources are provided to improve access to screening and treatment of cervical precancer for Māori women and, in particular, those who are more socially deprived (as defined by NZDep2013)¹. Intervention strategies should take into consideration both the practical and cultural needs of these women/wahine.
- iv. Resources should also be provided to improve access to screening and treatment of cervical precancer for Asian and Pacific women.
- v. The sensitivity of the cervical screening test be improved. This will be achieved by the introduction of HPV-based primary screening.
- vi. Trends of cancer incidence and screening coverage in young women are carefully monitored (in view of the apparent increase in cervical cancer diagnosis in women under 35 years).
- vii. The NZCR inform the NCSP-R of any cervical cancer diagnosis.
- viii. The NZCR record the date of histological diagnosis of cancer (in addition to current SNOMED definition).
- ix. The NCSP-R enable data management to support future cervical cancer audits and reviews.
- x. Superficially invasive tumours continue to be distinguished from other cancers for the purpose of cervical cancer review.
- xi. The decreasing incidence of non-squamous cancer of the cervix is further examined to determine whether there is an underlying reason for this decrease.
- xii. A system for ongoing audit and review of cervical cancer cases is established which utilises a consistent methodology. In doing so, the following points should be taken in consideration:

- The NCSP-R should be matched with a population-based registry to allow the selection of control groups for case control studies. This will allow estimation of the protective effect of screening within different populations.
- Clinical and demographic data should be collected which will confirm diagnosis, stage, method of diagnosis, residency status and ethnicity.
- Clinical data would best be collected prospectively in conjunction with the three National gynaecological cancer treatment units.
- HPV genotype status of cervical tumours should be recorded.
- Review of negative screening tests in the screening period prior to the diagnosis of cancer should be undertaken.
- Clinical case review of the management of patients with prior abnormal screening tests should be undertaken.

Introduction

This is the second of two cancer case reviews performed by the same team within the University of Otago which has enabled consistency of methodology. This brings the retrospective reviews up to date and it is the understanding of the review team that work is underway to establish an ongoing programme of cancer case reviews for women with cervical cancer. The 2008-2012 review was published in 2018² on the NCSP website and a synopsis in the NZMJ.³ The findings and recommendations are publicly available.

In synopsis the key findings of the 2008-2012 review included:

There were limitations of the methodology due to the lack of a population-based register and absence of clinical data, limited availability of cancer stage data, and discrepancies in date of diagnosis between the NZCR and the NCSP-R. The review reiterated the relatively high incidence of cervical cancer in Māori. Lack of regular screening was identified for the majority of women diagnosed with cancer but approximately one third had undergone screening in the last 3 years and about half had been screened within the last 5 years. Māori women with cervical cancer were less likely to have access to cervical screening than non-Māori. It was noted that 39% of women who had been screened in the 6-84 months prior to their cervical cancer diagnosis had had at least 1 abnormal cervical cytology sample indicating a possible lost opportunity for earlier diagnosis or cancer prevention. Māori were over-represented in the group, with 48% of Māori women who had been screened in the 6-84 months prior to their cervical cancer diagnosis having had at least 1 abnormal cervical cytology sample.

Due to the fact that both the 2008-2012 and 2013-2017 reviews were retrospective, few of the recommendations from the 2008-2012 review were able to be incorporated prior to this review. The methodology of the current review is essentially unchanged, however for this review NCSP-R histories have been made available in electronic form so avoiding the need for manual transcription of data. Pathology reports from the NZCR

were provided in PDF format and were reviewed individually by an experienced gynaecological oncologist.

Prior to the two cancer case reviews performed by researchers from the University of Otago, two earlier audits of women with cervical cancer in New Zealand had been conducted. The first was performed following the ministerial inquiry into the under reporting of cervical abnormalities in the Gisborne region⁴ to determine if there was evidence of systemic failures leading to the under-reporting of cytological abnormalities.⁵ This was a formal external review that included women with histologically-proven cervical cancer between January 2000 and October 2002 and included 445 out of 562 (79%) women recorded as having cervical cancer by the NZCR. Exclusion criteria were: women in whom cervical cancer was not histologically proven, women over 80, and women who had not been resident in New Zealand for the four consecutive years prior to diagnosis. Clinical notes were reviewed for 376 women and this was accompanied by interviews of those women or their next of kin for 78% of women. This audit also included independent re-reading of negative screening cervical cytology samples among the included women. Cervical cytology samples were considered to be potentially part of the diagnostic process if performed within 6 months of the diagnosis and thus excluded from reviews of screening history. In this audit, screening histories were reviewed in relation to one screening interval (6-42 months prior to diagnosis), 2 screening intervals (6-84 months), and according to the audit's definition of adequate screening (at least 2 screening tests in the last 2 screening cycles with no interval of greater than 3 years).

The key findings of the 2000-2002 audit were that: 77% of cancers were SCC, 67% of all women and 63% of those with SCC had had a cervical cytology sample in the 6-84 months prior to diagnosis, 49% of all women had had a cervical cytology sample in the 6-42 month interval prior to diagnosis, and 21% were considered adequately screened by the criteria of that audit. Indeed, the audit concluded that approximately 80% of women with cancer were inadequately screened. Ethnicity data on both the NZCR and the NCSP-R was considered inaccurate in 20% of Māori women. Māori women were on average younger at the time of diagnosis, had more advanced disease, and were less likely to have been screened in the prior 6-42 months. Cervical cytology sample

re-reading showed that 18% of women with SCC had a cervical cytology sample reported as normal that was subsequently upgraded to high grade or possible high grade on the re-read. The recommendation from this audit was that priority should be given to improving the uptake and frequency of screening, with a special emphasis for Māori women.

The second audit was performed internally by staff within the NCSP. This audit included women recorded as being diagnosed with cervical cancer between January 2003 and December 2006.⁶ Data was extracted from both the NZCR and the NCSP-R but unlike the first audit, no further clinical information, (i.e. individual patient records) was available for review. This audit included 438 of 625 (70%) of potentially eligible women and excluded women with non-squamous cancers, and women over 80. As with the first audit, cervical cytology samples were considered to be part of the diagnostic process if they were performed within the 6 months prior to diagnosis. Screening history was reported as whether women were enrolled on the NCSP-R (qualified as any cervical cytology sample more than 6 months prior to diagnosis) and regularly screened (at least 5 yearly cervical cytology samples over their period of eligibility, dating back to 1990). Their key findings included that 69% of women were reported to have squamous cancers and 5% adenosquamous. 49% of women had never been screened and only 19% had been regularly screened.

As with the first audit, the second audit again concluded that ~80% of women with cervical cancer were inadequately screened. The recommendation being that improving coverage remains a priority, data linkage between the NZCR and NCSP-R was a useful form of monitoring, and further investigation of issues contributing to the development of cancer in women with a normal cervical cytology sample history is warranted.

Aims of the 2013-2017 Cervical Cancer Review

The aim of this review was to identify the demographics and screening histories of women diagnosed with cervical cancer in New Zealand from 2013-2017. This will help to enable the identification of factors associated with failure of prevention of cervical cancer and to help inform quality improvement initiatives by the NCSP.

Methods

Sample Selection

Case selection was conducted upon records supplied by the NZCR which were registered within the review timeframe of 1 January 2013 and 31 December 2017 as carrying a diagnosis of cervical cancer or possible cervical cancer. These records carried ICD-10 site codes of C530 (endocervix), C539 (cervix), C578 (overlapping sites of the female genital tract). In addition, four women were added who had been identified in the NZCR during the 2008-2012 review but excluded from the earlier review due to their date of diagnosis being in 2013.

Inclusion and exclusion criteria

Women included in this review were those that had a confirmed cervical cancer diagnosis within the review timeframe of 1 January 2013 and 31 December 2017. The identification of eligible women involved, in the first case, identifying a histology report which clearly describes a cancer arising from the cervix. Alternatively, if this information was not available, a diagnosis was inferred where there was at least a high grade cervical cytology sample (i.e., HSIL) or biopsy (i.e., CIN3) accompanied by documented clinical evidence of advanced cervical cancer. The exclusion criteria used in this review were as follows: women not confirmed as having cervical cancer (as defined in the section: “Data Quality” below), women with non-cervical cancer, women who following review were shown not to have cancer, and those whose date of histological diagnosis of cancer was outside of the review timeframe.

Women aged between 25 and 69 were considered eligible for the review of screening history. This age range was selected as it is in line with current NCSP monitoring, and

accounts for the fact that screening histories for those under 25 and over 70 will be different and likely to skew results. Thus, women under 25 (n=14) and over 70 (n=93) were considered separately in this review. In addition, women with rare cervical cancer types unlikely to be prevented by cervical screening (i.e. clear cell, serous, small cell, and neuroendocrine tumours, sarcoma, lymphoma) were excluded for the review of screening history.⁷

Data

Collection and management

All women registered with the NZCR as having a diagnosis of either cervical cancer (with ICD-10 site codes of C530 endocervix, site C539 cervix) or possible cervical cancer (with an ICD-10 site code of C578 overlapping sites of female genital tract) between 1 January 2013 and 31 December 2017 were identified from the NZCR records. For each record, the following information was extracted from their respective sources: relevant screening history report from the NCSP-R, all relevant pathology and cytology reports, staging data, data provided to the NZCR from the National Minimum Data Set (NMDS) and data extracted from death certificates. This information was provided to the review team by the Ministry of Health.

Data quality

All pathology reports available from the NZCR were reviewed in conjunction with the corresponding NZCR and NCSP-R records (screening histories) by the review team to confirm histological diagnosis, date of diagnosis, and FIGO staging (where available). When this information was unavailable, staging information was inferred from available clinical information and histology reports (for example, tumour dimensions), to group confirmed diagnoses into two broad categories of either stage 1a (superficially invasive*) or stage 1b and greater or unknown (FIGO pre-2018 definition).

* Note that the term 'microinvasive carcinoma' was used in the previous review to describe stage 1a lesions. The Lower Anogenital Squamous Terminology (LAST) Standardization Project for HPV-Associated Lesions: Background and Consensus Recommendations from the College of American Pathologists and the American Society for Colposcopy and Cervical Pathology now uses the term 'superficially invasive'.

A comparison of the information held in the NCSP-R and the NZCR was made and any discrepancies regarding: date of diagnosis, histological type, and stage were identified. Following review of pathology reports and available clinical information, the fidelity of data on the individual registers was assessed.

When considering discrepancies in the date of diagnosis, it is important to note that the NZCR uses an ICD 10 rule that uses the earliest date of diagnosis, even if not SNOMED cancer, when it is within 4 months before the SNOMED cancer diagnosis. So for the NZCR, if a woman is diagnosed with cervical cancer and had histology showing CIN 3 or high grade cytology 3 months earlier, the earlier date is taken. For most clinical purposes, the date of histological diagnosis of cancer is most commonly used. Therefore, use of the NZCR date of diagnosis may cause confusion if monitoring treatment of invasive cancer. In this review, we identify as significant a variance of greater than 31 days, as it is in line with the Ministry of Health Faster Cancer Treatment Times 31 day targets.⁸

Definitions

Date of diagnosis

The confirmed date of diagnosis was considered to be the earliest date of a pathology report carrying a histological diagnosis of cancer. In the small number of cases where histology was absent, cytology was utilised to confirm the diagnosis when presented in the presence of other supporting information suggestive of malignancy as described in the inclusion and exclusion criteria. In such a situation, the date of this cytology test was taken as the date of diagnosis of cancer.

Ethnicity

All ethnicity information for analysis is taken from the NZCR records. Up to three ethnicities were recorded for each individual, therefore ethnicity was grouped into the following level 1 categories and reported as total response as recommend by Statistics New Zealand^{9,10}; Māori, Pacific, Asian, , and European/Other (including NZ European). Due to small numbers and subsequent need to protect privacy, Middle Eastern Latin American or Africa (MELAA) cancer registration were included in the European/Other category. Cancer registrations were also analysed in the categories of Māori versus non-Māori ethnicity where records with any response for Māori were prioritised to Māori. In the Māori/non-Māori analysis, those with unknown ethnicity were excluded.

Deprivation and rurality

Deprivation was assessed using the New Zealand Index of Deprivation (NZDep2013), a small area classification that divides the population into ten evenly sized groups according to level of deprivation in the area surrounding their home, where 1 is least deprived and 10 is most deprived.¹ NZDep2013 deciles were aggregated where numbers were small.

Women's addresses, as recorded on the NCSP-R at the time of diagnosis, were geocoded using the Statistics New Zealand Classification Coding System¹¹ to obtain meshblocks. Resulting meshblocks were linked to Area Concordance Files¹² containing NZ Index of deprivation and urban/rural classifications. Meshblocks and classifications from the 2013 census data were used.

Screening history

Consistent with previous reviews, any cervical cytology samples taken within 6 months of diagnosis were considered to be part of the diagnostic process and not screening cervical cytology samples.^{5,6} The number and proportion of women with the following screening histories were reported: those ever screened, those screened within the last 3 years, 5 years, and 7 years. In addition, we reported the proportion undergoing regular screening as defined in 2002 and 2006 audits.^{5,6}

Women are recommended to have three yearly screens from the age of 20 years. The following six definitions of screening adequacy have been used although it is recognised that other definitions have been employed elsewhere (for example, the NCSP-R monitors a regularity of screening indicator that defines adequacy as three yearly screens plus or minus 3 months).

For all definitions, cervical cytology samples that occurred less than six months prior to diagnosis were considered to be ‘diagnostic cervical cytology samples’ and therefore excluded. Time frames were defined in calendar time, so monthly and yearly intervals may not be represented by an exact number of days.

Ever screened

At least one cervical cytology sample recorded between 1 January 1990, when the NCSP-R was established, and six months immediately prior to diagnosis.

Cervical cytology sample in six to 84 months prior to diagnosis

At least one cervical cytology sample in the 6 to 84 months (7 years) immediately prior to diagnosis (i.e., two screening cycles).

Cervical cytology sample in six to 66 months prior to diagnosis

At least one cervical cytology sample in the 6 to 66 months (5.5 years) prior to diagnosis. This means at least one cervical cytology sample in the five years before the six months immediately prior to diagnosis.

Cervical cytology sample in six to 42 months prior to diagnosis

At least one cervical cytology sample in the 6 to 42 months (3.5 years) prior to diagnosis. This means at least one cervical cytology sample in the three years before the six months immediately prior to diagnosis.

Regular screening

As per the definition used by Lewis *et al.*⁶ regular screening is defined such that women must have undergone a cervical cytology sample within five years of becoming eligible for screening and then have had at least one cervical cytology sample every 5 years thereafter (until her 70th birthday or) to six months immediately prior to diagnosis. A woman was defined as having become eligible for screening from the establishment of the National Cervical Screening Programme (defined as 1 January 1990), or from the date of her 20th birthday if this occurred after 1 January 1990.

Adequate screening

Consistent with the 2000-2002 and 2008-2012 reviews^{2,3,5}, but different to the Regularity of Screening Indicator employed by the NCSP, adequate screening is defined as no interval of more than three calendar years between cervical cytology samples in the period 6 to 84 months (7 years) prior to diagnosis. To fulfil this criterion, a woman would have to have had at least two cervical cytology samples less than three years apart in the 6 to 84 months prior to diagnosis. Further, the interval between the start of the period and the first cervical cytology sample, and between the last cervical cytology sample and the end of the period, would also have to be less than three years.

Analysis

The number and proportion of eligible women was summarised by demographic (age, ethnicity, deprivation), pathological (histological type and stage), and geographical (rurality, cancer network region) characteristics, with cross-tabulations by year, Māori ethnicity, and pathology. Counts less than 5 have been suppressed at the request of the Ministry of Health for privacy reasons.

Cervical cancer incident rates by year, age, region, and Māori ethnicity, were calculated using the New Zealand estimated resident (ERP) female populations at June of each year obtained from Statistics New Zealand (via nz.stat or infoshare). Incidence rates by derivation and urban area were calculated using population counts based upon the 2013 census usually resident population and supplied by June Atkinson (University of Otago, Wellington). For international and subgroup comparisons rates were directly age-standardised, using 5-year age categories, to the World (WHO 2000-2025) Standard Population or the Maori 2001 female census population respectively. Rates are presented per 100,000 person-years, with 95% confidence intervals (CI) calculated using the Wilson method for unadjusted rates or via a gamma distribution for age standardised rates.¹³ The denominator dataset and reference populations used for each analysis are listed with the associated table or figure legend.

Screening history was presented in relation to key demographic factors as described previously. In order to determine if the failure of adequate treatment or monitoring of women with screen detected abnormalities contributed to diagnostic delay or cancer occurrences, women with previous screen detected abnormalities outside the 6 month diagnostic period were identified and subsequent colposcopy or cervical biopsy were recorded.

Results

The following section presents selected key findings of this review. Complete results of this review can be found later in this report in Sections 1-4 of the Presentation of Tables and Figures for the 2013-2017 review of Cervical Cancer Occurrences.

Population

The Ministry of Health identified 809 reports of cervical cancer diagnosed between 2013 and 2017 according to information available in the NZCR. Two women were found to have each been diagnosed with two cancers of different morphology, in which case the earlier cancer diagnosis was kept and the later diagnosis excluded. Among the remaining 807 reports, 776 had an ICD-10 diagnosis code of C539 (malignant neoplasm of cervix uteri, unspecified), and 31 a code of C578 (malignant neoplasm of overlapping sites of female genital organs). The Ministry of Health identified that, 794 of the 807 women had clinical details recorded in the NCSP-R.

Review of available pathology information

Following review of the pathology reports made available by the NZCR, only 743 women could be confirmed to have cervical cancer. This included 17 women who had no histology but could be confirmed on the basis of cytology and recorded clinical findings. Seven women were excluded as the date of first histological diagnosis was outside the review period, however, four women were added who had been identified in the NZCR during the 2008-2012 review but excluded from the earlier review due to their date of histological diagnosis being in 2013. 35 women had cancer but were excluded as it could not be confirmed as primary cervical. 15 women lacked histology or cytology that could confirm the diagnosis. None of the 31 women coded C578 could confidently be confirmed to have primary cervical cancer. A total of 747 women were therefore included in the review (see Figure 1-1 for a flow chart showing inclusions and exclusions).

Comparison of information in the NZCR and NCSP-R following review

Information in the NZCR was compared to that recorded in the NCSP-R for the 794 women for whom records were identified in both datasets. In 171 cases the date of

diagnosis was discrepant by more than 31 days. It is important to note that the NZCR uses an ICD-10 rule that uses the earliest date of abnormal cytology/histology, even if not invasive cancer as defined by SNOMED, when it is within 4 months before the SNOMED cancer diagnosis. So for the NZCR, if a woman was diagnosed with cervical cancer and had histology showing CIN 3 or high grade cytology 3 months earlier, the earlier date was taken.

