Review of Cervical Cancer Occurrences in relation to Screening History in New Zealand for the years 2008-2012.

Prepared for the National Cervical Screening Programme

Final Report

Department of Obstetrics & Gynaecology

University of Otago – Christchurch

Christchurch Women's Hospital – Level 3

2 Riccarton Avenue

Private Bag 4711, Christchurch

Phone +64 3 364 4630 Fax: +64 3 364 4634

Email: peter.sykes@otago.ac.nz

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

The review was developed in conjunction with the Ministry of Health and has used data supplied by the Ministry from the National Cancer Registry (NCR) and the National Cervical Screening Programme Register (NCSP-R).

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

The members of the review team are:

Associate Professor Peter Sykes, CGO, FRANZCOG, MBChB, is a Gynaecologic Oncologist and lead investigator of this Review

Dr Phil Hider FAFPHM, FNZCPHM, MBChB, MPH (Otago), MMedSci (Newcastle), is a Public Health Physician at the University of Otago.

Dr Kieran Dempster-Rivett, MRANZCOG, MBChB, MSc (Waikato), BHB, is a Clinical Research Fellow at the University of Otago.

Dr Jonathan Williman, PhD (Otago), BSc (Hons) is a consultant Biostatistician at the University of Otago.

Michelle Dempster-Rivett, MSc (Waikato), BSc (Tech) is a Clinical Research Assistant at the University of Otago.

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The National Kaitiaki Group

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Dr Lyn Sadler; Epidemiologist, Women's Health, Auckland District Health Board
Dr Melissa McLeod; Senior Research Fellow, Department of Public Health, University of Otago Wellington
Dr Andrew Miller; Pathologist, University of Otago, Christchurch and Canterbury District Health Board.

The following people donated their time to assist in editing the final report:

Dr Carrie Innes
Ms Dianne Harker
Dr Amanda Tristram.

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Executive Summary

Summary of the University of Otago review of cervical cancer occurrences for the period between 1st January 2008 and 31st December 2012. This report was prepared for The National Cervical Screening Programme (NCSP).

- The Ministry of Health identified 852 women from the National Cancer Registry (NCR) as having or likely to have cervical cancer.
- NCR records for these women were matched with NCSP-R records. Paper copies of the corresponding NCSP-R records, an NCR data extract, and copies of the relevant pathology reports were forwarded to the audit team.
- The scope of the audit was limited by a lack of access to clinical information, lack of patient supplied information, lack of a review of cytology specimens, and lack of a population based control.
- Data from the NCSP-R and NCR were compared for fidelity. 805 of 852 women were registered with the NCSP-R. Data discrepancies were noted between the NCR and the NCSP-R in 50% of the records. While the majority of the discrepancies were minor, in 10% of cases the diagnosis of cancer was not recorded on the NCSP-R.
- In 17.5% of cases the date of diagnosis recorded on the NCR differed by greater than 31 days from that indicated through review of available pathology reports.
- All available clinical information contained within these records was reviewed by a medical practitioner familiar with the management of women with cervical cancer. 772 women were confirmed to have cancer of the cervix diagnosed within the review timeframe.
- 72% of cervical cancers were squamous cell, 19% adenocarcinoma of endocervical type or not otherwise specified, 3% were adenosquamous carcinoma, and 6% were cervical cancers of other histological types.

- FIGO staging data was only available for 49% of women. Following review of available pathology reports for the 542 women with SCC, it was determined that 26% had microinvasive disease, 56% had stage 1b disease or greater, while no determination regarding the extent of disease could be made for 18%.
- Ethnicity data was retrieved from the NCR and reported as total response ethnicity. 22% of women were identified as Māori, 9% of women identified as Pacific island, and 7% of women were identified as Asian
- High levels of social deprivation and Māori ethnicity appear to be associated with an increased occurrence of cervical cancer.
- A total of 14% of the 772 women with confirmed cervical cancer were outside the 25-69 year screening age group in whom the screening history was audited and 3% had non-HPV related cancer types.
- A review of screening history was performed on 644 women aged 25-69 years. Smears performed in the 6 months prior to diagnosis were considered to be part of the diagnostic process and therefore excluded. For all women with cervical cancer, 70% had ever been screened, 46% had been screened in the 5 year and 37% had been screened in the 3 year interval prior to their diagnosis.
- Using the definition of 2 smears 3 years apart in the 6-84 months prior to diagnosis only 13% of women age 25-69 with cervical cancer had been adequately screened and only 17 % had undergone five yearly screens.
- For women with SCC, 66% had ever been screened, 40% had been screened in the 5 years prior to diagnosis, and 32% in the 3 years prior to diagnosis. Only 11% had been adequately screened.
- Māori women and women from higher levels of deprivation were less likely to have been screened prior to their diagnosis.
- One third of the 366 women who had been screened in the 6-84 months prior to diagnosis had an abnormal screening test. Therefore an opportunity for prevention or earlier diagnosis of cancer may have been missed.

- The proportion of women with cervical cancer who had participated in screening prior to their diagnosis appeared lower in this review in comparison to that reported by the 2000-2002 audit.
- Assessments of screening adequacy are consistent with a high quality national screening programme.
- Failure to engage women in regular cervical screening appears to be the most important modifiable factor that is related to the screening programme and the diagnosis of cervical cancer in this cohort of women.
- There was insufficient clinical information to allow evaluation of the factors associated with the development of cancer in those who participated in screening.
- Cervical cancer is rare in young women and appears to be predominantly screen detected.

Recommendations from the Review

Recommendations are made on the basis of the findings in this audit, we acknowledge the NCSP may already be addressing some of these issues.

Recommendations are not in order of importance.

(i) The NCR may form the basis of future NCSP-R cervical cancer audits and reviews.
(ii) The NCR inform the NCSP-R of any cervical cancer diagnosis.
(iii) The NCR use the date of histological diagnosis of cancer.
(iv) The NCSP-R enable data management to support future cervical cancer audits and reviews.
(v) For future reviews consideration should be given to recording at the time of diagnosis (i.e. in "real time") identification, verification, and classification of the diagnosis and staging of cervical cancer cases for the NCSP-R and NCR.
(vi) For future audits and reviews, a case control methodology from a population based registry should be used to estimate the protective effect of cervical screening.
(vii) A consistent definition of regular screening that can be applied to both monitoring of the screened population and to the group of women with cancer should be agreed upon.
(viii) Emphasis should continue to be placed on both enrolling and maintaining participation in the screening programme.
(ix) To prioritise improved access and quality of screening, and treatment of cervical cancer for Māori women and the more socially deprived.
(x) Intervention strategies should take into consideration both the practical and cultural needs of these groups.
(xi) Improve collection and recording of ethnicity data on the NCSP-R, including the recording of more than one ethnic group.
(xii) "Real time" data collection may enable improved collection of ethnicity data.
(xiii) The protective effects of screening in relation to age continue to be monitored.
(xiv) That steps should be taken to ensure the regular participation in screening from the recommended age of commencement.
(xv) For the purpose of cervical cancer review that micro-invasive tumours continue to be distinguished from other cancers.
(xvi) The NCSP should continue to aim to reduce the incidence of all cervical cancers, including micro-invasive tumours.
(xvii) Formal review of normal screening tests in women who develop cervical cancer should be undertaken and reported on for educational and quality improvement purposes.
(xviii) We endorse the introduction of HPV based screening, efforts should be made to ensure that there is no reduction in 5 year cervical screening coverage rates.

(xix) A formal clinical case review for patients who have developed cervical cancer following previous screen detected abnormalities should be performed. This should be used to inform the programme, laboratories and medical practitioners of any modifiable factors that have contributed to the outcome.

(xx) In view of the proposed changes to the age of commencement of screening it is important the NCSP acknowledge the rare risk to young women including the upstaging of screen detectable cancers and the possibility of increased incidence of cancer in women under 30.

(xxi) That the NCSP should continue to monitor cancer incidence trends in women under 30.

(xxii) An emphasis is made on engaging women with a high coverage rate at age 25.

(xxiii) That 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;

(xxiv) Matching the NCSP-R 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.

(xxv) Including clinical data, this will confirm diagnosis, stage, method of diagnosis, residency status and ethnicity.

(xxvi) Clinical data would best be collected prospectively in conjunction with the 3 national gynaecological cancer treatment units.

(xxvii) HPV type status of cervical tumours should be recorded.

(xxviii) Review of negative screening tests in the screening period prior to the diagnosis of cancer.

(xxix) Case review of patients with prior abnormal screening tests.

Introduction

Globally cervical cancer is a common cause of morbidity and mortality in women. The introduction of organized screening programmes has resulted in significant reductions in the morbidity and mortality of cervical cancer in developed nations.[1] This has been mirrored in New Zealand since the introduction of the National Cervical Screening Programme (NCSP) in 1990.[2 3.] In New Zealand, all diagnoses of cancer are required by law to be notified to the New Zealand Cancer Registry (NCR). From NCR data for the year 2012, the incidence of cervical cancer was reported to be 6.3 per 100,000 women per year, with an associated mortality of 1.8 per 100,000 women. Based on this data from 2012, this corresponds to 166 new cervical cancer diagnoses and 56 deaths.[4]
Despite the general success of the NCSP in reducing the overall incidence of cervical cancer and its associated mortality among the total population, some groups remain underserved by the programme. The NCSP regularly reports lower levels of screening coverage for Māori women, despite this group having double the rates of incidence and mortality from cervical cancer (incidence and mortality of 12.6 and 3.7 per 100,000 women per year respectively in 2011).[4 5] Reducing inequity in cervical screening and disease outcomes for Māori women remains an important goal.

It is well established that almost all cervical cancers develop subsequent to persistent high risk Human Papilloma Virus (HPV) infection and are preceded by a prolonged period of precancerous changes affecting the cervix.[6] These precancerous changes are both detectable and treatable, meaning that in theory almost all cases of cervical cancer are preventable. This pre-cancerous phase is well described and occurs almost invariably in women with squamous cell cancers (SCC), however the natural history of adenocarcinomas, which comprise the second largest histological group of cervical cancers is less well defined. Adenocarcinoma in situ (AIS) of the cervix is a well-recognised screen detectable entity which frequently occurs alongside squamous intraepithelial neoplasia (SIL). Like its squamous counterparts, AIS can be effectively treated by local treatments. Unfortunately as screening methods are less sensitive for glandular lesions, and the risk of progression to malignancy differs from that of

squamous lesions, screening currently offers limited protection from adenocarcinoma.[7] When compared to SCC, adenocarcinomas are present in a relatively high proportion in screened versus non-screened populations. In addition, there are a small number of women with rare tumours that are not HPV related, it is highly unlikely that these can be prevented by screening or HPV vaccination.[8]

The NCSP aims to reduce morbidity and mortality from cervical cancer through screening with cervical cytology followed by the subsequent treatment of screen detected abnormalities. The intensity of screening must be balanced with practicality, cost benefit and the risk of potential harm. Current screening recommendations are that eligible women should undergo cervical cytology screens at 3 yearly intervals from the age of 20-69. These recommendations will be reviewed in 2018 with the introduction of HPV based screening.

Monitoring of the NCSP is multifaceted and is summarised through the publication of regular monitoring reports. Indicators relating to screening history which are reported include coverage (as a percentage of women aged 25-69 who were screened in the last 3 years) and regularity of screening (as the cumulative probability of attending for a repeat smear following a normal smear). In the years 2008 to 2012, these rates were reasonably stable; coverage rates were approximately 76% (with a 5 year coverage of 90%), the probability of rescreening was 67% within 3 years, and 93% within 5 years of a normal smear. Rates of coverage are lower among Māori, Pacific, and Asian women, as well as in women aged under 35 and over 60.[4 5]

It is well accepted that in practice not all cervical cancers can be prevented by screening, but the review of cervical cancer cases within a screened population may inform us of areas where the screening pathway may be improved. As such these reviews form an important aspect of quality control.

The screening pathway is complex and failure may result from barriers to enrol and recall patients, difficulties in performing cytology tests adequately, a lack of sensitivity

of the screening test, errors in its interpretation and failure to adequately investigate, and failure to treat screen detected abnormalities.

Two previous audits of women with cervical cancer in New Zealand have been conducted. The first was performed following the ministerial inquiry into the under reporting of cervical abnormalities in the Gisborne region[9] to determine if there was evidence of systemic failures leading to the under reporting of cytological abnormalities.[2] 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 NCR. 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 cases. This audit also included independent re-reading of negative screening smears among the included women. Smears 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 history was 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 this audit were that: 77% of cancers were SCC, 67% of all women and 63% of those with SCC had had a smear in the 6-84 months prior to diagnosis, 49% of all women had had a smear in the 6-42 month interval prior to diagnosis, and only 20% were considered adequately screened by the criteria of that audit. Indeed, the audit concluded that 80% of women with cancer were inadequately screened. Ethnicity data on both the NCR 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. Smear re-reading showed that 15% of women with cancer had a smear 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 being diagnosed with cervical cancer between January 2003 and December 2006.[10] Data was extracted from both the NCR 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 or adenosquamous cancers, and women over 80. As with the first audit, smears 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 smear more than 6 months prior to diagnosis) and regularly screened (at least 5 yearly smears 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 NCR 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 smear history is warranted.

Aims of the 2008-2012 Cervical Cancer Review

The aim of this review is to identify information from the demographics of women diagnosed with cervical cancer in New Zealand and their screening histories in order to help inform quality improvement initiatives by the NCSP.

In order to do this, women in New Zealand diagnosed with cervical cancer between January 1 2008 and 31 December 2012 were identified, and their screening histories reviewed. This information was correlated with key demographic information.

The proportion of eligible women who had participated in screening over specified time periods was determined, alongside the proportion of women who had a regular screening history. A further aim of this review was to document the proportion of women who had participated in screening yet ultimately had a diagnosis of cancer.

Methods

Sample Selection

Case selection was conducted upon records supplied by the NCR which were registered within the review timeframe of 1 January 2008 and 31 December 2012 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.)

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 2008 and 31 December 2012. 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 smear (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.

A subset of 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 and over 70 are considered separately in this review. In addition women with rare non-HPV types of cervical cancer (i.e. clear cell, serous, small cell, and neuroendocrine tumours) were excluded for the review of screening history.[11]

Data

Collection and management

All women registered with the NCR as having a diagnosis of either cervical cancer or possible cervical cancer (with ICD-10 site codes of C530 endocervix, site C539 cervix and C578 overlapping sites of female genital tract) between January 1 2008 and 31 December 2012 were identified from the NCR 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. The NCR data extract was downloaded into a custom database created in Microsoft Access™. Data from the provided screening history records were then manually transcribed into the database.

Data quality

Data entry was audited in two ways. During the initial development phase of the review database, every fifth record (45 out of 225 records) that had been entered into the

database during this period were independently reviewed for fidelity. This was to ensure that when changes were made to the database structure in Microsoft Access™ records already in the database were updated. Once the database assumed its final iteration, a global audit was performed by randomly selecting 105 records for review. Four transcription errors were noted, each relating to the date of diagnosis as recorded by the NCSP-R. These errors occurred in records which were included in the first 200 entries made to the database, corresponding to the early development of the database itself. Data entry for those records were reviewed to ensure all relevant data has been entered into the correct database fields following any updates to the database structure.

All pathology reports were reviewed in conjunction with the corresponding NCR and NCSP-R records 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 or stage 1b and greater.

A comparison of the information held in the NCSP-R and the NCR was made and any discrepancies regarding: date of diagnosis, histological type, stage, and mode of diagnosis were identified. When considering discrepancies in the date of diagnosis, a variance of greater than 31 days was chosen as it is in line with the Ministry of Health Faster Cancer Treatment Times 31 day targets.[12] Following review of pathology reports and available clinical information the fidelity of data on the individual registers was assessed.

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

Ethnicity information was found to be largely absent on the provided NCSP-R screening histories and therefore all ethnicity information for analysis is taken from the NCR 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[13 14]; Māori, Pacific, Asian, Middle Eastern Latin American or Africa (MELAA), and European/Other (including NZ European). Women were also dichotomised into Māori versus non-Māori ethnicity and those with any response for Māori were prioritised to Māori, those with unknown ethnicity were excluded from Māori versus non-Māori comparisons but included in all other analyses.

