Bloodstream infection rates in Aboriginal and non-Aboriginal people in Central Australia, 2014–2018

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Bloodstream infection rates are an indirect measure of social disadvantage and population health.[1] Rates of chronic disease and harmful alcohol consumption are higher among socio-economically disadvantaged people, who often live in overcrowded houses with poor sanitation; all these factors are recognised risk factors for bloodstream infections.[2] Thirty-four percent of the disparity in health outcomes between Indigenous and non-Indigenous Australians is attributed to high levels of unemployment, lower educational attainment and household income, and inadequate housing, and a further 19% to health risk factors, including alcohol consumption and smoking.[3]

Two estimates of mean annual bloodstream infection incidence in the Alice Springs area at the start of the 21st century were much higher for Aboriginal than non-Aboriginal people (2001–2006: 937 *v* 64 per 100 000 person-years[1]; 2001–2005: 1355 *v* 70 per 100 000 person-years[4]). To investigate whether incidence and patterns of antimicrobial resistance have changed in the meantime, we retrospectively reviewed Alice Springs Hospital records for all episodes of adults (15 years or older) admitted with bloodstream infections during 1 January 2014 – 31 December 2018. Population rates (based on 2016 census data[5]) of infection with major pathogens were estimated both overall and by Indigenous status, and compared with incident rates calculated from the 2001–2006 dataset.[1] All statistical analyses were conducted in Stata 17.0. The study was approved by the Central Australian Human Research Ethics Committee (CA-19-3344).

The mean annual bloodstream infection episode rate during 2014–2018 was 996 episodes per 100 000 Aboriginal adults (667 episodes) and 115 episodes per 100 000 non-Aboriginal adults (132 episodes); the estimated episode rate ratio (Aboriginal *v* non-Aboriginal) was 8.42 (95% confidence interval [CI], 8.41–8.43). The mean annual incidence rate was 784 per 100 000 Aboriginal adults (541 people) and 105 per 100 000 non-Aboriginal adults (121 people); the estimated IRR was 7.45 (95% CI, 7.45–7.46). Ninety-two people (84 Aboriginal, eight non-Aboriginal) had more than one infection episode in a single calendar year. The incident rate for Aboriginal town camp residents (46 people, 1040 per 100 000) was higher than for Aboriginal people living remotely (361 people, 731 per 100 000; IRR, 1.42; 95% CI, 1.42–1.42).

The mean ages of people with bloodstream infections and of those who died were each lower for Aboriginal than non-Aboriginal people (Box) (median follow-up time: Aboriginal people, 2.7 years; interquartile range [IQR], 0.0–6.0 years; non-Aboriginal people, 2.0 years; IQR, 0.0–5.9 years).

The most frequently isolated pathogen species (all people) were *Escherichia coli* (192 of 662 people, 29%; 95% CI, 26–33%), *Staphylococcus aureus* (110 of 662; 17%; 95% CI, 14–20%), *Streptococcus pyogenes* (77 of 662, 12%; 95% CI, 9–14%), and *Streptococcus pneumoniae* (77 of 662, 12%; 95% CI, 9–14%) (Box). The annual population-based incidence rate of *S. pyogenes* bloodstream infections increased from 64.6 (95% CI, 47.9–87.2) per 100 000 adults during 2003–2007 to 106 (95% CI, 84.7–132) per 100 000 during 2014–2018 (IRR, 1.63; 95% CI, 1.13–2.37). The annual population-based incidence rate of *S. pneumoniae* bloodstream infections in Aboriginal adults was slightly lower during 2014–2018 (104 [95% CI, 83–130] per 100 000) than during 2003–2007 (141 [95% CI, 115–172] per 100 000; IRR, 0.74; 95% CI, 0.55–0.996).

Methicillin-resistant *S. aureus* was isolated from 53 of 110 people with *S. aureus* bloodstream infections (48%), including 46 of 81 infections in Aboriginal people (57%); these proportions were substantially larger than earlier reports (for Aboriginal people: 28%[1] or 29%[4]; non-Aboriginal people: 5%[1] or 6%[4]).

Bloodstream infection rates in Aboriginal residents of Central Australia remain extremely high. Continuing overall differences between Aboriginal and non-Aboriginal people with respect to incidence and age at onset of bloodstream infections, and the increasing incidence of *S. pyogenes* bloodstream infections (like *S. pneumoniae*, associated with poverty and household overcrowding[6,7]), indicate that risk factors, including chronic diseases and the social determinants of health, must be remediated. The evidence for increasing rates of infection with antibiotic-resistant *S. aureus* is also concerning.