Application of inclusion and exclusion criteria

Figure 1-1 presents a flow diagram illustrating the application of the inclusion and exclusion criteria for the screening review.

Among the 807 women registered on the NZCR, 747 were confirmed to have a diagnosis of cervical cancer within the review time frame.

Women aged 25-69 with cervical cancer likely to be preventable by cervical screening were considered eligible for the review of screening history. Thus, 107 women outside this age group were excluded. In addition, 16 women with cancer types unlikely to be prevented by screening (pure neuroendocrine or non-HPV-related) were excluded. Four women were both outside the age range and had cancer types unlikely to be prevented by screening, thus 119 women were excluded from the screening review in total. This left a total of 628 eligible for the review of screening history.

The screening histories of women outside the specified age range will be considered separately.

Demographics of women with cancer

The demographics of women included in this review are presented in full in Section 3 of the Presentation of Tables and Figures for the 2013-2017 review of Cervical Cancer Occurrences later in this document. Below we present selected key results from the 747 women with confirmed cervical cancer included in the review timeframe.

Incidence of cervical cancer

Over the 5 year period from 2013 to 2017, the annual number of confirmed cases of cervical cancer varied from 133-170 (Table 3-2) with an average of 149 diagnoses of cervical cancer per year. Overall this represented a crude incidence rate of 6.37 (95% CI 5.93, 6.84) and a standardised (WHO 2000-2025 reference population) rate of 5.70 (95% CI 5.28, 6.14) per 100,000 female population (Table 3-1).

Age at diagnosis of cervical cancer

The median age at diagnosis was 45 years, with a peak of occurrences in the 40-44 year old bracket (Table 3-3 and Table 3-6). Among all women with cervical cancer, 2% of women were aged under 25 years (11% under 30) at diagnosis and 12% were over 70 years (Table 3-3).

Histological type

Data describing the various histological types and relevant demographics are described in Table 3-4 and Table 3-7. Among the common cancers, SCC (75%) was the most common, followed by adenocarcinoma (18%) and adenosquamous (4%). Other and non-HPV related cancers (including small cell) comprised 4% of all cervical cancers for the review period. In general, the proportion of cancers that were SCC was found to be lower in women aged 30–50 years at diagnosis (Table 3-12). However, this proportion is highest in those aged under 30 or over 80 (Table 3-12), and in those identifying as Māori (Table 3-11).

FIGO staging

FIGO staging was included in only 187 (25%) NZCR records. 41 (22%) of these were recorded as FIGO stage (pre 2018) 1a (superficially invasive) and the remaining 78% of women were recorded as stage 1b or greater. Following review of histology reports and clinical information by the review team, it was determined that 26% of the 747 women were definitively FIGO stage 1a and the remaining 74% of women were assumed to be stage 1b or greater.

Superficially invasive disease was found more commonly with SCC (30%) than with adenocarcinoma (15%) and was more common in younger women. For example, when

considering SCC, 49% of women 20-39 years had superficially invasive disease at diagnosis compared to 25% in women 40-69 years (Table 3-12).

Ethnicity

Ethnicity was documented in the NZCR for 739/747 (99%) women. Among all women with cervical cancer, when using total response ethnicity, 66% were identified in the NZCR as New Zealand European, 22% were identified as Māori, 7% as Pacific Islander and 12% as Asian (Table 3-3). It should be noted that up to 3 ethnicities could be recorded when using total response ethnicity, hence individuals can be counted multiple times across multiple ethnicities.

The crude incidence for Māori exceeded that for non-Māori in all years covered by the review (Table 3-2). This same trend was accentuated when the incidence rate was age standardised using Māori 2001 population as the reference population (Table 3-2). The overall age-standardised (Māori 2001 population) rates per 100,000 female population were 8.1 (6.9 to 9.6) among Māori and 4.4 (4.0 to 4.8) among non-Māori.

The median age at diagnosis was the same for both Māori and non-Māori (45 years). However, the peak of cervical cancer occurrences was older in Māori (45-49 years) than non-Māori (40-44 years), as shown in Table 3-8. The peak incidence was also older in Māori (40-49 years) than in non-Māori (30-39 years) as shown in Figure 3-3. As the Māori population has a younger population than non-Māori, more women would be expected among the younger age-groups (Table 3-8). Incident rates for Māori women were higher than non-Māori for all age groups (Figure 3-3).

In this review, a higher proportion of Māori women had SCC than non-Māori women (81% vs 73%) (Table 3-11). However, across all histological types, a higher proportion of Māori had early stage disease than non-Māori women (29% vs 25%) (Table 3-11). Among those with SCC, 31% of Māori and 30% of non-Māori had superficially invasive disease (Table 3-11).

In general, Māori women with cancer resided in areas of greater deprivation than non-Māori. This is consistent with the general population, however, the greatest difference in cervical cancer incidence between Māori and non-Māori was seen in women residing

in the areas of greatest deprivation (NZDep2013 deciles 9 and 10) (Table 3-8 and Figure 3-4).

The proportion of women amongst those residing in main urban areas was lower among Māori compared with non-Māori but higher in minor urban areas (Table 3-9). When considering rurality, the greatest difference in incidence between Māori and non-Māori was seen in women residing in minor urban areas (Figure 3-5).

As the number of women with either Pacific or Asian ethnicity were low in this dataset, further analysis beyond that presented in Section 3 was not performed.

For calculated incidence for Māori and non-Māori subpopulations see Supplementary Data.

Deprivation index

Data relating to cervical cancer and deprivation index are presented in Table 3-3, Table 3-6, Table 3-8, Table 3-14, and Figure 3-4. In this review, overall there was no clear association between cancer incidence and deprivation index. However, when considering only SCC, rates were highest in NZDep2013 index decile 9 and 10 areas (Figure 3-8 and Table 3-14). A high proportion of Māori women with cervical cancer were domiciled in deprivation index levels 9 and 10 (Table 3-8). This distribution is consistent with the overall population. As noted above, the greatest difference in cervical cancer incidence between Māori and non-Māori was seen in women residing in the areas of greatest deprivation (NZDep2013 deciles 9 and 10).

Residence at Time of Diagnosis

Rurality

The majority of cervical cancer diagnoses (68%) occurred among women residing in Main Urban Areas (Table 3-9).

As noted above, among Māori, the proportion from minor urban areas exceeds that of non-Māori (Table 3-9). There was no clear pattern between histological type and stage between Urban and Rural residence (Table 3-15).

Cancer Network Residence at diagnosis

The number of diagnoses varied from 152 (Midland) to 243 (Northern) between Cancer Networks. Cancer incidence across Cancer Networks was similar (Figure 3-6).

Review of cervical screening adequacy

For the purpose of the review of screening histories the following exclusion criteria were applied, as detailed in Section 2 Presentation of Tables and Figures for the 2013-2017 Review of Cervical Cancer Occurrences later in this document:

- Women aged 70 or over who are outside the screening age.
- Women under 25 years (due to having a limited period of time when eligible for screening and a limited number of screening tests when fully compliant with NCSP recommendations).
- Women with rare or non-HPV related cancer types that are unlikely to be preventable by screening.
- One woman in whom cervical cancer was diagnosed outside NZ.

Following application of these exclusion criteria, 628 eligible women confirmed to have cervical cancer aged 25 years or older and under 70 years were identified for whom regular screening as recommended by the NCSP had the potential to prevent the diagnosis of cervical cancer. Ethnicity was documented in the NZCR for 626/628 (99.7%) women. Of these women, 64% identified as European, 23% as Māori, 7% as Pacific Island, and 13% as Asian (Table 3-6).

As per previous reviews, in this review we considered that cervical cytology samples in the 6 months prior to diagnosis were likely to be part of the diagnostic process (see Figure 4-1), hence the decision to exclude them from the screening history review.

Of the 628 women who were diagnosed with cervical cancer between 2013-2017, 55% had a cervical cytology sample within the 6-84 months prior to diagnosis, 50% had had a cervical cytology sample in the 6-66 months (5 years) and 37% had a cervical cytology sample between 6-42 months (3 years) prior to diagnosis (Table 4-1). Amongst these 628 women, only 12% had an adequate screening history over the 84 months prior to

diagnosis by the criteria used in the 2002 Review⁵ (adequate screening is defined such that there is no between-cervical cytology sample interval of three calendar years or more in 6 to less than 84 months prior to diagnosis). Based on the data provided in Table 4-1, Table 4-2, and Table 4-5, the following observations can be made for women with cervical cancer included in the review of screening histories:

- In general terms, older women were less likely to have been screened than younger women. 19% of women age 35-39 had been adequately screened compared with 3% of women aged 60-64. In the prior 6-42 months, 46% of women aged 25-29 had been screened compared to 23% of women aged 60-69.
- For women with cervical cancer, Māori women were less likely to have been adequately screened (10 vs 15%) than European women or screened 5 yearly (18% vs 30%). Pacific and Asian women were less likely than European or Māori women to have been screened by all measures.
- There was a trend towards women of higher deprivation being screened less often.
- The proportion of women with SCC who were screened at all time intervals was lower than for adenocarcinoma.
- Women with superficially invasive (stage 1A) cancers were more likely to have been screened at all time intervals (excluding the 0-6 months prior to diagnosis) than women with more advanced tumours.
- Comparing data between regions there appeared to be some variation in screening history by region. However the small numbers involved and demographic differences will likely influence these results.

The accuracy of cervical cytology

In total, 1127 cervical cytology samples were taken in the 3 years prior to diagnosis (i.e. 0-36 months) of which 1112 were satisfactory. Of these, 81% were abnormal with 839 (75%) high grade and 57 (5%) low grade abnormalities (Figure 4-1). 180 women also had high risk HPV genotype testing at some point prior to their diagnosis. Of the 169

women who had HPV testing in the 3 years prior to their diagnosis, 152 (90%) were high risk HPV genotype positive (see Supplementary Data).

Patients with prior screen detected abnormalities

In principle, women who had a screen detected abnormality more than 6 months prior to the diagnosis of cancer could potentially have had their cancer either diagnosed earlier or prevented. Of the 628 women included in the cervical cytology sample history review, 346 women had had at least one screen in the 6-84 months prior to their diagnosis. 116 of these women had had an abnormal cervical cytology sample. In 77 women, the abnormal cervical cytology sample had been high grade. This suggests that there was some element of the diagnostic or treatment pathway that failed and resulted in either the delayed diagnosis or failure of prevention in 18% of the entire cohort or 34% who had had a cervical cytology sample in that timeframe. It is important to note that Māori and Pacific women were over-represented in this group, and in particular, where a high grade abnormality was present prior to their diagnosis of cancer, the discrepancy was at its greatest – 40% of Māori women and 53% of Pacific women who were screened in that time period had had a high grade cervical cytology sample as opposed to 16% of European women who had been similarly screened. This suggests particular barriers for Māori and Pacific women in accessing diagnostic and treatment services. Further investigations of the factors that are associated with the failure of the screening and treatment pathway are under investigation in a detailed study of clinical information available in hospital records and the NCSP-R. This will be reported separately.

Screening history in women with adenocarcinoma

Cervical screening is known to offer greater protection for women against SCC than adenocarcinoma. In this cohort of women, 50% of women with SCC had had no screening in the 6-84 months prior to their diagnosis compared to 28% of women with adenocarcinoma. Furthermore, 57% of women with SCC who had been screened in the 6-84 months prior to their diagnosis had had only normal screens compared with 89% of women with adenocarcinoma. Failure of diagnosis or treatment following an abnormal cytology test appears to be a less common issue for women with adenocarcinoma than for women with SCC.

Special Populations (women aged under 30 and over 70)

Special consideration is given to women under 25 and over 70 years of age. These groups have different access to screening as per the NCSP guidelines for screening and as a result, the definitions for regular or adequate screening cannot apply to this group. We also consider women aged between 25 to 29 years separately as proposed changes to the screening programme may change access of this group to a history of regular screening. The relevant findings are presented below:

Women aged under 25 years

- Among all women with cervical cancer, 2% (14) were under 25.
- 86% (12/14) were diagnosed with SCC and 7% (1/14) adenocarcinoma.
- 36% (5/14) were of Māori ethnicity.
- Among women with SCC, 75% (9/12) were stage 1a and were likely to be diagnosed as a result of cervical screening.
- 13 of 14 women had a cervical cytology sample taken as part of the diagnostic process. (All had a cervical cytology sample taken, however, one did not have a cervical cytology sample taken within six months of diagnosis).
- 71% (10/14) of women had had a cervical cytology sample taken in the 6-42 months prior to diagnosis.
- 29% (4/14) had had at least 2 previous cervical cytology samples taken. (Excluding cervical cytology samples taken within 6 months of diagnosis).

Women 25-29 years

- Women in this age group represent 9% (69) of cervical cancers.
- 25% (17/69) were of Māori ethnicity.
- 84% (58/69) were diagnosed with SCC, and of these 53% (31/58) were Stage 1a.
- 46% (32/69) were screened in the 6-42 months prior to their diagnosis but only 10% (7/69) were adequately screened by the 2002 Review Standard.

Women aged over 70 years

- Represent 12% (93) of women with cervical cancer.
- Predominantly non-Māori with advanced disease.

Women aged between 70-79 years

Of the 53 women:

- 44 were non-Māori and six were Māori (3 unknown).
- 77% (41/53) of women in this age group were diagnosed with SCC.
- 46 (70%) had ever had a cervical cytology sample taken, however only 29 had a cervical cytology sample taken greater than 6 months prior to diagnosis.

Women aged over 80 years

- 40 women were diagnosed with cervical cancer over the age of 80.
- Of those, four were Māori.
- The predominant histological types were SCC (85%, 34/40). There were two women diagnosed with adenocarcinoma (5%), and two women diagnosed with adenosquamous (5%).
- 20 of the 40 (50%) women had had a prior screening test. (“Ever screened”, excluding in six months prior to diagnosis).

Comparison of results from cervical screening programme reviews 2008-2012 and 2013-2017

Below is a summary of the main differences in the current review (2013-2017) compared with the previous review (2008-2012). Note: all numbers are presented as current review versus previous review.

Among women with confirmed cervical cancer:

- There were fewer women with confirmed cervical cancer (747 versus 772). While overall 5-year incidence rates were lower, based on the overlap of confidence intervals, there was no evidence of a statistically significant decrease between the two periods.
- There was an increased proportion of superficially invasive (stage 1a) SCC in the current review (30% versus 26%).
- There was a decrease in the absolute numbers and incidence of adenocarcinoma, other, and non-HPV related cancers (186 versus 220), however, there was no decrease in the numbers or incidence of SCC (561 versus 552).
- There were more women in the 20-35 year age group (182 versus 158) but fewer women >35 years (565 versus 614)
- There were slightly fewer Māori women (162 versus 169) and fewer Pacific Island women (49 versus 72) but more Asian women (91 versus 57).
- There were more women from areas associated with less deprivation (NZDep2013 deciles 1 and 2) (154 versus 126).

Among women eligible for screening review

- Overall, screening histories were similar between the two reviews.
- As an exception, screening history by any measure of adequacy assessed was lower among women 25-29 years (e.g., adequate screening 10% versus 24% or in the prior 6 to 84 months 66% versus 80%). Additionally, screening history by any measure was slightly lower among women aged >55 years (e.g., adequate screening 7% versus 13% or in the prior 6-84 months 36% versus 42%).
- Screening history by any measure for Māori women slightly increased overall (e.g., adequate screening 10% versus 6% or in the prior 6-84 months 56% versus 45%). This was especially so among Māori women aged 40-49 years (e.g., adequate

screening 16% versus 2% or in the prior 6-84 months 60% versus 36%) but has decreased for Māori women 25-29 years (e.g., screening in the prior 6-84 months 65% versus 100%).

- The number Asian women increased (82 versus 49) and by any measure were less well screened (e.g., adequate screening 9% versus 10% or in the prior 6-84 months 37% versus 51%).

Number of women identified

The number of women included in the NZCR was lower in the current review compared with the previous review (807 versus 852). Following review of histology reports, 747 were included in the current review compared with 772 women in the previous review and. In addition, there were fewer women aged 25-69 years who were eligible for inclusion in the current review of screening histories compared with the previous review (628 versus 644).

The decrease in the number of women in the current review was explained by a reduction in the number of adenocarcinomas (131 versus 150) and other rarer cancers (28 versus 50). The numbers of women diagnosed with SCC and adenosquamous tumours increased slightly (572 versus 587). These trends were true for both Māori and non-Māori.

Annual incidence

The annual incidence of cervical cancer either unadjusted or when standardised to world populations was lower for the current review compared with the previous review (unadjusted 6.37 versus 6.94 cases per 100,000 female population). While there was no reduction in the incidence of squamous carcinomas the incidence of non-squamous carcinomas dropped significantly (see Supplementary Data).

Annual incidence by year and ethnicity

Māori and non-Māori cervical cancer incidence rates fell in the current review period compared with the previous review period. The incidence rate in Māori women was 8.9 versus 9.9 per 100,000 while the age-standardised incidence rate among non-Māori was 4.4 versus 4.6 per 100,000 women. On closer examination of the annual incident

rates, the incident rate for non-Māori was constant, while for Maori the incident rate fell slightly, thus reducing the difference between Māori and non-Māori (Figure 3-2). However based on an assessment of the confidence intervals for the results, changes were not statistically significance.

Stage at diagnosis

There was an increased proportion of superficially invasive cancer of all types. Most notably in SCC (30% versus 26%).

Demographics for all cervical cancer diagnoses

Some variations are evident between the two study periods in relation to the number of cases of cervical cancer diagnosed in each 5 year age band. Consistently in both audit periods, the age group associated with the highest number of incident cases was women aged 40—44 years. Most women in both audits identified within the categories of European/other or Māori ethnicities. Fewer women were recorded as Pacific (49 versus 72), while more women were recorded as Asian (91 versus 57). More women were associated with less deprived areas (NZDep2013 deciles 1 and 2) in the current review (154 versus 126).

Demographics among women eligible for screening history review

The number of women diagnosed with cervical cancer eligible for screening history review in all the 5 year bands were lower except among women aged 25-29 years (67 versus 50) and 30-34 years (98 versus 81). The number of Māori and Pacific Island women decreased (147 versus 159 and 43 versus 64 respectively), while the number of Asian women increased (82 versus 49). More women were associated with less deprived areas in the current review (128 versus 102).

The number of women with adenocarcinoma decreased (122 versus 132) and there was an increase in the number of women with stage 1a disease (182 versus 159).

Age as a proportion of Māori and non-Māori women

The proportions of each 5 year age bands that were Māori or non-Māori were similar between previous and current reviews, however, the number of non-Māori women at

both extremes of age were lower in the current review and consequently the proportion of Māori in the 20-24, 75-79 and 80+ age bands were relatively higher in the current audit.