Deprivation and rurality

Deprivation was assessed using the New Zealand Index of Deprivation (NZDep), 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.[15] Deciles were collapsed into quintiles where numbers were small.

Rurality was defined according to the following Statistics New Zealand population-based urban and rural classifications;[16] main urban areas (population of 30,000 or more), secondary urban (population of 10,000 to 29,999), minor urban (population of 1,000 to 9,999), rural centres (population of 300 to 999), other rural (areas not otherwise classified).

Women's addresses, as recorded on the NCR at the time of diagnosis, were geocoded using the Statistics New Zealand Classification Coding System[17] to obtain meshblocks. Resulting meshblocks were linked to Area Concordance Files[18] containing NZ Index of deprivation and urban/rural classifications. Women with a date of diagnosis prior to 2010 were coded using meshblocks and classifications defined using 2006 census data, otherwise meshblocks and classifications from 2013 census data were used.

Screening history

Consistent with previous reviews, any smears taken within 6 months of diagnosis were considered to be part of the diagnostic process and not screening smears.[2 10] 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.[2 10]

The following five definitions were used to assess the frequency of a woman's screening history in order to allow comparisons with previous reports. These definitions are listed below in order from the loosest, or "easiest to achieve" through to the most strict. Women are recommended to have three yearly screens from the age of 20 years. The following 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 regularlity of screening indicator that defines adequacy as three yearly screens plus or minus 3 months).

For all definitions smears that occurred less than six months prior to diagnosis were considered to be 'diagnostic smears' 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.

Any screening

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

Smear in six to 84 months prior to diagnosis

At least one smear in the 6 to less than 84 months immediately prior to diagnosis. This means at least one smear in the six years six months before the six months immediately prior to diagnosis.

Smear in six to 66 months prior to diagnosis

At least one smear in the 6 to less than 66 calendar months prior to diagnosis. This means at least one smear in the five years before the six months immediately prior to diagnosis.

Smear in six to 42 months prior to diagnosis

At least one smear in the 6 to less than 42 calendar months prior to diagnosis. This means at least one smear in the three years before the six months immediately prior to diagnosis.

Regular screening

As per the definition used by Lewis *et al.*[10] regular screening is defined such that woman must have undergone a smear within five years of becoming eligible for screening and then have had at least one smear 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 1991), or from the date of her 20th birthday if this occurred after 1 January 1991.

Adequate screening

Consistent with the 2000-2002 Review[2], but different to the Regularity of Screening Indicator employed by the NCSP, adequate screening is defined such that no between-smear interval of three calendar years or more in 6 to less than 84 months prior to diagnosis. To fulfil this criterion, a woman would have to have had at least two smears in the six year six month period of less than three years apart. Further, the interval between the start of the period and the first smear, and between the last smear 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, DHB, cancer network region) characteristics, with cross-tabulations by year, Māori ethnicity, and pathology.

Cervical cancer incident rates by year, age, and Māori ethnicity, were calculated using New Zealand estimated resident (ERP) female populations obtained from Statistics New Zealand (via nz.stat or infoshare). Population counts by deprivation, age, and Māori ethnicity were supplied by June Aitkinson and are based on 2006 or 2013 census usual resident population counts. Rates are presented per 100,000 female population, with binomial 95% confidence intervals (CI) calculated using the Wilson method. For international and subgroup comparisons rates were directly age-standardised to reference populations using 5-year age categories, with 95% CI based upon a gamma distribution.[19] 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 2008-2012 review of Cervical Cancer Occurrences.

Population

The Ministry of Health identified 854 cases of cervical cancer cases diagnosed between 2008 and 2012 according to information available in the NCR. Two were found to be duplicate records and were deleted (Table 1.1). Among the 852 cases, 831 were coded as C539 (cervix) according to the ICD10-AM, 20 were coded as C578 (overlapping female genital tract) and one was coded as C530 (endocervix). These data are described in Table S1.1a. Based on information from the Ministry of Health who matched details related to name, date of birth and NHI, 805 of the 852 women were registered with the NCSP-R (Table 1.1).

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

Information in the NCR was compared to that recorded in the NCSP-R for the 805 women for whom records were identified in both datasets. Discrepancies were identified within the information recorded in the two registries. There were 141 instances where the date of diagnosis differed by greater than 31 days, another 114 instances where there was no date of diagnosis in the NCSP-R records, and 11 instances where the histological type differed between registers (Table 1.2). In relation to records where there was no date of diagnosis on the NCSP-R, 78 cases were primary cervical cancer, 21 did not include a histology report to enable confirmation of diagnosis, 11 were non-cervical cancers and 4 were not cancer (Table S1.2a).

Among the 78 (Table S1.2b) where there was no diagnosis of cancer recorded on the NCSP-R but for whom subsequent review confirmed the presence of primary cervical cancer, the most common reasons for the absence of information was either that the diagnostic event was not recorded on the NCSP-R (38) or the diagnostic event was miscoded as pre-invasive (38).

Comparison of information on the NCR following review

When the NCR data was compared by the audit team to the available histological information, a number of discrepancies were observed (Section 2).

The most common discrepancy was in the date of diagnosis, which in 17.5% (139) varied by greater than 31 days. In a further 35 occurrences, the cancer was found to be non-cervical (Table 2.1). In 32 cases, there was no histology report in the records, and therefore cancer could not be confirmed.

Among the 35 women where the primary site of cancer was determined to be non-cervical following review, 19 of these women were coded in the NCR as C539 (malignant neoplasm of cervix uteri, unspecified) and 16 were labelled as C578 (malignant neoplasm of overlapping sites of female genital organs) (Table S2.1a).

In 32 women, the diagnosis of cervical cancer was unable to be confirmed through review of histology or cytology reports nor from available clinical information. This number includes seven cases where cancer was included on the NCR on the basis of information presented on the death certificate alone without supporting clinical information (Table 2.3).

Comparison of information on the NCSP-R following review

Discrepancies observed in the NCSP-R are described in Table 2.2, the most common of these being where no date of diagnosis of cancer was recorded in the NCSP-R. This

occurred in 78 instances, in addition, there were 23 occurrences where the date of diagnosis was discrepant by over 31 days. There were 30 instances where on review the data on the NCSP-R incorrectly coded primary cervical cancer as non-cervical (topology codes E and F). Conversely, 17 instances were identified where the NCSP-R incorrectly identified non-cervical cancers as primary cervical. Seven cases of primary cervical cancer were identified where the histological type was incorrectly recorded. Histological information was not available to confirm the cancer diagnosis in 27 records.

Application of inclusion and exclusion criteria

Figure 2.4 presents a flow diagram illustrating the application of the inclusion and exclusion criteria for the screening review.

Among the 852 women registered on the NCR, 772 were confirmed to have a diagnosis of cervical cancer within the review time frame (Table 2.4a). This included 757 women with a histological diagnosis and 15 women for whom no histological diagnosis of cancer appears to have been made, but sufficient clinical information was available consistent with advanced cancer of the cervix and was supported by the presence of at least high grade cytology.

635 women were included in the screening history review, women not aged between 25 and 69 (108) were excluded, along with 21 for whom cervical cancer was non-HPV related cancer (21) and one case where cancer was diagnosed overseas (Table 2.4b).

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 2008-2012 review of Cervical Cancer Occurrences later in this document. Below we present selected key results from the

772 confirmed cases of cervical cancer included in the review timeframe from 1 January 2008 through 31 December 2012 (Table 3.1).

Incidence of cervical cancer

Over the 5 year period from 2008 to 2012, the annual number of confirmed cases of cervical cancer varied from 132-168 (Table 3.2b). Overall this represented a crude incidence rate of 6.9 (95% CI 6.5 to 7.5) per 100,000 female population (Table 3.2a). The crude incidence for Māori exceeded that for Non-Māori in all years covered by the review (Table 3.2b). This same trend was seen when the incidence rate was age standardised using Māori as the reference population (Table 3.2b). The annual age-standardised rates per 100,000 female population for Māori exceeded those for Non-Māori in each of the five years of the study period. The overall age-standardised rates per 100,000 female population were 9.9 (8.5-11.5) among Māori and 4.6 (4.3-5.1) among Non-Māori (Table 3.2b).

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, 3.5, and Figure 3.5a). The peak of occurrences in Māori was younger (35-39 year olds) than Non-Māori (40-44 year olds) as shown in Figure 3.5a. However, age adjusted rates suggest that the younger age of diagnosis in Māori women may be apparent and associated with population distributions (Table 3.7 and Figure 3.7a). Among all cancer cases, 10% of women were aged under 30 years at diagnosis and 11% were over 70 years (Table 3.3).

Histological type

Data describing the various histological types and relevant demographics are described in Tables 3.4 and 3.6. Among the HPV related cancers, SCC (72%) was the most

common, followed by Adenocarcinoma (19%) and Adenosquamous (3%). Other, non-HPV related cancers (including small cell and neuroendocrine) comprised 6% of all cervical cancers for the review period. In general, the proportion of SCC was found to be lower in the screened population when aged under 70 years at diagnosis (Table 3.3 and 3.13). However, this proportion is higher in those aged 70 and over, and in those identifying as Māori (Table 3.13).

FIGO staging

As presented in Tables 3.11a and 3.11b, FIGO staging was included in 49% of NCR records. Overall, 72% of cases with FIGO staging data corresponded to FIGO Stage 1 and 28% Stage 2 or greater (3.11b). Following review of histology reports and clinical information by the review team, further analysis revealed that 23% were Stage 1a (microinvasive) and 60% were Stage 1b or greater. In 17% of cases, insufficient information was available for estimating stage (Table 3.4, 3.6, 3.11a and b).

Microinvasive disease was found more commonly with SCC (27%) than with Adenocarcinoma (19%) and was more common in younger women. For example, when considering SCC, 48% of women under 40 had microinvasive disease at diagnosis compared to just 5% in women over 60 (Table 3.6).

Ethnicity

Among all cancer cases, when using total response ethnicity, (Table 3.3) 64% were identified on the NCR as New Zealand European, 22 % were identified as Māori, 9 % as Pacific Islander and 7% as Asian. In addition, four women (0.5%) were identified as both Māori and Pacific Islander. 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.

By prioritising for Māori ethnicity, of the 772 confirmed cases, 76% were Non-Māori, 22% were Māori, while the remaining 2% were of unknown ethnicity (Table 3.3.) As described in Sections 2 and 3, a total of 644 met the eligibility criteria for the screening review, 73% were Non-Māori, 25% Māori and 98% of all cases were enrolled on the NCSP-R (Table 3.5 and Table 3.7).

Cervical cancer annual incidence rates were higher in Māori than non-Māori (Table 3.2b) with the raw incidence for non-Māori varying between 5.6-6.7 per 100,000 and for those prioritised as Māori ranging between 8.1-11.4 per 100,000. The annual incidence rates for non-Māori when standardised to the Māori age distribution were significantly lower than Māori and were between 3.9-5.0 per 100,000.

In general, Māori women with cancer were younger at diagnosis than non-Māori. Among all women, 39% with cervical cancer who were prioritised as Māori were under 40 compared with 31% of non-Māori who were under 40. Māori incident rates were higher than non-Māori especially between ages 30-70 and over 70 years (Figure 3.5a). As the Māori population has a younger population than non-Māori, more cases would be expected among than younger age-groups (Table 3.7).

Māori women were more likely than non-Māori to have SCC (75% vs 71%) and less likely to have early stage disease across all histological types (Figure 3.12a.) Among those with SCC, 20% of Māori and 24% of non-Māori had stage 1a disease. (Table 3.10)

The proportion of cases amongst those residing in main urban areas was lower among Māori compared with non-Māori but higher in minor urban areas (Table 3.8).

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 possible.

Deprivation index

Data relating to cervical cancer and deprivation index are presented in Tables 3.3, 3.5, 3.7a and 3.7b. Cervical cancer occurred more commonly amongst those with higher levels of social deprivation. Among non-Māori, the highest number of cases were associated with decile 9 (deciles 9 and 10 are the most deprived) and among Māori there was a step-wise increase in the number of cases from decile 4. Māori women with cancer were over represented among those in more deprived deciles (Table 3.5) as expected because more Māori live in the most deprived deciles[12]. 37% of women with cancer in deciles 9 and 10 identified as Māori compared with 8% in deciles 1 and 2. However, incidence rates were still higher among Māori compared with non-Māori in the more deprived deciles (deciles 5-10) suggesting cervical cancer was more common for Māori regardless of deprivation (Figure 3.5b). Amongst specific histological types, particularly SCC and SCC stage 1b+, most cases occurred in the most deprived two deciles (Table 3.14).

Residence at Time of Diagnosis

Rurality

The majority of cases (70%) occurred among women residing in Main Urban Areas (Table 3.8). Among Māori, the proportion from minor urban areas exceeds that of Non-Māori. There was no clear pattern between histological type and stage between Urban and Rural residence (Table 3.15).

DHB of residence at diagnosis

The number of diagnoses varied from 6 to 111 amongst the DHB's (Table 3.16) and 139 (Midland) to 288 (Northern) between Cancer Networks.

Review of cervical screening adequacy

For the purpose of the review of screening histories the following exclusion criteria were applied, as detailed in Section 2a of the Presentation of Tables and Figures for the 2008-2012 review of Cervical Cancer Occurrences later in this document;

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

Following application of these exclusion criteria, 644 eligible women 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. Of these 644 women, 98% were registered with the NCSP-R.

Review of the screening histories of these women demonstrated a clearly increased number of smears in the 5 months prior to the date of cancer diagnosis. The majority of these smears were abnormal (Table 4.1, Figure 4.1a). Therefore within this review we consider smears in the 6 months prior to diagnosis to be part of the diagnostic process, hence the decision to exclude them from the screening history review.

Overall 70% of the 644 women who were diagnosed with cervical cancer between 2008-2012 had any smear recorded on the NCSP-R, and 51% had a smear within the 6-84 months prior to diagnosis while 37% had a smear between 6-42 months prior to diagnosis. Amongst these 644 women, only 13% had an adequate screening history over the 84 months prior to diagnosis by the criteria used in the 2002 Review[2] (adequate screening is defined such that there is no between-smear 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 and 4.2 the following observations can be made:

With regard to age

- Women aged under 45 years were more likely to have ever been screened than older women (80.6% versus 59.6%).
- The proportion of women who had had adequate screening was low (<25%) across all age groups, especially for those aged 60-65 (6%).

With regard to ethnicity

- Pacific and Asian women were less likely than European or Māori women (54% and 59% versus 76% and 73%) to have ever had a cervical smear.
- The proportion of Māori and Pacific women who were adequately screened was low (6% and 5%) and less than European or Asian women (18% and 11%).
- Māori women were less likely than non-Māori to have had a smear in the 6-42 months prior to diagnosis (33% versus 39%). The exceptiononn to this may be among women aged 25-29 who appear more likely, albeit in small numbers, to have had a smear in the 6-42 months prior to diagnosis. (Table 4.3)

With regard to histological type and stage

- The proportion of women with SCC who were screened at any time interval was lower than for adenocarcinoma histological type (66% versus 89%).
- The proportion of cases with adequate screening was lower (11%) among women with SCC compared with adeno- and adenosquamous carcinomas (19% and 21%).
- Women with micro-invasive cancers were more likely to have had smears at 6-66 and 6-84 months prior to diagnosis than women with more advanced disease, but no more likely to have had smears within 6-42 months of diagnosis. These women were also unlikely to have had adequate screening.

With regard to deprivation index and rurality

- There appears to be an association with screening and deprivation index, women at higher deprivation index were less likely to have smears at most time intervals and less likely to have regular smears than women who were less deprived.
- Comparing data between DHBs and regions there appeared to be some variation in screening history by DHB and region (Table 4.5 and 4.6). However the small numbers involved likely influence these results.

The accuracy of cervical cytology

In total, 1215 cytology tests were performed in the 3 years prior to diagnosis (i.e. 0-36 months). 70% were abnormal with 784 (65%) high grade and 67 (6%) low grade abnormalities (Figure 4.1a).

Patients with prior screen detected abnormalities

In principle, women who had a screen detected abnormality prior to the diagnosis of cancer could potentially have had their cancer either diagnosed earlier or prevented. Of the 328 women who had had a smear in the 6-84 months prior to their diagnosis 127 women (approximately one third) had an abnormal screen. This represents 20% of women with cancer in the 25-69 age group (Table 4.8 and 4.9).

