The excess burden of severe sepsis in Indigenous Australian children: can anything be done?

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Reducing the transmission of *Staphylococcus aureus* and early treatment are key factors

Sepsis, a significant health care problem, is a leading cause of mortality in children.[1] In this issue of the *MJA*, Ostrowski and colleagues report for the first time the excess burden of invasive infections resulting in the admission of Indigenous children to general and paediatric intensive care units (ICUs) across Australia. This well conducted and culturally secure, retrospective analysis of data from the Australian and New Zealand Paediatric Intensive Care (ANZPIC) registry produced several important findings: Indigenous children are over-represented among severely ill children admitted to Australian ICUs, and *Staphylococcus aureus* is the infectious organism most frequently implicated.[2]

The authors report a slow increase across the 12-year study period (2002–2013) in the proportion of children admitted to ICUs who were Indigenous Australians. One-quarter of these admissions were for invasive infections, of which 1 in 10 involved severe sepsis or septic shock. The rate of ICU admission for infectious diseases was three times higher for Indigenous than for non-Indigenous children. While crude ICU mortality for Indigenous patients (5.6%) was similar to that for non-Indigenous children (6.5%), the population-based age-standardised ICU mortality rate was almost three times that of their non-Indigenous peers (2.67 *v* 1.04 deaths per 100 000 children per year). Whether this difference in adjusted ICU mortality reflects increasing access to ICUs by Indigenous Australians cannot be determined from this study.

The median age of the Indigenous patients was 1.7 years, and 56% were boys. The higher ICU admission rate for Indigenous children was partially explained by the sevenfold higher population-based ICU admission rate associated with complications of infection with *S. aureus* (isolated from 22% of Indigenous children admitted to an ICU with sepsis), such as pneumonia and osteomyelitis. A recent large study of children presenting with *S. aureus* bacteraemia in Australia and New Zealand also found an over-representation of Indigenous Australian children; 34% of infections occurred during the first year of life, and infancy was a risk factor for mortality.[3] These findings may contribute to explaining the young age and higher population-based mortality among Indigenous patients found by Ostrowski and colleagues, although their study did not include neonatal ICUs. However, the excess burden of infection in Indigenous children from birth is probably more important, especially that of severe infections (including by staphylococci), affecting Indigenous children early in life. This reflects the social determinants of health in disadvantaged communities, where household overcrowding, poverty, and limited access to health care result in poor health outcomes.

The high burden of staphylococcal infections in Indigenous Australians is well documented. This may be attributable to the high rates of impetigo in Indigenous children,[4] the highest in the world.[5] Combined infection with *S. aureus* and *Streptococcus pyogenes* occurs in impetigo;[6] if untreated, complications, including sepsis, may ensue. Preventing *S. aureus* infection by reducing the high burden of skin infections in Indigenous children would contribute to reducing their rates of sepsis and other complications; this is an important strategy, as there is currently no vaccine to prevent staphylococcal infections. Skin disease control programs are therefore an important priority in regional and remote Australia,[5] particularly for improving the recognition, treatment and prevention of skin infections in Indigenous children.

Research into reducing *S. aureus* colonisation and transmission in Indigenous Australians is urgently needed. Few population-based studies of the control of community-level *S. aureus* transmission have been reported. In a military setting, frequent use of chlorhexidine body wash was associated with decreased colonisation by methicillin-resistant *S. aureus*;[7] a decolonisation regimen of intranasal mupirocin with chlorhexidine body washes reduced skin and soft tissue infection rates in contact persons in households.[8] Bleach baths reduce *S. aureus* carriage,[9] which may prevent skin infections; a reduction in the prevalence of skin infections was also associated, for example, with the introduction of chlorinated swimming pools in remote areas of Australia.[10] Individual and community-level strategies for reducing the burden of *S. aureus* infections warrant further investigation.

Immunisation is a crucial strategy for reducing sepsis caused by vaccine-preventable infections, such as *Streptococcus pneumoniae* and *Neisseria meningitidis*. Good uptake of immunisation by Indigenous Australian children (about 90%), albeit with delays, has been achieved.[11] About 11% of the patients with sepsis or septic shock described by Ostrowski and co-authors had a viral co-infection. Influenza infection preceding invasive *S. aureus* infections is well described,[12] highlighting the importance of annual influenza vaccinations in this population.

The study reported in this issue of the *MJA* confirms the disproportionate burden and population-based mortality in Indigenous

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children associated with invasive infections, and identifies *S. aureus* as one major factor that could be a focus of preventive action. The social health inequity that underpins the disparity must be high on policy and research agendas. Maintaining the widespread and timely uptake of vaccination programs is important. As a staphylococcal vaccine is not likely to be available in the near future, efforts for improving outcomes for Indigenous Australian children should focus on reducing *S. aureus* transmission, detecting and treating superficial *S. aureus* infections, and accelerating clinical trials of adjunctive treatment for *S. aureus*, each from as early in life as possible. The impacts on Indigenous Australian families of separation from country, admission to an ICU, and long term morbidity and mortality associated with severe infections will otherwise remain significant.

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