While the health of non-Aboriginal Australians has steadily improved over the last few decades, health indicators for Aboriginal* Australians have remained static. An example of the disparity in risk between Aboriginal and non-Aboriginal Australians is cervical cancer which, for Aboriginal women, is the leading cause of death from cancer, with an overall mortality rate that is six to eight times that of non-Aboriginal women. A detailed examination of the nature of, and the reasons for, the disparities in health status between Aboriginal and non-Aboriginal Australians has been hindered by poor recording of Aboriginality in health data collections. However, it is apparent that relatively poor access to health services is at least part of the explanation; 33% of working age Aboriginal people live in communities of less than 1000 people compared with less than 15% of non-Aboriginal people.

There is little information on rates of cervical screening in Aboriginal women, but women living in rural and remote areas are less likely to be screened and Aboriginal women over 40 years have been described as being especially reluctant to have a Papanicolaou test. The limited evidence on rates of cervical intraepithelial neoplasia (CIN) in rural and remote Aboriginal communities suggests they may be lower than the national average. However, poor access to, and utilization of, screening services in rural and remote areas would lead to the expectation that incidence and mortality rates for cervical cancer would be higher in these areas. This study examines the geographical distribution of risk of death from cervical cancer between Aboriginal and non-Aboriginal women in Australia.
Methods

Data from death registers provided to the Australian Institute of Health and Welfare from states and territories who have relatively complete identification of Aboriginal people in their death data (South Australia [SA], Western Australia [WA] and the Northern Territory [NT]), were examined for 1986–1997 to obtain a list of all deaths where the primary cause was given as cancer of the cervix (International Classification of Diseases, Ninth Revision, rubric 180). All other states and territories have only recently begun to collect information identifying Aboriginal status on death registration forms and the quality of such data may take some years to become consistent. Details obtained for each death included whether the person was Aboriginal, age at death, the year in which the death occurred and the Australian Standard Geographical Classification (ASGC) code of the person’s place of residence.

Each ASGC code corresponds to one Statistical Local Area (SLA) which is the principal geographical unit used by the Australian Bureau of Statistics (ABS); together, these units cover the whole of Australia. The SLA for each place of death was classified as metropolitan, rural or remote using the 1991 Census edition of the Rural, Remote and Metropolitan Classification. Metropolitan areas are the state and territory capital city statistical divisions plus other statistical subdivisions which include urban centres of at least 100 000 population. Non-metropolitan SLA are then classified as rural or remote. Remoteness is conceptualized in terms of low population density and long distances to large population centres. The index of remoteness is a number calculated for each SLA using an algorithm taking into account the population density (people per unit area) and the distance of the centroid of the SLA from the centroid of the nearest urban centre. Remote zones consist of those SLA which have an index of remoteness greater than an agreed threshold. Rural zones are those non-metropolitan SLA whose index of remoteness is less than the threshold.

Population data were obtained in electronic form from the ABS. This provided the number of females identifying themselves as Aboriginal, the number identifying themselves as not Aboriginal and the number who chose not to be so identified for the 1991 census. Population data were categorized by 5-year age groups (0–4 to ≥85 years), by the metropolitan, rural or remote category described above and by their identification as Aboriginal or non-Aboriginal Australian.

Primary analysis excluded those who were in the group who chose not to state whether they considered themselves Aboriginal or not. A sensitivity analysis was performed which alternately classified all those in the ‘not stated’ group as Aboriginal or as non-Aboriginal. The 1991 census falls near the middle of the period for which death data are examined and are the most recent population data available which can be categorized in the detail described.

