



Socioeconomic deprivation and the incidence of cervical cancer in New Zealand: 1988–1998

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Abstract

Aim This study aims to identify the relationship between socioeconomic deprivation and cervical cancer incidence in New Zealand.

Method A 10-year cohort of cervical cancer cases was identified from the population-based New Zealand Cancer Registry. The New Zealand Deprivation Index (NZDep96) is a validated census-based measure of material and social deprivation in geographically defined small-population groups. Incidence rates of cervical cancer were correlated with socioeconomic deprivation.

Results There were 2629 new registrations of cervical cancer from 1988 to 1998. A positive association was found between socioeconomic deprivation and incidence rates of cervical cancer. Women living in the most socially and materially deprived areas of New Zealand were more than twice as likely to develop cervical cancer than women living in socially and materially advantaged areas.

Conclusion Greater socioeconomic deprivation is associated with an increased incidence of cervical cancer in New Zealand. The link between socioeconomic deprivation and cervical cancer incidence is likely to be complex. The identification of modifiable factors in cervical screening uptake in areas of socioeconomic deprivation should be a research priority.

The two-fold aims of the National Cervical Screening Programme (NCSP) are to reduce the incidence and mortality of cervical cancer in New Zealand women.¹ The New Zealand Ministry of Health has also highlighted a further overarching aim of health care, which is to identify and reduce inequalities in health outcomes.^{2,3}

Although there has been intense political and community interest in cervical cancer (Cartwright 1988 and Duffy 2001)^{4,5} it is interesting to note that there have been relatively few publications in the medical literature regarding cervical cancer outcomes in New Zealand women. Early work (two decades ago) identified differing trends in the risk of cervical cancer in older and younger women. Age-specific rates in older women were declining, but younger women were showing a marked increase in incidence rates.⁶ Subsequent mortality and incidence rates of cervical cancer, especially for women in earlier birth-cohorts, have fallen.⁷ These changes reflect the introduction of cervical screening into New Zealand. More recent publications have focused on NCSP audit cycles.⁸

This paper aims to identify the relationship between socioeconomic deprivation and the incidence of cervical cancer (for the purpose of informing and developing improved strategies for increasing cervical screening uptake amongst social groups where cervical cancer incidence may be highest).

Method

All cases of invasive cervical cancer for the period 1988 to 1998 were identified from the New Zealand Cancer Registry. Cancer variables used in this study were tumour site, year of registration, and the age of each woman. The New Zealand Health Information Service (NZHIS) is custodian and guardian of the national Cancer Registry, and is required by law to register all diagnoses of invasive cancer in New Zealand—the type of cancer and demographic details are recorded.

Laboratories have a legal obligation to notify cases of cancer to the Cancer Registry. This was legislated for in 1994, and (prior to that) the Registry relied on voluntary notification. Unlike certain other cancers, for which there was a marked increase in registered incidence after the introduction of compulsory notification, the registration rate for cervical cancer changed by only –0.9% between 1993 and 1994,⁹ implying that excellent notification already existed. In addition to laboratory notification, the Cancer Registry reviews death certificates, post mortem reports, coroners' certificates, and both public and private hospital discharge information.

The tool chosen to measure socioeconomic deprivation is the New Zealand Deprivation Index, or NZDep96.¹⁰ This index combines nine variables that reflect social and material deprivation from the 1996 Census of Populations and Dwellings (Table 1). A score is calculated for each 'meshblock' in New Zealand. A meshblock is a geographically defined unit containing a median of 90 people.

