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High rates of hospitalised burn injury in Indigenous children living in remote areas: a population data linkage study

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Burns are a leading cause of child morbidity and mortality in Australia.^{1,2} Previous studies have shown that Indigenous children and children living in rural and remote areas are disproportionately affected by burn injuries.^{3,4} A much larger proportion of Indigenous (5.1%) compared with non-Indigenous (0.5%) children live in remote areas.⁵ However, to our knowledge, it has not yet been explored if living in remote areas impacts differently on the risk of burn injury in Indigenous compared with non-Indigenous children. This level of information is important to inform if burn injury prevention measures specifically targeted at Indigenous children in remote areas are needed.

Methods

Data sources and the study cohort have been described in detail elsewhere.⁶ Briefly, this study used linked hospital data from the NSW Admitted Patient Data Collection (APDC) from July 2000 to March 2014 for analysis. From the linked data, a cohort of children resident in NSW who were born in a hospital in NSW in 2000-2012 was defined (N=1,124,717), of whom 35,749 were Indigenous. The maximum age at the end of follow-up was 13 years. The study outcome was first hospitalisation for burn injury, defined as a principal diagnosis of injury (ICD-10-AM S00-T75 or T79) and an external cause code

of flame burn or contact burn (ICD-10-AM code X00-X19). Indigenous status and sex were identified from the child's birth record. Geographical remoteness was assigned at the Statistical Local Area of residence at birth, classified using the Accessibility/Remoteness Index of Australia (ARIA+).⁷ Person-years at risk were calculated from the date of birth to the first of the following events: hospitalisation for burn injury, death, or end of follow-up. Hospital admission rates were calculated by dividing the number of first burn injury hospital admissions by the person years accumulated. We built multi-level Cox regression models with a random intercept allowing the overall rate of burn hospitalisations to vary by area of residence to explore the effect of remoteness on the relative risk of burn. To determine the effect of area-level remoteness on burn injuries for Indigenous compared with non-Indigenous children, the interaction term of Indigenous status and geographical remoteness was added to the multi-level model. The effect measure modification of geographical remoteness by Indigenous status was assessed on the additive and multiplicative scale, calculated as the Synergy Index (SI) and the ratio of hazard ratios, respectively.^{8,9} Statistical analyses were carried out using Stata 12¹⁰ and SAS 9.3.¹¹

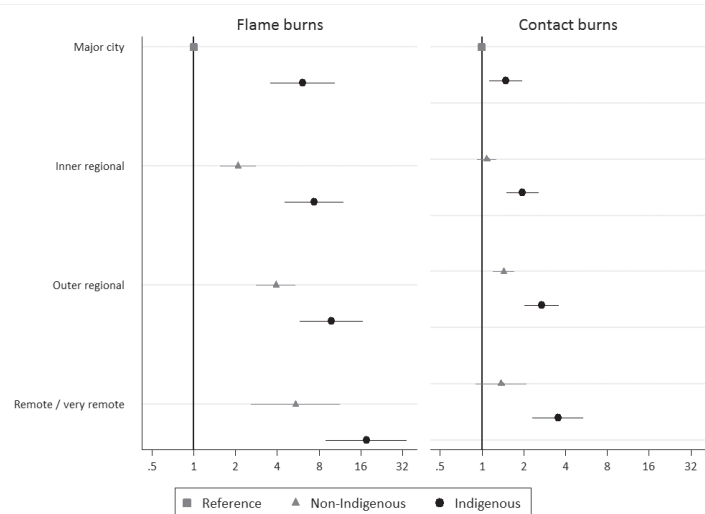
Results

Of children in the cohort, 66 (28.5 per 100,000 person-years) Indigenous and 364 (4.6 per 100,000 person-years) non-Indigenous

children were admitted to a NSW hospital for flame burns, while 224 (97.1 per 100,000 person-years) Indigenous and 3,459 (43.7 per 100,000 person-years) non-Indigenous children were admitted for contact burns. Indigenous children had 6.0 (95% CI 4.6-7.8) and 2.1 (95% CI 1.8-2.4) times higher rates of flame and contact burns than non-Indigenous children, respectively. After adjusting for clustering by area and sex, Indigenous children had a 4.4 times (95% CI 3.3-5.7) higher risk of flame burns and a 1.9 times (95% CI 1.6-2.1) higher risk of contact burns compared with non-Indigenous children and children living in remote areas had an 8.4 times (95% CI 4.8-14.7) and 2 times (95% CI 1.4-2.8) higher risk of hospitalisation for flame and contact burns, respectively, compared with children living in major cities. Adding interaction terms of Indigenous status with geographical remoteness to the multilevel model showed that Indigenous children had a higher risk of hospitalisation for contact burns in all categories of geographical remoteness and for flame burns in metropolitan and inner and outer regional areas, compared with non-Indigenous children. Compared with non-Indigenous children living in major cities, Indigenous children living in remote areas had 17.6 (95% CI 9-34.4) and 3.5 (95% CI 2.3-5.4) times higher risks of hospitalisation for flame and contact burns, respectively (Figure 1).

Analysis of effect measure modification on the additive scale showed that the risk of

Figure 1: Adjusted^a hazard ratios for hospitalization for heat and hot substance and smoke, fire and flame injury for interaction term Indigenous status x remoteness.^b



a: accounting for clustering within SLA and sex, the referent groups were non-Aboriginal children living in major cities
b: ARIA+, Accessibility/Remoteness Index of Australia

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injury from contact burns for Indigenous children in remote areas was significantly higher than that for non-Indigenous children, beyond what could be explained by adding the independent risks for Indigenous children and rural children (SI 2.8, 95% CI 1.2-7.2).

Discussion and implications

Children living in remote areas had the highest risk of burn injury hospitalisation, especially for flame burns. This was consistent with previous Australian studies,^{2,12} but for the first time we demonstrated that Indigenous children had a higher risk of burn injury for all categories of remoteness and that the effect of living in remote areas on the risk of hospitalisations for contact burns was greater in Indigenous compared with non-Indigenous children. Adjusting for geographical clustering reduced inequalities in the risk of burn injury hospitalisation between Indigenous and non-Indigenous children, but substantial differences remained. This suggests that contextual area factors contribute to but do not fully explain inequalities in hospitalised burns between Indigenous and non-Indigenous children. Socioeconomic disadvantage is likely to be a major contributor to disparities in burn injury between Indigenous and non-Indigenous children and between urban and rural areas.¹³⁻¹⁵ The bigger impact of remoteness on rates of burn injury in Indigenous children may reflect the more marked socioeconomic disadvantage experienced by Indigenous

people who live in remote areas.¹⁶ Higher rates of hospital admissions in remote areas may also reflect differences in access to other health care providers and services.¹⁷

Our results indicate that there is substantial scope to reduce inequalities in burn injury by targeting injury prevention measures towards children living in remote areas and Indigenous children. Considered together with findings from previous research that has demonstrated a strong socioeconomic gradient of burn injuries,³ it is likely that a mixture of targeted programs and continuing support for the broader policy measures that aim to address inequalities in the socioeconomic determinants of health, will help to reduce burn injuries overall as well as inequalities in burn injuries between Indigenous and non-Indigenous Australian children.

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