Incidence rates by age and ethnicity

Incidence rates appear generally similar between the current and previous review periods. Incidence rates for Māori aged 70-79 years are slightly higher in the current review, although it should be noted that confidence intervals overlap.

Incidence rates by deprivation and ethnicity

Annual incidence rates per 100,000 women of cervical cancer by deprivation and ethnicity appear similar between the current and previous review periods.

Diagnoses by rurality and ethnicity

There were no major differences in results by rurality and ethnicity between the current and previous review periods.

Diagnoses by Cancer Network and ethnicity

There were no major differences in results related to the cancer network regions and ethnicity between the current and previous review periods.

Screening adequacy by demographics

Screening adequacy among women in the two youngest 5 year age bands (25-29 years and 30-34 years) was lower in the current review period compared with the previous review period, (10% and 12% compared with 24% and 17%). Screening adequacy among women aged 55-59 years was also lower in the current review period (7% versus 17%). Results were similar by deprivation deciles, with small decreases in adequacy noted among the four lowest deciles in the current review period (16% and 15% compared with 19% and 18% for aggregated deciles 1-2 and 3-4, respectively).

Screening adequacy by histological type and stage

The percentage of women with cervical cancer that were adequately screened were generally similar between the previous review and current review periods in relation to

histological type. Some differences were apparent in the percentage of women with adenocarcinoma disease adequately screened, 43% in the current review period compared with 21% in the previous review period, but small numbers limit any conclusions from these observations. The proportion of women with stage 1a disease that were adequately screened increased in current review period (14% compared with 8%) while the proportion adequately screened decreased among women with stage 1b+ disease (11% compared with 14%).

Screening adequacy and ethnicity

Screening adequacy among Māori women slightly increased in the current review period (10% versus 6%). Most of the increase in screening adequacy was among Māori women aged 40-49 years (16% versus 2%). By contrast, adequacy decreased among Māori women in the youngest age group (25-29 years 6% versus 15%), although it should be noted that numbers were low in this group in each review period (16 and 13 women, respectively). Among non-Māori women, screening adequacy was similar between the two study periods although a decrease in adequacy was evident among women aged 25-29 years (12% compared with 28%).

Screening history in 6-84 months period to diagnosis

Findings were generally similar between the current and previous review periods, however the results for some age groups were notably different. Among women aged 25-29 years, more women had not had a cervical cytology sample taken in the 6-84 months prior to diagnosis in the current review period (34% compared with 20%). By contrast, fewer women aged 30-34 years recorded no screening in the 6-84 months prior to diagnosis in the current review period (29% compared with 40%).

The number and percentage of Māori women that had had no screens in the previous 6-84 months was lower in the current review period compared with the previous review period (44% compared with 55%). Likewise, the number and proportion among Pacific Island women also decreased (55% compared with 69%). However, the number and proportion without screening in the previous 6-84 months increased among Asian women (63% compared with 49%).

Discussion

This is the second retrospective review of women with cervical cancer performed by the University of Otago team in close succession. A very similar methodology was utilised which made the results comparable. However, as the reviews are retrospective and were performed in close succession, there was little or no ability for policy change as a result of the first review to affect the outcome of the current review. The results are therefore similar and the recommendations are similar. Some differences are evident between the results of the reviews and these are discussed later in this section.

The methodology was based on the identification of women with cervical cancer by the NZCR and matching these data with the screening data in the NCSPR. The available histology reports and clinical information of all patients recorded on the NZCR was reviewed by an experienced gynaecological oncologist to confirm, if possible, the diagnosis and the date of diagnosis. A number of weaknesses are inherent in this methodology.

These weaknesses include:

- The audit cannot be performed until all cases are collated by the NZCR.
- Some cases of cervical cancer may not be identified as such on the NZCR and therefore would not be included in the review.
- The review was limited to the data available to the review team. There were particular issues with the availability of clinical data. For some women, we are unable to confirm the diagnosis, determine the stage at presentation, or determine the mode of diagnosis of cancer.
- As only data on women identified as having cancer was utilised, there is no ability to compare the screening histories of women with cancer to the screening histories of women without cancer. We can therefore make no determination of the effectiveness of screening in different populations.
- As no review of cytology was performed we are unable to determine the extent that under reporting of identifiable cervical abnormalities contributed to the occurrence of cancer in screened women.

Cervical cancer was most easily confirmed when patients recorded as having cervical cancer on the NZCR had a confirmatory biopsy record. For other women, further clinical information would have been helpful in determining the actual diagnosis. To minimise the number of exclusions, patients were included if they had abnormal cytology or histology consistent with, but not diagnostic of, cervical cancer and a recorded clinical history on the NZCR consistent with advanced cervical cancer.

Similar to the 2008-2012 review, a number of patients were excluded on review. None of the patients coded as C578 (overlapping sites of the female genital tract) were confirmed as having cervical cancer and no patients were identified as C530 (endocervix), suggesting that these patients do not need to be included in the review. Of the women coded C539 (cervix), approximately 5% could not be confirmed as having cervical cancer on the information made available to us. This proportion is slightly lower than those excluded in the previous audit. This method may slightly under-represent the number of women with cervical cancer. Further accuracy could be achieved by reviewing the clinical notes of the patients in question or closer communication between NZCR and clinical carers or, alternatively, the prospective registration of patients diagnosed with cervical cancer following multidisciplinary review.

As per SNOMED, the date of diagnosis recorded by the cancer registry dates back to abnormal cytology up to 4 months preceding the diagnosis. However, for the purpose of the review, the date of diagnosis was the date of first histological diagnosis of cancer. This leads to discrepancies in the date of diagnosis of up to 4 months. While, for most patients, the cancer may have been present at the earlier date, this is not certain for all women, and to some extent this date is arbitrary. Caution needs to be exercised when using the NZCR diagnosis date for audit of the management of women with invasive cervical cancer. For this reason, it would be an appropriate addition for the NZCR to record the date of histological diagnosis. As a result of this discrepancy, seven women with an NZCR diagnosis date within the review period had a histological diagnosis outside the period. To eliminate this bias, women identified from the NZCR as having a date of diagnosis in the 2008-2012 time period but who had a histological diagnosis in 2013 were included in this cohort (4 women).

In this review, it remains clear that a number of women who have a histological diagnosis of cancer are not coded as such on the NCSP-R. This often seems to be due to a SNOMED code recorded on the NCSP-R which is consistent with a high grade intraepithelial lesion but with a final diagnosis of invasive cancer recorded in the NZCR. Crosschecking of these diagnoses between the data sources would appear to be appropriate.

Having excluded unconfirmed cases, on average there were 149 diagnoses of cervical cancer per year resulting in a raw incidence of 6.37 per hundred thousand population per year and an age adjusted (WHO 2000-2025) incidence of 5.70. This is amongst the lowest in the world and is consistent with a highly successful screening programme. Unfortunately, however, the incidence of cervical cancer in Māori remains significantly higher than that of non-Māori. This is consistent with reduced access to screening and treatment of cervical precancer for Māori women.

The demographics of women in this review are similar to those of the 2008-12 review and other sources. The data were derived from the NZCR. This was reliably documented and methodologically consistent with the previous review. The demographics from the NCSP-R were not used. Women may move prior to their diagnosis with cervical cancer. Thus, there may be minor variations if the NCSP-R data was utilised.

The median age of women with cancer was 45 years with the peak age range being 40-45 years. Cervical cancer was rare in women under 25 years. 75% of cervical cancers were SCC and 18% adenocarcinoma. The remainder were adenosquamous cancers or a variety of rare histological types. FIGO stage was poorly reported but, on the basis of their histology report, 26% of cancers were superficially invasive. Women with superficially invasive disease have an excellent prognosis even with conservative surgery. The combination of a low incidence of cancer and a high proportion of superficially invasive cancers is associated with successful screening and a low mortality from cervical cancer. FIGO staging information was very poorly recorded in the NZCR over the review period. FIGO stage recording has decreased since the 2003-2006 audit where FIGO stage was recorded for 55% of cervical cancer cases (see Table 6-5).⁶ As

clinical assessment is required to denote FIGO stage, it is clear that more access to clinical information is required to improve stage data. It is recommended that all patients with cervical cancer are managed in conjunction with a regional gynaecology multidisciplinary meeting (MDM). Sharing of information between MDMs and the NZCR would improve the recording of FIGO stage information in the NZCR. Improved stage data is important because screening downstages disease and prognosis correlates well with stage.

The occurrence of cervical cancer varied between regions but the reasons for these variations are likely to be complex and cannot be ascertained in this study. Overall, there was no clear association between deprivation index and the incidence of cervical cancer, but higher proportions of squamous cancers were associated with greater deprivation. Māori women with cervical cancer are over-represented within the lowest two deciles of deprivation and there was an apparent increase in incidence of cancer for Māori women in these most deprived deciles. Māori women continue to be socially and economically disadvantaged and, for disadvantaged Māori women, the risk of cervical cancer is increased. It seems likely this, at least in part, is due to increased barriers to screening and treatment of precancerous abnormalities.

A review of the screening history of women aged between 25 and 69 was undertaken. Younger and older women were excluded because the screening history of women outside the screening programme, and those who have just entered the programme, is not comparable to those of other age groups. Screening, however, does have an impact on women of these age groups. Young women with cancer often have superficially invasive cancers which are only picked up by screening. The risk of cancer in women over 70 years, who make up 12% of the group, will be influenced by their lifetime history of screening. We also excluded a small number of women with rare cancers for whom screening is unlikely to prevent the disease (including pure neuroendocrine tumours serous and clear cell tumours). The review of screening history included 84% of the entire cohort. It must be remembered the impact of the screening programme is different for the remaining 16% of women.

As per previous reviews, cervical cytology samples taken in the 6 months prior to the diagnosis, were excluded from consideration in the review of cervical screening history because of the high likelihood they were part of the diagnostic process (even if they were taken as a screening test for an asymptomatic woman). This is somewhat arbitrary and may underestimate screening activity for some women. Previously, we demonstrated an excess of tests in this period and that the majority of the results are abnormal. In the absence of further clinical information, this definition remains a standard. Some similar reviews exclude a shorter time frame.¹⁴

If, hypothetically, screening would prevent the vast majority of cancers, we can identify four major causes of screening failure. The first is lack of screening and in particular regular screening. The second is lack of sensitivity of the screening test, i.e., the test fails to detect a precancerous lesion that is present on a woman's cervix. The third is failure of appropriate treatment of a precancerous abnormality that has been detected by the screening test. In addition, for some women, cervical cancer may not be preceded by a precancerous lesion detectable by the screening test.

As for all previous audits and reviews, the review of screening history clearly demonstrates that the vast majority of women with cervical cancer have not undergone regular or adequate screening. In this review, only 12% of women had undergone adequate screening as defined by no screening interval of greater than 3 years in the 6-84 months prior to the diagnosis. Similarly, only 23% of women had had regular smears less than 5 years apart back to 1990 or their age of 20. It is somewhat disappointing that there has been little substantive change to cervical cancer rates and cervical cytology coverage since 2005. Increasing the coverage and regularity of cervical cytology testing remains the most effective way of decreasing cervical cancer incidence. This implies that there should be an ongoing emphasis on improving 3- and 5-year screening. According to data available in NCSP 6-monthly reports, 3-year coverage remained fairly constant between 2010 and 2017 in women (25-69 years) at around 76%, but decreased by 5% (from 55% to 50%) in women aged 20-24 years and by 2% (from 67% to 65%) in women aged 25-29 years.^{15,16} It is apparent that renewed efforts and novel approaches are required to improve screening coverage.

Ideally, access to a population-based register (such as the NHI) would enable us to determine screening patterns in specific populations of women, so determining the apparent protective effect of different screening patterns in different groups of women. This approach has been used to determine screening policy in other countries.¹⁴

Māori women have a higher incidence of cervical cancer than non-Māori, have a higher proportion of squamous cancers, a lower proportion of superficially invasive disease, and a lower probability of screening prior to the diagnosis of cancer than non-Māori. All these support the fact that Māori women have reduced access to screening. According to data available in NCSP 6-monthly reports, 3-year coverage increased for Māori women by 8% (from 56% to 64%) between 2010 and 2017. However, coverage for Māori women is still lower than for European women (e.g., 3-year coverage of 64% for Māori women versus 81% for European women in 2017)¹⁶ and as such should remain a priority of the NCSP.

Regarding shorter screening intervals, 37% of women with cancer had had a cervical cytology sample taken in the 6-42 months (3 years) prior to their diagnosis and 50% had had a test in the 6-66 (5 years) months prior. While these rates are significant, these are well below the national 3 and 5 year coverage rates reported by the NCSP. For example, the 76.5% of eligible women aged 25-69 years had been screened in the three years prior to 31 December 2013.¹⁷ This infers significant protection against cancer from a single test but once again comparator groups are required to estimate the degree.

We expect that cancer is preceded by a precancerous lesion for a prolonged period of time, therefore in the majority of these women a lesion would have been present but not detected. As it is known that cervical cytology has a limited sensitivity we would expect in a well screened population many women with cancer would have been screened prior to their diagnosis. As the cytology tests have not been re-examined we are not able to determine the relative importance of the limitations of the test itself and limitations of the interpretation of the test by cytotechnologists and

cytopathologists. While it cannot be excluded, there is no reason to suspect systematic under-reporting of abnormal cervical cytology.

The cervical cytology test has a limited sensitivity and cervical cancer is preceded by a long precancerous phase, thus, to provide optimal protection, cervical cytology tests need to be performed at regular intervals. Improving the frequency and regularity that women have tests and improving the sensitivity of the test would improve cancer protection. There is sound evidence that the HPV primary screening offers greater sensitivity in the detection of cervical precancers and the prevention of cervical cancer. The National Screening Unit has planned to change the NZ screening test from a cervical cytology based screening test to HPV primary screening. HPV primary screening would be more likely to detect abnormalities in the 5 years prior to diagnosis, thus its introduction would be likely to have a significant impact on the incidence of cancer provided coverage does not reduce. Further delays in the implementation of HPV primary screening will result in avoidable morbidity and mortality from cervical cancer for New Zealand women.

It is important to note that a proportion of women screened prior to the diagnosis of cancer will have had an abnormal test. In theory, for these women there has been a failure of the diagnostic or treatment pathway that has prevented their cancer from either being prevented or diagnosed earlier. In this population, one third of women screened in the 6-84 months prior to their diagnosis had had an abnormal screen. Māori women were over-represented in this group, 40% of Māori women and 53% of Pacific women who were screened in that time period had had a high grade cervical cytology. This suggests that barriers to effective diagnosis and treatment is an important cause of inequity. Further study into the factors associated with this treatment failure is being undertaken and will be presented separately.

Cervical screening is largely aimed at the prevention of SCC of the cervix which are preceded by CIN lesions that are easily detectable by cytology tests. Adenocarcinomas have a less well defined natural history and precancerous phase, thus the incidence of adenocarcinomas is normally not reduced by cervical cytology screening and are normally present in a greater proportion in screened populations. Some rarer cancers

may not be impacted by screening at all. In this review, as expected, patients with adenocarcinoma were more likely to have been screened prior to their diagnosis. Adenocarcinomas were seen in a smaller proportion of Māori women compared with non-Māori.

There are some identifiable differences between the 2008-2012 and the 2013-2017 period. The most notable is that, despite a small rise in population, there was a reduction in the number of cervical cancer diagnoses, this was seen in the number of women identified on the NZCR, the number of women confirmed to have cervical cancer (772 vs 747), and the number included in the screening review. This results in a decreased raw and age-standardised incidence of cancer over the two periods. The reduction in incidence was seen in both Māori and non-Māori.

On closer scrutiny, it appears that the reduction is confined to women with adenocarcinoma or other rare tumour types. Squamous cancers do not appear to have reduced 552 (2008-12) vs 560 (2013-17). These trends were seen in Māori and non-Māori women. It is difficult to explain this reduction, and this trend has not been published by other registries. It may be a chance finding, it may be due to the cancer registration process, or it may reflect a true reduction in incidence.

Our findings suggest a significant decline in non-squamous cervical cancer incidence over the 2008 to 2017 period. However, there is no identifiable step change and the number of exclusions was less in our later cohort, so it seems unlikely this is a bias of this review methodology (see Supplementary Data). It is possible that the number of registrations have reduced, as following review at a multidisciplinary meeting, an increasing number of adenocarcinomas or other rare tumours have been identified to have a primary source outside the cervix. It is however possible that the reduction is due to an increase in the quality of cytological screening to detect glandular abnormalities. Compared with the 2008-2012 review, there has been very little change in the screening histories of women diagnosed with adenocarcinoma. Other jurisdictions have reported an increased identification of adenocarcinoma in situ but stable rates of adenocarcinoma.¹⁸⁻²⁰ Perhaps the increased detection of adenocarcinoma in situ will lead to a reduction in rates of adenocarcinoma, but this is

yet to be reported by other registries. Regardless of the reason this is an interesting trend worthy of further inquiry.

There has been no reduction in the numbers of squamous cancers. However, there are some signals of improved performance of the screening programme between the time periods including the increased proportion of superficially invasive SCC (26% in 2008-2012 review versus 30% in 2013-2017 review). There are, however, some trends that may suggest that this is not so for all women. For example, there is an increase in the number of women under 40 with cancer as opposed to a reduction in the numbers of women age 40-69, and by some measures, younger women with cancer had less screening coverage than in the previous review period.

There was a non-statistical decrease in cervical cancer incidence for Māori women in this review period, however, in line with the total population, this fall was in non-squamous cancers. There were, however, some signs that screening coverage for Māori improved, the proportion of superficially invasive tumours increased and by most measures the proportion of Māori women with cervical cancer that had been screened at differing time intervals improved, suggesting improved coverage. As noted above, NCSP data indicates that 3-year coverage increased for Māori women by 8% between 2010 and 2017. However, Māori women continue to have lower 3-year coverage and a higher incidence of cancer than non-Māori women.

The increase in the number of Asian women in this cohort, and their low rate of adequate screening, draws attention to the importance of screening in Asian women.

In summary, this review has the same limitations as the 2008 to 2012 review. However, the results are consistent with a high quality screening programme. The number of cervical cancer cases has reduced but, because this reduction is due to a reduction in the numbers of non-squamous cancers, we are unsure if this can be attributed to improvements in the screening programme. The modifiable factors that are associated with the occurrence of cervical cancer include a lack of regular screening tests, the sensitivity of the screening test, and failure of the diagnostic and treatment pathway. Māori women particularly those living in the most deprived two deciles appear to be at

greater risk than non-Māori. Care needs to be taken to ensure regular screening in younger women, as the occurrence in cancer in younger women may be increasing, associated with lower coverage.

Ongoing and renewed efforts to improve the regularity of screening, the introduction of a more sensitive screening test, and improvements in the screening and diagnostic pathway will further reduce the incidence of cervical cancer in New Zealand. In addition, attention must be given to improving access and quality across the screening pathway for Māori and Pacific women. Ongoing and more detailed review of cervical cancer occurrences generally, and the identification of intervention points to address inequities across the screening pathway for Māori and Pacific women, is recommended to ensure the ongoing high quality of the NCSP.