Table 1. NZDep96 variables from the 1996 Census of Population and Dwellings

<i>NZDep96 Variables</i>
Communication - no access to a telephone
Income - aged 18-59y receiving a means tested benefit
Employment - aged 18-59y unemployed
Income - equivalised household income below defined threshold
Transport - no access to a car
Support - aged <60y living in a single parent family
Qualifications - aged 18-59y without any qualifications
Owned home - not living in own home
Living space - living below equivalised bedroom occupancy threshold

The NZDep96 score from 1 to 10 divides New Zealand into deciles; for example, a score of 10 indicates that the meshblock is in the most-deprived 10% of areas in New Zealand. Because each meshblock contains a median of only 90 people, NZDep96 allows a detailed map of the distribution of socioeconomic deprivation in New Zealand to be built. NZDep96 was developed nationally, and has been validated in the New Zealand setting.¹¹ It provides a readily useable and comprehensive measure of socioeconomic position. Occupational class measures alone are problematic in a study such as this because they can only be applied to those in the formal labour force and not to the unemployed, home-makers, or the retired.

As Cancer Registry ascertainment of accurate ethnicity status has been variable, ethnicity data was not incorporated in this study.

Reasons for suboptimal ethnicity data have been:

- Firstly, that it was not legally possible for the Cancer Registry to utilise highly stringent census-based ethnicity data, and
- Secondly, historical methods of ethnicity data capture were not robust.

More recently information from death certificates, the cervical screening register, and private and public hospital discharge data have been used. These sources are more robust, but still not as reliable as census data.

The residential address of each incident case was matched to the respective NZDep96 meshblock code to yield an NZDep96 score; anonymity of individual patient identifiers was preserved during this process. Female population data were obtained from the New Zealand Statistics estimation of population at December 31 annually.¹² Age-standardised incidence rates were calculated and adjusted to Segi's world population. Analyses were carried out using SAS v8.2 software.

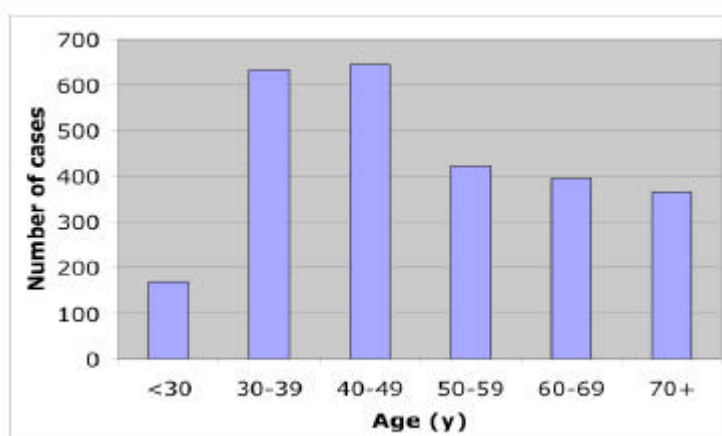
Results

From 1988 to 1998 in New Zealand there were 2629 new registrations of invasive cervical cancer (Table 2). The crude-incidence rate declined significantly over the study period ($p < 0.001$), and age-standardised rates reflect this. Cases ranged from 17 to 96 years of age, with the median being 47 years and the interquartile range being 37 to 62 years (Figure 1). Cases of invasive cervical cancer occurring under the age of 20 years were rare. In the 10-year study period there were only four histologically confirmed cases. Three of these were microinvasive early stage tumours eligible for surgically curative treatment.

Table 2: Annual incidence of cervical cancer in New Zealand, 1988–1998

Year	Female population	Number of cases	Crude incidence rate per 100 000 women	Age-standardised incidence rate per 100 000 women
1988	1 695 500	281	17.2	15.1
1989	1 710 100	247	14.9	12.8
1990	1 728 500	251	14.9	12.9
1991	1 778 800	275	16.1	13.7
1992	1 796 000	225	13.0	11.0
1993	1 818 200	226	12.8	10.9
1994	1 843 300	218	12.2	10.1
1995	1 871 500	237	13.1	10.5
1996	1 898 400	220	12.0	10.0
1997	1 917 900	223	11.9	9.3
1998	1 930 800	224	11.8	9.6