- 92 women had at least 1 high grade smear, 9 had no high grade smear but at least 2 low grade smears, and 26 a single low grade.
- 44% of women with SCC who had a smear in the 6-84 months prior to diagnosis had a smear which was abnormal.
- 46% of Māori women who had a screen in the 6-84 month screening period had had an abnormal one, compared to 26% of non-Māori.

- Of the 92 women with a prior high grade screen 36% were Māori.
- Of the 92 women with a prior high grade screen 82% had a colposcopy appointment registered on the NCSP-R
- 67% of these women have a biopsy or treatment recorded on the NCSP-R.

Screening history in women with adenocarcinoma

For women included in the screening history review, a total of 255 smears were performed in the 36 months prior to the diagnosis of adenocarcinoma (Table 4.10). Of these, 164 (64%) were abnormal including 151 with high grade abnormalities and 13 low grade. Among those interpreted as high grade, 127 were interpreted as having glandular abnormalities and 13 with squamous abnormalities. Where a high grade glandular abnormality was identified, 26 of the 127 showed features consistent with invasion compared to 2 of the 13 smears with squamous abnormalities.

The proportion of abnormal smears taken in the 36 months prior to diagnosis of adenocarcinoma (64%) was less than that for SCC (73%).

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, 3% (24) were under 25.
- 66% had SCC and 25% adenocarcinoma.

- 21% of these women were Māori.
- Among women with SCC, 73% were stage 1a and were likely to be diagnosed as a result of cervical screening.
- 22 of 24 women had a smear as part of the diagnostic process.
- 58% of women had had a smear in the 6-42 months prior to diagnosis.
- 38% had had at least 2 previous smears.

Women 25-29 years

- Women in this age group represent 6 % of cervical cancers.
- 26% were of Māori ethnicity.
- 65% were SCC, and of these 58% were Stage 1a.
- 56% were screened in the 6-42 months prior to their diagnosis and 24% adequately screened by the 2002 Review Standard.

Women aged over 70 years

- Represent 11% of cancer cases.
- Predominantly non-Māori with advanced disease.

Women aged between 70-79 years

- 45 were non-Māori and one was Māori
- 70% of women in this age group were diagnosed with SCC.
- 33 (70%) had ever had a cervical smear, however in 11 women this smear was performed in the 6 months prior to diagnosis.
- Of the 33 who had ever had a cervical smear, 22 were enrolled in the screening programme prior to the age of 70.
- Of those enrolled on the NCSP-R, only 2 had previously had a high grade smear, both of whom had been treated for CIN3.

Women aged over 80 years

- 39 women were diagnosed with cervical cancer over the age of 80.
- Of those, two were Māori.
- The predominant histological types were SCC (77%) followed by adenocarcinoma (15%).
- 3 of the 39 women had had a prior screening test.

Comparison with previous audits

A comparison of key results from this review to previous audits is presented in Appendix 1 of this document.

NCR statistics show that the annual cervical cancer incidence rate has fallen from 8.4 per 100,000 in 2000 to 6.2 per 100,000 in 2012. The majority of this fall appears to occur between 2000 and 2004. In this time period screening coverage is reported to have increased slightly, although there have been some changes in the method by which coverage is calculated. There appears to be some increase in coverage for Māori in more recent years. Women with cancer appear to be less likely to have been screened on the latest review compared with previous cohorts. The proportion of Māori women with cancer who have never been screened has decreased in the most recent review but it still remains higher than the proportion for non-Māori.

The proportion of cervical cancers that were adenocarcinomas has increased from 15% to 19% although this change was evident from 2003. Likewise, the percentage of adenocarcinomas has increased among Māori women.

The percentage of squamous cancers that are microinvasive has fluctuated over the review periods between 37% (2002) and 21% (2006). However, these fluctuations may have resulted from the different methodologies employed by the two previous audits.

The proportion of women with cancer who are Māori has decreased although the source of ethnicity data has changed over time. Between 2000-2002 ethnicity data were obtained from the NHI whereas from 2008 it has been taken from the NCR.

Discussion

Methods

This review was conducted with a similar methodology to the two previous audits[2 10] in that NCR registrations form the basis of the assessment. NCR registrations were reviewed and women included if the diagnosis of cervical cancer could be confirmed using the provided information. These cases were matched by the Ministry of Health using NHI and date of birth to identify corresponding NCSP-R screening records.

Various data were not available for this review which were available to previous audits. In particular, individual patients' clinical records were not available for review, which limited the researchers' ability to verify information on either database. FIGO stage data was also notably lacking. However most of the supplied histology reports combined with what clinical information was presented contained sufficient information to broadly classify cancers into Stage 1a and above. There was no history describing the duration of national residency, thus the presented results may include women who have not been resident in New Zealand during previous screening periods. Denominator numbers used to calculate rates were based on census data but they did not allow for the number of women who had undergone a hysterectomy and may therefore underestimate the incidence rates among the population at risk of developing cervical cancer. Ethnicity data was only available from NCR records as ethnicity was not included in most of the provided NCSP-R reports. Where ethnicity was included in the NCSP-R histories, only a single ethnicity was presented which precluded any assessment for those who identified with multiple ethnicities. Furthermore, ethnicity information collected in New Zealand datasets are known to be subject to inaccuracies and can vary according to data source.[2]

Information regarding management of screen detected abnormalities and the diagnostic pathway were limited, with data regarding referrals to colposcopy, subsequent treatment and their outcomes being infrequently and inconsistently

recorded. Thus, without access to individual patient records, detailed assessment of the screening and management pathways was not possible.

The exclusion criteria used in the present study differed from the previous two audits, which in turn varied between themselves.[2 10] This review included 15 women without a histological diagnosis of cancer but had a high grade cytology result and clinical information consistent with advanced cervical cancer. In addition, for the evaluation of the screening history we excluded 24 women under 25, as coverage of these women is no longer reported by the NCSP-R and those in this age-group have had limited opportunities for screening when compared with older women. 21 women were excluded whose documented pathology was unlikely to be associated with HPV infection. Numbers in these groups are small and unlikely to have a major influence on results, but in the authors' opinions these criteria most accurately reflect the intent of the NCSP. This is particularly relevant when one considers the planned changes to screening from 2018.

As there was no reliable clinical information regarding presentation among the data supplied by the NCR and NCSP-R, differentiating between screening and diagnostic smears was not possible outside of using a time limit. Consistent with previous audits, a cut-off 6 months prior to diagnosis was used in the definition of diagnostic smears. While it is accepted that this is a somewhat arbitrary cut off, its use is supported by the data presented in Section 4 and illustrated in Figure 4.1a.

Unlike the 2002 Audit, no re-reading of smears were performed as part of this review, therefore no comment can be made regarding screening failure in this context.

For this review, the NCSP-R was unable to supply an electronic dataset requiring the transcription of paper records to a research database. This process was not only costly but potentially prone to error. However several internal reviews of the accuracy of data transcription were conducted and no significant errors were identified.

As the data matching was undertaken by the Ministry of Health, we are unaware of any difficulties with linking records between the datasets.

Based on the comparison of data on both registries, it is apparent that for a significant proportion of women (14%) the diagnosis of cervical cancer is not recorded on the NCSP-R. It is also relevant that for a significant proportion of women the NCR date of diagnosis does not match the date on which the first histological diagnosis of cancer was made. Within the NCR, pre-invasive diagnoses are recorded in the same record as those which are malignant. Because of this it appears that the date of diagnosis is recorded as the date of the earliest biopsy regardless of whether it is malignant or pre-invasive, meaning that in 73 cases the date of diagnosis is recorded incorrectly due the date of diagnosis apparently being made from a pre-invasive result. Similar discrepancies are seen in 110 cases where cervical cytology results are recorded on the NCR. Again, if the cervical cytology result pre-dates all other reports on record, be they pre-invasive or otherwise, then this date appears to be what is taken on the NCR as the date of diagnosis of the associated cancer. Where possible, the date of histological diagnosis is utilised for this review.

As the NCR was used as the starting point for identification of cervical cases prior to matching, women with cervical cancer who are not registered on NCR, those registered with an incorrect ICD 10 code or whose date was incorrectly recorded outside review period were not included in this review.

Recommendations

- The NCR should form the basis of future NCSP-R cervical cancer reviews
- The NCR inform the NCSP-R of any cervical cancer diagnosis
- The NCR record the date of histological diagnosis of cancer.
- The NCSP-R enable data management to support cervical cancer review.
- For future reviews consideration should be given to recording at the time of diagnosis (i.e. in “real time”) identification, verification, and

classification of the diagnosis and staging of cervical cancer cases for the NCSP-R and NCR.

Screening coverage

Despite the limitations of this study the results clearly reveal that the vast majority of women who develop cervical cancer have not been adequately screened. In fact, only 13% of women age 25-69 with confirmed cancer had adequate screening as defined by the strict definition of regular cytology tests no more than 3 years apart in the 6-84 month period prior to their diagnosis and 17% had 5 yearly screening from 1990 or from age 20. This was even lower in women with SCC, Māori women, and those that experience higher levels of socioeconomic deprivation. Similarly only 37% of women with cervical cancer had had a cytology test in the 6-42 months and 46% in the 6-66 months prior to diagnosis. Again screening rates were lower in women with SCC, Māori women, and those that experience higher levels of socioeconomic deprivation. Some variation in screening by region was noted, however these data are difficult to interpret.

In order to determine the protective effect of screening, it is important to compare cancer rates in screened and unscreened women. In the UK screening programme audit a control cohort is selected, and in so doing, a case control methodology is used to infer the protective effect of the screening test.[20] We are unable to do this directly, however we can compare our review results with NCSP published estimates of screening coverage. In 2012, the 3 year coverage was 76%.[4] There are no published estimates of the proportion of women in the screen eligible population undergoing regular screening over a defined period as per our methodology. However the rate of rescreening following a normal or abnormal smear is published in the NCSP annual monitoring report. In 2012 the three year probability of rescreening following a normal smear was 67%,[4] this implies that approximately 50% of women are likely to have smears at no more than 3 yearly intervals.

If we extrapolate and compare estimated coverage from the NCSP to data from this review, 63% of cancers in women of screening age occur in the estimated 24% who have not had a smear in the last 3 years. When comparing this to 37% of cancers in the estimated 76% of women who have had a smear in the last 3 years it appears that women who have not had a smear in the last 3 years have about 5.4 times the risk of developing cancer than those who have had a smear. In addition if we compare the 63% of cancers occurring in 24% of women who have not had a smear in the prior 3 years to the 13% of cancers in the estimated 50% of women screened regularly. Women who have not had a smear in the prior 3 years are at 10 times the risk of being diagnosed with cancer when compared with those who are regularly screened. Interestingly, 55 (42%) of the 132 adenocarcinomas occurred in women who had had a smear in the 3 years prior to diagnosis. This suggests that unscreened women have 4.5 times the risk of adenocarcinoma than women who had had a smear in the last 3 years. Because populations of screened and unscreened women will vary in numerous ways, these figures can only be considered an estimate. Reduction in risk may be also due to other confounding variables, however these figures are consistent with those expected from a high quality screening programme.

It is well known that the cytology screening test has limited sensitivity and as a result a single test offers limited protection. This is emphasised by the fact that over a third of women had a screening test in the 3 year screening period prior to their diagnostic event. It is therefore believed that regular repeated screens are the key to prevention. In order to provide accurate figures regarding the protective effect of screening, the utilisation of a case control methodology from a population based registry with a consistent definition of regular screening that can be applied to both the screened population and the group of women with cancer is required. We note that the NCSP currently consider the appropriate screening interval to be 3 years +/- 6 months[21].

Failure to engage women with regular cervical screening appears to be the most important factor associated with the diagnosis of cervical cancer that could be modified by the NCSP in this cohort of women.

Recommendations

- Emphasis should continue to be placed both on enrolling women in the screening programme and ensuring that they get regular ongoing screening tests, with a particular focus on Māori.
- For future audits and reviews, a case control methodology from a population based registry should be used to estimate the protective effect of cervical screening.
- A consistent definition of regular screening that can be applied to both monitoring of the screened population and to the group of women with cancer should be agreed upon.

Māori women

NCR statistics show that Māori women have an increased incidence and mortality from cervical cancer. Incidence rates calculated using the current dataset are similar to those found in previous audits. It is acknowledged that the ethnicity data in this review has its limitations, as ethnicity data is collected from only one source. As ethnicity data may vary between datasets, collecting ethnicity data at the point of diagnosis may improve reporting.

It is possible that this review overestimates the proportion of unscreened women with disease. However as in other audits this review appears to confirm Māori women are under screened and as a result suffer from relatively more cervical cancer than non-Māori women.[2] Māori women also appear to be diagnosed more frequently at a later stage, although due to the limited stage data available to us the accuracy of this is uncertain.

There is a strong correlation between ethnicity and deprivation index for women with cervical cancer. Māori are relatively more deprived than non-Māori, and this was reflected in the number of cases by deprivation level observed in this review. However, even within deprivation quintiles, Māori women had higher rates of cervical cancer than non-Māori suggesting that both increased deprivation and identifying as Māori may contribute to higher rates of disease for this group. In this review it was also apparent that Māori women with cancer were over represented in rural and minor urban centres compared to the national average.

We are unable to determine the relative importance of social deprivation and ethnicity. As for many areas of health inequality, cervical cancer rates are likely to be an expression of social inequity where access to and quality of screening and treatment are inferior. Intervention strategies should prioritise both the practical and cultural needs of these groups.

The disparity in incidence of cervical cancer between Māori and non-Māori has been persistent despite improved efforts to engage Māori women with screening. Renewed and novel efforts are required. Fortunately both HPV vaccination and HPV self-sampling may offer real opportunities to reduce these disparities. However this does not mean that the NCSP should not continue to push for an equitable screening programme in New Zealand. The number of women of Pacific Island and Asian ethnicity were low in this study, but these groups are also known to be under screened and strategies to address differential access for these groups should also remain a focus of the NSCP.

Recommendations

- Emphasis should continue to be placed on both enrolling and maintaining participation in the screening programme.
- To prioritise improved access and quality of screening, and treatment of cervical cancer for Māori women and the more socially deprived.

- Intervention strategies should take into consideration both the practical and cultural needs of these groups.
- Improve collection and recording of ethnicity data on the NCSP-R, including the recording of more than one ethnic group.
- "Real time" data collection may enable improved collection of ethnicity data.

Screening and age

There is an interesting association between age and screening history. Younger women with cancer were more likely to have had a screening test in the 3 and 5 year period prior to their diagnosis of cancer than older women with the diagnosis. This is despite the fact young women are known to have lower coverage. However young women show low levels of having had regular smears similar to those in older women. Reduced protection against cancer by cytology screening has been noted by other investigators.[22]

It is likely that there are a combination of factors that explain this phenomenon. The most likely is that screened women of older age are more likely to have undergone multiple screens and so be afforded greater protection compared with screened women of younger age who are likely to have had only one or two screens and therefore have less protection. Possible other contributors include the high proportion of women of this age group with high grade abnormalities, a greater incidence of HPV 16 related disease which may be associated with a shorter natural history, greater levels of transience making follow up and treatment of abnormalities more challenging. It is also possible that the cervical cytology test is more difficult to interpret in this age group. It appears that not only the enrolment of young women but their regular participation and adherence to recommendations is required to minimise their risk of cancer. The current policy of 2 cytology tests 1 year apart at the commencement of screening therefore has merit, however at the age of 20 it may be too early in the natural history of the disease to have great effect.

Recommendations

- That the protective effect of screening in relation to age continue to be monitored.
- That steps should be taken to ensure the regular participation in screening from the recommended age of commencement.

Microinvasive tumours

Microinvasive squamous cell cancers are entirely curable and are almost always screen detected.[23] [24] Arguably the diagnosis can be considered a screening success however their treatment may have a significant impact on a woman's fertility and as they are invasive tumours may represent a failure of screening. Clinically they are often associated with large pre-invasive lesions and likely to be associated with underscreening.[25] In this review 26% of squamous cancers were microinvasive. They occurred more frequently in young women and less frequently in Māori. While women with microinvasive tumours were more likely to have ever been screened, only 8% had been adequately screened and only 36% had had a screening test within the last three years. This supports the hypothesis that microinvasive lesions are associated with suboptimal screening. Less effective screening would result in upstaging of these cases.

