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Which factors account for the ethnic inequalities in stage at diagnosis and cervical cancer survival in New Zealand?

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ABSTRACT

Objective: There are substantial ethnic inequalities in stage at diagnosis and cervical cancer survival in New Zealand. We assessed what proportions of these differences were due to screening history (for the analyses of late stage diagnosis), stage at diagnosis (for the analyses of survival), comorbid conditions (for the analyses of survival), and travel time to the nearest General Practitioner and cancer centre. *Methods*: The study involved 1594 cervical cancer cases registered during 1994–2005. We used G-computation to assess the validity of the estimates obtained by standard logistic regression methods. *Results*: Māori women had a higher risk of late stage diagnosis compared with 'Other' (mainly European) women (odds ratio (OR) = 2.71; 95% confidence interval 1.98, 3.72); this decreased only slightly (OR 2.39; 1.72, 3.30) after adjustment for screening history, and travel time to the nearest General Practitioner and cancer centre. In contrast, the (non-significantly) elevated risk in Pacific women (1.39; 0.76, 2.54) disappeared almost completely when adjusted for the same factors (1.06; 0.57, 1.96). The hazard ratio of mortality for cervical cancer for Māori women was 2.10 (1.61, 2.73) and decreased to 1.45 (1.10, 1.92) after adjustment for stage at diagnosis, comorbid conditions, and travel time to the nearest General Practitioner and cancer centre; the corresponding estimates for Pacific women were 1.96 (1.23, 3.13) and 1.55 (0.93, 2.57). The G-computation analyses gave similar findings. *Conclusions*: The excess relative risk of late stage diagnosis in Māori women remains largely unexplained, while more than half of the excess relative risk of mortality in Māori and Pacific women is explained by differences in stage at diagnosis and comorbid conditions.

1. Introduction

It is well-established that there are major ethnic inequalities in cervical cancer screening [1], stage at diagnosis [2] and mortality in New Zealand [2,3], but the reasons for these differences are unclear. In particular, the increased risk of mortality in Māori and Pacific (this is the term currently commonly used to refer to people from the Pacific Island states) women (compared to 'Other', predominantly European women) is only partially explained by adjustment for stage at diagnosis, socio-economic position (SEP), and urban/rural residence [2]. Screening rates have increased over time, with 29.5% of cases registered between 1994 and 1997 having had a screening smear, and 52.6% of cases registered between 2002 and 2005 having been screened [2]. The patterns of the factors that are potentially important in the increased risk of mortality in Māori and Pacific women have also varied over time, with post-diagnostic factors playing an important role in the high Māori mortality rates in the 1990s, but in more recent years the excess mortality in Māori women appeared to be almost entirely due to stage at diagnosis [2]. Ethnic differences in stage at diagnosis are not entirely explained by differences in screening history [1]. Adjustment for comorbid conditions accounts for only a moderate proportion of the ethnic differences in mortality [4]. In a separate analysis [5], we found that travel time and distance were only weakly associated with cervical cancer screening, stage at diagnosis and mortality in New Zealand. However, travel time may account for a small proportion of the ethnic differences in stage at diagnosis, and to a lesser extent mortality, particularly for Pacific women.

To further explore the reasons for the ethnic differences in mortality from cervical cancer, we have further analysed the New

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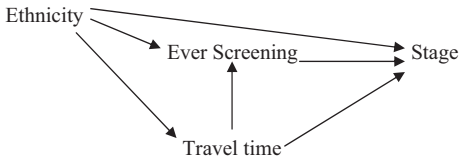

Fig. 1. Directed Acyclic Graph (DAG) showing the association between ethnicity and stage (corresponds to Table 2).

Zealand data to understand the relative importance, with regard to cervical cancer stage at diagnosis and subsequent survival, of various factors (screening history, stage at diagnosis, comorbid conditions, and travel time to the nearest General Practitioner (GP) or cancer centre) which have previously only been considered separately [1,2,4,5].

Furthermore, we examined the direct effects of ethnicity on stage and mortality after taking into account possible mediators, such as screening history and comorbidity, in order to examine whether the standard methods that have been used previously provide valid estimates of the proportions of the excess relative risks mediated through these factors. The variables involved in these analyses are shown in the form of Directed Acyclic Graphs (DAGs) in Fig. 1 (stage at diagnosis) and Fig. 2 (cervical cancer survival). We were interested in what proportion of the ethnic differences in stage at diagnosis could not be attributed to differences in screening, and what proportion of the ethnic differences in mortality could not be attributed to stage at diagnosis and comorbidity.

2. Material and methods

The New Zealand Central Ethics Committee granted ethical approval for the study (CEN/08/04/EXP).