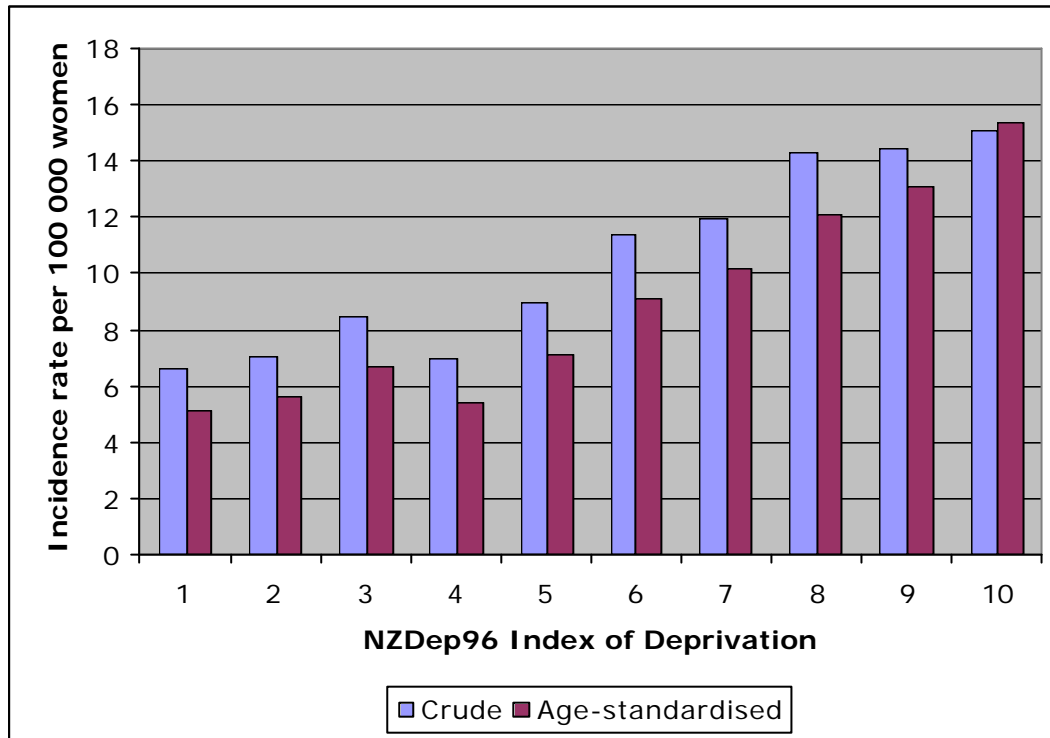
Figure 1: Age distribution of cervical cancer cases in New Zealand, 1988–1998



An association was found between NZDep96 score and both crude and age-standardised incidence rates of cervical cancer (Figure 2). There was a significant 2.5-fold increase (95% CI 2.3-2.8) in crude incidence rates between NZDep96 groups 1 and 10. Women dwelling in the least deprived geographical areas had a crude incidence rate of 6.6 per 100,000 women, and women dwelling in the most deprived