Recommendations

- For the purpose of cervical cancer review micro-invasive tumours continue to be distinguished from other cancers.
- The NCSP should continue to aim to reduce the incidence of all cervical cancers including microinvasive tumours.

The cytology test

The cervical cytology test has a reported sensitivity of between 57 and 90% for the detection of a high grade abnormality.[26 27] Determining the sensitivity of the screening test within a screening programme is difficult to determine and can only be inferred by a number of indirect measures. 37% of women with cancer had had a smear within the 6-42 month screening period prior to their diagnosis. This is evidence of the false negative rate of the screening test and an accurate measure of the sensitivity of cytology cannot be gleaned from this information because the sample is biased. These patients have a diagnosis of cancer, therefore it is more likely that their last screening smear was negative. Smears taken during the diagnostic period within 6 months of the diagnosis are more likely to be abnormal as they may have led to the diagnosis. That 70% of screens taken within the 3 years of diagnosis were abnormal is one measure of the performance of the test that may be comparable between this review and other audits.

There is no reason to believe the sensitivity of the cervical cytology test in New Zealand is unacceptable. Despite improved coverage and a reduced incidence, the proportion of women with cancer who have been screened has reduced since the 2000-2002 audit. This would suggest improved performance of cytology based screening. However it could also reflect poorer coverage of those at highest risk of cervical cancer.

As no re-reading of cytology slides was undertaken, we are unable to comment on the contribution of cytology interpretation to the false negative rate. In the previous audit 18% of re-reported smears were subsequently considered high grade or possible high grade. We are unable to determine what the rate would be in this sample. While this process is of limited value to determining the overall sensitivity of the screening programme open review of “normal” screening tests prior to the diagnosis of cancer has obvious educational and quality assurance value. There will be concern regarding the possible negative consequences of employing an open process in that public awareness of screening failures may undermine confidence in the programme, however such a process will help to provide a high level quality assurance and thus ultimately enhance delivery of the programme.

Increasing the sensitivity of the screening test is likely to reduce the incidence of cancer in screened women. This is likely to be achieved with the introduction of HPV based screening. If we conservatively postulate an increase in sensitivity to 80-90% we may see a 50% reduction in cancers in women who have had normal smears in the 5 year screening period prior to their diagnosis. This may be about 25 women per year or approximately 15% of cancers in women age 25-69 provided 5 year coverage rates are maintained. This is consistent with NCSP predictions.[28]

Recommendations

- Formal review of normal screening tests in women who develop cancer should be undertaken and reported on for educational and quality improvement purposes.
- We endorse the introduction of HPV based screening and efforts should be made to ensure that there is no reduction in 5 year cervical screening coverage rates.

The management of screen detected abnormalities.

Approximately one third of women who underwent screening in the 6-84 months prior to their diagnosis had an abnormal screen. This represents 20% of women with cancer in the 25-69 age group. The majority of these had a high grade abnormality. In principle these women should either have had their cancer diagnosed earlier or the cancer prevented. There are a large number of reasons why cancers may not be prevented in such patients, these include failure to access colposcopy or treatment, inadequate treatment or follow up. The information available to the audit team from NCSP-R records was of limited value, while 87% of women in this sub-group had a colposcopy appointment or referral registered on the NCSP-R, only 67% actually have a corresponding biopsy or treatment registered on the NCSP-R from which attendance can be inferred. Without access to clinical records, limited inferences can be made

regarding the management pathway. As such, we are unable to further determine the factors that contribute to treatment failure in these women.

As this group represents a significant proportion of women of screening age with cervical cancer and Māori women are over represented in this group, a more detailed clinical review is indicated to determine if there are identifiable factors that contribute to these failures. This would be an important contribution to quality assurance and education for colposcopy services. Following the 2003-2006 review it was also noted that further investigation of the factors contributing to the occurrence of cancer in women undergoing regular screening was required. To our knowledge such a review has not been undertaken.

Recommendation

- A formal clinical case review for patients who have developed cervical cancer following previous screen detected abnormalities should be performed. This should be used to inform the programme, laboratories and medical practitioners of any modifiable factors that have contributed to the outcome.

Screening history in women with adenocarcinoma

According to our calculations, screening offers some protection from cervical adenocarcinoma, and it is interesting that occurrences increase with increasing levels of deprivation. Among those who had been screened in the 36 months prior to being diagnosed with adenocarcinoma, 50% had high-grade glandular abnormalities identified on cervical cytology in the 36 months prior to diagnosis. 45% of that number were interpreted as atypical glandular cells with NZ Modified Bethesda codes AG1-5. The associated lesions are not well identified by colposcopy and by extension, directed biopsy. In this setting excisional biopsy should be considered.

Special Populations – Women aged under 30

Only 24 (3%) women were diagnosed with cervical cancer under the age of 25. Other investigators have demonstrated that cervical screening of under 25s has little impact on the incidence of cervical cancer in this age group.[22 29 30] It is noted however that 54% of cases are microinvasive and that the majority of cases are diagnosed as the result of screening and that without screening these cases were likely to be diagnosed at a more advanced stage.

The minimal population benefit and high cost of cervical screening in this age group is acknowledged and as such we do not recommend screening as part of the programme. However at the individual level significant benefits can be realised for the few affected women. Therefore if screening at this age is to cease then strategies to mitigate the risk of disease, which would include HPV vaccination and education regarding the investigation of symptoms, should be emphasised.

Fifty-one (6.5%) women with cancer were aged between 25-29 years old. Of these, 36 (70%) were SCC's and 58% were stage 1a. Withdrawal of screening under the age of 25 in the UK was associated with (but not necessarily the cause of) a significant increase in the incidence of cervical cancer in the 25-29age group.[20 31 32] In NZ this effect may be minimised by the prior introduction of HPV vaccination and the higher sensitivity of the HPV test. Early enrolment of women at the age of 25 should be considered with the goal of high coverage. Careful monitoring of cancer incidence in this age group is indicated with changes in NCSP policy.

Recommendations

- In view of the proposed changes to the age of commencement of screening it is important the NCSP acknowledge the rare risk to young women including the upstaging of screen detectable cancers and the possibility of increased incidence of cancer in women under 30.

- That the NCSP should continue to monitor cancer incidence trends in women under 30.
- An emphasis is made on engaging women with a high coverage rate at age 25.

Special Populations – Women over 70

Six percent of women with cervical cancer were aged 70-79. These women were outside the screening age range for the NCSP at the time of diagnosis, however 75% of women had had smears prior to the age of 70 and 5% were treated previously for pre-invasive disease. The majority had a histological diagnosis of SCC (70%) while 14% had adenocarcinoma. Micro invasive cancer was rare in this group.

It does not appear that screening prior to the age of 70 offers prolonged protection to women, however a more detailed case control study would be necessary to more accurately determine this finding. It has been suggested that women continue to be screened up to the age of 75. Given the apparent limited ability of screening prior to the age of 70 to give prolonged protection to women, this would appear to be appropriate for women in otherwise good health. However, due to the small numbers, the benefit would be small.

Five percent of women were over age 80. 7% were Māori and 15% of cancers were adenocarcinoma. Only 8% had been involved with cervical screening prior to the age of 70, likely due to the older age of these women at the commencement of the screening programme.

Comparison with previous audits

The following observations are made with the caveat that any comparisons between reviews are significantly limited by any differences that may exist between the studies.

This is particularly prudent in relation to the data used in each study and the methods employed.

Between 2000 and 2012 the time period covered by the 2 cervical cancer audits and the current review, there has been a fall in the incidence of cervical cancer from 8.4 to 6.3 per 100,000 per year. The majority of this occurred prior to 2003. During this time, the proportion of adenocarcinomas has increased slightly, from 15 to 19%, which again appears to have occurred prior to 2003. Between 2006 and 2012 changes in these rates have been minimal. This would suggest that improvements in screening were made prior to 2003 and have subsequently reached a steady state. Since 2006 there has been a reported improvement in 3 yearly coverage, which one expects would lead to a reduced incidence which was not apparent in this review. However the impact of this improved coverage may not become apparent until a later date.

In comparison to the 2000-2002 audit the proportion of women with cancer that have been screened by all measures has reduced. It is important to note that women who were not resident in NZ for the prior 4 years were excluded in the previous audit, whereas we were unable to determine residency in this review. In addition we included some women with cytological rather than histological confirmation of disease who had advanced disease and were perhaps less likely to be screened. The reduction in the proportion of women that had been screened observed between reviews may be due to differences in our methodology, reduced coverage or increased protection from cancer by screening. As coverage is likely to have improved slightly over recent years, this reduction may in part be due to improved quality within the screening programme.

Unfortunately from 2000 to 2012 there appears to be little change in the incidence of cervical cancer in Māori. The information from this review suggests that Māori, particularly those with higher levels of social deprivation continue to be under screened. It is however recognised that the NCSP has placed an emphasis on enrolling Māori women and coverage rates have improved since 2010. It may be that this improvement in coverage is yet to show an impact on Māori cancer incidence. There

however are some encouraging signs, for example Māori mortality has reduced since 2010, perhaps an early indication of the down staging associated with increased coverage. Of note in Māori the proportion of invasive adenocarcinoma has increased from 10-15% which may be a sign of improved screening. Despite this there is a clear need for renewed effort and novel approaches to the prevention of cervical cancer in Māori women.

The interpretation of these trends is challenging and complicated by changes in methodology between studies. The overall message is the same that the vast majority of women that develop cervical cancer are not adequately screened. That the percentage of women screened in this group is falling despite increasing coverage may suggest an increase in efficacy of the programme over time but perhaps reduced coverage in women at most risk.

Recommendations

- That 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 into consideration:
    - Matching the NCSP-R 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.
    - Including clinical data, this will confirm diagnosis, stage, method of diagnosis, residency status and ethnicity.
    - Clinical data should be collected prospectively in conjunction with the 3 national gynaecological cancer treatment centres.
    - HPV subtype status of cervical tumours should be recorded.
    - Review of negative screening tests in the screening period prior to the diagnosis of cancer.
    - Case review of patients with prior abnormal screening tests.

Impact of the HPV Vaccine and the future of the NCSP

In 2008 the HPV vaccine was introduced and the screening programme has announced its intention to change to a HPV based programme in 2018. This will incorporate a 5 yearly screening interval and screening will commence at age 25. These are major changes to our approach to cervical cancer prevention with an exciting potential to markedly reduce mortality and morbidity from invasive cervical cancer. These programmes are an important investment and careful monitoring of the impact of these changes is warranted. Potential cause of failure of prevention of cervical cancer will be increasingly complex. HPV epidemiology, HPV vaccination, vaccination coverage, screening coverage, screening tests and treatment algorithms will all be relevant and important to monitor.

Ongoing audit of cervical cancer occurrences would appear to be an important aspect of quality assurance for our cervical cancer prevention strategy. While continuation of retrospective matching of the NCR and NCSP-R records are feasible it is important that any modification of the NCSP data management systems allow the collation and transfer of electronic data to support such an audit. However, this type of audit offers limited information with minimal opportunities for related quality improvement activities.

Presentation of Tables and Figures for the 2008-2012 review of Cervical Cancer Occurrences

Section 1: Description of discrepancies between the databases

Table 1.1: Description of NCR records Popn: 852

All cervical and related cancer incidences on NCR diagnosed 2008-2012, and the number of these with associated screening histories on the NCSP-R register.

NCR Records	n
Total number of cases received from the NCR	854
Two of these were duplicate entries so are excluded	852
Total number of the 852 cases who are enrolled in NCSP-R	805

Supplementary Table S1.1a: ICD10 cancer codes for all NCR records Popn: 852

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

NCR codes received in full dataset (852)	ICD10	n
Malignant neoplasm of cervix uteri	C539	831
Malignant neoplasm of endocervix	C530	1
Malignant neoplasm of overlapping sites of female genital organs	C578	20

Table 1.2: Description of discrepancies between NCR and NCSP-R databases

Popn: 805

Data was compared between the NCR and NCSP-R databases and assessed for inconsistencies. This table is a list of the significant discrepancies between the two registries for all records of cervical cancer between 2008-2012 enrolled on the NCSP-R. (This excludes those not enrolled on NCSP-R).

Description of discrepancies between NCR and NCSP-R databases	n
No date of diagnosis on NCSP-R records	114
Date of diagnosis differs by over 31 days	141
Difference in histological type	11
Total	**266**

Supplementary Table S1.2A: Diagnosis type for all with no date of diagnosis on NCSP-R

Popn: 114

Corresponding records on the NCR and NCSP-R were reviewed, including histological reports for cases of cervical cancer which have no diagnosis date confirmed in NCSP-R screening records. This table outlines the diagnosis given upon review by the review team for those enrolled on the NCSP-R but without a cancer diagnosis on their screening record.

Diagnosis type	n
Not cancer (cannot be confirmed from histology)	4
No histology report (cannot confirm cancer)	21
Non-cervical cancer	11
Primary cervical cancer	78

Supplementary Table S1.2B: Reasons for no date of diagnosis in NCSP-R for confirmed primary cervical cancer cases Popn: 78

Review of reasons of confirmed primary cervical cancer cases for women enrolled on the NCSP-R who do not have a recorded date of diagnosis of cancer on the NCSP-R. 9 cases are counted twice (as they had two reasons for no date). Other includes: clinical confirmation possible, diagnosis on post-mortem, no histology report.

No date in NCSP-R for primary cervical cancer cases	n
Diagnostic event not recorded	38
MDT review not updated	6
Miscoding of diagnostic event (miscoded as pre-invasive)	38
Other	5

Section 2: Description of discrepancies within each database compared to a review of histological reports.

Table 2.1: Description of inconsistencies between NCR data against histological review Popn: 852

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

Inconsistencies between histological review and NCR	n
Date of diagnosis is incorrect by over 31 days	139
Date of diagnosis is outside of review timeframe	7
Cancer is non-cervical	35
Incorrect histology type	4
Clinical confirmation based on cytology (no histology report in records)	15
No diagnosis of cancer can be confirmed from histology reports	6
No histology report in records - cannot confirm cancer	32

Supplementary Table S2.1A: Description of discrepancies for cases with a diagnosis of non-cervical cancer

Cases identified according to the NCR as cancer but non-cervical in origin upon review of histology reports are classified according to their appropriate ICD10 codes. This table also identifies whether data held on the register is concordant with these codes.

Non-Cervical cancer cases	Total n
C539 in NCR but confirmed non-cervical	19
C578 in NCR and confirmed as non-cervical	16
TOTAL	35
C578 in NCR but confirmed as cervical	3
C578 cannot be confirmed (no histology report)	1

Table 2.2: Description of inconsistencies between NCSP-R data against histological review Popn: 805

Review of NCSP-R screening records with cancer registry and histological reports showed the following information.

Discrepancies between histological review and NCSP-R	n
Date of diagnosis is incorrect (>31 days)	23
Date of diagnosis is outside of review timeframe	7
No date of diagnosis in register for primary cervical cancers	78
Recorded as Cervical Cancer in the NCSP-R but is non-cervical	17
Histology shows grade E, F (non cervical / not primary)	30
Incorrect histology type	7
Clinical confirmation based on cytology (no histology report in records)	15
No diagnosis of cancer can be confirmed from histology reports	5
No histology report in records - cannot confirm cancer	22

Table 2.3: Diagnosis by death certificate

There were 7 cases on the NCR where the diagnosis of cervical cancer was taken from information presented on the death certificate alone without a corresponding histology report to allow for review. One case did include cervical cytology and thus cervical cancer was able to be confirmed on the basis of this result

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Diagnosis from DC	n = 7
No histology report for confirmation	5
Not cervical	1
Clinical confirmation from cytology	1

Section 2a: Description of eligibility for the screening history review

Table 2.4: Description of exclusion criteria for review of cancer occurrences

Figure 2.4: Application of inclusion and exclusion criteria to the full dataset as supplied by the NCR and NCSP-R for selection of cases eligible to the screening review.