Tables and Figures for the 2013-2017 review of Cervical Cancer Occurrences

1. Identification of eligible cervical cancer cases

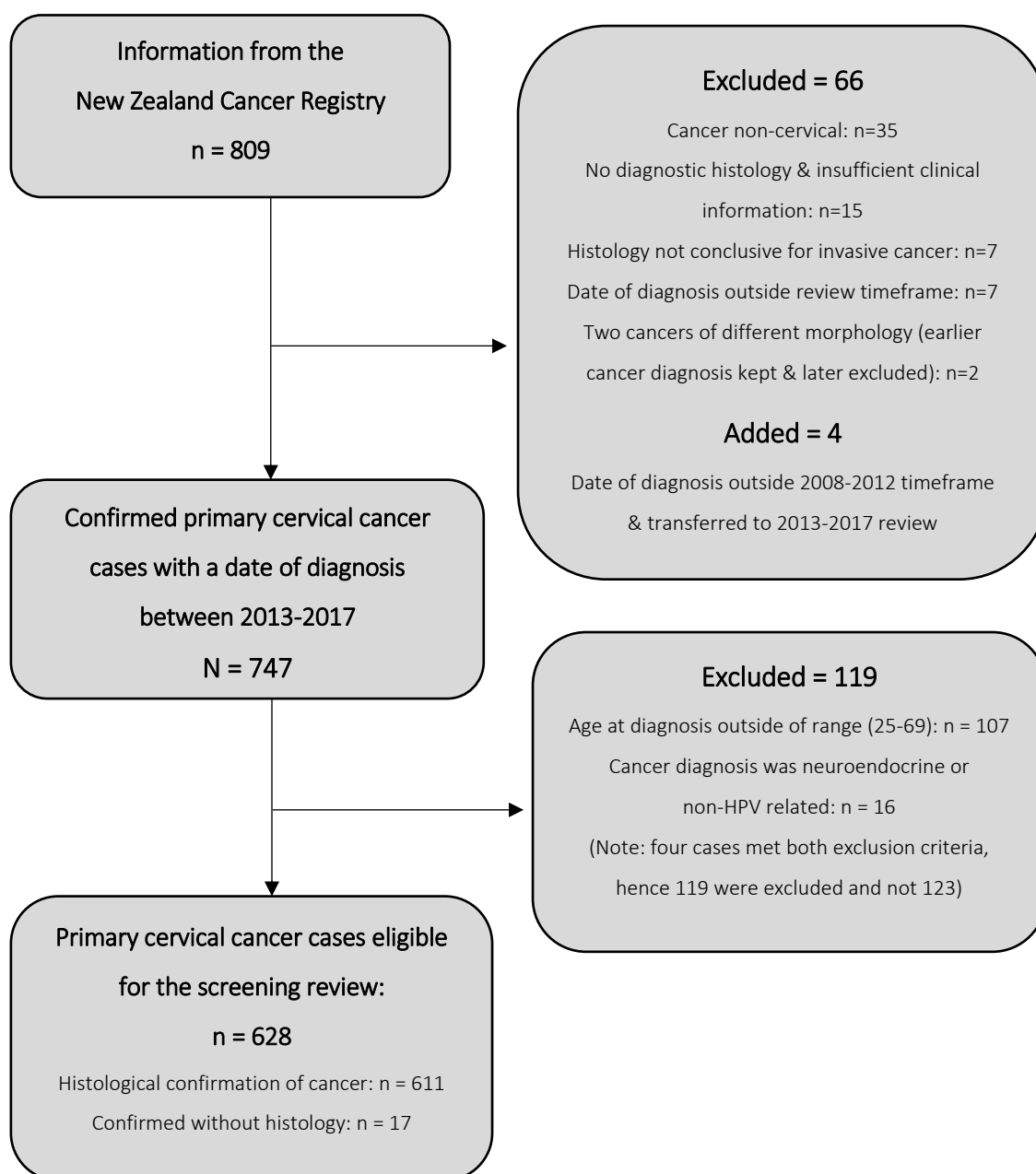


Figure 1-1 Application of inclusion and exclusion criteria to the full dataset as supplied by the NZCR and NCSP-R for selection of women eligible for the screening review

Table 1-1 Description of NZCR records

Popn: 807

NZCR Records	2013–2017
	n
Total number of cases received from the NZCR	809
Total number of individual women*	807

All cervical and related cancer incidences on the NZCR diagnosed 2013-2017, and the number of these with associated screening histories on the NCSP-R register. *Two women were found to have each been diagnosed with two cancers of different morphology, in which case the earlier cancer diagnosis was kept and the later diagnosis excluded.

Table 1-2 ICD10 cancer codes for all NZCR records

Popn: 807

NZCR codes received in full dataset	ICD10	2013–2017
		n
Malignant neoplasm of cervix uteri	C539	776
Malignant neoplasm of endocervix	C530	0
Malignant neoplasm of overlapping sites of female genital organs	C578	31
Total		807

ICD10 cancer codes for all records received from the NZCR of cervical and related cancers. Cervical cancers include C539 and C530. The genital organs cancers (C578) were included in the dataset population also.

Table 1-3 Women excluded from the review following review of histology reports**Popn: 64**

Review of Cancer Registry records and corresponding histology reports revealed the following information.

Exclusion reason	C539	C578	Total
No diagnostic histology, insufficient clinical information on which to base a date of diagnosis	15	0	15*
Histology not conclusive for invasive cancer	6	1	7 [#]
Cancer is not confirmed cervical	5	30	35
Date of diagnosis outside of review timeframe	7	0	7 [^]
Total excluded	33	31	64

*Typically metastatic tumours, diagnosis from a death certificate or the National Minimum Data Set. [^]One recurrence from 2002. Six had a histological diagnosis in 2018. [#]Usually "suspicious for invasion" but not confirmed.

Table 1-4 Women excluded from the review for other reasons**Popn: 119**

Exclusion reason	Total
Age at diagnosis outside of range (25-69 years)	107
Cancer diagnosis was rare or non-HPV related	16
Total excluded	119*

* Four women met both exclusion criteria, hence 119 were excluded and not 123

Table 1-5 Mode of confirmation of cases included in the screening review**Popn: 628**

This table describes the grounds on which 628 women were identified for inclusion in the screening review following review of available records.

Description of those included in screening review	n
Confirmed histological diagnosis of cervical cancer	611
Cervical cancer confirmed on basis of clinical information and the presence of at least a high grade cytology but without a histology report available	17
Total	628

2. Concordance between NZCR and NCSP databases

Table 2-1 Number of cases of cervical cancer as reported by NZCR, NCSP-R and following histological review by the review team

Year	NZCR	NCSP-R	Confirmed cervical cancer diagnosed within review period	Screening history reviewed*
2013	161	159	152	122
2014	143	142	133	105
2015	149	146	136	117
2016	183	182	170	145
2017	168	165	156	139
Total	804	794	747	628

* Women aged 25-69 years excluding rare cancers

Note, the total NZCR number excludes seven women who were out of range (diagnosed before or after the 2013-2017 review period) and includes four women from the 2008-2012 review who were out of range due to being diagnosed in 2013 and were transferred to the 2013-2017 review (807 – 7 + 4 = 804).

Table 2-2 Concordance of histology and date of diagnosis data between the NZCR and NCSP Popn: 747

Review of Cancer Registry records and corresponding histology reports revealed the following information.

	Confirmed Histology Grade			Total	
	C	E	None*	n	%
All records	727	16	4	747	100
Concordance with NZCR date of diagnosis					
More than 3 days later	1	0	0	1	0.1
Within +/-3 days	430	10	4	444	59.4
3 days to 1 month (30 days) earlier	128	3	0	131	17.5
1 month to 4 months (<122 days) earlier	161	3	0	164	22.0
More than 4 months (122+ days) earlier	7	0	0	7	0.9
Concordance with NCSP-R histology					
Diagnostic event recorded	624	14	0	638	85.4
Diagnostic event miscoded as lower grade	68	1	0	69	9.2
Diagnostic event recorded on a later date	4	1	0	5	0.7
Only non-diagnostic events recorded	11	0	0	11	1.5
No histology recorded	16	0	4	20	2.7
Not enrolled	4	0	0	4	0.5

SNOMED code C - Cancer of the cervix. ^SNOMED code E - Other primary epithelial malignancy (n = 9), Small cell carcinoma (n = 3), carcinosarcoma (n = 1), or miscellaneous primary tumour (n = 1). * None = No histological confirmation (Date of diagnosis based upon high grade cytology result).

3. Cancer and Patient Demographics

Notes: Individual counts under 5 are suppressed for privacy. As described previously, ethnicity as presented in the following tables is either prioritised for Māori and non-Māori or employs total response ethnicity. Please refer to the relevant table legends.

Table 3-1 Annual incidence of confirmed cervical cancer per 100,000 female population across the review period, unadjusted or age-standardised to world standards (Segi, European, and WHO 2000-2025)

Age adjustment	2013–2017 Average annual incidence (95% CI)
Mean annual cases (population)	149.4 (2,345,098)
Unadjusted rate per 100,000 women	6.37 (5.93, 6.84)
Segi World Standard rate per 100,000 women	5.13 (4.75, 5.54)
European rate per 100,000 women	6.18 (5.74, 6.64)
World Health Organization (WHO 2000-2025) standard rate per 100,000 women	5.70 (5.28, 6.14)

This table presents the estimated annual incidence of cervical cancer for all women for years 2013 to 2017. Rates were calculated using the 747 women divided by the sum of the estimated resident female New Zealand population at June of each year (11,725,490), and direct age-standardised to international reference populations.

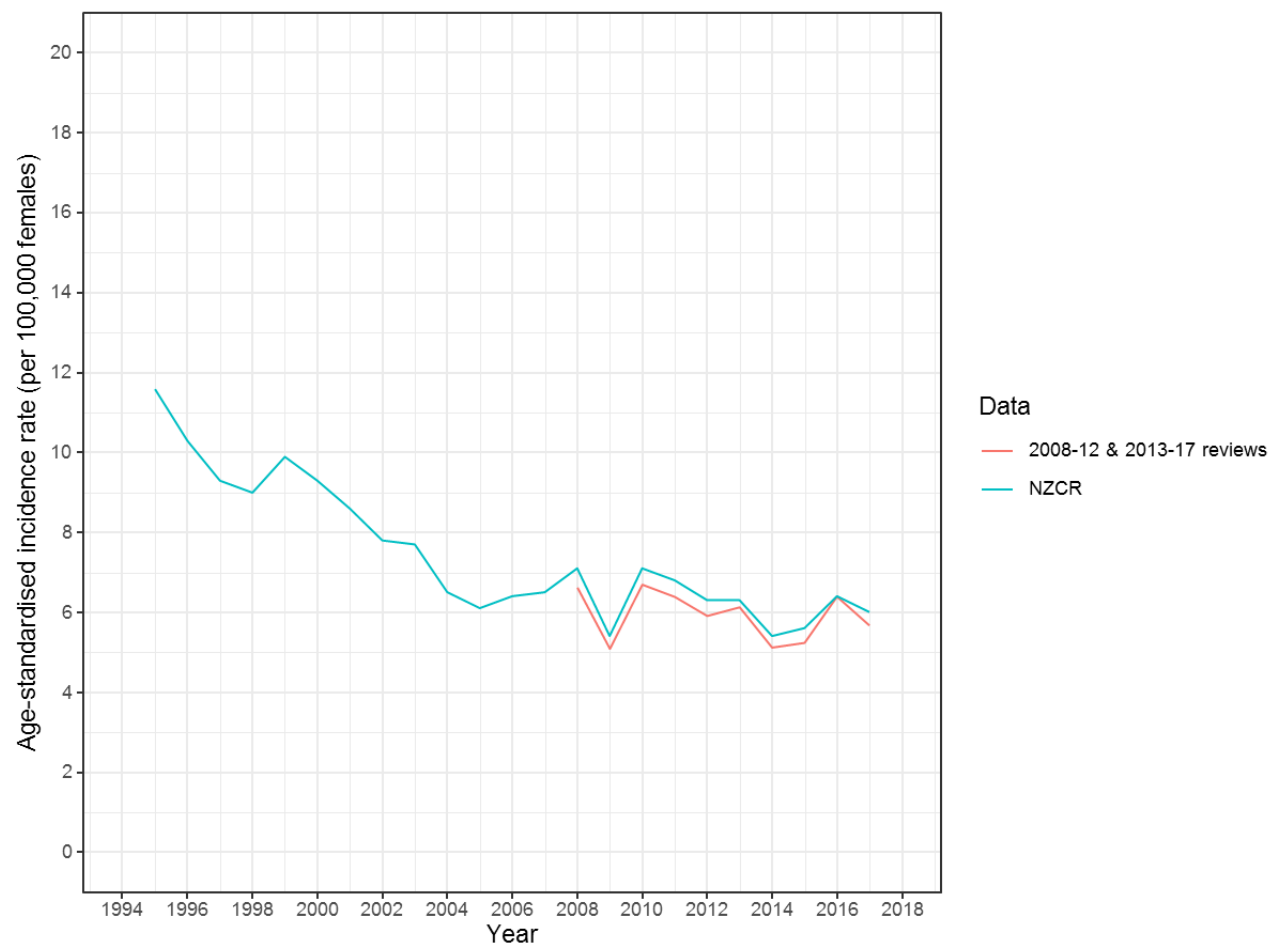


Figure 3-1 Annual age-standardised (WHO 2000-2025) incidence of cervical cancer cases per 100,000 female population by year

Rates were calculated according to the annual New Zealand June estimated resident population and direct age-standardised to the WHO 2000-2025 world standard population.

Table 3-2 Annual incidence of confirmed cervical cancer cases per 100,000 female population by year and ethnicity
Popn: 747

Year	Total		Māori			Non- Māori		
	n	IR (95% CI)	n	IR	Age std IR (95% CI)	n	IR	Age std. IR* (95% CI)
2013	152	6.7 (5.7, 7.8)	33	9.3	8.0 (5.4 to 11.6)	117	6.1	5.0 (4.0 to 6.2)
2014	133	5.8 (4.9, 6.9)	32	8.8	8.0 (5.4 to 11.6)	99	5.1	3.7 (2.9 to 4.8)
2015	136	5.8 (4.9, 6.9)	33	8.9	8.8 (5.9 to 12.5)	103	5.2	3.8 (3.0 to 4.8)
2016	170	7.1 (6.1, 8.3)	33	8.8	8.6 (5.8 to 12.4)	134	6.7	5.0 (4.1 to 6.1)
2017	156	6.4 (5.5, 7.5)	31	8.1	7.4 (5.0 to 10.8)	124	6.1	4.4 (3.6 to 5.5)
Total	747	6.4 (5.9, 6.8)	162	8.8	8.1 (6.9 to 9.6)	577	5.8	4.4 (4.0 to 4.8)

IR = Unadjusted incidence rates per 100,000 females. Age std. IR = Incidence rates per 100,000 females age standardized to the 2001 Census Maori female population. Māori and non-Māori total do not include n=8 women with unknown ethnicity

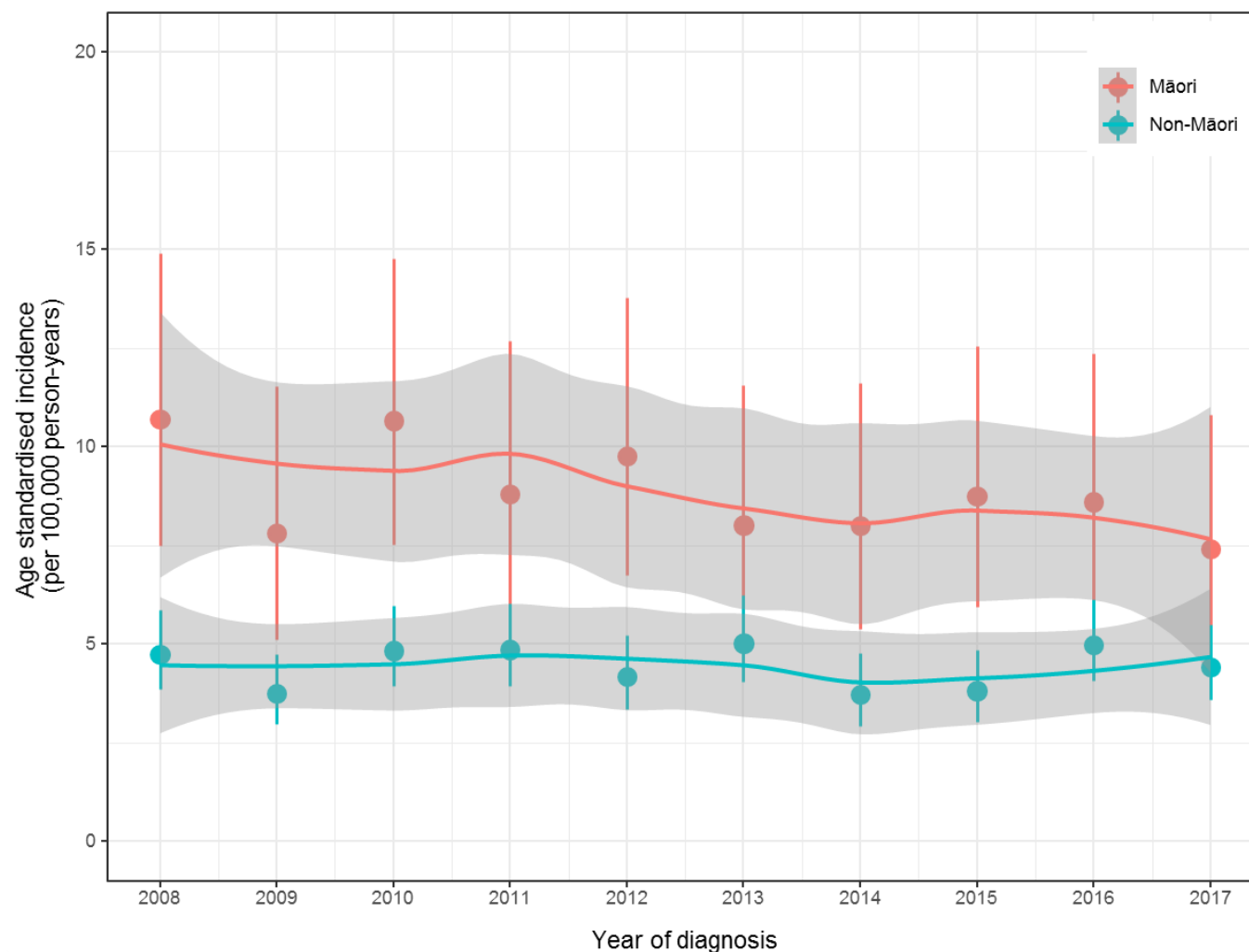


Figure 3-2 Age standardised (to Māori 2001 census) incidence of cervical cancer cases per 100,000 person-years by year of diagnosis (2008-2017) for Māori and non-Māori

Table 3-3 Demographics for all cervical cancer diagnoses by year (2013-2017) Popn: 747

		2013	2014	2015	2016	2017	TOTAL
Total		152	133	136	170	156	747
Age	20-24	6	<5	<5	<5	<5	14
	25-29	22	14	12	14	7	69
	30-34	17	10	20	31	21	99
	35-39	17	17	13	20	14	81
	40-44	20	21	22	16	27	106
	45-49	11	14	15	21	16	77
	50-54	7	15	10	14	16	62
	55-59	13	6	14	16	13	62
	60-64	9	5	7	7	11	39
	65-69	8	5	5	11	16	45
	70+	22	23	16	20	12	93
Ethnicity (Total response)	European/Other	95	85	99	123	96	498
	Māori	33	32	33	33	31	162
	Pacific Island	13	13	<5	9	10	49
	Asian	17	12	17	19	26	91
Deprivation Index	1	16	15	11	19	20	81
	2	9	13	17	16	18	73
	3	15	12	6	11	13	57
	4	12	6	11	13	12	54
	5	14	9	9	18	19	69
	6	17	15	15	18	8	73
	7	22	12	14	24	18	90
	8	8	14	15	10	14	61
	9	12	14	15	18	14	73
	10	25	20	23	21	19	108

All confirmed cases of primary cervical cancer sorted by review year (2013-2017), age, ethnicity, histology and deprivation index. Deprivation Index data is taken from the 2013 census data. Note: Total response ethnicity is reported, therefore totals are greater than 747. **n=8** women with no reported ethnicity are excluded from the table. **N=8** women are excluded from the table due to a missing NZDep2013 Index score (two had an overseas address, two provided PO Box addresses only (in the NZCR and NCSP-R), and four resided in meshblocks without an associated 2013 NZDep2013 Index score).