2.1. Study population and risk factors

The population comprised all cervical cancer cases registered with the New Zealand Cancer Registry (NZCR) between 1 January 1994 and 31 December 2005 [1,2,4,5]. The NZCR records self-identified ethnicity, and allows for multiple responses. Participants who reported more than one ethnicity were classified into a single ethnicity using the standard system of prioritisation: Māori > Pacific > Asian > 'Other' [6]. Participants with missing ethnicity data were included in the 'Other' (predominantly European) ethnic group. This approach is standard practice in New Zealand health research [7,8]. All registrations include the National Health Index (NHI) number which uniquely identifies individual health care users; this was used to obtain cause-specific mortality data (from the Mortality Collection) up to the end of December 2005 (the most recent year for which data were available), hospital events data (from the National Minimum Dataset (NMDS)) from 1988 to 31 December 2005, and the women's cervical screening history from the National Cervical Screening Programme – Register from 1986 to 31 December 2006.

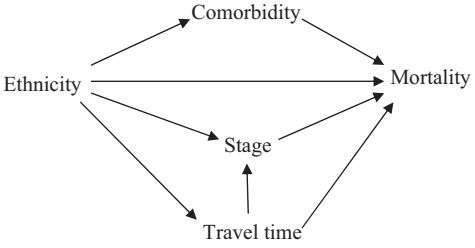

Fig. 2. DAG showing association between ethnicity and mortality (corresponds to Table 3).

SEP was estimated using the New Zealand Deprivation Index 2001 (NZDep), an area-based measure derived from a combination of nine socioeconomic variables derived from the national census [9]. Each participant was assigned a score based upon the residential area (the domicile code) in which they lived, as recorded on the NZCR at the time of registration. These scores were then grouped into quintiles [9].

Data on stage at diagnosis were obtained from the NZCR, and reported using the International Federation of Gynecology and Obstetrics (FIGO) [10] classification. In order to provide sufficient numbers in each category, the FIGO stages were grouped into four categories: stages 0–IB2; II–IIB; III–IIIB; IVA–IVB. Women with an unknown stage at diagnosis, or who could not be allocated a deprivation score, were excluded from the analyses. There was little ethnic or socioeconomic difference in the percentage of cases with missing FIGO codes [1].

The classifications of screening history were based on those used for the New Zealand Cervical Cancer audit [11] and for quality monitoring by the National Cervical Screening Programme [12]. Women were categorised as 'not screened' or 'ever screened'. We excluded all of the smears taken in the six months immediately prior to diagnosis since some of these will have been taken for diagnostic, not screening, purposes [13,14]. The full details of the categorisation have been described elsewhere [1]. Cervical screening guidelines are extremely complex [15], and the categories used in this study are therefore only able to approximate the women's screening histories [11].

Comorbidity was assessed using the hospital events data, according to the coding algorithms of Quan et al. [16] for the Charlson Comorbidity Index (CCI) [17] and the Elixhauser [18] instrument. Our previous analyses [4] identified 12 important comorbid conditions (congestive heart failure, valvular disease, complicated hypertension, chronic pulmonary disease, complicated diabetes, renal failure, liver disease, coagulopathy, obesity, fluid and electrolyte disorders, blood loss anaemia, and drug abuse) which, when adjusted for concurrently, had a stronger mediating effect than either the Elixhauser instrument or the CCI on cervical cancer-specific mortality by ethnicity. We therefore concurrently adjusted for these 12 comorbid conditions.

The methods used to estimate travel time and distance to the nearest GP and cancer centre were based on those of Haynes et al. [19] and Pearce et al. [20]. The travel time (in minutes, and proportions of minutes) and distance (in metres) to the nearest GP surgery, and the nearest of the six cancer centres, were calculated, using a geographical information system [19]. Our previous analyses [5] showed similar findings for travel time and travel distance, and in the current analyses we therefore adjusted only for travel time. The travel times were categorised according to the method of Haynes et al. [19]: low: the lowest quartile using the whole sample; medium: quartiles two and three, incorporating half the records around the median; high: records between the 75 and 95 percentiles; highest: the highest 5% of records.

2.2. Data analysis

As stated above, the variables involved in these analyses are shown in the form of DAGs in Fig. 1 (stage at diagnosis) and Fig. 2 (cervical cancer survival). In the analyses of late stage diagnosis (Fig. 1), the exposure is ethnicity, the mediator is screening history, and the outcome is stage at diagnosis. Travel time is considered to be a confounder of the relationship between screening history and stage at diagnosis, and to be affected by ethnicity. In the analyses of survival (Fig. 2), the exposure is ethnicity, the mediators are stage at diagnosis and comorbidities,