

Childhood burn injury—impacts beyond discharge

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Despite improvements in burn injury related in-hospital mortality over the past decades, evidence of post-burn morbidity means that burn injury continues to present challenges for both clinicians and burn survivors (1). Our 33-year study of long-term mortality after pediatric burn injury, found increased long-term mortality after both minor and severe burn injury (2). Our study used population-based linked administrative health data from the Western Australian Data Linkage System (WADLS) (3), a validated whole-of-population data linkage system that routinely links data from core datasets for the population of Western Australia. The WADLS infrastructure enables probabilistic person links to be created and maintained between the state's population-based data collections.

Our retrospective longitudinal study included data of 10,426 children hospitalised for a burn injury during 1980 to 2012 and an age and gender frequency matched uninjured cohort, where 50% of the burn cohort had at least 18 years of follow-up. Australia is one of only a few countries to have a comprehensive population-based record linkage system to support long-term health outcomes and hospital service research, acknowledged by Rosanova *et al.* (4). As large prospective studies are logistically difficult and costly to administer, the use of population-based linked administrative health data provides a cost-effective means to examine long-term mortality post-burn for an entire pediatric burn patient cohort. However, given that administrative health data are not collected for the purposes of research, limitations exist as discussed by Hyland and Holland (5).

While the administrative health datasets provide accurate

baseline demographic and health status information; these datasets do not routinely collect data on risk-taking behaviours, important factors when making holistic considerations of long-term health outcomes after injury, including mortality. This is a limitation which was acknowledged in the original paper. This being said, objective measures of alcohol, smoking and other substances of abuse are not routinely collected and the validity and reliability of self-reported risk-taking behaviours are questionable. While specific measures of risk-taking behaviour (e.g., alcohol and other substances of abuse) were not included in our models, we included an index of socio-economic disadvantage (6) that has been correlated with lifestyle risk factors including smoking, alcohol, nutrition and physical activity, all of which could have an effect on mortality (7-9). Although the social disadvantage index used was not an individual-based measure, it did provide a geocoded summary measure that represented a 200-household proximity to the place of residence of the patient's family address. Inclusion of indices of social disadvantage and geographic distance to services (10) in the analyses, while not optimal, did provide proxy measures of lifestyle and risk taking factors and a means to adjust for a level of residual confounding.

As individuals age they progress through a number of physical, psychological and emotional developmental stages that are recognised as complex risk factors for injury (11). Infants and young children (0 to 5 years) explore their physical environment before they fully understand and have the skills to respond to hazards, while older children (5 to 15 years) having increasing capacity to make decisions about

safety issues as they are further exposed to a broader range of settings (12). Hyland and Holland (5) make an interesting suggestion that a child who survives a severe burn injury is likely to engage in future risky activity based on a personal understanding and assessment of their survival of their initial injury i.e., if they survived one severe injury they are likely to survive another. Whilst this may be the case, in our original study 65% of the burn cohort was younger than 5 years at the time of their first burn admission, with 50% younger than 2 years of age, and it is uncertain whether the majority of these paediatric burn patients would have capacity to understand the hazards and severity of their injuries and/or their injury survival that would necessarily influence future risk-taking activities. A proportion of children did have a record of an additional non-burn injury admission that may potentially have put them at increased risk of additional secondary pathologies related to systemic responses to non-burn trauma, as suggested by Hyland and Holland (5). In response to this, the data were reanalysed using multivariate Cox regression analysis, excluding members of the burn cohort who had any record of a principal diagnosis non-burn injury admission (prior, post-burn), and potentially excluding those of high risk-taking behaviour. After adjustment of all covariates included in our previous analysis (2), the adjusted mortality rate ratio (MRR) remained elevated and statistically significant [MRR, 1.55; 95% confidence interval (CI): 1.27-2.02]. Future research is planned that will incorporate data of the burn cohort with gender and age frequency matched non-burn trauma and uninjured cohorts, and population-data based measures of injury severity [International Classification of Disease Injury Severity Score (ICISS)] (13,14). Such research will support a more superior investigation and quantification of any potential additive effects on non-burn trauma identified as principal or additional diagnosis admissions.

As noted by Hyland and Holland (5), a large proportion of the deaths in both the burn and the uninjured cohorts were due to injuries. The use of an age and gender-frequency matched comparison cohort was important and enabled quantification of the background risk for injury fatality that existed in this uninjured cohort. No significant difference in long-term mortality due to injury (MRR, 1.0; 95% CI: 0.7-1.2) was found between the burn and uninjured cohorts (7), suggesting that other diseases may have an important role. Our analyses of burn survivors 45 years and older (15), that had sufficient statistical power to examine long-term mortality post-burn by cause of death, found increased long-term mortality due to neoplasms and diseases of the

cardiovascular and digestive systems. Again, no difference was found between the burn and uninjured cohorts with respect to long-term mortality caused by injuries.