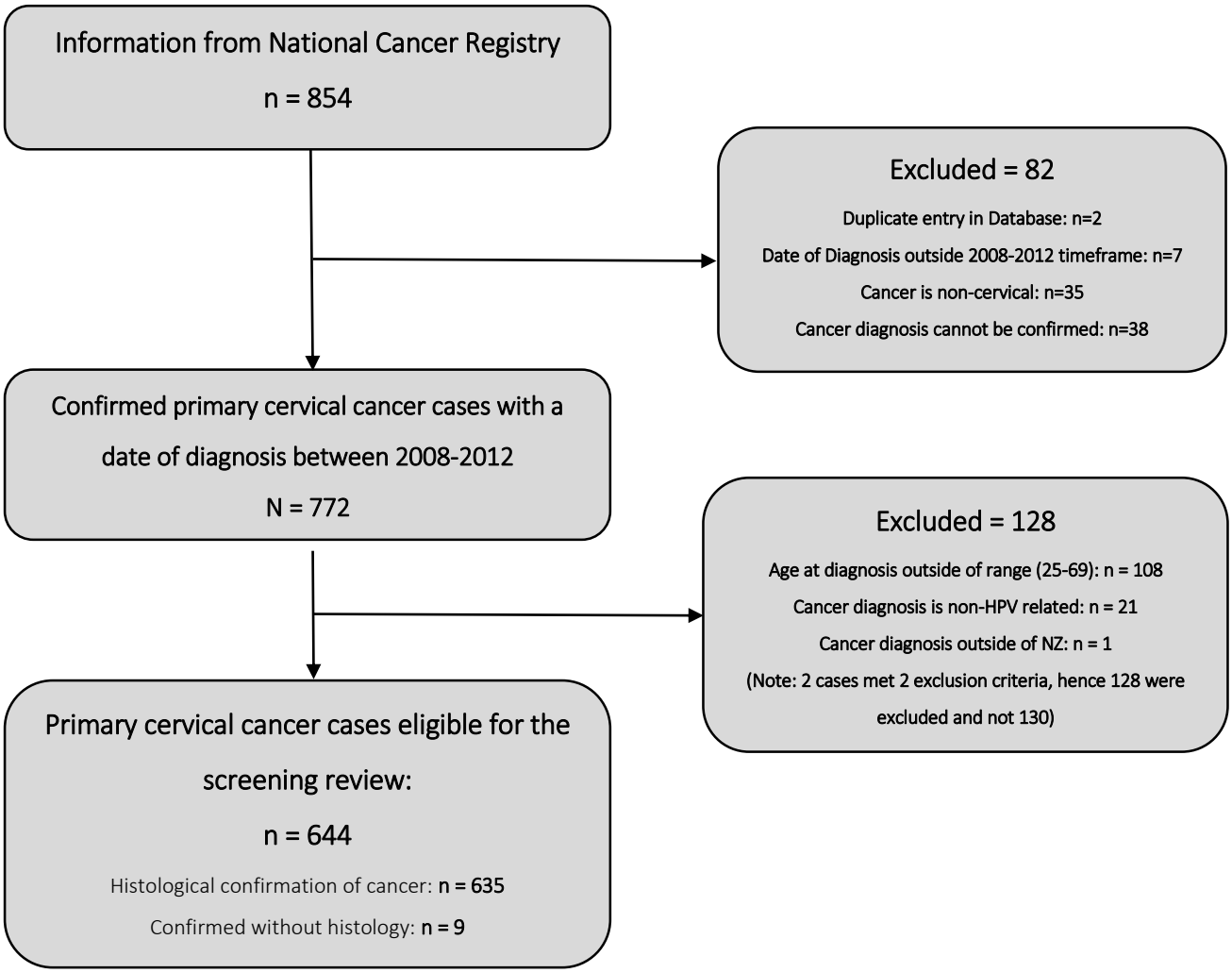

Table 2.4: Mode of confirmation of cases included in the review of the screening programme

This table describes the grounds on which 644 cases 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	635
Cervical cancer confirmed on basis of clinical information and the presence of at least a high grade cytology but without a histology report available	9
Total	644

Section 3: Cancer and Patient Demographics.

Note: 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: Number of cases of cervical cancer as reported by NCR, NCSP-R and following histological review by the review team

Year	NCR	NCSP-R	Review
2008	176	167	162
2009	148	138	132
2010	181	174	168
2011	174	163	157
2012	173	163	153
Total	852	805	772

Table 3.2: Incidence of cervical cancer per 100,000 population.

Table 3.2a: 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)

This table presents the estimated annual incidence of cervical cancer for all women for years 2008-2012. Rates were calculated using the 772 cases divided by the estimated resident female population in New Zealand in June 2010 (2,223,970), and direct age-standardised to international reference populations.

Age adjustment	Annual incident rate (95% Confidence intervals)
Unadjusted	6.94 (6.47, 7.45)
Segi World Standard	5.55 (5.15, 5.98)
European	6.74 (6.27, 7.24)
World Health Organization (WHO) standard	6.13 (5.69, 6.59)

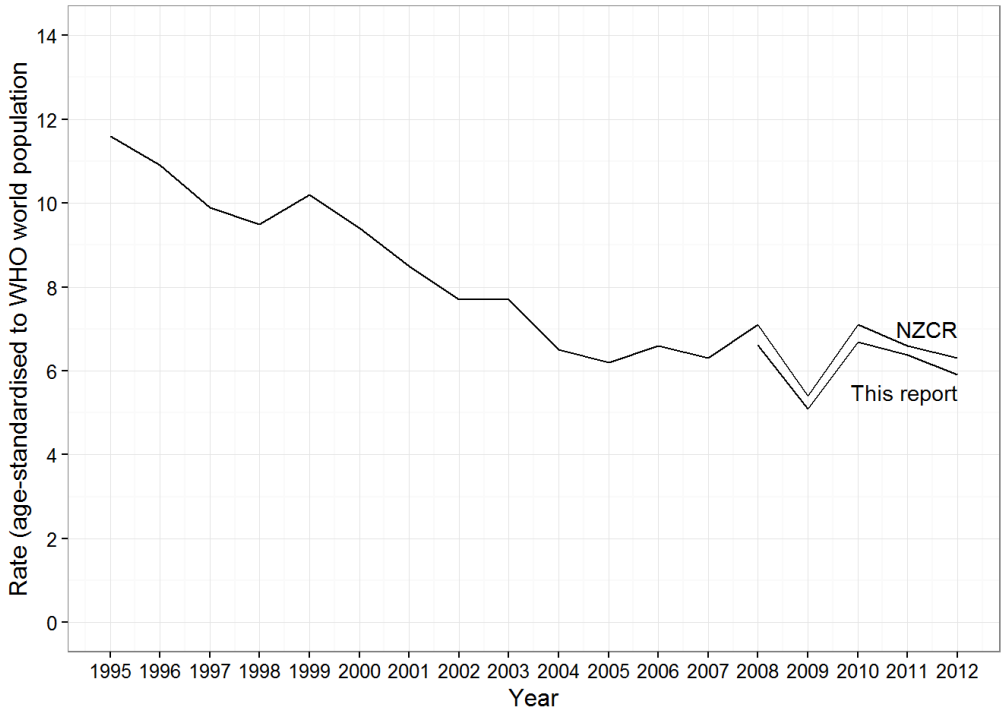

Figure 3.2a: Annual age-standardised incidence of confirmed cervical cancer cases per 100,000 female population by year. Rates were calculated according to the annual New Zealand June estimated resident population and direct age-standardised to the WHO world standard population.

Table 3.2b: Annual incidence of confirmed cervical cancer cases per 100,000 female population by year and ethnicity. Rates were calculated according to the annual New Zealand June estimated resident population and direct age-standardised to the Māori population.

Year	Total		Māori		Non-Māori		
	n	IR (95% CI) (unadjusted)	n	IR (95% CI) (unadjusted)	n	IR (95% CI) (unadjusted)	IR (95% CI) (age-standardised)
2008	162	7.4 (6.4, 8.7)	37	11.2 (8.1, 15.5)	120	6.5 (5.4, 7.8)	4.9 (4.0, 6.0)
2009	132	6.0 (5.1, 7.1)	27	8.1 (5.5, 11.7)	104	5.6 (4.6, 6.8)	3.9 (3.1, 4.9)
2010	168	7.6 (6.5, 8.8)	39	11.4 (8.4, 15.6)	126	6.7 (5.6, 8.0)	5.0 (4.1, 6.1)
2011	157	7.0 (6.0, 8.2)	31	9.0 (6.3, 12.7)	123	6.5 (5.4, 7.7)	5.0 (4.1, 6.1)
2012	153	6.8 (5.8, 8.0)	35	10.0 (7.2, 13.9)	115	6.0 (5.0, 7.3)	4.5 (3.6, 5.5)
Total	**772**	**6.9 (6.5, 7.5)**	**169**	**9.9 (8.5, 11.5)**	**588**	**6.2 (5.8, 6.8)**	**4.6 (4.3, 5.1)**

Table 3.3: Demographics for all cervical cancer diagnoses by year (2008-2012)

Popn: 772

All confirmed cases of primary cervical cancer sorted by review year (2008-2012), age, ethnicity, histology and deprivation index. Deprivation Index data is taken from the 2006 census (for review period 2008-2009), and 2013 census data for review period (2010-2012). Note: Total response ethnicity is reported, totals are greater than 772.

		2008	2009	2010	2011	2012	TOTAL
Total		162	132	168	157	153	772
Age	20-<25	5	1	7	6	5	24
	25-<30	10	7	13	14	7	51
	30-<35	20	11	15	24	13	83
	35-<40	20	20	19	16	19	94
	40-<45	21	23	24	15	27	110
	45-<50	18	16	24	21	16	95
	50-<55	20	8	15	10	14	67
	55-<60	16	12	11	17	15	71
	60-<65	10	9	10	7	13	49
	65-<70	7	6	13	9	9	44
	70-<75	4	2	7	8	4	25
	75-<80	4	8	2	3	3	20
	80+	7	9	8	7	8	39
Ethnicity	European/Other	97	90	104	103	99	493
(Total Response)	Māori	37	27	39	31	35	169
	Pacific Island	11	19	14	16	12	72
	Asian	12	7	16	9	13	57
	MELAA	6	1	3	2	1	13
	Unknown	5	1	3	3	3	15
Deprivation Index	1	17	16	14	8	10	65
	2	14	9	15	9	14	61
	3	8	10	8	16	17	59
	4	14	12	16	9	9	60
	5	11	9	17	19	10	66
	6	18	16	18	12	15	79
	7	15	8	14	14	13	64
	8	17	9	23	16	20	85
	9	26	23	21	20	14	104
	10	20	19	17	23	25	104
	Unknown	2	1	5	11	6	25

Table 3.4 Tumour characteristics for all cervical cancer diagnoses by year (2008-2012)

		2008	2009	2010	2011	2012	TOTAL
Type	SCC	118	87	120	113	114	552
	Adeno	25	30	33	37	25	150
	Adenosquamous	8	5	4	2	1	20
	Other	7	8	6	1	7	29
	Non-HPV related	4	2	5	4	6	21
Stage	1a	35	22	45	42	32	176
	1b+	93	89	96	90	100	468
	Not Available	34	21	27	25	21	128
	Total	**162**	**132**	**168**	**157**	**153**	**772**

Table 3.5: Demographics for all cervical cancer diagnoses eligible for the screening history review by year (2008-2012) Popn: 644

Demographics for cervical cancer cases meeting eligibility criteria for the screening history review. These are sorted by year (2008-2012), age, ethnicity, histology, and deprivation index. Deprivation Index data is taken from the 2006 census (for review period 2008-2009), and 2013 census data for review period (2010-2012). Ethnicity data is from the NCR records and uses total response ethnicity.

Note: These data exclude non-HPV related cancers.

		2008	2009	2010	2011	2012	TOTAL
Total		138	110	140	129	127	644
Age	25-<30	10	7	13	13	7	50
	30-<35	20	10	15	24	12	81
	35-<40	20	20	18	16	19	93
	40-<45	21	23	22	15	25	106
	45-<50	17	15	24	21	16	93
	50-<55	20	8	15	9	13	65
	55-<60	14	12	10	16	14	66
	60-<65	10	9	10	6	12	47
	65-<70	6	6	13	9	9	43
Ethnicity	European/Other	76	70	82	82	81	391
(Total Response)	Māori	36	26	35	29	33	159
	Pacific Island	10	18	12	14	10	64
	Asian	11	7	14	8	9	49
	MELAA	6	1	3	1	1	12
	Unknown	5	0	3	1	3	12
Deprivation Index	1	15	14	11	8	9	57
	2	10	6	12	6	11	45
	3	7	7	7	13	12	46
	4	10	9	13	8	7	47
	5	8	9	14	15	10	56
	6	16	14	14	11	12	67
	7	14	6	9	10	13	52
	8	14	8	22	14	15	73
	9	25	18	21	19	9	92
	10	18	18	12	17	23	88
	Unknown	1	1	5	8	6	21

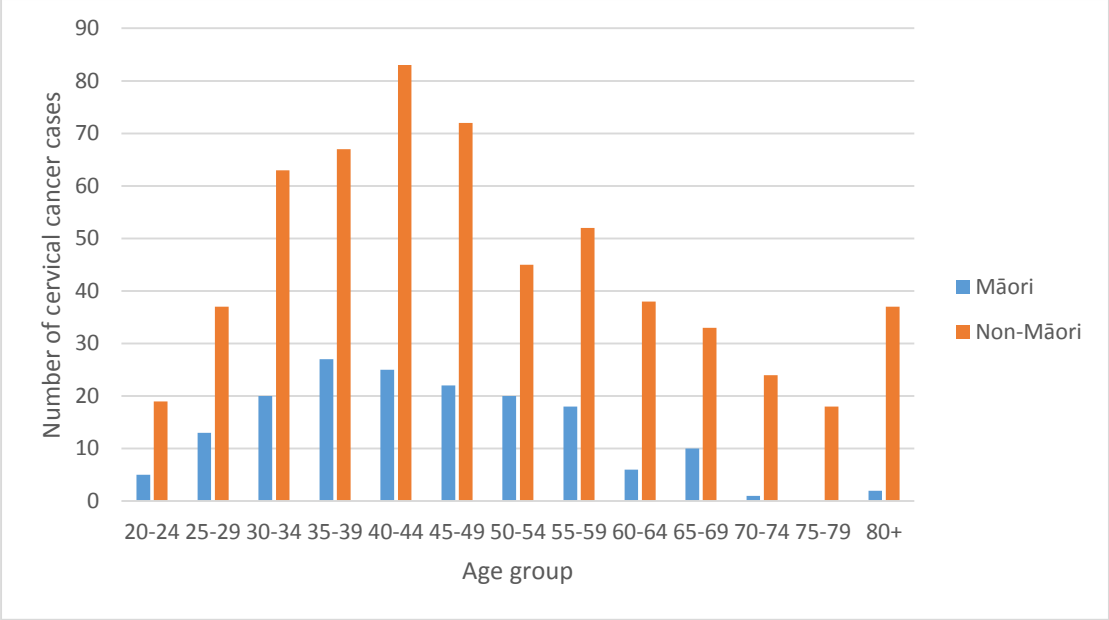

Figure 3.5a Distribution of cervical cancer cases by age and ethnicity.