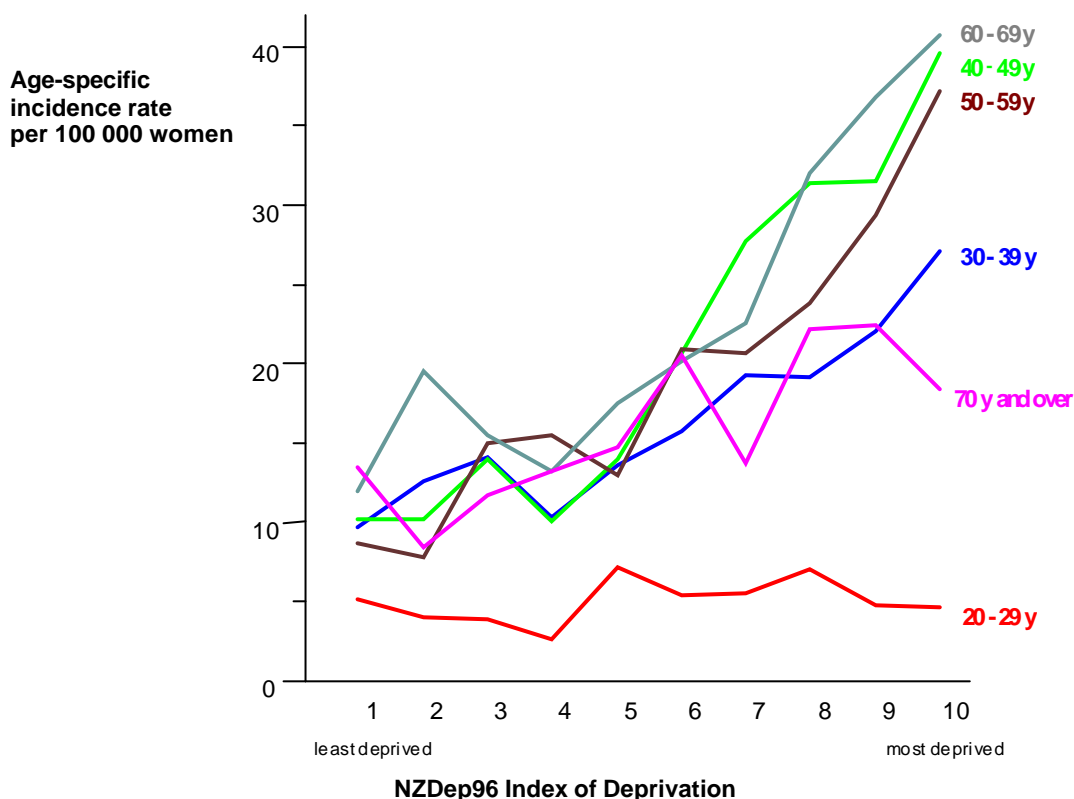
geographical areas had a crude rate of 15.1 per 100,000 women. Age-standardised incidence rates increased 3.0-fold, from 5.1 per 100,000 women dwelling in the least deprived areas to 15.4 per 100 000 women in the most deprived geographical areas.

Figure 2. Cervical cancer incidence and socioeconomic deprivation in New Zealand, 1988–1998



When stratified by decade of age, the relationship between non-adjusted incidence and level of deprivation was most apparent in women aged 30 to 69 years. The association was less apparent in women aged above 70 years, and appeared non-existent in women below 30 years of age (Figure 3).

Figure 3. Cervical cancer incidence and socioeconomic deprivation by age decades; New Zealand, 1988–1998



Discussion

This study explores the relationship between socioeconomic deprivation and the incidence of cervical cancer in New Zealand. We demonstrated that (from 1988 to 1998) there is a statistically significant and positive association between increasing incidence of cervical cancer and increasing socioeconomic deprivation, as measured by a validated national deprivation index: NZDep96.

These findings are consistent with other published accounts of cervical cancer. A relationship between cervical cancer and socioeconomic position has been recognised since the 1950s. For example, the Cardiff Cervical Cytology Study demonstrated twice the prevalence of cervical cancer in social classes IV and V compared with social classes I and II,¹³ and a population-based study of cervical cancer in Sheffield showed that electoral wards with more residents in social classes IV and V also had a greater incidence of cervical cancer.¹⁴

In addition, detailed work by Carstairs and Morris identified twice the rate of cancer of the cervix in the most deprived group of the Scottish population, compared to the most affluent group.¹⁵ Similarly, Lamont et al showed nearly three times the age-standardised incidence rate of cervical cancer in the most deprived areas compared to the most affluent areas in the West of Scotland.¹⁶

Links between socioeconomic deprivation and other diseases have been observed in New Zealand. Higher levels of deprivation are associated with a wide-range of adverse outcomes such as total mortality, lung cancer incidence, diabetes, rheumatic fever, ischaemic heart disease, and complications of pregnancy.¹¹