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Characteristics of people aged 15 years or more admitted to Alice Springs Hospital with bloodstream infections, 2014–2018

Characteristic	Indigenous status*		All people
	Aboriginal	Non-Aboriginal	
People with bloodstream infections	541	121	662
Bloodstream infection episodes†	667	132	799
Age (years), mean (SD)	50 (15.9)	60 (19.5)	52 (17.0)
Sex (women)	348 (64.3%)	48 (40%)	396 (59.8%)
Residence			
Alice Springs, excluding town camps (urban)	135 (25%)	111 (92%)	246 (37%)
Alice Springs town camp	45 (8%)	0	45 (7%)
Remote community (> 80 km from Alice Springs)	361 (67%)	10 (8%)	371 (56%)
Comorbid conditions‡			
Diabetes	155/226 (69%)	16/60 (26.7%)	171/286 (60%)
Chronic kidney disease, stages 3–4	35/226 (16%)	8/60 (13.3%)	43/286 (15%)
Chronic kidney disease, stage 5	38/226 (17%)	1/60 (2%)	39/286 (14%)
Cirrhosis	23/226 (10%)	1/60 (2%)	24/286 (8%)
Bronchiectasis	16/226 (7%)	1/60 (2%)	17/286 (6%)
Congestive cardiac failure	49/226 (22%)	8/60 (13%)	57/286 (20%)
Ischaemic heart disease	43/226 (19%)	8/60 (13%)	51/286 (18%)
Valvular heart disease	29/226 (13%)	6/60 (10%)	35/286 (12%)
Rheumatic heart disease	17/226 (8%)	0/60	17/286 (6%)
Malignancy	10/226 (4%)	15/60 (25%)	25/286 (9%)
Harmful alcohol consumption‡	70/226 (31%)	6/60 (10%)	76/286 (27%)
Injecting drug use‡	0/226	1/60 (2%)	1/286 (< 1%)
Primary focus of bloodstream infection‡			
None	29/226 (13%)	5/60 (8%)	34/286 (12%)
Pyelonephritis	60/226 (26%)	13/60 (22%)	73/286 (26%)
Pneumonia	40/226 (18%)	5/60 (8%)	45/286 (16%)
Skin abscess	25/226 (11%)	12/60 (20%)	37/286 (13%)
Bone/joint	12/226 (5%)	6/60 (10%)	18/286 (6%)
Enteritis	9/226 (4%)	2/60 (3%)	11/286 (4%)
Other	26/226 (12%)	7/60 (12%)	33/286 (12%)
Community-acquired infections	206/224 (92%)	50/59 (85%)	256/283 (90%)
Deaths§	125 (23%)	36 (30%)	161 (24%)
Within 28 days	27 (5%)	9 (7%)	36 (5%)
Age at death (years), mean (SD)	59.6 (14.9)	67.8 (16.5)	61.4 (15.6)
Significant bloodstream infection pathogens			
Enterobacterales	229 (42%)	51 (42%)	280 (42%)
Extended spectrum beta-lactamase-producing	*22/229 (10%)*	*3/51 (6%)*	*25/280 (9%)*
Escherichia coli	158 (29%)	34 (28%)	192 (29%)
Staphylococcus aureus	81 (15%)	29 (24%)	110 (17%)
Methicillin-resistant *S. aureus*	*46/81 (57%)*	*7/29 (24%)*	*53/110 (48%)*
Streptococcus pneumoniae	71 (13%)	6 (5%)	77 (12%)
Streptococcus pyogenes	59 (11%)	18 (15%)	77 (12%)
Klebsiella pneumoniae	20 (4%)	7 (6%)	27 (4%)
Enterococcus spp.	13 (2%)	0	13 (2%)
Vancomycin-resistant *Enterococci*	*5/13 (39%)*	*0*	*5/13 (38%)*

* As recorded in hospital records. † Pathogen isolated by blood culture. Repeated culturing of the same organism was deemed a single episode if blood samples were collected less than four weeks apart. ‡ For people admitted to hospital 1 January 2017 – 31 December 2018. More detailed data were collected only during the final two years of the study years because of resource constraints. § As recorded in Alice Springs Hospital records, which are linked to the Northern Territory Births, Deaths and Marriages registry; includes deaths in South Australian hospitals (but not all deaths in South Australia outside of hospitals).

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