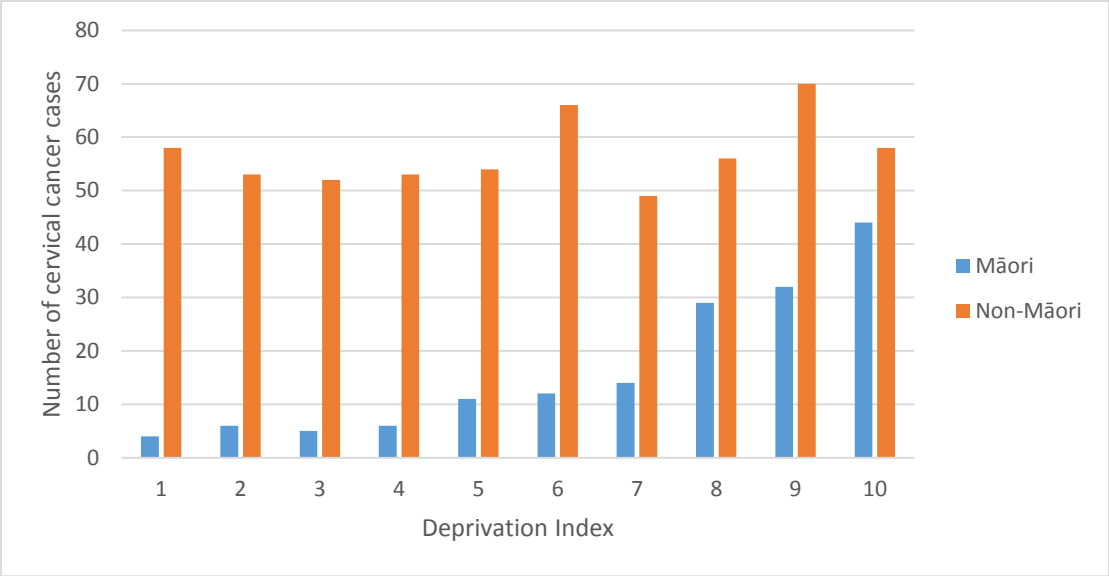

Figure 3.5b Distribution of cervical cancer cases by deprivation index and ethnicity.

Table 3.6 : Tumour characteristics for all cervical cancer diagnoses eligible for the screening history review by year (2008-2012)

		2008	2009	2010	2011	2012	TOTAL
Total		138	110	140	129	127	644
Type	SCC	102	74	103	95	98	472
	Adeno	23	28	28	31	22	132
	Adenosquamous	7	5	4	2	1	19
	Other	6	3	5	1	6	21
Stage	1a	31	22	40	38	28	159
	1b+	83	71	81	73	82	390
	Not Available	24	17	19	18	17	95

Table 3.7 Cases of cervical cancer by age and deprivation index, as a proportion of Māori and non-Māori populations Popn: 757

Cervical cancer cases diagnosed within the review period by: ethnicity, age and deprivation index. Deprivation Index data is taken from the 2006 census (for review period 2008-2009), and 2013 census data for review period (2010-2012). Ethnicity is categorised as Māori or non-Māori, therefore any individuals with unknown ethnicity are excluded (n=15). Ethnicity data is taken from the NCR records.

		Māori			Non-Māori		
Age		n	% Māori	% age	n	% Non-Māori	% age
	20-<25	5	3	21	19	3	79
	25-<30	13	8	26	37	6	74
	30-<35	20	12	24	63	11	76
	35-<40	27	16	29	67	11	71
	40-<45	25	15	23	83	14	77
	45-<50	22	13	23	72	12	77
	50-<55	20	12	31	45	8	69
	55-<60	18	11	26	52	9	74
	60-<65	6	4	14	38	6	86
	65-<70	10	6	23	33	6	77
	70-<75	1	1	4	24	4	96
	75-<80	0	0	0	18	3	100
	80+	2	1	5	37	6	95
	TOTAL	169	100		588	100	
Deprivation Index	1	4	2	6	58	10	94
	2	6	4	10	53	9	90
	3	5	3	9	52	9	91
	4	6	4	10	53	9	90
	5	11	7	17	54	9	83
	6	12	7	15	66	11	85
	7	14	8	22	49	8	78
	8	29	17	34	56	10	66
	9	32	19	31	70	12	69
	10	44	26	43	58	10	57
	Unknown	6	4	24	19	3	76
	Total	169	100		588	100	

Figure 3.7a: Annual incident rate of cervical cancer per 100,000 women by age and ethnicity. Rates were calculated according to the annual New Zealand June estimated resident population.

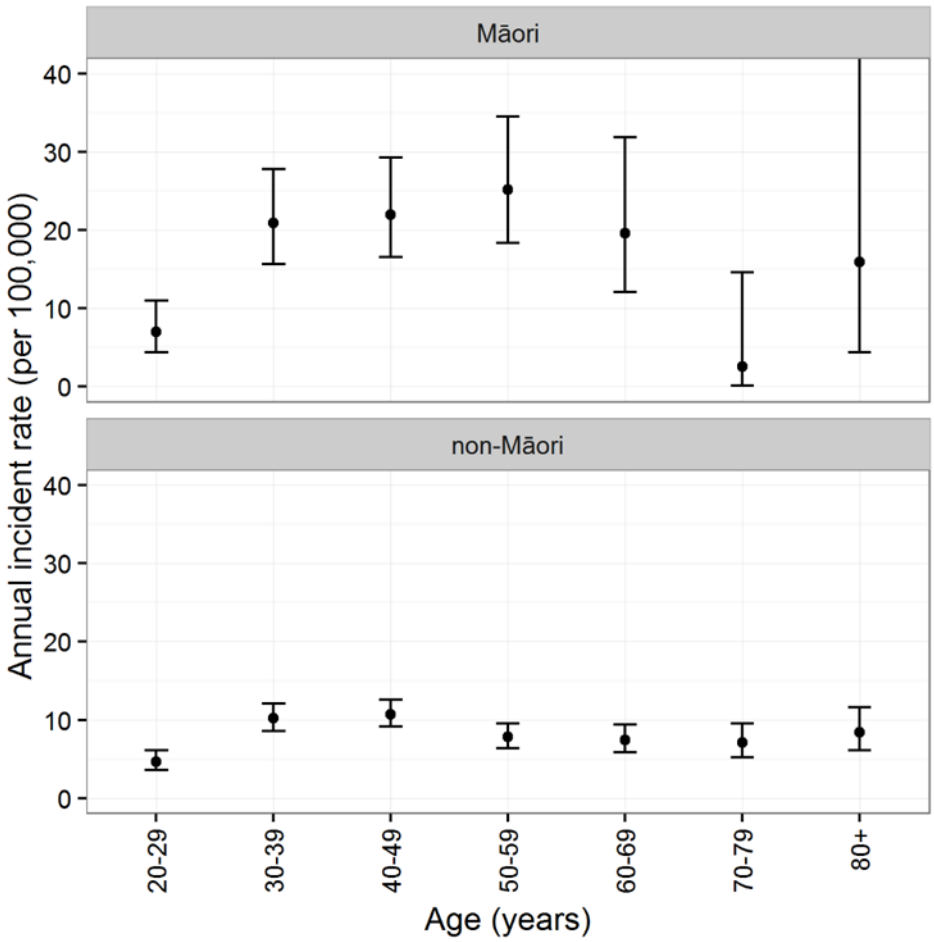

Figure 3.7b: Annual incident rate per 100,000 women of cervical cancer by deprivation quintile for Māori and non-Māori. Rates were calculated according to the annual New Zealand June estimated resident population.

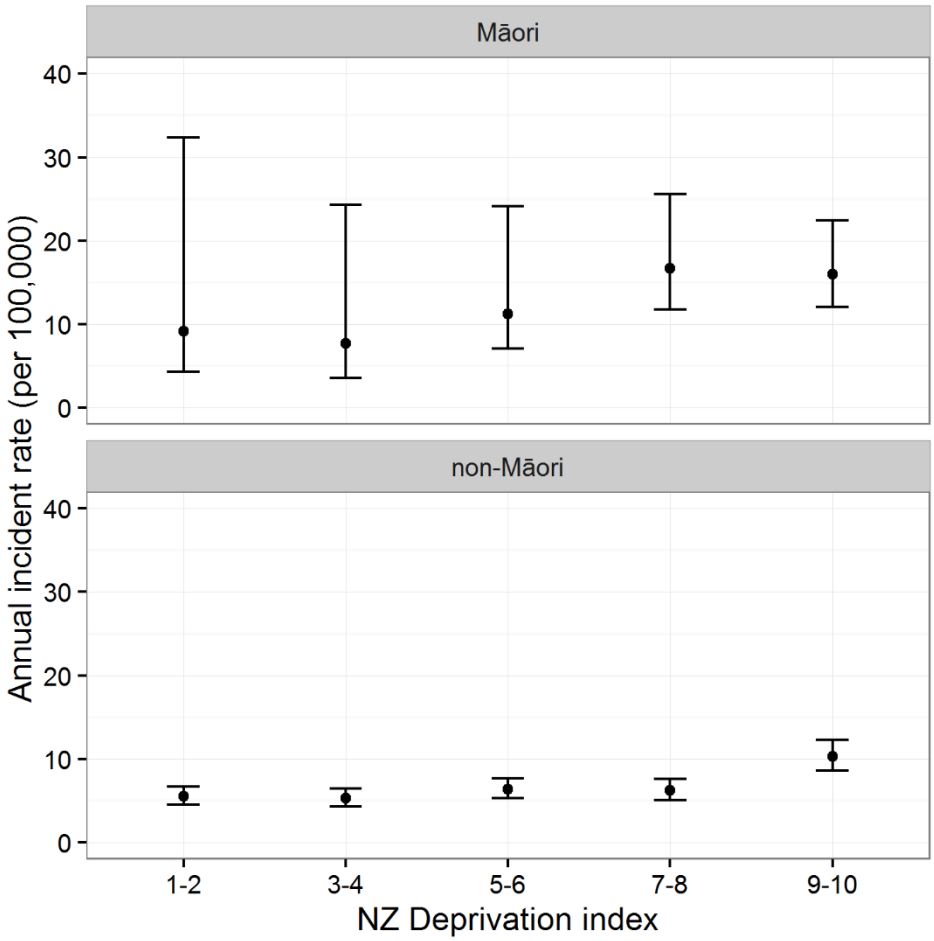
Māori
non-Māori
Annual incident rate (per 100,000)
0
10
20
30
40
1-2
3-4
5-6
7-8
9-10
NZ Deprivation index

Table 3.8: Cervical cancer diagnoses by rurality and ethnicity Popn: 757

All cervical cancer cases diagnosed within the review period by ethnicity and rurality. Ethnicity data is taken from NCR records and is categorised as Māori or Non-Māori. Rurality is based on census area units from the 2006 census data for review period 2008-2009, and 2013 census data for review period 2010-2012 for the address recorded on NCR at the time of diagnosis. This table excludes those with unknown ethnicity (n = 15).

	Māori		Non-Māori		Total	
	n	% Māori	n	% Non-Māori	n	%
Main Urban Area	105	62	428	73	533	70
Secondary Urban Area	13	8	42	7	55	7
Minor Urban Area	30	18	35	6	65	9
Rural Centre	4	2	6	1	10	1
Other Rural	11	7	59	10	70	9
Not Available	6	4	18	3	24	3
Total	**169**	**100**	**588**	**100**	**757**	**100**

Table 3.9: Cancer Network regions by ethnicity Popn: 756

All cervical cancer cases diagnosed within the review period by Cancer Network Regions, ethnicity, histological type and stage. This excludes one case diagnosed overseas, and any cases with unknown ethnicity (n=15).

Table 3.9a: 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	52	31	232	40	284	38
Midland	49	29	87	15	136	18
Central	40	24	111	19	151	20
Southern	28	17	157	27	185	24
TOTAL	169	100	587	100	756	100

Table 3.9b: Cervical cancer cases by ethnicity as a proportion of cases within each Cancer Network region

Cancer Network	Māori		Non-Māori		Total	
	n	%	n	%	n	%
Northern	52	18	232	82	284	100
Midland	49	36	87	64	136	100
Central	40	26	111	74	151	100
Southern	28	15	157	85	185	100

Table 3.10: Histological type and stage by ethnicity Popn: 757

All cervical cancer cases diagnosed within the review period by histological type and stage, and ethnicity. The Non-Māori ethnicity classification excludes any cases with unknown ethnicity (n=15), but these cases are included in the All Women column. (Note: rounding to whole numbers has been performed when presenting percentages)

		Māori		Non-Māori		All women	
		n	%	n	%	n	%
Histological type	SCC	127	75	415	71	552	72
	Adenocarcinoma	27	16	121	21	150	19
	Adenosquamous	4	2	16	3	20	2
	Other	11	7	36	6	50	6
	TOTAL	169	100	588	100	757	100
Stage - all types	1a	33	20	141	24	174	22
	1b+	106	63	351	60	457	60
	Unavailable	30	18	96	16	126	16
	TOTAL	169	100	588	100	757	100
Stage - SCC	1a	28	22	113	27	141	26
	1b+	78	61	228	55	306	56
	Unknown	21	17	74	18	95	17
	TOTAL	127	100	415	100	542	100
Stage - adenocarcinoma	1a	5	19	23	19	28	19
	1b+	20	74	88	73	108	72
	Unknown	2	7	10	8	12	8
	Total	**27**	**100**	**121**	**100**	**148**	**100**

Table 3.11: FIGO Staging Popn: 377

From all the cervical cancer cases diagnosed within the review period there are 377 cases which have a FIGO stage recorded in the NCR (49%). These are described in Table 3.11a, a more generalised breakdown is presented in Table 3.11b allowing for comparison to previous audits

Table 3.11a: FIGO staging for all histological types

FIGO	SCC	Adeno-carinoma	Adeno-squamous	Other	Total
I	1	1	0	0	2
IA	9	0	0	0	9
IA1	96	17	1	2	116
IA2	9	2	0	1	12
IB	52	26	4	1	83
IB1	26	13	0	2	41
IB2	5	2	0	2	9
II	4	0	0	0	4
IIA	3	2	0	0	5
IIB	30	9	2	1	42
III	1	0	0	0	1
IIIA	3	0	0	0	3
IIIB	31	1	1	3	36
IVA	7	1	0	0	8
IVB	5	0	0	1	6

Table 3.11b: FIGO stages as 1 or 2+

377 NCR records recorded FIGO staging data, the following table describes these as a proportion of those representing both stage 1 and stage 2 and greater cancers.

FIGO	n	% of FIGO
Stage 1	272	72
Stage 2+	105	28

Table 3.12: Histological type and stage by age at diagnosis Popn: 772

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

	All women							
Type / Age	20-29	30-39	40-49	50-59	60-69	70-79	80+	Total
SCC	51	128	138	102	70	33	30	552
1a	31	46	38	21	4	1	2	143
1b+	18	69	79	62	47	18	20	313
Unknown	2	13	21	19	19	14	8	96
Adenocarinoma	18	35	51	22	12	7	5	150
1a	6	10	6	4	2	0	0	28
1b+	11	21	42	16	9	6	5	110
Unknown	1	4	3	2	1	1	0	12
Adenosquamous	2	7	5	3	3	0	0	20
Other	4	7	11	11	8	5	4	50
Total	75	177	205	138	93	45	39	772

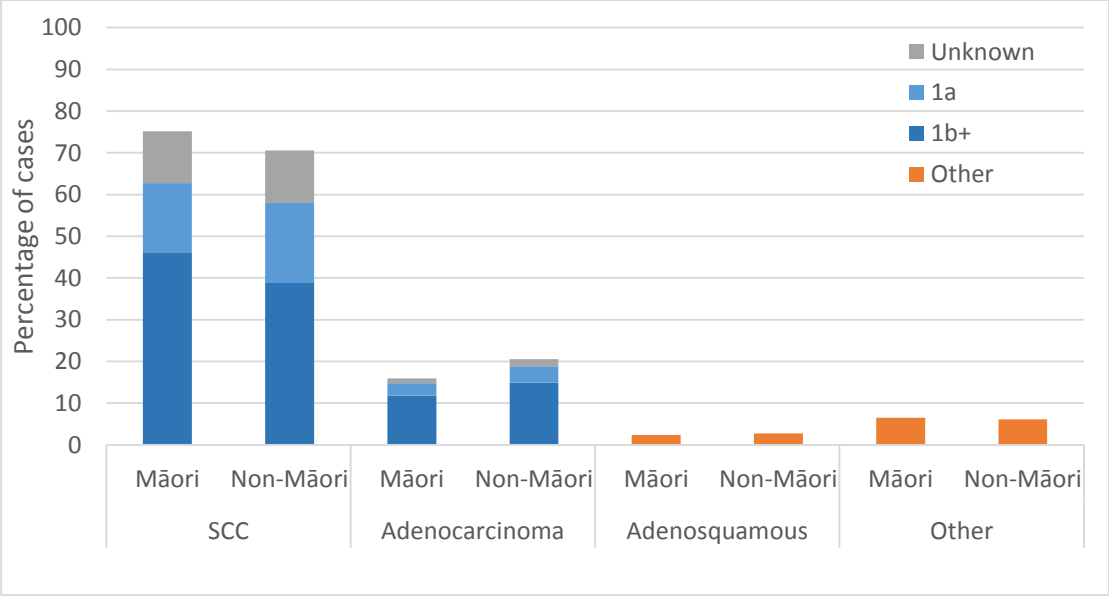

Figure 3.12a: Differences in histological type, stage by ethnicity for all cases of cervical cancer included in the review.

