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Differences in impact of Aboriginal and Torres Strait Islander status on cancer stage and survival by level of socio-economic disadvantage and remoteness of residence—A population-based cohort study in Australia

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ABSTRACT

Background: Aboriginal and Torres Strait Islander people (referred to in this paper as "Aboriginal people") generally have lower cancer survivals and more advanced stages at diagnosis than non-Aboriginal people. There is conflicting evidence on whether these disparities vary by socio-economic disadvantage and geographic remoteness. This study examines variations in these disparities in New South Wales (NSW), Australia.

Methods: Data for cancers diagnosed in 2000–2008 were extracted from the NSW Cancer Registry (n = 264,219). Missing Aboriginal status (13.3%) was multiply imputed. Logistic regression and competing risk regression models were used to examine likelihood of advanced summary stage and risk of cancer death among Aboriginal compared with non-Aboriginal people by socio-economic disadvantage (categorised into quintiles 1: least disadvantaged—5: most disadvantaged) and remoteness.

Results: Aboriginal people showed a general pattern of more advanced stage at diagnosis compared with non-Aboriginal people across socio-economic disadvantage and remoteness categories. After adjusting for demographic factors, year of diagnosis, summary stage and cancer site, Aboriginal people living outside the least disadvantaged areas had an increased risk of cancer death compared with non-Aboriginal people living in similar areas (sub-hazard ratio SHR 1.41, 95% confidence interval CI 1.09–1.81; SHR 1.59, 95%CI 1.31–1.93; SHR 1.42, 95%CI 1.22–1.64 and SHR 1.34, 95%CI 1.22–1.48 for quintiles 2–5, respectively). Compared with non-Aboriginal people, Aboriginal people had an elevation in the risk of cancer death irrespective of the remoteness, with the most pronounced elevations detected in remote/very remote areas (SHR 1.56, 95%CI 1.10–2.21).

Conclusion: Compared with non-Aboriginal people, Aboriginal people had a higher risk of cancer death and higher likelihood of more advanced stage across socio-economic disadvantage and remoteness categories. All areas appear to require attention in endeavours to improve cancer survival outcomes for Aboriginal people.

1. Introduction

Australian Aboriginal and Torres Strait Islander people (referred to in this paper as "Aboriginal people") generally have lower cancer survivals than non-Aboriginal Australians [1–3]. They are also more likely to have more advanced cancer stages at diagnosis compared with non-Aboriginal people [4,5] although inconsistencies have been reported by cancer site [6]. Stage at diagnosis appears only to partly explain differences in survival by Aboriginal

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status [5,7,8]. Underlying causes of disparities in survival (and stage) between the Aboriginal and non-Aboriginal populations are thought to be multi-faceted and variable, but probably include differences in socio-demographic characteristics, behavioural risk factors, co-morbidities, and utilization and quality of health care services [3,9,10].

Previous Australian studies have generally shown residents of regional and remote areas to have higher cancer death rates and lower survivals than their metropolitan counterparts [11–13]. Evidence has been presented indicating that remoteness is also associated with more advanced stage at diagnosis for breast and colorectal cancers [14,15]. Other studies have shown increasing area-level socio-economic disadvantage to be related to lower breast and colorectal cancer survival [16,17]. Survival disparities related to remoteness and socio-economic status are thought to be interconnected because these factors are often overlapping at an individual and community level [18].

Most studies examining cancer disparities among Aboriginal people have indicated, either directly or indirectly through statistical adjustment or matching, the potential effects of socio-economic status and remoteness on these disparities [1–3,6,7,10,19,20]. However, few have specifically examined variations by remoteness and socio-economic status in extent of survival and stage disparities between Aboriginal and non-Aboriginal people.

A study from Queensland reported that survival differences between Aboriginal and non-Aboriginal people did not vary by socio-economic status (SES) or remoteness category ($p = 0.845$ and $p = 0.780$ for interactions between Aboriginal status and SES/remoteness, respectively) [1]. However, there were clear gradients by remoteness, with increasing remoteness being associated with increasing hazard of death among both Aboriginal and non-Aboriginal people [1,21]. Another study from Queensland found no differences in cancer stage between Aboriginal and non-Aboriginal people living in similar remoteness areas [3]. A national study reported that very remote residence was associated with 65% higher cancer death rates in comparison with urban areas among Aboriginal people [2]. However, between 1991 and 2005 survival increased more among Aboriginal people living in remote compared with Aboriginal people living in urban areas leading to a decrease in survival difference. It is possible that differences in disparities between Aboriginal and non-Aboriginal people vary substantially by study setting due to differences in service access and other factors.