Table 3-4 Tumour characteristics for all cervical cancer diagnoses by year (2013-2017) Popn: 747

		2013	2014	2015	2016	2017	TOTAL
Type	SCC	117	93	104	128	119	561
	Adenocarcinoma	26	31	21	25	28	131
	Adenosquamous	5	<5	6	9	<5	27
	Other	<5	<5	<5	<5	<5	12
	Non-HPV related	<5	5	<5	5	<5	16
Stage	1a	41	37	37	48	31	194
	1b+	111	96	99	122	125	553

Table 3-5 Age at diagnosis by ethnicity

	Mean (years)	Median (years)	Range (years)
Māori	45.3	45.0	21–82
Non-Māori	48.3	45.0	20–96
Total	48.3	45.0	20–96

Table 3-6 Demographics for all cervical cancer diagnoses eligible for the screening history review by year (2013-2017)
Popn: 628

		2013	2014	2015	2016	2017	TOTAL
Total		122	105	117	145	139	628
Age	25-29	22	13	12	13	7	67
	30-34	17	10	20	31	20	98
	35-39	16	17	12	20	14	79
	40-44	20	21	22	14	26	103
	45-49	11	13	15	21	16	76
	50-54	7	15	10	14	16	62
	55-59	13	6	14	14	13	60
	60-64	9	5	7	7	11	39
	65-69	7	5	5	11	16	44
Ethnicity (Total response)	European/Other	74	63	83	105	82	407
	Māori	28	29	30	30	30	147
	Pacific Island	12	11	<5	8	10	43
	Asian	15	10	16	16	25	82
Deprivation Index deciles	1	13	12	10	14	18	67
	2	8	8	14	14	17	61
	3	13	9	6	10	11	49
	4	10	<5	9	12	11	46
	5	11	8	7	16	18	60
	6	12	14	15	15	6	62
	7	16	9	10	19	16	70
	8	7	11	12	8	13	51
	9	9	12	15	17	12	65
	10	22	15	19	19	16	91

Demographics for women diagnosed with cervical cancer and meeting eligibility criteria for the screening history review. These are sorted by year, age, ethnicity, histology, and deprivation index. Deprivation Index data is taken from the 2013 census data. Ethnicity data is from the NZCR records and uses total response ethnicity. **n=2** women with no reported ethnicity are excluded from the table. **N=6** women are excluded from the table due to a missing NZDep2013 Index score

Note: These data **exclude** non-HPV related cancers.

Table 3-7 Tumour characteristics for all cervical cancer diagnoses eligible for the screening history review by year (2013-2017) Popn: 628

		2013	2014	2015	2016	2017	TOTAL
Type	SCC	95	75	89	111	104	474
	Adenocarcinoma	23	27	20	24	28	122
	Adenosquamous	<5	<5	6	8	<5	23
	Other	<5	<5	<5	<5	<5	9
Stage	1a	38	34	37	45	28	182
	1b+	84	71	80	100	111	446

Table 3-8 Women with cervical cancer by age and deprivation index, as a proportion of Māori and non-Māori populations Popn: 747

Age	Māori			Non-Māori			
	n	% Māori	% age	n	% Non-Māori	% age	
20-24	5	3	38	8	1	62	
25-29	17	10	25	52	9	75	
30-34	22	14	22	77	13	78	
35-39	16	10	20	64	11	80	
40-44	19	12	18	87	15	82	
45-49	26	16	34	51	9	66	
50-54	20	12	32	42	7	68	
55-59	12	7	20	48	8	80	
60-64	10	6	26	29	5	74	
65-69	5	3	11	40	7	89	
70+	10	6	11	79	14	89	
Total	162			577			
Deprivation Index	1	6	4	7	75	13	93
	2	5	3	7	68	12	93
	3	7	4	12	50	9	88
	4	8	5	15	45	8	85
	5	7	4	10	60	10	90
	6	11	7	15	62	11	85
	7	18	11	20	70	12	80
	8	18	11	30	42	7	70
	9	26	16	36	46	8	64
	10	55	34	51	52	9	49
Total	161			570			

Women diagnosed with cervical cancer within the review period by: ethnicity, age and deprivation index. Ethnicity data is taken from the NZCR records. Ethnicity is categorised as Māori or non-Māori, therefore any individuals with unknown ethnicity are excluded (n=8). Deprivation Index data is taken from the 2013 census data. An addition n=8 women are excluded due to unknown Deprivation Index.

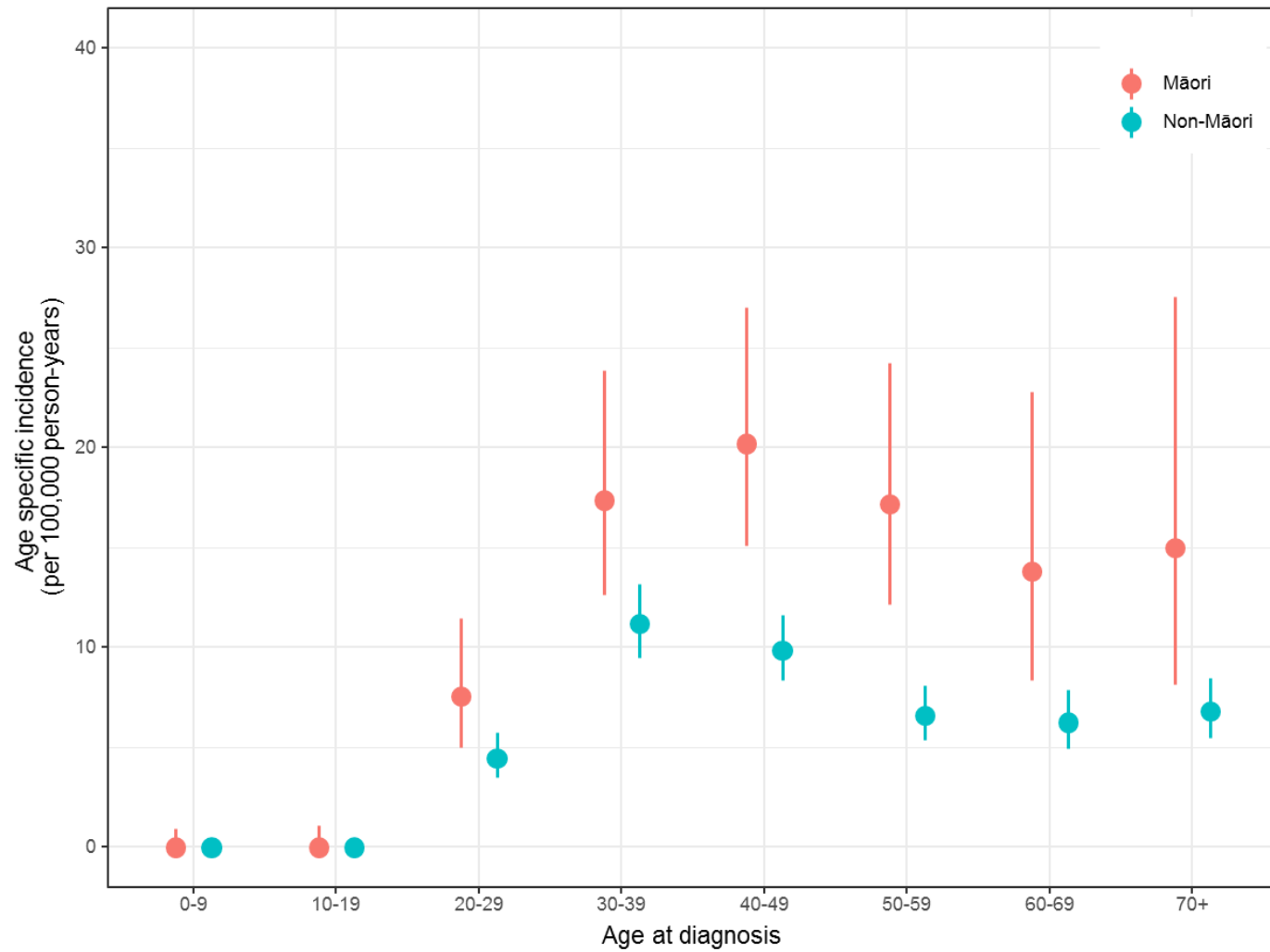


Figure 3-3 Age specific incidence of cervical cancer cases per 100,000 person-years by age for Māori and non-Māori.

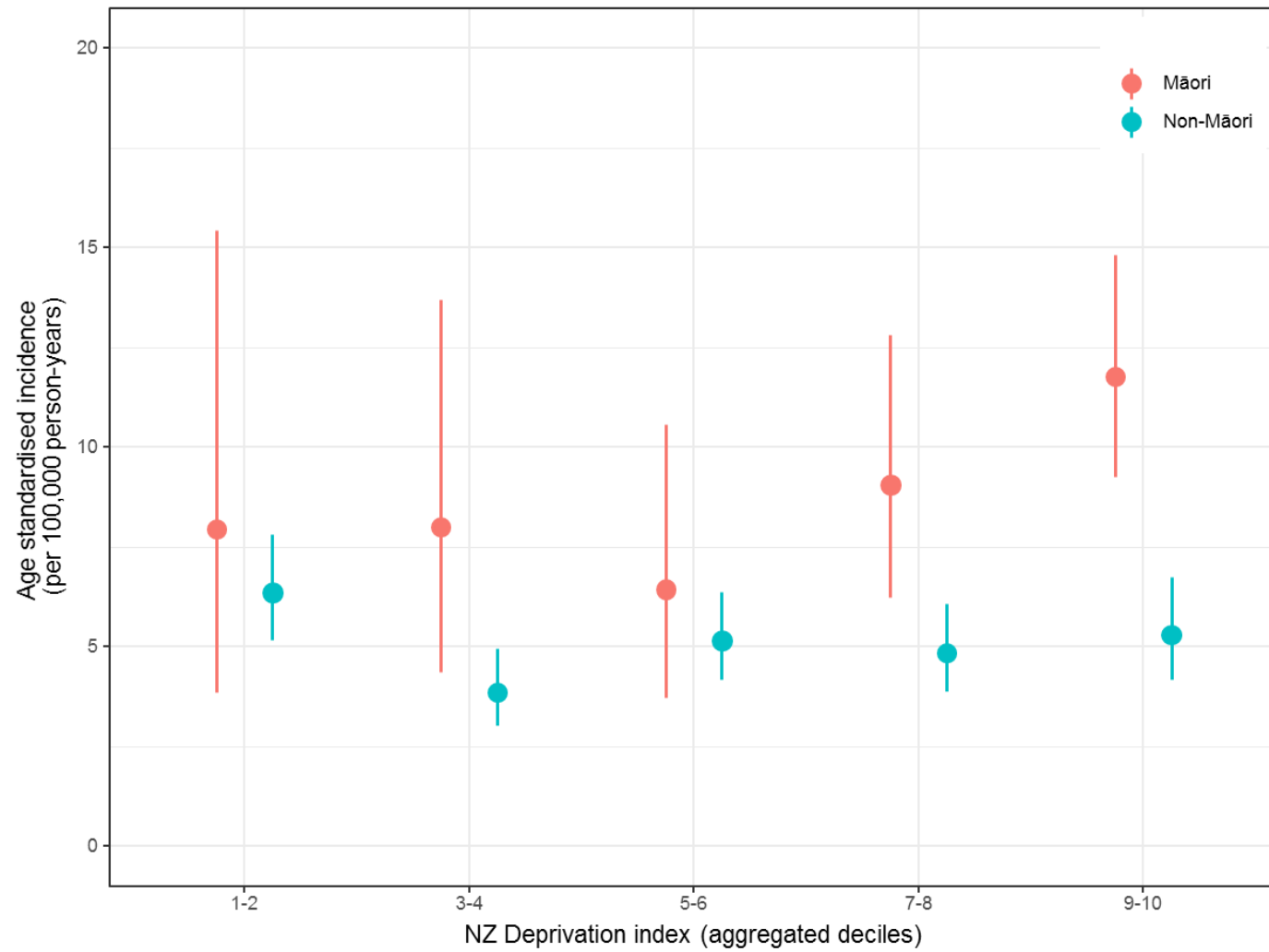


Figure 3-4 Age-standardised (to Māori 2001 census) incidence of cervical cancer per 100,000 persons-years by aggregated deprivation decile for Māori and non-Māori.

Table 3-9 Cervical cancer diagnoses by rurality and ethnicity Popn: 747

	Māori		Non-Māori		Total	
	n	% Māori	n	% Non-Māori	n	% total
Main Urban Area	97	60	411	72	510	69
Secondary Urban Area	15	9	46	8	62	8
Minor Urban Area	32	20	40	7	75	10
Rural Centre	6	4	12	2	18	2
Other Rural	12	7	64	11	78	10
Total	162	100	573	100	743	100

All women diagnosed with cervical cancer within the review period by ethnicity and rurality. Ethnicity data is taken from NZCR records and is categorised as Māori or non-Māori. Rurality is based on census area units from the 2013 census data for the address recorded on NZCR at the time of diagnosis. Data in the Māori and non-Māori columns exclude those with unknown ethnicity (**n = 8**). An addition **n=4** women are excluded due to unknown rurality.

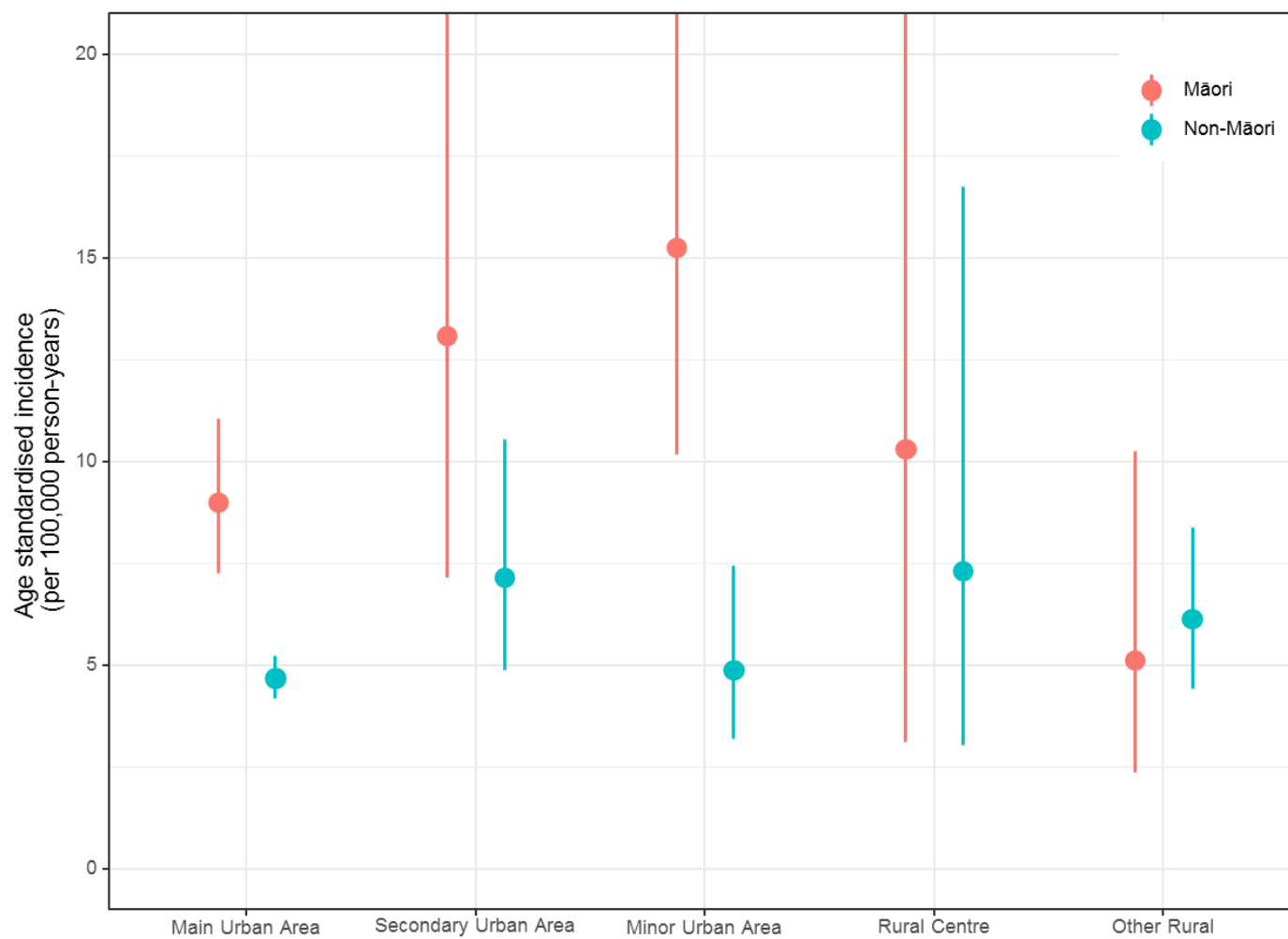


Figure 3-5 Age standardised (to Māori 2001 census) incidence of cervical cancer cases per 100,000 person-years by rurality for Māori and non-Māori.

