High Burden of Staphylococcal Disease in Indigenous Communities

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Numerous studies in the past 2 decades have recorded an apparently high rate of Staphylococcus aureus infection in so-called indigenous populations—in particular, a high rate of infection caused by methicillin-resistant strains of S. aureus (MRSA) [1]. Such problems have been documented among Native Americans [2], Pacific Islanders in Hawaii [3], Alaskan Natives [4, 5], aboriginal Canadians (First Nations, Métis, and Inuit) [6, 7], Western Samoans and other Pacific Islanders living in Auckland, New Zealand [8, 9], and Australian Aboriginals [10].

In this context, the concept of indigenous populations stems from the modern histories of the United States, Canada, and Australia. These histories have many parallels, one of which is the displacement and resettlement of indigenous populations that had occupied these countries for the previous tens of thousands of years. These populations became the “Fourth World,” that is, the “Third World inside the First,” because their well being and health status have suffered as a result of their resettlement, often to remote communities and reservations. Notably, the infectious diseases burden in these communities has remained high or even increased, compared with that of the nonindigenous population, and it has contributed to a significantly shorter life expectancy. As a result, staphylococcal infections, both minor and serious, are a prominent part of the infectious disease burden in indigenous populations.

In recent years, attention has been focused on MRSA infection in indigenous communities. All of the references cited above deal with infection due to community-associated MRSA (CA-MRSA) strains, and indeed infection with CA-MRSA strains has become a prominent problem in indigenous communities. One of the earliest appearances of CA-MRSA anywhere in the world was in the remote indigenous communities of the Kimberley region in northern Western Australia, with the first isolates clearly documented in 1983 [11]. Only the reports of infection among injection drug users in Detroit, Michigan, around 1980 preceded this appearance [12]. The “Kimberley” strain of MRSA was notable for its resistance to β-lactam antibiotics only, in contrast to the multidrug-resistant strain that had become established in many tertiary care hospitals on the eastern seaboard of Australia some years before. Subsequently, other strains of CA-MRSA started appearing in Australia, including 1 that was initially associated with ethnic minorities in Australia from Tonga and Western Samoa [13]. This proved to be the same strain that had been noted to be prevalent among immigrant Pacific Islanders in urban New Zealand [8], sometimes called the Oceania strain. A notable difference between the 2 strains is that the Oceania strain possesses Panton-Valentine leukocidin, whereas the Kimberley strain does not [14]. Panton-Valentine leukocidin is a prominent feature of the USA300 strain of CA-MRSA, which is very widespread in the United States [15], and infections due to this strain are a notable problem among Native Americans [16].

In this edition of the Journal, Tong et al. focus on one indigenous population, the Aboriginal people of the Top End of the Northern Territory in Australia [17]. Tong et al. show the rate of S. aureus bacteremia among Aboriginals to be almost 6 times higher than that among the non-Aboriginal population in that part of Australia. The validity of their analysis is strengthened by the fact the study was population based and one-quarter of that population is Aboriginal (the overall percentage of Aboriginals in Australia’s population is estimated to be 2.5% [18]). They also provide a comparison of invasive infection caused by methicillin-susceptible strains of S. aureus and invasive infection.
caused by methicillin-resistant strains, the former being 4 times more common. While not denying the importance of MRSA infection, we can sometimes forget that methicillin-susceptible strains are still prevalent in all communities and are potentially lethal when invasive.

What is driving these increased rates of minor and invasive staphylococcal disease in aboriginal populations, caused by both methicillin-susceptible and methicillin-resistant strains? A number of potential factors suggest themselves, including higher rates of staphylococcal colonization, skin disease, other comorbidities, and antimicrobial exposure. Some of these factors are linked to the substandard living conditions endured by those in remote indigenous communities, which involve crowding and unreliable or deficient water supplies [1]. The evidence for these factors is incomplete but is now at least partially addressed by Tong et al. [17].