The expected number of deaths from cervical cancer for Aboriginal and non-Aboriginal women for the 12-year period 1986–1997 was calculated for each of the areas used for classification, i.e. metropolitan, rural and remote. Indirect standardization was used, whence population numbers in each age group in the population being examined (the special population) are multiplied by the age-specific mortality rates in a reference population (the standard population). This gives an estimate of the number of deaths expected in the special population if it had the same age-specific mortality rates as the standard population. The standardized mortality ratio (SMR) is then calculated as the ratio between the observed and expected number of deaths in the special population. Using metropolitan Aboriginal women as the standard population, the SMR for cancer of the cervix for Aboriginal women living in rural and remote areas was calculated. Similarly the SMR for non-Aboriginal women living in rural and remote areas was calculated using non-Aboriginal women in metropolitan areas as the standard population. In addition, the SMR for Aboriginal women in each of the three areas was calculated using non-Aboriginal women in the same areas as the standard populations.

Age-specific death rates for Aboriginal and non-Aboriginal women were plotted on a semi-logarithmic scale with exact 95% CI for a Poisson distribution calculated about each point.

The means of the age at death for Aboriginal and non-Aboriginal women in metropolitan, rural and remote areas were calculated and the two-sample t-test applied to determine if there were any significant differences in mean age at death. Calculations were done using Microsoft Excel, Total Access Statistics for Microsoft Access and the SAS statistical package.

Results

The total number of deaths recorded with primary cause of death listed as cancer of the cervix for the period 1986–1997 in SA, WA and the NT was 727, of which 76 were Aboriginal and 651 were non-Aboriginal. Of these, 25 (3 Aboriginal, 22 non-Aboriginal) were excluded from analysis because the ASGC code could not be matched to a 1991 census ASGC code. Thus 702 deaths were available for analysis; of these 73 were classified as Aboriginal and 629 were non-Aboriginal.

Table 1 shows the number of deaths, the population describing themselves as Aboriginal, those describing themselves as non-Aboriginal and those who chose to give no answer to that question for the 1991 census and the crude mortality rate for cancer of the cervix for the 12-year period 1986–1997 for the

<table>
<thead>
<tr>
<th>Category</th>
<th>No. of deaths (1986–1997)</th>
<th>Female population (1991 census)</th>
<th>Crude annual mortality rate (per 100 000)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Aboriginal</td>
<td>Non-Aboriginal</td>
<td>Aboriginal</td>
</tr>
<tr>
<td>Metropolitan</td>
<td>10</td>
<td>306</td>
<td>12 913</td>
</tr>
<tr>
<td>Rural</td>
<td>9</td>
<td>105</td>
<td>6467</td>
</tr>
<tr>
<td>Remote</td>
<td>54</td>
<td>18</td>
<td>30 142</td>
</tr>
<tr>
<td>Total, all areas</td>
<td>73</td>
<td>629</td>
<td>49 522</td>
</tr>
</tbody>
</table>
three states examined. The number in the ‘not stated’ group is large in relation to the Aboriginal group in the metropolitan and rural areas. The percentage of the total female population choosing to not indicate whether they consider themselves as Aboriginal or not is relatively constant across the three areas (2.7% in metropolitan areas, 2.8% in rural areas and 3.0% in remote areas), whereas the percentage of women describing themselves as Aboriginal increases from 1.1% in metropolitan areas to 2.1% in rural areas and 2.8% in remote areas.

Age-specific rates are plotted for each of the 5-year age groups (15–19 to ≥85 years) in Figure 1 where the rates for Aboriginal women can be seen to be generally higher than those for non-Aboriginal women.

The mean age at death is lower in Aboriginal women compared with non-Aboriginal women in each region. However, it is statistically significant only for the metropolitan area and for all areas combined (Table 2).

Within racial groups (Aboriginal and non-Aboriginal) there were no significant differences in mean age at death when comparing any two of the three area categories (metropolitan versus rural, metropolitan versus remote and rural versus remote).

Table 3 shows the risk of death from cervical cancer for Aboriginal women living in rural and remote areas to be about twice that for those living in metropolitan regions. The trend for non-Aboriginal women is in the opposite direction, with non-Aboriginal women in remote areas having only 52% of the risk of those living in metropolitan areas.