Table 3.13: Histological type and stage by ethnicity and age at diagnosis

Popn: 757

All cervical cancer cases diagnosed within the review period by ethnicity, histological type, stage and age at diagnosis. The Non-Māori ethnicity classification excludes any cases with unknown ethnicity **(n=15)**. Staging data is presented in two categories covering both microinvasive cancer and greater.

Māori								
Type / Age	20-29	30-39	40-49	50-59	60-69	70-79	80+	Total
SCC 1a	4	11	5	7	1	0	0	28
SCC 1b+	5	22	24	17	8	1	1	78
SCC Unknown	2	4	6	6	3	0	0	21
Adeno 1a	1	2	2	0	0	0	0	5
Adeno 1b+	3	5	7	3	1	1	0	20
Adeno Unknown	1	0	1	0	0	0	0	2
Adenosquamous	0	0	0	3	1	0	0	4
Other	2	3	2	2	2	0	0	11
Total	**18**	**47**	**47**	**38**	**16**	**2**	**1**	**169**

Non-Māori								
Type / Age	20-29	30-39	40-49	50-59	60-69	70-79	80+	Total
SCC 1a	26	35	32	14	3	1	2	113
SCC 1b+	13	47	53	43	36	17	19	228
SCC Unknown	0	9	15	13	15	14	8	74
Adeno 1a	5	8	4	4	2	0	0	23
Adeno 1b+	8	16	35	12	8	5	4	88
Adeno Unknown	0	4	2	2	1	1	0	10
Adenosquamous	2	7	5	0	2	0	0	16
Other	2	4	9	9	4	4	4	36
Total	**56**	**130**	**155**	**97**	**71**	**42**	**37**	**588**

Table 3.14: Histological type and quintile Popn: 747

All cervical cancer cases diagnosed within the audit period by histological type and deprivation index by quintile. Deprivation Index data is taken from the 2006 census (for audit period 2008-2009), and 2013 census data for audit period (2010-2012). Cases with unknown deprivation index are omitted from this table (n=25).

	NZ Deprivation index									
	1-2		3-4		5-6		7-8		9-10	
Type	n	%	n	%	n	%	n	%	n	%
SCC	88	70	80	67	98	68	119	80	145	70
1a	22	17	23	19	29	20	28	19	32	15
1b+	49	39	43	36	51	35	77	52	83	40
Unknown	17	13	14	12	18	12	14	9	30	14
Adenocarinoma	29	23	25	21	37	26	19	13	38	18
1a	6	5	2	2	8	6	4	3	8	4
1b+	20	16	21	18	24	17	15	10	28	13
Unknown	3	2	2	2	5	3	0	0	2	1
Adenosquamous	2	2	2	2	4	3	3	2	8	4
Other	7	6	12	10	6	4	8	5	17	8
Total	**126**	**100**	**119**	**100**	**145**	**100**	**149**	**100**	**208**	**100**

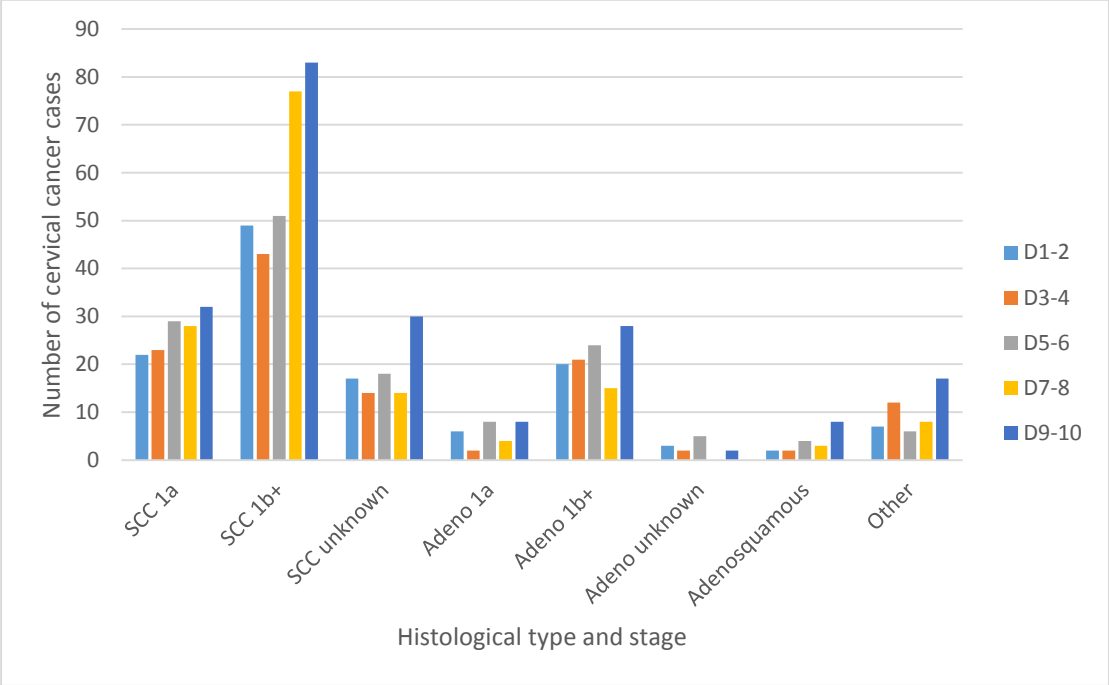

Figure 3.14a: Deprivation index data expresed as quintiles for cervical cancer cases by histological type and stage

Table 3.15: Type and stage by rurality Popn: 748

All cervical cancer cases diagnosed within the review period by histological type and stage, and rurality. Rurality index is based on census unit data taken from the 2006 census (for review period 2008-2009), and 2013 census data (for review period 2010-2012). Percentages expressed refer to the percentage of women in each rurality with the corresponding type and stage. Excludes patients whose rurality is unknown (n=24).

	Rurality									
	Main urban		Secondary urban		Minor urban		Rural centre		Other rural	
Type	n	%	n	%	n	%	n	%	n	%
SCC	389	72	41	73	42	63	9	82	50	71
1a	97	18	16	29	9	13	1	9	12	17
1b+	223	41	18	32	24	36	7	64	31	44
Unknown	69	13	7	13	9	13	1	9	7	10
Adenocarinoma	102	19	8	14	20	30	1	9	17	24
1a	20	4	1	2	4	6	0	0	3	4
1b+	73	13	7	13	15	22	1	9	12	17
Unknown	9	2	0	0	1	1	0	0	2	3
Adenosquamous	12	2	3	5	4	6	0	0	0	0
Other	41	8	4	7	1	1	1	9	3	4
Total	**544**	**100**	**56**	**100**	**67**	**100**	**11**	**100**	**70**	**100**

Table 3.16: Histological type and Domicile DHB at time of diagnosis Popn: 772

Cervical cancer cases diagnosed within the review period by DHB, histological type and stage.

	SCC			Adenocarcinoma			Adeno-		
DHB	1a	1b+	unknown	1a	1b+	unknown	squamous	Other	Total
Northland	0	20	3	1	2	0	1	2	29
Waitemata	14	34	4	2	10	1	3	6	74
Auckland	19	28	10	7	6	2	0	6	78
Counties Manukau	17	52	6	3	14	2	4	9	107
Waikato	13	25	12	1	9	0	2	4	66
Lakes	6	9	2	0	7	0	1	1	26
Bay of Plenty	6	16	6	5	8	2	1	3	47
Tairawhiti	1	3	1	1	1	0	0	0	7
Taranaki	4	7	7	0	1	0	1	3	23
Whanganui	0	4	1	0	0	0	1	0	6
MidCentral	4	9	3	0	2	0	1	1	20
Hawkes Bay	5	7	10	0	3	0	0	1	26
Wairarapa	2	6	1	0	1	0	0	0	10
Hutt Valley	4	4	6	0	4	3	1	3	25
Capital and Coast	6	14	8	0	5	0	0	3	36
Nelson Marlborough	9	9	1	2	3	0	1	1	26
Canterbury	26	48	4	2	22	0	3	6	111
South Canterbury	1	4	1	0	3	1	0	0	10
West Coast	2	3	1	1	1	0	0	0	8
Southern	4	10	9	3	8	1	0	1	36
Overseas	0	1	0	0	0	0	0	0	1
Total	**143**	**313**	**96**	**28**	**110**	**12**	**20**	**50**	**772**

Table 3.17: Type and stage by Regional Cancer Network Popn: 771

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

	Regional Cancer Network							
	Northern		Midland		Central		Southern	
Type	n	%	n	%	n	%	n	%
SCC	207	72	95	68	117	76	132	69
1a	50	17	25	18	26	17	42	22
1b+	134	47	50	36	54	35	74	39
Unknown	23	8	20	14	37	24	16	8
Adenocarinoma	50	17	32	23	21	14	47	25
1a	13	5	6	4	1	1	8	4
1b+	32	11	24	17	17	11	37	19
Unknown	5	2	2	1	3	2	2	1
Adenosquamous	8	3	4	3	4	3	4	2
Other	23	8	8	6	11	7	8	4
Total	**288**	**100**	**139**	**100**	**153**	**100**	**191**	**100**

Section 4: Assessment of Screening Adequacy

All data in this section refers only to the 644 eligible cases as determined by the application of the exclusion criteria described in Section 2.

For Tables 4.1-4.7 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 smears that occurred less than six months prior to diagnosis were considered to be 'diagnostic smears' 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

Assessment of screening adequacy of screening for all cervical cancer cases 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 smear 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.

	Total	Since 1990		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-<30	50	43	86	40	80	37	74	29	58	28	56	12	24
30-<35	81	67	83	49	60	44	54	36	44	26	32	14	17
35-<40	93	78	84	54	58	47	51	37	40	18	19	11	12
40-<45	106	78	74	54	51	47	44	39	37	10	9	12	11
45-<50	93	62	67	39	42	35	38	29	31	9	10	7	8
50-<55	65	36	55	27	42	25	38	23	35	4	6	5	8
55-<60	66	39	59	32	48	29	44	24	36	6	9	11	17
60-<65	47	24	51	16	34	15	32	11	23	6	13	3	6
65-<70	43	26	60	17	40	17	40	13	30	5	12	6	14
Ethnicity													
European	391	298	76	228	58	207	53	168	43	92	24	66	17
Māori	159	116	73	71	45	61	38	53	33	18	11	10	6
Pacific	64	36	56	20	31	17	27	15	23	3	5	4	6
Asian	49	27	55	25	51	24	49	18	37	4	8	5	10
MELAA	12	3	25	2	17	2	17	2	17	0	0	0	0
Unknown	12	7	58	5	42	5	42	4	33	1	8	0	0
Deprivation (quintile)													
1	102	76	75	64	63	59	58	43	42	27	26	19	19
2	93	70	75	59	63	56	60	45	48	23	25	17	18
3	123	85	69	67	54	57	46	48	39	24	20	13	11
4	125	84	67	55	44	47	38	43	34	16	13	12	10
5	180	121	67	71	39	67	37	54	30	18	10	18	10
Unknown	21	17	81	12	57	10	48	8	38	4	19	2	10
Total	**644**	**453**	**70**	**328**	**51**	**296**	**46**	**241**	**37**	**112**	**17**	**81**	**13**

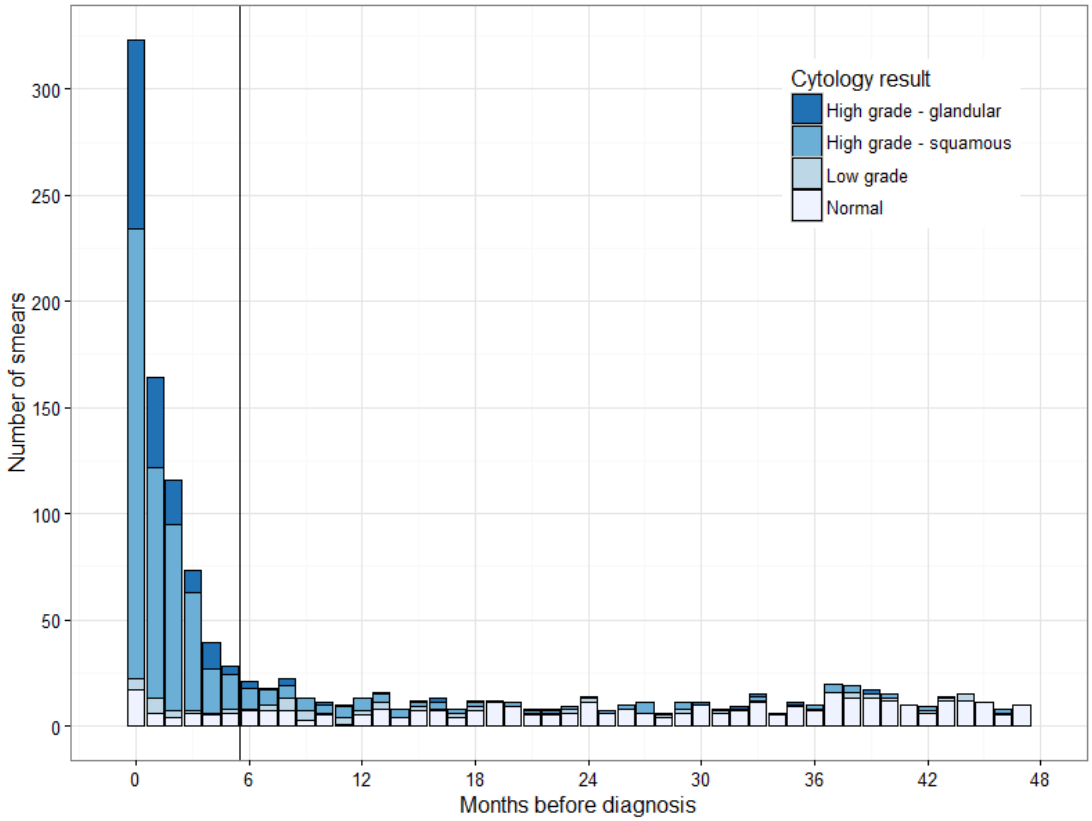

Figure 4.1a: Number of smears taken and associated cytological findings prior to diagnosis.

This demonstrates the high number of abnormal cytological findings in the 6 months prior to diagnosis. Both the number of smears, and the incidence of high grade cytology plateaus beyond 6 months, hence smears taken within the 6 months prior to diagnosis were considered to be part of the diagnostic process.