Hyland and Holland (5) rightly state that the impacts of burn injury are not limited to the burn patient; impacts often extend to the entire family. Such impacts may include emotional stress and mental health conditions, time off work by the parent, unemployment and financial stress, and potentially, to substance abuse, with characteristics of the family reported to have consequences for the recovery of the burn patient (16,17). Population-based administrative health data do not routinely include complex linkages of family members and their respective health outcomes, and as such outcomes of family members were not included in the analyses. It would be anticipated that the greatest psychosocial and economic impacts on the family, and therefore on the outcomes of the burn patient, would be experienced by those families of severely burned children. In this study, severe burns represented only 1.3% of the patient population, and significantly increased long-term mortality was found for those with minor and severe burns, and burns of unspecified TBSA.

Injuries, and subsequent psychological and physical impacts, are preventable and the authors support the importance of raising safety awareness and injury prevention in the community at every opportunity, including during primary care well-visits, any injury hospitalisation and ED attendance of children. Children and adolescents are vulnerable proportions of our population for whom the burden of post-injury morbidity may be experienced during the remainder of their lifetime. Integrating population-based research methodologies with existing core areas of basic scientific and clinical research of burn injury enhances our capacity to generate evidence to inform paediatric burn care. The finding of long-term mortality after paediatric burn injury adds to the current knowledge base of post-burn morbidity and has implications for initial trauma responses and post-burn patient surveillance, and possibly treatment, to improve long-term health outcomes after burn injury.

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Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

References

1. Jeschke MG, Gauglitz GG, Kulp GA, et al. Long-term persistence of the pathophysiologic response to severe burn injury. *PLoS One* 2011;6:e21245.
2. Duke JM, Rea S, Boyd JH, et al. Mortality after burn injury in children: a 33-year population-based study. *Pediatrics* 2015;135:e903-10.
3. Holman CD, Bass AJ, Rouse IL, et al. Population-based linkage of health records in Western Australia: development of a health services research linked database. *Aust N Z J Public Health* 1999;23:453-9.
4. Rosanova MT, Stamboulian D, Lede R. Long term mortality in burned children. *Transl Pediatr* 2015;4:203-5.
5. Hyland EJ, Holland AJ. Have we really decreased mortality due to severe burn injury in children? *Transl Pediatr* 2015;4:201-2.
6. Trewin D. Socio-economic Indexes for Areas (Information Paper, Census of Population and Housing). Canberra: Australian Bureau of Statistics, 2003.
7. Mishra G, Ball K, Patterson A, et al. Socio-demographic inequalities in the diets of mid-aged Australian women. *Eur J Clin Nutr* 2005;59:185-95.
8. Siahpush M, Borland R, Scollo M. Prevalence and socio-economic correlates of smoking among lone mothers in Australia. *Aust N Z J Public Health* 2002;26:132-5.
9. Taylor AW, Dal Grande E, Wu J, et al. Ten-year trends in major lifestyle risk factors using an ongoing population surveillance system in Australia. *Popul Health Metr* 2014;12:31.
10. Glover J, Tennant S. Remote Areas Statistical Geography in Australia: Notes on the Accessibility/Remoteness Index for Australia (ARIA+ version). Working Paper Series No. 9. Public Health Information Development Unit 2003.
11. Moller JN, Kreisfeld R. Progress and current issues in child injury prevention. Adelaide: AIHW NISU (Australian Institute of Health and Welfare National Injury Surveillance Unit)1997.
12. Australian Institute of Health and Welfare 2009. A picture of Australia's children 2009. Canberra: AIHW Contract No.: cat. no. PHE 112.
13. Osler T, Rutledge R, Deis J, et al. ICISS: an international classification of disease-9 based injury severity score. *J Trauma* 1996;41:380-6; discussion 386-8.
14. Stephenson S, Henley G, Harrison JE, et al. Diagnosis based injury severity scaling: investigation of a method using Australian and New Zealand hospitalisations. *Inj Prev* 2004;10:379-83.
15. Duke JM, Boyd JH, Rea S, et al. Long-term mortality among older adults with burn injury: a population-based study in Australia. *Bulletin of the World Health Organization* 2015;93:400-6.
16. Bakker A, Maertens KJ, Van Son MJ, et al. Psychological consequences of pediatric burns from a child and family perspective: a review of the empirical literature. *Clin Psychol Rev* 2013;33:361-71.
17. Sheridan RL, Lee AF, Kazis LE, et al. The effect of family characteristics on the recovery of burn injuries in children. *J Trauma Acute Care Surg* 2012;73:S205-12.

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