A recent systematic review concluded that more research is needed to understand how geographical location and Aboriginal status interact with each other in contributing to cancer disparities [21]. The aim of this study was to examine whether extent of stage and survival disparities among Aboriginal compared with non-Aboriginal people vary by socio-economic disadvantage and remoteness in NSW.

2. Methods

2.1. Study design

Data for cases diagnosed in 2000–2008 were extracted from the population-based NSW Cancer Registry (NSW CR). The completeness of Aboriginal status recording is considered to be high during this time period [5,22]. All cases of primary invasive cancer (with the exception of non-melanoma skin cancers) in NSW have been notifiable to the NSW CR since 1972, with high quality of data demonstrated [23]. All notifications relating to a particular cancer are linked by the NSW CR to a single person. If the same person is diagnosed with another cancer, this cancer counts as a second case. The NSW Registry of Births, Deaths and Marriages and the Australian Bureau of Statistics (ABS) are used to obtain death data which included deaths due to cancer and from all other causes. Those with missing information about socio-economic status were excluded ($n = 1{,}724$).

Approval for the study was obtained from the NSW Population and Health Services Research Ethics Committee (NSW PHSREC 2012 07 410) and the Aboriginal Health and Medical Research (AH & MRC) ethics committee. The study operated with guidance from the Aboriginal Advisory Group of the Cancer Institute NSW.

2.2. Measures

The main variable of interest was Aboriginal status. Information about Aboriginal status was obtained from multiple sources [24]. Due to low numbers of Torres Strait Islanders, Aboriginal and Torres Strait Islander people were grouped together. Multiple imputation (MI) was used to impute Aboriginal status for those with missing information.

Age was measured at the time of diagnosis and categorised for this study as 0–39 (reference category), 40–49, 50–59, 60–64, 65–69, 70–74, 75–79, 80–84 and 85+ years.

The International Classification of Diseases Oncology (ICD-O-3) was used to classify cancer sites [25]. Cases with central nervous or lymphohaematopoietic tumours (C70–C72, M959–M973, M976, M980–M994, M9963, M9987, C42 or C77 with M974, M975, M995-M996 (excluding M9963)) were excluded from the study ($n = 31{,}548$) because information on stage was not generally available for these tumours. The following classification was used to group the remaining cancer sites: stomach (C16), colorectal (C18, C19–C21), liver (C22), pancreas (C25), lung (C33, C34), melanoma (C44 with M872–M879), breast (C50), cervix (C53), uterus (C54, C55), prostate (C61), kidney (C64–C66, C68), bladder (C67), ill-defined and unspecified site and other rare cancers (C26, C39, C42, C48, C76, C80), and all other invasive cancer sites not included in other categories (referred to as "other cancers"). Causes of cancer deaths were categorised similarly. For non-cancer deaths, the NSW CR did not record the specific underlying cause. Cases with only death certificate information available (DCO cases) and cases found at post-mortem were excluded from the analyses ($n = 3{,}865$, 1.4%; with a similar proportion affecting both Aboriginal and non-Aboriginal people, $X^2_{[df=1]} = 1.2$, $p = 0.28$).

Summary stage was recorded for solid malignant tumours by the NSW CR. Summary stage is defined as the highest degree of spread based on all diagnostic and therapeutic evidence obtained within four months of cancer diagnosis according to the international guidelines [26]. Summary stage was categorised as localised, regional, distant and unknown.

Socio-economic status (SES) was measured by the Index of Relative Socio-Economic Advantage and Disadvantage (IRSAD) based on the Census Collection Districts of residence at the time of diagnosis [27]. IRSAD was categorised into quintiles (1: least disadvantaged—5: most disadvantaged).

Residential remoteness was based on the Accessibility/Remoteness Index of Australia (ARIA+) which is a measure based on physical road distance between populated localities and the nearest urban center [28]. Remoteness was categorised into major cities, inner regional, outer regional and remote/very remote areas.

2.3. Statistical analyses

Aboriginal status was multiply imputed for those with missing information ($n = 35{,}197$, 13.3%). The multiple imputation (MI) model based on earlier work by the NSW CR [5,29] was adjusted for the purposes of this study. Details concerning the development and assumptions of imputation model have been previously