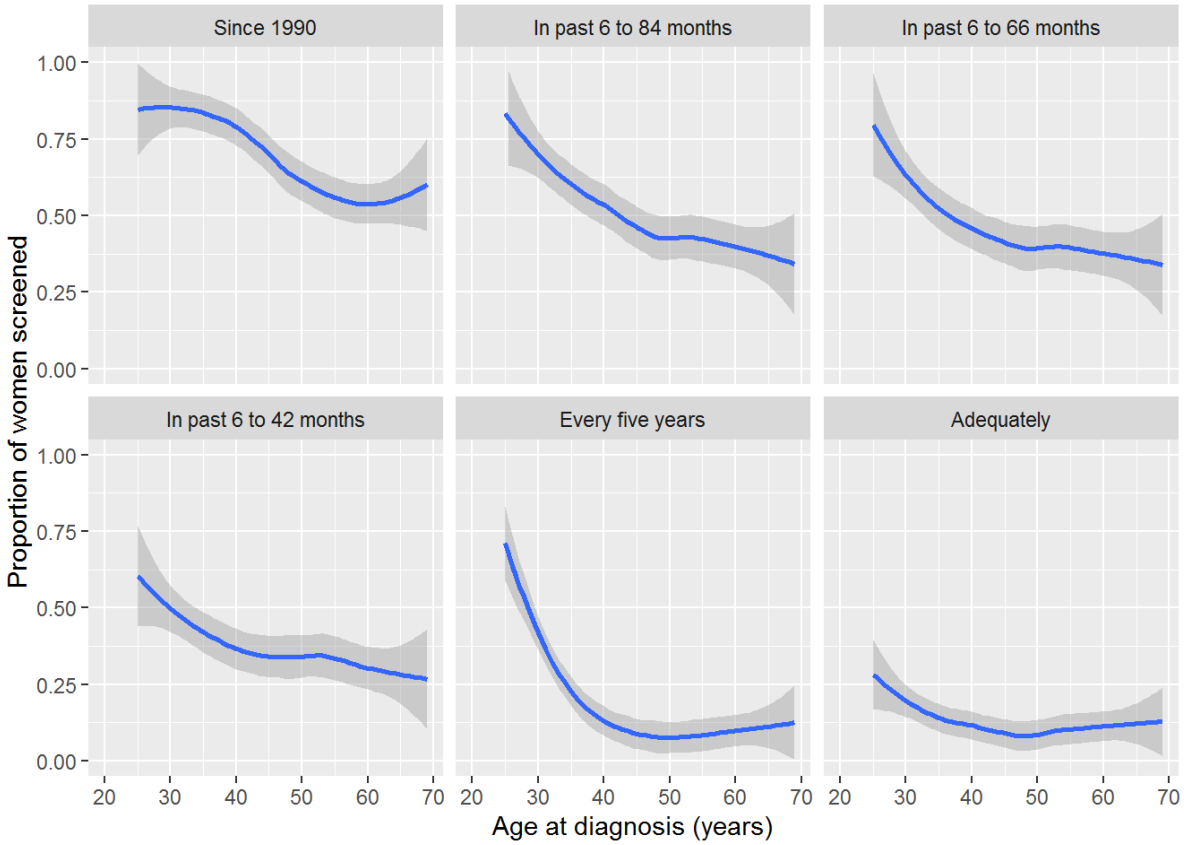

Figure 4.1b: Screening adequacy by age at diagnosis.

Table 4.2: Screening adequacy by histological type and stage

This table describes the number of all eligible cervical cancer cases included in the screening review with at least one smear 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.

Staging was grouped broadly into microinvasive or greater based on the available clinical information available on the NCR and histological review by the review team.

	Total	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	%	n	%
Type													
SCC	472	312	66	219	46	191	40	153	32	77	16	50	11
Adeno	132	117	89	90	68	88	67	73	55	31	23	25	19
Adeno-squamous	19	11	58	9	47	8	42	7	37	3	16	4	21
Other	21	13	62	10	48	9	43	7	33	1	5	2	10
Stage													
1a	159	126	79	97	61	87	55	61	38	36	23	13	8
1b+	390	281	72	197	51	177	45	153	39	61	16	53	14
Unknown	95	46	48	34	36	32	34	26	27	15	16	15	16
Total	**644**	**453**	**70**	**328**	**51**	**296**	**46**	**240**	**37**	**112**	**17**	**81**	**13**

Table 4.3: Screening adequacy by age and ethnicity

This table describes the number of individuals who had at least one smear 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. This excludes any cases where ethnicity was unknown **(n=12).**

Table 4.3a: Screening adequacy by age in 10 year age brackets for those women identified as Māori

Age	Total	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	%	n	%
25 to <30	13	13	100	13	100	11	85	11	85	5	38	2	15
30 to <40	47	42	89	25	53	22	47	16	34	10	21	4	9
40 to <50	47	32	68	17	36	13	28	11	23	1	2	1	2
50 to <60	36	20	56	13	36	12	33	12	33	1	3	2	6
60 to <70	16	9	56	3	19	3	19	3	19	1	6	1	6
Total	**159**	**116**	**73**	**71**	**45**	**61**	**38**	**53**	**33**	**18**	**11**	**10**	**6**

Table 4.3b: Screening adequacy by age in 10 year age brackets for those women identified as non-Māori

Age	Total	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	%	n	%
25 to <30	36	29	81	26	72	25	69	17	47	22	61	10	28
30 to <40	127	103	81	78	61	69	54	57	45	34	27	21	17
40 to <50	149	106	71	74	50	67	45	55	37	18	12	18	12
50 to <60	92	53	58	45	49	41	45	35	38	9	10	14	15
60 to <70	69	39	57	29	42	28	41	20	29	10	14	8	12
Total	**473**	**330**	**70**	**252**	**53**	**230**	**49**	**184**	**39**	**93**	**20**	**71**	**15**

Table 4.4: Screening adequacy by year of diagnosis

This table assesses screening adequacy by the year of diagnosis including the number of individuals who had at least one smear 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.

Year	Total	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	%	n	%
2008	138	93	67	66	48	58	42	46	33	21	15	14	10
2009	110	77	70	52	47	48	44	39	35	21	19	16	15
2010	140	97	69	77	55	68	49	55	39	27	19	13	9
2011	129	93	72	72	56	65	50	52	40	25	19	20	16
2012	127	93	73	61	48	57	45	49	39	18	14	18	14
Total	**644**	**453**	**70**	**328**	**51**	**296**	**46**	**240**	**37**	**112**	**17**	**81**	**13**

Table 4.5: Screening adequacy by DHB

This table assesses screening adequacy by the domicile DHB at the time of diagnosis and includes the number of individuals who were adequately screened.). Women with unknown ethnicity (n = 12) are excluded from Non-Māori category, but included in total.

DHB	Māori			Non-Māori			Total		
		No. Adequately screened			No. Adequately screened			No. Adequately screened	
	Total N	n	%	Total N	n	%	Total N	n	%
Northland	11	0	0	14	2	14	25	2	8
Waitemata	11	0	0	47	6	13	59	6	10
Auckland	9	0	0	56	9	16	67	9	13
Counties Manukau	20	0	0	75	3	4	96	3	3
Waikato	21	2	10	33	4	12	56	6	11
Lakes	10	1	10	11	1	9	21	2	10
Bay of Plenty	15	1	7	25	6	24	40	7	18
Tairawhiti	4	0	0	2	0	0	6	0	0
Taranaki	6	0	0	13	5	38	19	5	26
Whanganui	0	-		5	0	0	5	0	0
MidCentral	3	0	0	11	2	18	14	2	14
Hawkes Bay	8	1	12	15	2	13	23	3	13
Wairarapa	4	0	0	2	0	0	7	0	0
Hutt Valley	6	2	33	14	2	14	20	4	20
Capital and Coast	3	1	33	27	5	19	30	6	20
Nelson Marlborough	3	0	0	20	4	20	23	4	17
Canterbury	21	1	5	68	12	18	94	13	14
South Canterbury	1	0	0	9	1	11	10	1	10
West Coast	0	-		6	0	0	6	0	0
Southern	3	1	33	20	7	35	23	8	35
Total	**159**	**10**	**6**	**473**	**71**	**15**	**644**	**81**	**13**

Table 4.6: Screening adequacy by Regional Cancer Network

This table assesses 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 smear 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 = 12)** are excluded from Non-Māori, but included in total.

Māori

Region	Total	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	%	n	%
Northern	51	38	75	19	37	16	31	13	25	4	8	0	0
Midland	50	31	62	18	36	17	34	16	32	6	12	4	8
Central	30	24	80	19	63	15	50	14	47	3	10	4	13
Southern	28	23	82	15	54	13	46	10	36	5	18	2	7
Total	**159**	**116**	**73**	**71**	**45**	**61**	**38**	**53**	**33**	**18**	**11**	**10**	**6**

Non-Māori

Region	Total	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	%	n	%
Northern	192	126	66	93	48	85	44	64	33	33	17	20	10
Midland	71	49	69	39	55	38	54	34	48	12	17	11	15
Central	87	56	64	45	52	42	48	34	39	14	16	16	18
Southern	123	99	80	75	61	65	53	52	42	34	28	24	20
Total	**473**	**330**	**70**	**252**	**53**	**230**	**49**	**184**	**39**	**93**	**20**	**71**	**15**

Total

Region	Total	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	%	n	%
Northern	247	168	68	114	46	103	42	79	32	38	15	20	8
Midland	123	80	65	57	46	55	45	50	41	18	15	15	12
Central	118	80	68	64	54	57	48	48	41	17	14	20	17
Southern	156	125	80	93	60	81	52	64	41	39	25	26	17
Total	**644**	**453**	**70**	**328**	**51**	**296**	**46**	**241**	**37**	**112**	**17**	**81**	**13**

Table 4.7: Screening adequacy by rurality and ethnicity

All cervical cancer cases diagnosed within the review period by rurality, histological type and stage. Rurality is based on census unit data taken from the 2006 census (for review period 2008-2009), and 2013 census data (for review period 2010-2012. This includes individuals who had at least one smear 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 = 12) are excluded from Non-Māori category but included in the table for total women.

Māori

Region	Total	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	%	n	%
Main Urban	99	72	73	47	47	41	41	35	35	15	15	8	8
Secondary Urban	12	9	75	6	50	4	33	4	33	1	8	1	8
Minor Urban	29	21	72	11	38	10	34	8	28	2	7	1	3
Rural Centre	4	2	50	1	25	1	25	1	25	0	0	0	0
Other Rural	9	6	67	4	44	3	33	3	33	0	0	0	0
Unknown	6	6	100	2	33	2	33	2	33	0	0	0	0
Total	**159**	**116**	**73**	**71**	**45**	**61**	**38**	**53**	**33**	**18**	**11**	**10**	**6**

Non-Māori

Region	Total	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	%	n	%
Main Urban	344	232	67	177	51	164	48	131	38	61	18	47	14
Secondary Urban	30	21	70	15	50	12	40	9	30	8	27	5	17
Minor Urban	30	24	80	17	57	16	53	14	47	7	23	7	23
Rural Centre	6	3	50	3	50	3	50	3	50	2	33	0	0
Other Rural	48	39	81	30	62	27	56	21	44	11	23	10	21
Unknown	15	11	73	10	67	8	53	6	40	4	27	2	13
Total	**473**	**330**	**70**	**252**	**53**	**230**	**49**	**184**	**39**	**93**	**20**	**71**	**15**

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Table 4.7 continued: Screening adequacy by rurality and ethnicity

Total

Region	Total	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	%	n	%
Main Urban	452	311	69	229	51	210	46	170	38	77	17	55	12
Secondary Urban	43	30	70	21	49	16	37	13	30	9	21	6	14
Minor Urban	61	45	74	28	46	26	43	22	36	9	15	8	13
Rural Centre	10	5	50	4	40	4	40	4	40	2	20	0	0
Other Rural	57	45	79	34	60	30	53	24	42	11	19	10	18
Unknown	21	17	81	12	57	10	48	8	38	4	19	2	10
Total	**644**	**453**	**70**	**328**	**51**	**296**	**46**	**241**	**37**	**112**	**17**	**81**	**13**

Table 4.8: Screening history in the 6 to 84 months prior to diagnosis for all patients included in the Review

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

	Total	High grade		Two+ low grade		One low grade		One negative		Two+ negative		No screening	
	N	n	%	n	%	n	%	n	%	n	%	n	%
Age													
25-<30	50	8	16	2	4	5	10	9	18	16	32	10	20
30-<35	81	19	23	3	4	3	4	13	16	11	14	32	40
35-<40	93	10	11	1	1	6	6	13	14	24	26	39	42
40-<45	106	13	12	1	1	4	4	20	19	16	15	52	49
45-<50	93	14	15	2	2	5	5	10	11	8	9	54	58
50-<55	65	12	18	0	0	2	3	8	12	5	8	38	58
55-<60	66	11	17	1	2	1	2	10	15	9	14	34	52
60-<65	47	2	4	0	0	0	0	4	9	10	21	31	66
65-<70	43	3	7	0	0	0	0	2	5	12	28	26	60
Ethnicity													
European	391	54	14	5	1	21	5	57	15	91	23	163	42
Māori	159	31	19	1	1	2	1	23	14	14	9	88	55
Pacific	64	10	16	0	0	1	2	7	11	2	3	44	69
Asian	49	6	12	3	6	3	6	8	16	5	10	24	49
MELAA	12	2	17	0	0	0	0	0	0	0	0	10	83
Unknown	12	0	0	1	8	0	0	3	25	1	8	7	58
Deprivation (quintile)													
1	102	16	16	1	1	6	6	17	17	24	24	38	37
2	93	12	13	5	5	6	6	12	13	24	26	34	37
3	123	15	12	1	1	4	3	19	15	28	23	56	46
4	125	17	14	0	0	5	4	16	13	17	14	70	56
5	180	30	17	3	2	3	2	20	11	15	8	109	61
Unknown	102	16	16	1	1	6	6	17	17	24	24	38	37
Total	**644**	**92**	**14**	**10**	**2**	**26**	**4**	**89**	**14**	**111**	**17**	**316**	**49**

Table 4.9: Screening history in the 6 to 84 months prior to diagnosis by histological type and stage at diagnosis

Smear history for all eligible cervical cancer cases in the 6 to 84 months prior to diagnosis, according to histological type and stage at diagnosis. Smear history is defined as the highest of the following categories: at least one high grade smear, two or more low grade smears (but no high grade), one low grade smear (but no high grade), one negative smear, two or more negative smears, and no screening. Staging was grouped broadly into microinvasive or greater based on the available clinical information available on the NCR and histological review by the review team.

	Total	High grade		Two+ low grade		One low grade		One negative		Two+ negative		No screening	
	N	n	%	n	%	n	%	n	%	n	%	n	%
Type													
SCC	472	72	15	7	1	18	4	61	13	61	12	253	54
Adeno	132	18	14	3	2	8	6	22	17	39	29	42	32
Adeno-squamous	19	1	5	0	0	0	0	3	16	5	26	10	53
Other	21	1	5	0	0	0	0	3	14	6	29	11	52
Stage													
1a	159	28	18	6	4	11	7	29	18	23	14	62	38
1b+	389	56	14	3	0	15	4	52	13	71	18	192	49
Unknown	96	8	8	1	1	0	0	8	8	17	17	62	64
Total	**644**	**92**	**14**	**10**	**2**	**26**	**4**	**89**	**14**	**111**	**17**	**316**	**49**

Table 4.10: Cytological interpretation of high grade smears taken in the 36 months prior to the diagnosis of adenocarcinoma.

Interpretation	Grade	Code	n
Endocervical adenocarcinoma	HG-G	AC1	13
Endometrial adenocarcinoma	HG-G	AC2	5
Adenocarcinoma	HG-G	AC4	5
Malignant neoplasm	HG-G	AC5	3
Atypical endocervical cells	HG-G	AG1	25
Atypical endometrial cells	HG-G	AG2	2
Atypical glandular cells	HG-G	AG3	4
Atypical endocervical cells, neoplastic	HG-G	AG4	18
Atypical glandular cells, neoplastic	HG-G	AG5	9
Adenocarcinoma in-situ	HG-G	AIS	43
Atypical squamous cells present, possible high grade	HG-S	ASH	9
High grade intraepithelial lesion (CIN2 or CIN3)	HG-S	HS1	10
High grade intraepithelial lesion (suspect invasion)	HG-S	HS2	3
Squamous cell carcinoma	HG-S	SC	2
		Total Glandular	127
		Total Squamous	24
		Total Overall	151

Appendix 1: Comparison of key results with previous audits

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

Incidence	2000-2002	2003-2006	2008-2012
Overall	8.0-8.4	6.1-7.7	6.3-7.1
Māori	11.3-13.7	11.6-13.6	10.4-13.3
Histological Type			
SCC	77%	69%	72%
Adenocarcinoma	15%	19%	19%
FIGO Stage Recorded	25%	45%	49%
Microinvasive Disease at Diagnosis			
SCC	37%	21%	26%
Adenocarcinoma	74%	N/A	19%
Screening history in those with Confirmed Cervical Cancer			
Ever Screened	67%	64%	51%
6-42 Months pre diagnosis	49%		37%
Regularly Screened	21%	20%	13%
Screening history in those with Confirmed SCC			
Ever Screened	63%	49%	46%
6-42 Months pre diagnosis	49%		37%
Screening history in other groups with Cervical Cancer			
All Adenocarinoma	10%		15%
All Microinvasive Cancer	41%		22%
Screening history in other groups with Māori Women			
Māori Women	26%		22%
Ever Screened	59%		45%
6-42 Months pre-diagnosis	42%		33%
Regular Screening	15%		6%

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