Table 3-10 Cancer Network regions by ethnicity

Popn: 747

Table 3-10a Confirmed cases by cancer network region as a proportion of Māori and non-Māori populations

Cancer Network	Māori		Non-Māori		Total	
	n	% Māori	n	% non-Māori	n	% total
Northern	43	27	203	35	248	33
Midland	53	33	92	16	150	20
Central	45	28	116	20	161	22
Southern	21	13	162	28	184	25
Total	162	100	573	100	743	100

All women diagnosed with cervical cancer within the review period by Cancer Network Regions, ethnicity, histological type and stage. Data in the Māori and non-Māori columns exclude those with unknown ethnicity (n = 8). An additional n=4 women are excluded due to unknown Cancer Network.

Table 3-10b Cervical cancer cases by ethnicity as a proportion of cases within each Cancer Network region

Cancer Network	Māori		Non- Māori	
	n	%	n	%
Northern	43	17	203	83
Midland	53	37	92	63
Central	45	28	116	72
Southern	21	11	162	89
TOTAL	162	22	573	78

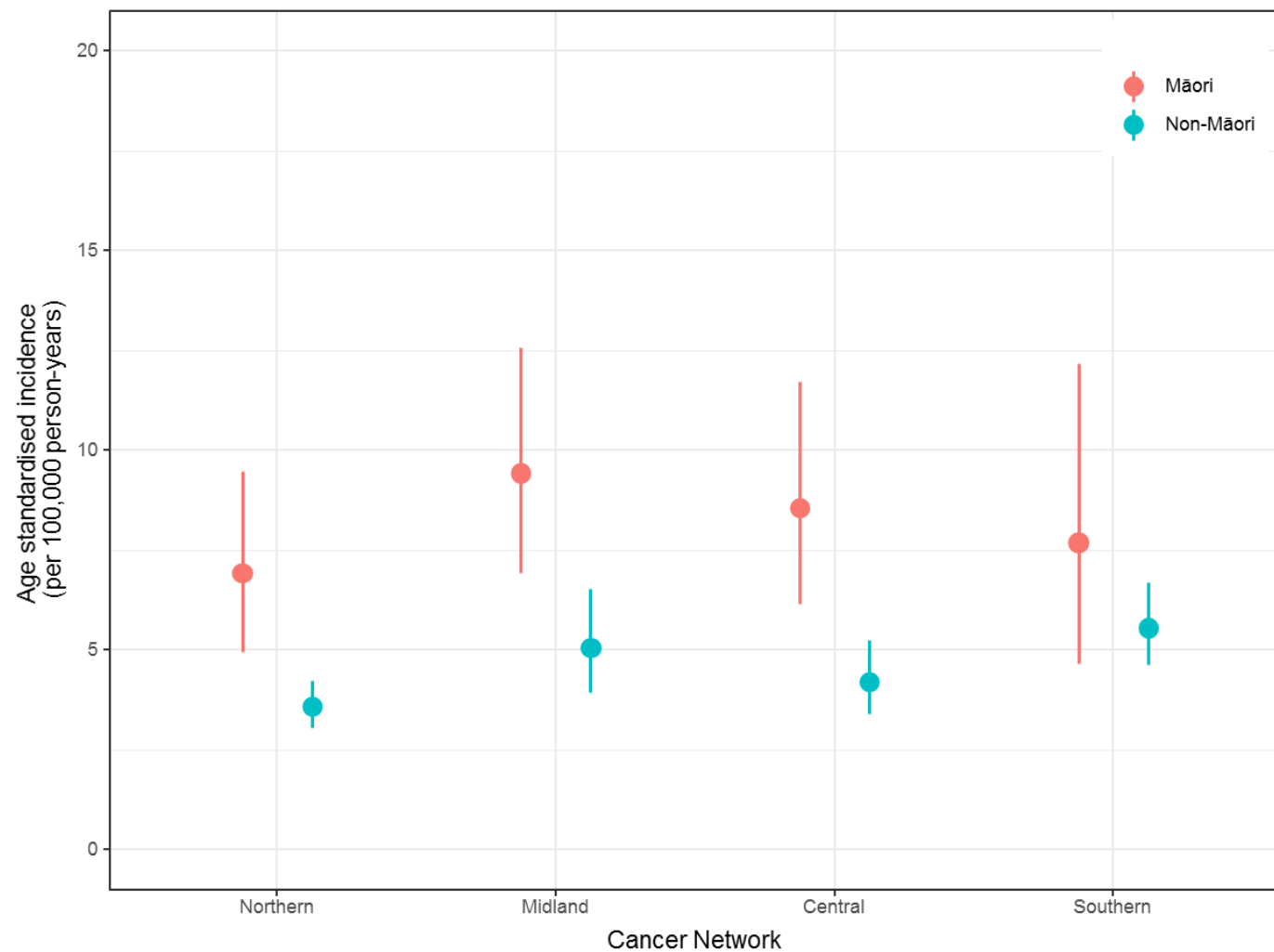


Figure 3-6 Age standardised (to Māori 2001 census) incidence of cervical cancer cases per 100,000 person-years by Cancer Network for Māori and non-Māori.

Table 3-11 Histological type and stage by ethnicity

Popn: 747

		Māori n=162		Non-Māori n=577		All women n=747	
		n	%	n	%	n	%
Histological type	SCC	132	81	423	73	561	75
	Adenocarcinoma	21	13	110	19	131	18
	Adenosquamous	7	4	19	3	27	4
	Other	<5		25	4	28	4
	TOTAL	162	100	577	100	747	100
Stage - all types	1a	47	29	146	25	194	26
	1b+	115	71	431	75	553	74
	TOTAL	162	100	577	100	747	100
Stage - SCC	1a	41	31	129	30	171	30
	1b+	91	69	294	70	390	70
	TOTAL	132	100	423	100	561	100
Stage - adenocarcinoma	1a	<5		17	15	19	15
	1b+	19	90	93	85	112	85
	TOTAL	21	100	110	100	131	100
Stage - adenosquamous	1a	<5		<5		<5	
	1b+	<5		19	100	24	89
	TOTAL	7	100	19	100	27	100

All women diagnosed with cervical cancer within the review period by histological type and stage, and ethnicity. The non-Māori ethnicity classification excludes any women with unknown ethnicity (n=8), but these women are included in the All Women column. (Note: rounding to whole numbers has been performed when presenting percentages)

Table 3-12 Histological type and stage by age at diagnosis

Popn: 747

Type / Age	All women						Total
	20-29	30-39	40-49	50-59	60-69	70+	
SCC	70	125	128	95	68	75	561
1a	38	58	43	19	11	<5	171
1b+	32	67	85	76	57	73	390
Adenocarcinoma	10	42	39	21	11	8	131
1a	<5	8	7	<5	<5	<5	19
1b+	8	34	32	20	10	8	112
Adenosquamous	<5	9	9	5	<5	<5	27
Other	<5	<5	7	<5	5	<5	28
Total	83	180	183	124	84	53	747

All women diagnosed with cervical cancer within the review period by histological type, stage and age at diagnosis. Staging data is presented in two categories covering both superficially invasive (microinvasive) cancer and greater.

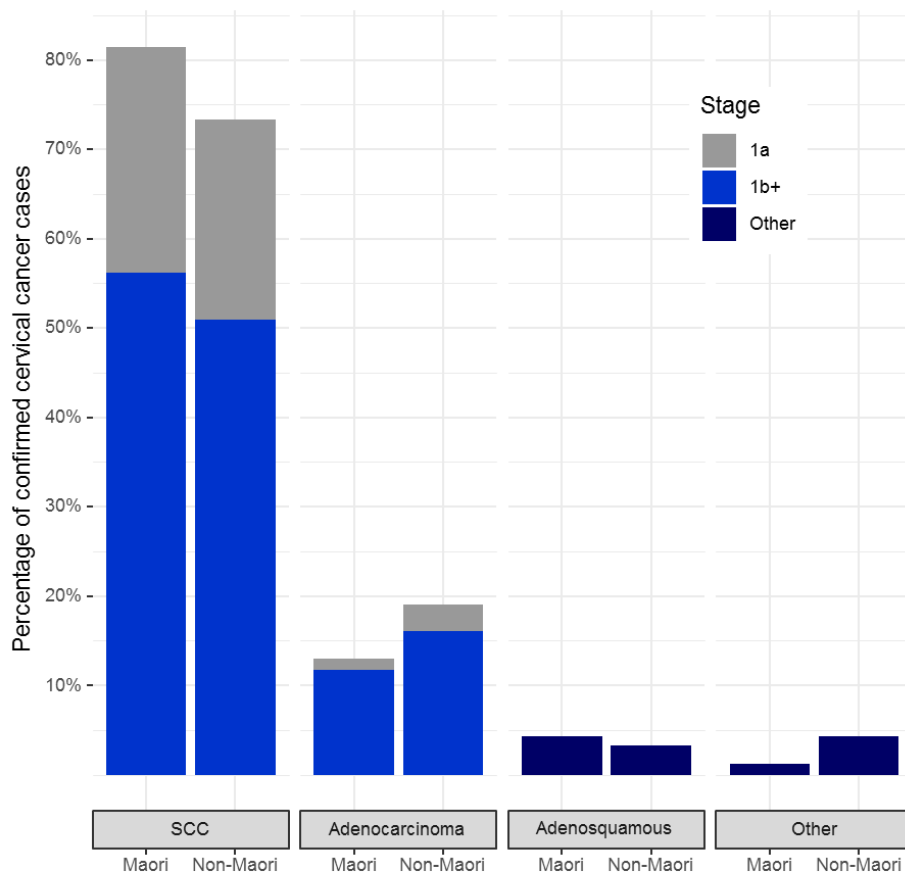


Figure 3-7 Differences in histological type, stage by ethnicity for all women diagnosed with cervical cancer included in the review.

Table 3-13 Histological type and stage by ethnicity and age at diagnosis

Popn: 747

Type / Age	Māori						Total
	20-29	30-39	40-49	50-59	60-69	70+	
SCC 1a	8	14	9	5	<5	<5	41
SCC 1b+	12	16	25	22	9	7	91
Non-squamous cell cancer	<5	8	11	5	<5	<5	30
Total	22	38	45	32	15	10	162

Type / Age	Non-Māori						Total
	20-29	30-39	40-49	50-59	60-69	70+	
SCC 1a	29	44	34	14	7	<5	129
SCC 1b+	20	50	60	54	48	62	294
Non-squamous cell cancer	11	47	44	22	14	16	154
Total	60	141	138	90	69	79	577

All women diagnosed with cervical cancer within the review period by ethnicity, histological type, stage and age at diagnosis. Any women with unknown ethnicity was excluded (**n=8**). Staging data is presented in two categories covering both superficially invasive (microinvasive) cancer and greater. Due to small numbers non-squamous cell cancer types have been aggregated.

Table 3-14 Histological type and aggregated NZ Deprivation Index decile

Popn: 747

Type	NZ Deprivation index (Aggregated Deciles)									
	1-2 (Least deprived)		3-4		5-6		7-8		9-10 (Most deprived)	
	n	%	n	%	n	%	n	%	n	%
SCC	105	68	73	66	109	77	116	77	150	83
1a	34	22	25	23	36	25	30	20	46	25
1b+	71	46	48	43	73	51	86	57	104	57
Adenocarcinoma	35	23	25	23	24	17	26	17	21	12
1a	6	4	<5		<5		<5		<5	
1b+	29	19	21	19	20	14	24	16	18	10
Adenosquamous	6	4	6	5	<5		5	3	6	3
Other	8	5	7	6	5	4	<5		<5	
Total	154	100	111	100	142	100	151	100	181	100

All women diagnosed with cervical cancer within the audit period by histological type and deprivation index by aggregated decile. Deprivation Index data is taken from the 2013 census. Women with unknown deprivation index are omitted from this table (n=13).

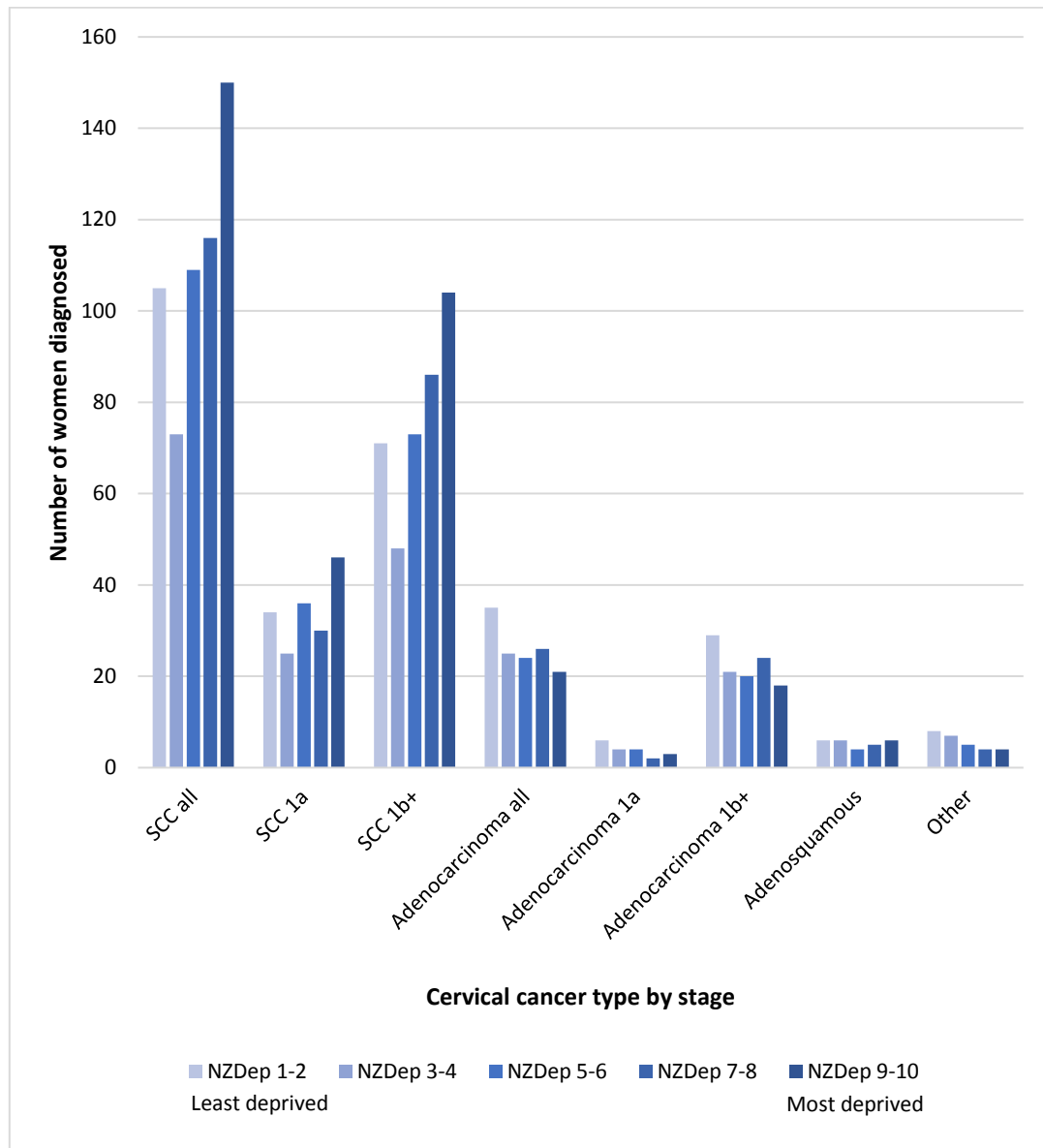


Figure 3-8 Deprivation index data expressed as aggregated deciles for cervical cancer cases by histological type and stage

Table 3-15 Type and stage by rurality

Popn: 747

Type	Rurality									
	Main urban		Secondary urban		Minor urban		Rural centre		Other rural	
	n	%	n	%	n	%	n	%	n	%
SCC	384	75	48	77	58	77	13	72	54	69
1a	122	24	14	23	16	21	<5		15	19
1b+	262	51	34	55	42	56	9	50	39	50
Non-squamous cell cancer	126	25	14	23	17	23	5	28	24	31
Total	510	100	62	100	75	100	18	100	78	100

All women diagnosed with cervical cancer within the review period by histological type and stage, and rurality. Rurality index is based on census unit data taken from the 2013 census data. Percentages expressed refer to the percentage of women in each rurality with the corresponding type and stage. Excludes women whose rurality is unknown (**n=4**). Due to small numbers non-squamous cell cancer types have been aggregated.

Table 3-16 Type and stage by Regional Cancer Network

Popn: 747

Type	Regional Cancer Network							
	Northern		Midland		Central		Southern	
	n	%	n	%	n	%	n	%
SCC	186	77	109	72	130	78	135	73
1a	58	24	29	19	44	26	40	22
1b+	128	53	80	53	86	51	95	52
Adenocarcinoma	43	18	28	18	23	14	37	20
1a	5	2	5	3	6	4	<5	
1b+	38	16	23	15	17	10	34	18
Adenosquamous	6	2	9	6	5	3	7	4
Other	8	3	6	4	9	5	5	3
Total	243	100	152	100	167	100	184	100

All women diagnosed with cervical cancer within the review period by Cancer Network and histological type and stage. This excludes **one** case which was diagnosed overseas.

4. Assessment of Screening Adequacy

All data in this section refers only to the 628 eligible women as determined by the application of the exclusion criteria described in Section 3.

The definitions outlined in the Screening History part of the Methods section were used to assess the frequency of a woman's screening history in order to allow comparisons with previous reports.

For all definitions, cervical cytology samples that occurred less than six months prior to diagnosis were considered to be 'diagnostic cervical cytology samples' and therefore excluded. Time frames were defined in calendar time, so monthly and yearly intervals may not be represented by an exact number of days.