The SMR for death from cervical cancer for Aboriginal women compared with non-Aboriginal women increased monotonically from metropolitan to rural to remote areas, with a SMR of 18.3 for Aboriginal women compared to non-Aboriginal women living in remote areas (Table 4).

The results of the sensitivity analysis are also shown in Table 4. In each case the SMR between Aboriginal and non-Aboriginal women dying from cervical cancer increases from metropolitan through rural to remote areas as those who chose not to classify themselves at the census were alternately considered as Aboriginal or non-Aboriginal for these calculations.

Discussion

This study shows for the first time the geographical disparity in risk of death from cervical cancer for Aboriginal women compared with non-Aboriginal women in Australia. The risk increased from approximately 4 times for women in metropolitan areas through nearly 10 times the risk for rural women to 18 times the risk for women in remote areas. Compared with Aboriginal women living in metropolitan areas, Aboriginal women living in a rural or remote area have approximately twice the chance of dying from cancer of the cervix, while for non-Aboriginal women the trend is reversed. While there are limitations in the data, largely due to potential misclassification bias in either death data or in population data, the magnitude of the differences in risk found and the ‘dose-response’ effect in relation to rurality indicate that the findings are valid. While the potential misclassification in death data cannot be corrected for, the sensitivity analysis shows that regardless of classifying those ‘not stated’ people from the census as either Aboriginal or non-Aboriginal, the strong gradient from metropolitan through rural and remote areas is maintained. Similarly, the impact of taking account of hysterectomy rates by Aboriginality and area of residence (if such data were available) is likely to be small in relation to the magnitude of the differences in risk described here. Another possible explanation is different patterns of change in residence
after diagnosis with terminal cancer, where urban Aboriginal women may be likely to return to their homelands in remote areas to die, rural or remote non-Aboriginal women may move to urban centres for palliative care.

Given the paucity of data on risk factors for cervical cancer for rural compared with urban-dwelling Aboriginal women, the reasons for these markedly higher rates in remote Aboriginal women are speculative. However, a likely explanation is relatively poor access to and utilization of screening services for Aboriginal women in rural and remote areas. The major known risk factors other than lack of screening include human papilloma virus (HPV) infection, sexual behaviour and cigarette smoking.2,17 While rates of smoking among Aboriginal women have been reported to be high in general,18–20 there is a dearth of data on smoking by geographical region. Smoking is not part of the traditional Aboriginal lifestyle for women and the increased rates might be expected to be associated with urbanization. The effect of smoking as a risk factor would therefore be to increase risk for metropolitan Aboriginal women compared with those in rural or remote areas—the reverse of the findings of this study. There is also a dearth of information on sexual behaviour of urban compared with rural or remote Aboriginal women, but the relatively low rates of HPV infection reported in rural and remote Aboriginal communities10,11 similarly indicate that, with regard to this important sexual behaviour related risk factor, women in urban environments would be at higher risk.

Of the major known risk factors for cervical cancer mortality, lack of screening and delayed diagnosis appear likely to be the main contributors to the excess mortality in rural and remote Aboriginal women. Given that the effect of the other major risk factors would appear to be to reduce the risk for rural and remote Aboriginal women, could it be that lack of screening and delayed diagnosis alone account for the excess risk, or are there other important factors related to causation and natural history operating? While the message from this study for health service planners is clearly to improve screening and early diagnosis for Aboriginal women in rural and remote areas, the findings of this study raise questions regarding the causation, natural history and prevention of cervical cancer in rural and remote Aboriginal women in Australia. Furthermore, given the probability that the disparity in risk is due to a large extent to poor access to services for screening and early diagnosis for cervical cancer, these findings support claims that the quality of, and access to, other essential services for prevention and early diagnosis are important remedial causes of the disparity in health status between Aboriginal and other Australians more generally.21

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