Information on comparative nasal carriage rates for S. aureus in aboriginal populations is limited. In one American Indian community in Washington State, a carriage rate of 27.3% was observed in a population of 475 subjects in 2001 [19], which is slightly but not significantly lower than the rate of 32.3% observed in a nationwide US study conducted the same year [20]. These same studies showed MRSA carriage rates of 1.9% and 0.8%, respectively. The rate of MRSA colonization has also been shown to be high among some Australian Aboriginal children—29% for S. aureus and 15% for MRSA [21]. In a rural population in Western Australia, rates of nasopharyngeal colonization were compared for Aboriginal and non-Aboriginal children from 1999 through 2003 [22]. The rate of S. aureus carriage was significantly lower in Aboriginal children (11.0%) than in non-Aboriginal children (22.3%). Thus, if anything, the rate of colonization may be lower in indigenous populations, at least at the conventional sampling sites.

Infective skin diseases are much more common in some indigenous communities [23–25]. The links between scabies, group A streptococcal skin disease, and S. aureus colonization show up whenever researchers perform studies that involve looking for 2 or 3 of these pathogens in indigenous patients [2, 24–27]. A previous study by Tong et al. has shown a strong link between the presence of scabies and infections due to non-multidrug-resistant MRSA [1]. Skin colonization by S. aureus is more likely in many kinds of skin disease in which the stratum corneum is breached by skin disease or trauma [28]. For instance, eczema has been shown to increase the risk of colonization and skin furunculosis caused by CA-MRSA strains in Alaskan Natives [4]. Poor hygiene and lack of available water may play an important role in the transmission of bacterial skin pathogens, although not of scabies per se [26].

Some comorbidities may contribute to the propensity to develop invasive disease, as suggested by Tong et al. [1, 17]. Common underlying illnesses in indigenous communities with plausible links to invasive staphylococcal infection include diabetes mellitus and chronic renal disease [23, 29]. Comorbidities have also been linked to an increased mortality rate for S. aureus bacteremia [30], although this is not known to be true for indigenous patients and did not show up in the analysis of Tong et al. [17].

High infection rates in indigenous communities inevitably imply high rates of antimicrobial consumption. Frequent antimicrobial exposure increases the risk of becoming colonized and subsequently infected with antimicrobial-resistant pathogens. It would, therefore, seem reasonable to suggest that the high rates of MRSA colonization and infection might be attributed to high levels of antimicrobial exposure. However, the data on this factor are conflicting. Groom et al. could not demonstrate a difference in the level of prior antimicrobial exposure among Native Americans infected with MRSA compared with Native Americans infected with methicillin-susceptible S. aureus, nor could they demonstrate a difference in the MRSA infection rate among those who had received ≥1 course of antimicrobials during the previous year and those who had not [2]. By contrast, a study of rural Alaskan Natives showed a substantially increased risk of skin infection due to CA-MRSA strains among those who had received multiple courses of antimicrobials during the previous year, and the risk was in proportion to the number of courses received [4].

Although our knowledge of the epidemiology of staphylococcal infection in indigenous communities is incomplete, there is some evidence to support the efficacy of interventions. The most intriguing, but also logical, step taken has been in Western Australia, where the installation of swimming pools in remote indigenous communities has resulted in substantial demonstrable reductions in the incidence of pyoderma in children [31]. In turn, this has been shown to reduce the rates of antimicrobial prescriptions significantly [32]. These same benefits also extend to middle ear and respiratory infections. In areas of Australia where access to clean water for bathing and showering is low, swimming pools provide entertainment, increase well being, and reduce infection among indigenous children in remote communities. Reduction of the burden of disease in children will, in turn, reduce the burden in adults from those communities. Interestingly, the use of saunas in an Alaskan Native community has been shown to reduce the rates of antimicrobial consumption in children [32]. These same benefits also extend to middle ear and respiratory infections. In areas of Australia where access to clean water for bathing and showering is low, swimming pools provide entertainment, increase well being, and reduce infection among indigenous children in remote communities. Reduction of the burden of disease in children will, in turn, reduce the burden in adults from those communities. Interestingly, the use of saunas in an Alaskan Native community has been shown to reduce the rates of antimicrobial consumption in children [32]. These same benefits also extend to middle ear and respiratory infections.

While members of the "Fourth World" either choose to, or are obliged to, live in rural and remote communities, and successive governments of the "First World" struggle to find acceptable ways to improve the health, housing, and hygiene of their Fourth World populations, the current high rates of staphylococcal infection, due to both methicillin-susceptible and methicillin-resistant strains, will continue. Interventions such as swimming pool installation and other more global measures to improve health, hygiene, and economic conditions are likely to have the greatest benefit by reducing the burden of
infection and of staphylococcal diseases in particular.

References