Table 4-1 Screening adequacy by patient demographics

Popn: 628

	Total	Ever screened		6 to 84 months		6 to 66 months		6 to 42 months		Every five years		Adequately	
	N	n	%	n	%	n	%	n	%	n	%	n	%
Age													
25-29	67	48	72	44	66	40	60	31	46	33	49	7	10
30-34	98	80	82	70	71	65	66	45	46	42	43	12	12
35-39	79	65	82	49	62	45	57	35	44	16	20	15	19
40-44	103	85	83	63	61	56	54	41	40	17	17	16	16
45-49	76	59	78	40	53	37	49	24	32	15	20	9	12
50-54	62	46	74	28	45	26	42	21	34	9	15	7	11
55-59	60	37	62	26	43	23	38	19	32	<5		<5	
60-64	39	22	56	11	28	10	26	9	23	<5		<5	
65-69	44	25	57	15	34	15	34	10	23	5	11	5	11
Total	628	467	74	346	55	317	50	235	37	143	23	76	12
Ethnicity													
European/Other	407	322	79	245	60	227	56	168	41	124	30	61	15
Māori	147	122	83	83	56	74	50	54	37	26	18	15	10
Pacific	43	29	67	19	44	16	37	13	30	<5		<5	
Asian	82	37	45	30	37	29	35	25	30	5	6	7	9
Deprivation (aggregated deciles)													
1-2	128	100	78	83	65	76	59	55	43	37	29	21	16
3-4	95	69	73	57	60	53	56	43	45	26	27	14	15
5-6	122	91	75	61	50	55	45	36	30	33	27	15	12
7-8	121	85	70	66	55	56	46	43	36	22	18	10	8
9-10	156	120	77	78	50	76	49	57	37	24	15	16	10
Total	622	465	75	345	55	316	51	234	38	142	23	76	12

Assessment of screening adequacy of screening for women with cervical cancer included in the screening review by 5-year age bracket, ethnicity, and deprivation index. This table describes the number of individuals who had at least one cervical cytology sample within 6-42, 6-66 and 6-84 months prior to diagnosis, those who were adequately screened and those who had ever had any screening. Ethnicity is total response. Women can fall into multiple ethnicity groups. N=8 women are excluded from the table due to no reported ethnicity (n=2) and missing NZDep2013 Index score (n=6).

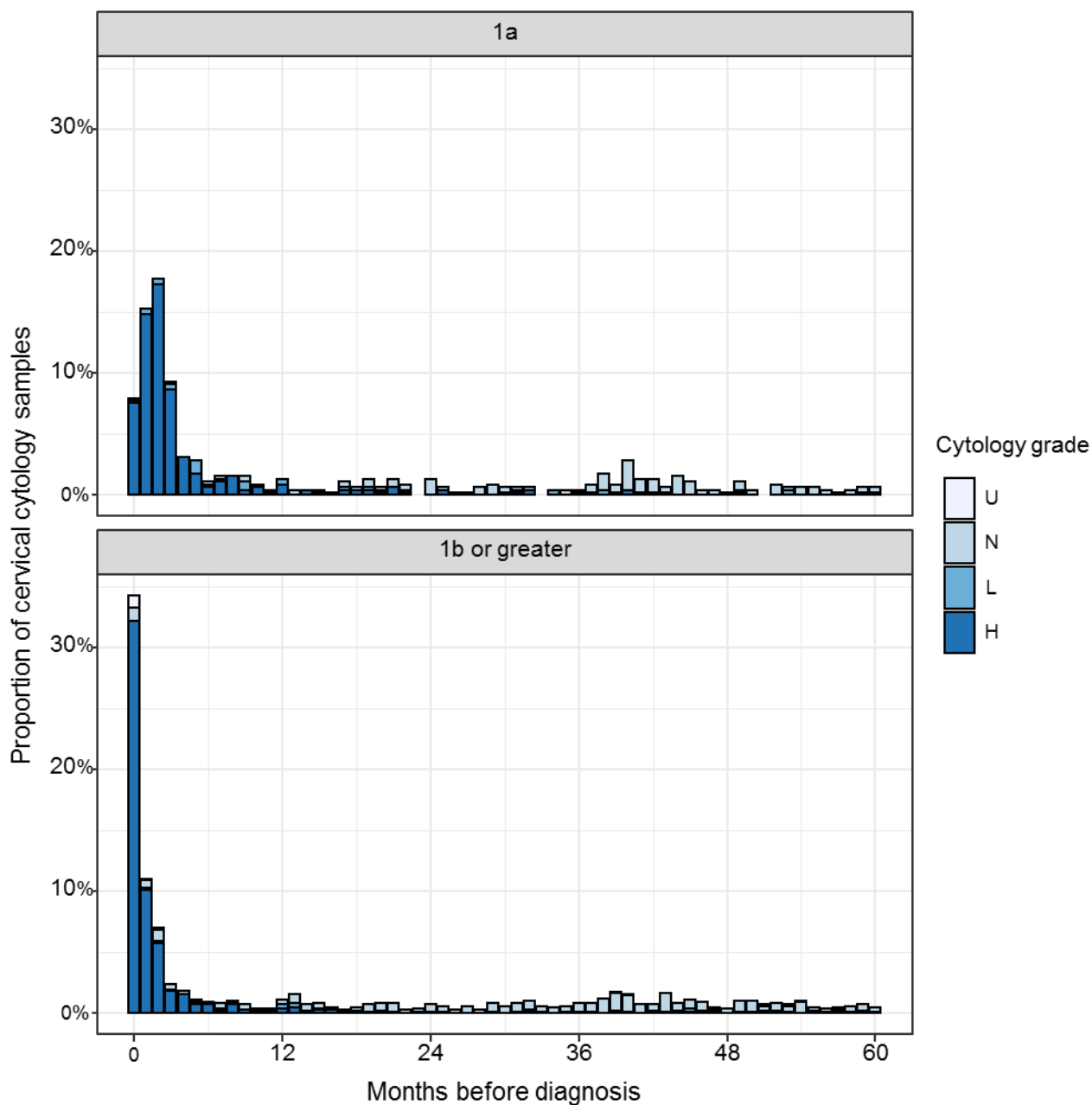


Figure 4-1 Proportion of cervical cytology samples taken per month and associated cytological findings in the 60 months prior to diagnosis.

This demonstrates the high proportion of abnormal cytological findings in the 6 months prior to diagnosis. Both the proportion of cervical cytology samples taken, and the incidence of high grade cytology plateaus beyond 6 months, hence cytology samples taken within the 6 months prior to diagnosis were considered to be part of the diagnostic process. Fewer than 17 cervical cytology samples were taken per month in 95% of months prior to cervical cancer diagnosis.

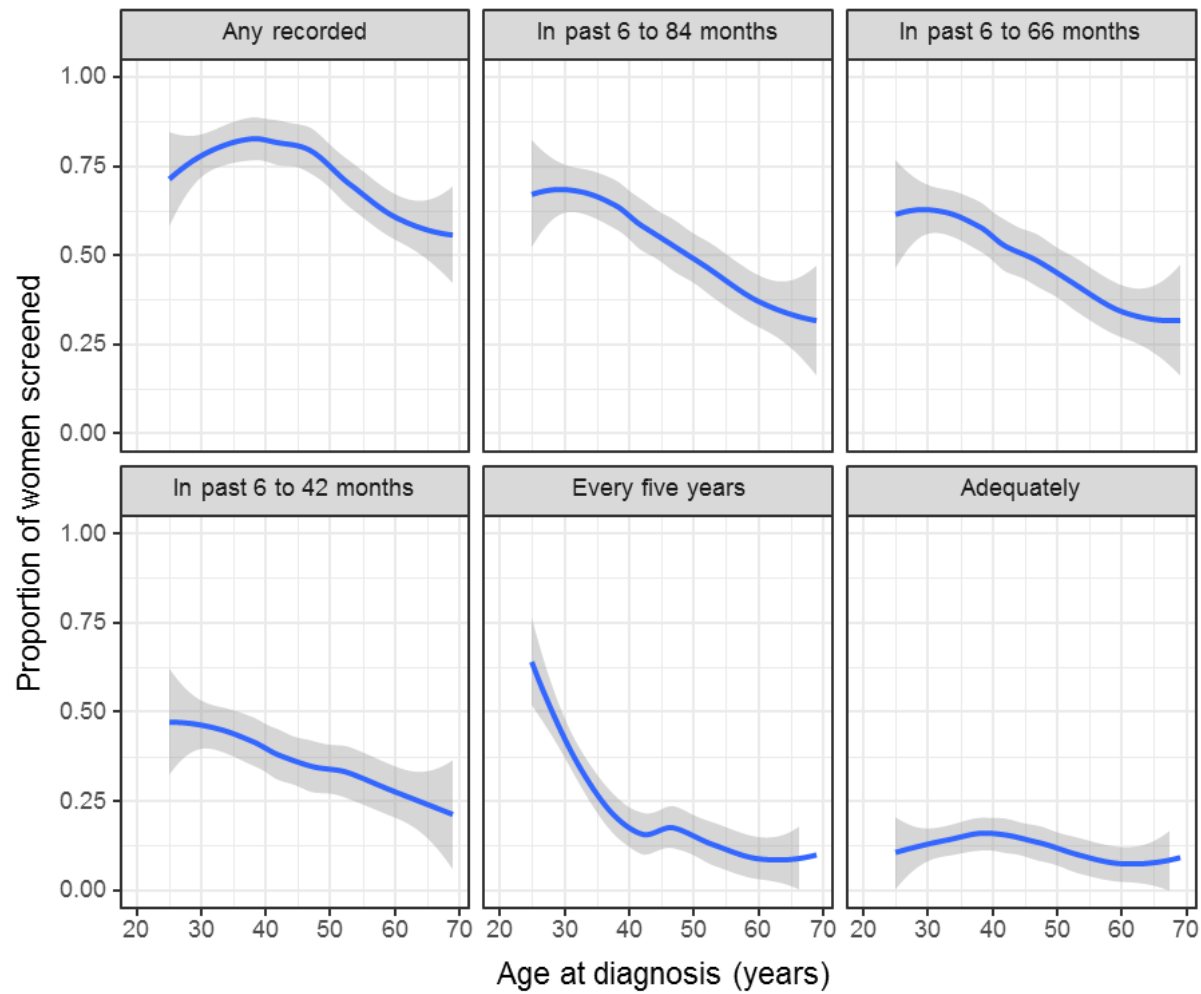


Figure 4-2 Screening adequacy by age at diagnosis

Table 4-2 Screening adequacy by histological type and stage

Popn: 628

	Total	Ever screened		6 to 84 months		6 to 66 months		6 to 42 months		Every five years		Adequately screened	
	N	n	%	n	%	n	%	n	%	n	%	n	%
Type													
SCC	474	334	70	235	50	215	45	161	34	91	19	49	10
Adenocarcinoma	122	105	86	88	72	80	66	55	45	44	36	17	14
Adenosquamous	23	21	91	19	83	19	83	17	74	8	35	10	43
Stage													
1a	182	147	81	118	65	108	59	82	45	56	31	26	14
1b+	446	320	72	228	51	209	47	153	34	87	20	50	11
Total	628	467	74	346	55	317	50	235	37	143	23	76	12

This table describes the number of all eligible women diagnosed with cervical cancer included in the screening review with at least one cervical cytology sample within 6-42, 6-66 and 6-84 months prior to diagnosis, those who were adequately screened and those who had ever had any screening by histological type and stage at the time of diagnosis. Due to the small number of 'other' cancers (n=9), these are not included in the Type section of the table, but are included in the Stage section.

Staging was grouped broadly into superficially invasive (microinvasive) or greater based on the available clinical information available on the NZCR and histological review by the review team.

Table 4-3 Screening adequacy by age and ethnicity

Popn: 628

Table 4-3a Screening adequacy by age in 10 year age brackets (except for 25-29 years) for those women identified as Māori

Age	Total N	Ever Screened		6 to 84 months		6 to 66 months		6 to 42 months		Every five years		Adequately Screened	
		n	%	n	%	n	%	n	%	n	%	n	%
25 to 29	17	12	71	11	65	9	53	7	41	7	41	<5	
30 to 39	38	34	89	24	63	23	61	16	42	7	18	<5	
40 to 49	45	42	93	27	60	24	53	20	44	9	20	7	16
50 to 59	32	25	78	13	41	11	34	6	19	<5		<5	
60 to 69	15	9	60	8	53	7	47	5	33	<5		<5	
Total	147	122	83	83	56	74	50	54	37	26	18	15	10

Table 4-3b Screening adequacy by age in 10 year age brackets (except for 25-29 years) for those women identified as non-Māori

Age	Total N	Ever Screened		6 to 84 months		6 to 66 months		6 to 42 months		Every five years		Adequately Screened	
		n	%	n	%	n	%	n	%	n	%	n	%
25 to 29	50	36	72	33	66	31	62	24	48	26	52	6	12
30 to 39	138	110	80	95	69	87	63	64	46	51	37	23	17
40 to 49	134	102	76	76	57	69	51	45	34	23	17	18	13
50 to 59	89	57	64	41	46	38	43	34	38	11	12	9	10
60 to 69	68	38	56	18	26	18	26	14	21	6	9	5	7
Total	479	343	72	263	55	243	51	181	38	117	24	61	13

The number of individuals who had at least one cervical cytology sample within 6-42, 6-66 and 6-84 months prior to diagnosis, those who were adequately screened and those who had ever had any screening since the inception of the screening programme. Any women where ethnicity was unknown are excluded (n=2).

Table 4-4 Screening adequacy by year of diagnosis

Popn: 628

Year	Total	Ever Screened		6 to 84 months		6 to 66 months		6 to 42 months		Every five years		Adequately screened	
	N	n	%	n	%	n	%	n	%	n	%	n	%
2013	122	89	73	70	57	65	53	44	36	30	25	12	10
2014	105	81	77	57	54	53	50	41	39	20	19	13	12
2015	117	81	69	57	49	50	43	35	30	22	19	6	5
2016	145	113	78	83	57	75	52	60	41	39	27	23	16
2017	139	103	74	79	57	74	53	55	40	32	23	22	16
Total	628	467	74	346	55	317	50	235	37	143	23	76	12

This table assesses screening adequacy by the year of diagnosis including the number of individuals who had at least one cervical cytology sample within 6-42, 6-66 and 6-84 months prior to diagnosis, those who were adequately screened, those who had ever been screened, and those who had ever had any screening since the inception of the screening programme.

Table 4-5 Screening adequacy by Regional Cancer Network

Popn: 628

Māori

Region	Total N	Since 1990		6 to 84 months		6 to 66 months		6 to 42 months		Every five years		Adequately Screened	
		n	%	n	%	n	%	n	%	n	%	n	%
Northern	36	30	83	21	58	18	50	13	36	5	14	<5	
Midland	49	42	86	29	59	26	53	18	37	11	22	9	18
Central	43	34	79	24	56	21	49	15	35	5	12	<5	
Southern	19	16	84	9	47	9	47	8	42	5	26	<5	
Total	147	122	83	83	56	74	50	54	37	26	18	15	10

Non-Māori

Region	Total N	Since 1990		6 to 84 months		6 to 66 months		6 to 42 months		Every five years		Adequately Screened	
		n	%	n	%	n	%	n	%	n	%	n	%
Northern	165	106	64	82	50	77	47	60	36	33	20	23	14
Midland	80	67	84	43	54	41	51	35	44	17	21	7	9
Central	98	69	70	54	55	49	50	34	35	29	30	11	11
Southern	135	101	75	84	62	76	56	52	39	38	28	20	15
Total	478	343	72	263	55	243	51	181	38	117	24	61	13

Total

Region	Total N	Since 1990		6 to 84 months		6 to 66 months		6 to 42 months		Every five years		Adequately Screened	
		n	%	n	%	n	%	n	%	n	%	n	%
Northern	201	136	68	103	51	95	47	73	36	38	19	25	12
Midland	129	109	84	72	56	67	52	53	41	28	22	16	12
Central	141	103	73	78	55	70	50	49	35	34	24	12	9
Southern	156	119	76	93	60	85	54	60	38	43	28	23	15
Total	627	467	74	346	55	317	50	235	37	143	23	76	12

Screening adequacy in relation to the Regional Cancer Network the woman resided in at the time of diagnosis and ethnicity. This table includes individuals who had at least one cervical cytology sample within 6-42, 6-66 and 6-84 months prior to diagnosis, those who were adequately screened and those who had ever had any screening since the inception of the screening programme. Women with unknown ethnicity (**n = 2**) are excluded from Māori and non-Māori categories, but included in total. **N=1** woman with an overseas address is excluded.

Table 4-6 Screening adequacy by rurality and ethnicity

Popn: 628

Māori

Region	Total N	Since 1990		6 to 84 months		6 to 66 months		6 to 42 months		Every five years		Adequately Screened	
		n	%	n	%	n	%	n	%	n	%	n	%
Main Urban	90	73	81	49	54	42	47	28	31	15	17	7	8
Secondary Urban	14	11	79	6	43	6	43	<5		<5		<5	
Minor Urban	29	26	90	18	62	18	62	16	55	7	24	5	17
Rural Centre	5	<5		<5		<5		<5		<5		<5	
Other Rural	9	8	89	7	78	5	56	5	56	<5		<5	
Total	147	122	83	83	56	74	50	54	37	26	18	15	10

Non-Māori

Region	Total N	Since 1990		6 to 84 months		6 to 66 months		6 to 42 months		Every five years		Adequately Screened	
		n	%	n	%	n	%	n	%	n	%	n	%
Main Urban	344	246	72	185	54	170	49	126	37	78	23	42	12
Secondary Urban	34	21	62	18	53	16	47	14	41	10	29	5	15
Minor Urban	34	25	74	18	53	17	50	11	32	7	21	3	
Rural Centre	9	6	67	5	56	5	56	3		3		1	
Other Rural	54	44	81	36	67	34	63	26	48	18	33	10	19
Total	475	342	72	262	55	242	51	180	38	116	24	61	13

Total

Region	Total N	Since 1990		6 to 84 months		6 to 66 months		6 to 42 months		Every five years		Adequately Screened	
		n	%	n	%	n	%	n	%	n	%	n	%
Main Urban	435	320	74	234	54	212	49	154	35	93	21	49	11
Secondary Urban	48	32	67	24	50	22	46	17	35	10	21	6	12
Minor Urban	63	51	81	36	57	35	56	27	43	14	22	8	13
Rural Centre	14	10	71	8	57	8	57	5	36	4	29	1	7
Other Rural	64	53	83	43	67	39	61	31	48	21	33	12	19
Total	624	466	75	345	55	316	51	234	38	142	23	76	12

All women diagnosed with cervical cancer and eligible for screening review by rurality, histological type and stage. Rurality is based on census unit data taken from the 2013 census data. This includes individuals who had at least one cervical cytology sample within 6-42, 6-66 and 6-84 months prior to diagnosis, those who were adequately screened and those who had ever had any screening since the inception of the screening programme. Women with unknown ethnicity (**n = 2**) are excluded from Māori and non-Māori categories but included in the table for total women. Women with unknown rurality are excluded (**n=4**).