The association demonstrated in this study between cervical cancer incidence and socioeconomic deprivation most likely relates to inequitable cervical screening uptake. It has been shown that the incidence of cervical cancer was relatively stable until the introduction of the National Cervical Screening Programme in 1990, and has been decreasing since.³

This study confirms that the greatest discrepancies in cervical cancer incidence occurs between women living in areas of high and low deprivation who fall into the screening program target ages (20–70 years of age), with the most marked inequities occurring in older age groups. These findings are consistent with an earlier New Zealand report that linked low household income with suboptimal smear uptake.²⁰

The achievement of optimum screening uptake in older women (who live in socially-deprived areas) has challenged screening programs in all developed countries. Specifically, there are likely to be modifiable factors discouraging women residing in areas of socioeconomic deprivation from accessing cervical screening. Identification and modification of these factors may lead to a further reduction in the incidence of cervical cancer, however, and should be a research priority in New Zealand.

The relationship between socioeconomic deprivation and cervical cancer incidence is not apparent in woman under 30 years old (Figure 3). Although the data are limited, they suggest that either the benefit of cervical screening is limited in younger women, or that current levels of screening uptake in younger New Zealand women is optimal (greater than 85%). There is a paucity of census-based New Zealand data examining screening uptake.

Evidence from the United Kingdom suggests that screening young women may not be as effective in reducing incidence of cancer. Using screening histories of women with frankly invasive cervical cancer and women without cancer as controls, Sasieni et al found that cervical screening in women aged 20–39 years of age was less effective than screening in older women.¹⁷ Indeed, the benefits and costs of screening women less than 30 years of age deserve further investigation.

Although cervical screening uptake is the most likely explanation for the association between cervical cancer incidence and socioeconomic deprivation, other possibilities could be considered such as a differential prevalence of oncogenic human papillomavirus (HPV), patterns of sexual behaviour, smoking status, and ethnicity.

HPV has been found in virtually all cases of cervical carcinomas and it is now accepted that oncogenic HPV is the cause of cervical cancer.¹⁸ There is no evidence that the prevalence of oncogenic HPV is greater amongst women of low socioeconomic status, but subtype clusterings may vary in individual populations.

Sexual behaviour and cervical cancer occurrence has become an unpopular research agenda.²¹ It is likely that the molecular epidemiology of HPV reflects population sexual behavioural patterns, and detailed research in New Zealand may facilitate the introduction of a HPV vaccine. Cigarette smoking is more common in areas of increased socioeconomic deprivation in New Zealand, and more common in women

who develop cervical cancer. However the association between smoking and increased socioeconomic deprivation is weaker in older women (in contrast to the association between cervical cancer incidence and deprivation), therefore smoking is unlikely to explain the findings of this study.¹⁹

Ethnicity and sexual behaviour may also be confounding factors. This study was not able to assess the association between ethnicity, cervical cancer incidence and socioeconomic deprivation due to the lack of robust ethnicity data.

The strength of this study lies in its population-based, simple design, and use of a robust validated research tool. Unfortunately, accurate and complete data on ethnicity, clinical stage of disease, smoking status, or cervical smear history were not readily available. Explanations for the observed inequities between women residing in areas of low and high socioeconomic deprivation are constrained by the lack of cancer registry links with census and clinical datasets. There exists the potential to improve data utilisation through linkage of the National Cancer Registry to census-based data, screening programmes and clinical datasets; currently the New Zealand Health Information Service (NZHIS) is exploring linkage in ways to enhance meaningful outcome measurement of cervical screening activity.

In summary, this study reports a significant association between New Zealand cervical cancer incidence and socioeconomic deprivation (as measured by the NZDep96 deprivation index). The reasons why this strong association exists are not currently clear, but inequitable access to the National Cervical Screening Programme could partly explain this finding.

Research examining the relationship between cervical screening uptake and socioeconomic deprivation is warranted. Such research is required to inform accurate targeting of National Cervical Screening Programme resources.

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