Table 4-7 Screening history in the 6 to 84 months prior to diagnosis for all patients included in the Review
Popn: 628

	Total	High grade		Two+ low grade		One low grade		One negative		Two+ negative		No screening	
	N	n	%	n	%	n	%	n	%	n	%	n	%
Age													
25-29	67	9	13	<5		8	12	11	16	14	21	23	34
30-34	98	15	15	<5		7	7	24	24	23	23	28	29
35-39	79	9	11	<5		3		18	23	18	23	30	38
40-44	103	12	12	<5		5	5	20	19	25	24	40	39
45-49	76	11	14	<5		<5		13	17	13	17	36	47
50-54	62	8	13	<5		<5		6	10	11	18	34	55
55-59	60	8	13	<5		<5		9	15	7	12	34	57
60-64	39	<5		<5		<5		<5		6	15	28	72
65-69	44	<5		<5		<5		<5		6	14	29	66
Ethnicity													
European & other	407	39	10	<5		26	6	76	19	100	25	162	40
Māori	147	33	22	<5		5	3	21	14	24	16	64	44
Pacific	43	10	23	<5		<5		6	14	<5		24	56
Asian	82	<5		<5		<5		11	13	10	12	52	63
Total	628	77	12	6	1	33	5	107	17	123	20	282	45

Cervical cytology sample history in the 6 to 84 months prior to diagnosis for all eligible women diagnosed with cervical cancer, according to age and ethnicity. Cervical cytology sample history is defined as the highest of the following categories: at least one high grade cervical cytology sample, two or more low grade cervical cytology samples (but no high grade), one low grade cervical cytology sample (but no high grade), one negative cervical cytology sample, two or more negative cervical cytology samples, and no screening. Ethnicity is total response.

Table 4-8 Screening history in the 6 to 84 months prior to diagnosis by histological type and stage at diagnosis

Popn: 628

Type	Total	High grade		Two+ low grade		One low grade		One negative		Two+ negative		No screening	
	N	n	%	n	%	n	%	n	%	n	%	n	%
SCC	474	65	14	5	1	31	7	66	14	68	14	239	50
Adenocarcinoma	122	9	7	<5		<5		35	29	43	35	34	28
Adenosquamous	23	<5		<5		<5		<5		10	43	<5	
Stage													
1a	182	31	17	<5		17	9	27	15	39	21	64	35
1b+	446	46	10	<5		16	4	80	18	84	19	218	49
Total	628	77	12	6	1	33	5	107	17	123	20	282	45

Cervical cytology sample history in the 6 to 84 months prior to diagnosis for all eligible women diagnosed with cervical cancer, according to histological type and stage at diagnosis. Cervical cytology sample history is defined as the highest of the following categories: at least one high grade cervical cytology sample, two or more low grade cervical cytology samples (but no high grade), one low grade cervical cytology sample (but no high grade), one negative cervical cytology sample, two or more negative cervical cytology samples, and no screening. Staging was grouped broadly into superficially invasive (microinvasive) or greater based on the available clinical information available on the NZCR and histological review by the review team. Due to the small number of 'other' cancers (n=9), these are not included in the Type section of the table, but are included in the Stage section. The No screening column includes **one** woman with a single unsatisfactory cervical cytology sample in the 6 to 84 months prior to diagnosis.

Table 4-9 Cytological interpretation of high grade cervical cytology samples taken in the 0-36 months prior to the diagnosis of adenocarcinoma.

Interpretation	Grade	Code	n
Endocervical adenocarcinoma	HG-G	AC1	15
Endometrial adenocarcinoma	HG-G	AC2	3
Extrauterine adenocarcinoma	HG-G	AC3	0
Adenocarcinoma	HG-G	AC4	9
Malignant neoplasm	HG-G	AC5	1
Atypical endocervical cells	HG-G	AG1	10
Atypical endometrial cells	HG-G	AG2	3
Atypical glandular cells	HG-G	AG3	0
Atypical endocervical cells, neoplastic	HG-G	AG4	8
Atypical glandular cells, neoplastic	HG-G	AG5	6
Adenocarcinoma in-situ	HG-G	AIS	55
Atypical squamous cells present, possible high grade	HG-S	ASH	5
High grade intraepithelial lesion (CIN2 or CIN3)	HG-S	HS1	10
High grade intraepithelial lesion (suspect invasion)	HG-S	HS2	4
Squamous cell carcinoma	HG-S	SC	2
Total Glandular			110
Total Squamous			21
Total Overall			131

Appendix 1: Comparison of key results with previous review and audits

5. Description of data comparing 2008-2012 and 2013-2017

Table 5-1 Description of NZCR records comparing 2008-2012 and 2013-2017

All cervical and related cancer incidences on NZCR diagnosed 2008-2012 and 2013-2017.

NZCR Records	2008–2012	2013–2017
	n	n
Total number of cases received from the NZCR	854	809
Two of these were second cancer diagnoses and are excluded	852	807

Table 5-2 ICD10 cancer codes for all NZCR records comparing 2008-2012 and 2013-2017

NZCR codes received in full dataset	ICD10	2008–2012	2013–2017
		n*	n
Malignant neoplasm of cervix uteri	C539	830	776
Malignant neoplasm of endocervix	C530	1	0
Malignant neoplasm of overlapping sites of female genital organs	C578	20	31
Total		851	807

ICD10 cancer codes for all records received from NZCR of cervical and related cancers. Cervical cancers include C539 and C530. The genital organs cancers (C578) were included in the dataset population also.

* One women was listed in both the 2008-2012 and 2013-2017 NZCR data extracts. This women was considered to have Cancer-non-cervical diagnosed in 2012 but to have a diagnosis of Cervical cancer in 2015. She was thus excluded from the 2008-2012 numbers below (total = 852-1 = 851).

6. Cancer and Patient Demographics comparing 2008-2012 and 2013-2017

Table 6-1 Number of cases of cervical cancer as reported by NZCR, NCSP-R comparing 2008-2012 and 2013-2017

Review period	2008–2012	2013–2017
	n	n
NZCR	851	807
NCSP-R	805	794
Review	772	747

Table 6-2 Number of cases of cervical cancer following histological review by the review team comparing 2008-2012 and 2013-2017

Review records	2008-2012	2013-2017
	n	n
Total individuals in range	844	804
Excluding non-cervical	34	35
Excluding Diagnosis unconfirmed	38	22
Confirmed primary cervical Cancer	772	747
Excluding Age outside range	108	107
Excluding non-HPV cancers	22	16
Plus women added from previous audit (were out of range)		4
Included in review	644	628
Confirmed histology	623	611
Confirmed without histology	21	17

Table 6-3 Annual incidence of confirmed cervical cancer cases per 100,000 female population by year, unadjusted or age-standardised to world standards (Segi, European, and WHO 2000-2025) comparing 2008-2012 and 2013-2017

Age adjustment	2008–2012	2013–2017
	Annual incident rate (95% CI)	Annual incident rate (95% CI)
<i>Mean annual cases (population)</i>	154.4 (2,218,122)	149.4 (2,345,098)
Unadjusted	6.96 (6.49, 7.47)	6.37 (5.93, 6.84)
Segi World Standard	5.57 (5.17, 6.00)	5.13 (4.75, 5.54)
European	6.75 (6.28, 7.25)	6.18 (5.74, 6.64)
World Health Organization (WHO 2000-2025) standard	6.14 (5.70, 6.61)	5.70 (5.28, 6.14)

Table 6-4 Annual incidence of confirmed cervical cancer cases per 100,000 female population, age-standardised to the WHO 2000-2025 Standard Population (all ages) as reported in the NCSP Annual report 2015²¹

Year	Overall	Incidence	Māori	Incidence
	N		N	
2002	181	7.7	33	15.1
2003	178	7.7	33	13.5
2004	157	6.6	33	14.4
2005	154	6.1	25	10.1
2006	158	6.4	28	11.0
2007	163	6.5	34	12.9
2008	175	7.1	39	13.9
2009	142	5.5	30	10.7
2010	180	7.1	36	11.8
2011	169	6.7	37	12.3
2012	168	6.4	40	12.3
2013	159	6.3	39	12.7
2014	144	5.5	35	10.8
2015	142	5.4	29	9.1

Table 6-5 Key comparisons between the current review and previous audits and review

The following table summarises key direct comparisons that can be made between the current review and previous audits and review.

	2000-2002	2003-2006	2008-2012	2013-2017
Histological Type				
SCC	77%	69%	72%	75%
Adenosquamous	6%	5%	2%	4%
Adenocarcinoma	15%	19%	19%	17%
FIGO Stage Recorded				
	74%	55%	49%	25%
Superficially Invasive (microinvasive) Disease at Diagnosis				
SCC	37%	21%	26%	31%
Adenocarcinoma	— [#]	—	19%	15%
Screening history				
Confirmed Cervical Cancer				
Ever Screened	—	—	70%	74%
6-42 Months pre diagnosis	49%	—	37%	38%
Regularly Screened [^]	—	—	17%	23%
Adequately Screened [†]	21%	—	13%	12%
SCC + Adenosquamous				
Ever Screened	—	51%	66%	71%
6-42 Months pre diagnosis	43%	—	33%	36%
Regularly Screened [^]	—	19%	16%	20%
Adequately Screened [†]	17%	—	11%	12%
Adenocarcinoma				
Ever Screened	—	—	89%	86%
6-42 Months pre diagnosis	74%	—	55%	46%
Regularly Screened [^]	—	—	23%	36%
Adequately Screened [†]	32%	—	19%	15%
Superficially Invasive (microinvasive)				
Ever Screened	—	—	79%	80%
6-42 Months pre diagnosis	54% [‡]	—	38%	45%
Regularly Screened [^]	—	29%	23%	31%
Adequately Screened [†]	22% [‡]	—	8%	14%
Screening history in Māori Women				
Proportion of women with cervical cancer who were Māori				
Ever Screened	22%	—	22%	22%
6-42 Months pre-diagnosis	42%	—	33%	37%
Regular Screening [^]	—	—	11%	18%
Adequately Screened	20%	—	6%	10%

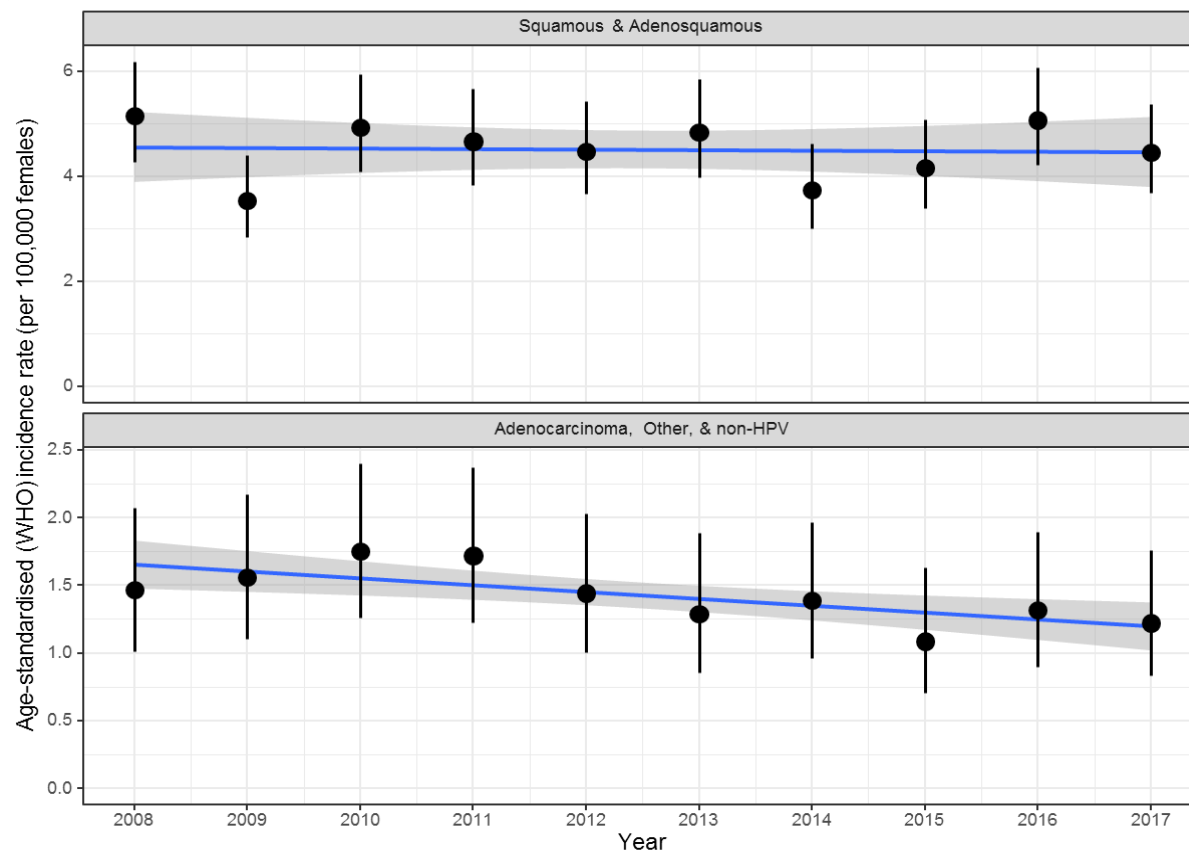
*2003-2006 review excluded non-squamous cancers in screening histology information. [^]Regularly screened as defined in Definitions (page 22). [†]Adequately screened as defined in Definitions (page 22). [‡] Only included stage 1A for SCC. “—” = not reported. # Reported as Stage 1 or 2+ but not reported for just Stage 1A.

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Supplementary Data



Supplementary Figure 1. Annual incidence of cervical cancer diagnosis by cancer type.

Supplementary Table 1 Aggregated list of morphology in confirmed cervical cancer registrations

Morphology in Cancer Registry	n
Squamous cell tumours and precursors	562
Adenocarcinoma, endocervical or not otherwise specified	116
Adenosquamous	28
Adenocarcinoma, intestinal type	10
Carcinoma, not otherwise specified	5
Small cell neuroendocrine carcinoma, not otherwise specified	5
Endometrioid adenocarcinoma, not otherwise specified	4
Neuroendocrine carcinoma, not otherwise specified	4
Adenosarcoma	3
Carcinosarcoma, not otherwise specified	2
Sarcoma, not otherwise specified	2
Serous carcinoma	2
Adenoid basal carcinoma	1
Clear cell adenocarcinoma, not otherwise specified	1
Embryonal rhabdomyosarcoma	1
Lymphoepithelioma-like carcinoma	1
TOTAL	747

Supplementary Table 2 Incidence rates by year, age, NZDep2013 quintile, rurality, and Cancer Network for Māori and non-Māori

Variable		Maori				Non-Maori			
		n	IR raw	IR adj	95% CI	n	IR raw	IR adj	95% CI
Total	[2013,2017]	162	8.8	8.1	6.9 to 9.6	577	5.8	4.4	4.0 to 4.8
Type	Squamous & Adenosquamous	139	7.5	6.9	5.8 to 8.3	442	4.5	3.3	2.9 to 3.7
Type	Adenocarcinoma, Other, & non-HPV	23	1.2	1.2	0.7 to 1.8	135	1.4	1.1	0.9 to 1.3
Year	2013	33	9.3	8.0	5.4 to 11.6	117	6.1	5.0	4.0 to 6.2
Year	2014	32	8.8	8.0	5.4 to 11.6	99	5.1	3.7	2.9 to 4.8
Year	2015	33	8.9	8.8	5.9 to 12.5	103	5.2	3.8	3.0 to 4.8
Year	2016	33	8.8	8.6	5.8 to 12.4	134	6.7	5.0	4.1 to 6.1
Year	2017	31	8.1	7.4	5.0 to 10.8	124	6.1	4.4	3.6 to 5.5
Age	0-9	0	0.0		0.0 to 1.0	0	0.0		0.0 to 0.3
Age	10-19	0	0.0		0.0 to 1.1	0	0.0		0.0 to 0.3
Age	20-29	22	7.6		5.0 to 11.5	60	4.5		3.5 to 5.8
Age	30-39	38	17.4		12.7 to 23.8	141	11.2		9.5 to 13.2
Age	40-49	45	20.2		15.1 to 27.0	138	9.9		8.3 to 11.6
Age	50-59	32	17.2		12.2 to 24.3	90	6.6		5.4 to 8.1
Age	60-69	15	13.8		8.4 to 22.8	69	6.3		4.9 to 7.9
Age	70+	10	15.0		8.1 to 27.6	79	6.8		5.5 to 8.5
NZ_Dep	1	11	42.6	39.7	19.4 to 77.2	143	35.3	31.8	25.8 to 39.1
NZ_Dep	2	15	43.1	40.0	21.9 to 68.5	95	24.8	19.3	15.1 to 24.8
NZ_Dep	3	18	36.3	32.2	18.6 to 52.8	122	34.0	25.8	20.9 to 31.9
NZ_Dep	4	36	50.6	45.3	31.3 to 64.0	112	33.8	24.2	19.4 to 30.5
NZ_Dep	5	81	63.1	58.9	46.3 to 74.2	98	36.7	26.5	20.9 to 33.7
UrbanArea	Main	97	9.6	9.0	7.3 to 11.1	411	6.3	4.7	4.2 to 5.2
UrbanArea	Secondary	15	14.4	13.1	7.2 to 22.5	46	9.5	7.2	4.9 to 10.5
UrbanArea	Minor	32	16.4	15.3	10.2 to 22.2	40	6.3	4.9	3.2 to 7.5
UrbanArea	Rural Centre	6	12.8	10.3	3.1 to 27.3	12	9.8	7.3	3.0 to 16.8
UrbanArea	Other Rural	12	6.4	5.1	2.4 to 10.3	64	6.4	6.1	4.4 to 8.4
Cancer network	Northern	44	7.2	6.9	5.0 to 9.5	198	5.1	3.6	3.1 to 4.2
Cancer network	Midland	52	9.9	9.4	6.9 to 12.6	95	6.6	5.1	3.9 to 6.5
Cancer network	Central	45	9.8	8.6	6.2 to 11.7	122	5.8	4.2	3.4 to 5.3
Cancer network	Southern	21	8.4	7.7	4.7 to 12.2	161	6.5	5.6	4.6 to 6.7

Supplementary Table 3 Proportion of women with cervical cancer (n=747) who had had prior high risk HPV genotype testing

Time prior to diagnosis	Tested		High risk HPV positive			HR HPV (16/18)
	n	%	n	% of tested	% Total	n
Within 3 years	169	22.6%	152	89.9%	20.3%	112
Within 5 years	177	23.7%	155	87.6%	20.7%	114
Any time	180	24.1%	158	87.8%	21.2%	114

Time prior to diagnosis	Tested		High risk HPV positive			HR HPV (16/18)
	n	%	n	% of tested	% Total	n
6 months to 3.5 years	54	7.2%	44	81.5%	5.9%	29
6 months to 5.5 years	61	8.2%	47	77.0%	6.3%	31
Any time prior to 6 months	64	8.6%	54	84.4%	7.2%	32

Note: Percentages for high risk HPV types 16 and 18 have not been provided, as it was not clear when genotyping was or was not performed therefore a valid denominator could not be determined.