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Research

Availability of drinking water in rural and remote communities in New South Wales, Australia

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Abstract. Many rural communities in New South Wales (NSW), Australia, have poor-quality water supplies. The lack of a palatable alternative increases the risk of the high consumption of sugar-sweetened beverages, a significant contributor to adverse health outcomes. This disproportionately effects Aboriginal people living in these towns, who are also profoundly affected by the social determinants of health. Therefore, examining health inequalities linked to water access is important. This study investigated the availability of drinking water fountains in rural and remote communities in NSW. Telephone interviewer-assisted surveys were conducted with 32 representatives from local government councils or Local Aboriginal Land Councils in NSW from communities with a population of <5000 and an Aboriginal population of at least 3%. The results were analysed descriptively. Towns and communities with a higher population of Aboriginal people and lower median weekly income were less likely to have access to free refrigerated and filtered water within the community or at local schools compared with towns and communities with a lower Aboriginal population and higher median weekly income. The availability of free, clean and refrigerated water in rural and remote communities is critical to reducing the consumption of sugar-sweetened beverages and the promotion of water as the preferred drink.

Keywords: water, rural, remote, Aboriginal, population health, health promotion, NSW, Australia.

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Introduction

Australian Aboriginal and Torres Strait Islander people have a rich and diverse culture that has survived over 60 000 years (Australian Museum 2021). Central to Aboriginal and Torres Strait Islander culture is spirituality, music, art, storytelling and connection to land and water (Australian Museum 2021). Connection to water has not only been critical for the survival of Aboriginal and Torres Strait Islander people in the harsh Australian environment, but is also significant in culture, identity, defining language boundaries and in ceremonies (Waterwise Queensland 2021). Dreamtime stories often explain how spirits created water sources, and traditional knowledge has been passed down many generations through oral instruction, artworks or rock carvings on how to locate, use and protect these precious water sources (Waterwise Queensland 2021). The devastating impact of colonisation for many Aboriginal and Torres Strait Islander people has included severed connections to land and water (Australian Museum 2021).

The disruption to culture and a combination of intergenerational trauma, racism, the social determinants of health and health risk factors, all arising from colonisation, have affected the health of Aboriginal and Torres Strait Islander people and created significant health inequity with other Australians (Australian Institute of Health and Welfare (AIHW) 2018; Bourke *et al.* 2019). These health disparities are frequently multimorbid and shorten the life expectancies for Aboriginal and Torres Strait Islander people (AIHW 2011). Despite significant improvements in some health indicators, the leading causes of death include cardiovascular diseases and metabolic and nutritional disorders (AIHW 2011). These poor health outcomes are correlated with asthma, diabetes, high cholesterol and hypertension (Shi *et al.* 2015; Kajons *et al.* 2018); they are

particularly associated with overweight and obesity, both of which compound poor health outcomes (Garnett *et al.* 2013). Both children and adults in Australia have high rates of being overweight or obese, with one in four children aged 5–17 years over the healthy weight for their age (Kajons *et al.* 2018).

One key factor that drives high rates of overweight and obesity is the high consumption of sugar-sweetened beverages (SSBs). Research suggests that some children as young as 2 years consume SSBs daily (Garnett *et al.* 2013). Furthermore, research also suggests that children develop food and taste preferences early in life and that such patterns of nutrition are largely persistent into adulthood (Garnett *et al.* 2013). Because children often increase their consumption of SSBs through adolescence, the health risks are compounded. Further to the risk of being overweight or obese, children who drink SSBs daily are also at risk of developing asthma and Type 2 diabetes and having poor emotional health and academic performance (Kajons *et al.* 2018). These poor health outcomes multiply well into adulthood. A study among adults in South Australia found associations between high consumption levels of SSBs ($\geq$0.5 L day^{-1}) and health outcomes, including diabetes, asthma, cardiovascular and pulmonary diseases, high cholesterol, mental health problems, hypertension and arthritis (Shi *et al.* 2015). More importantly, the study found a positive correlation between daily high consumption of SSBs and multimorbid diagnoses (Shi *et al.* 2015). A report on the consumption of SSBs among people in New South Wales (NSW) and the associated consequences also noted connections between high SSB consumption and poor health outcomes (Hector *et al.* 2009). These studies and reports demonstrate the detrimental health outcomes among Australians from SSBs (Hector *et al.* 2009; Shi *et al.* 2015).

Research suggests that Australians drink, on average, 131 L SSBs per year, and that these drinks are much more affordable in Australia than in other countries (Ferretti and Mariani 2019). Furthermore, Australian evidence supports a link between lower socioeconomic status and higher consumption of SSBs (Australian Bureau of Statistics (ABS) 2014). Aboriginal and Torres Strait Islander people tend to have lower incomes than non-Aboriginal and Torres Strait Islander Australians (AIHW 2019), and may therefore be disproportionately affected by the affordability of SSBs and may consequently experience poorer health outcomes, contributing to higher rates of overweight and obesity.

From here, this paper refers to Aboriginal people residing in NSW, Australia. In NSW, 18% of Aboriginal children are overweight and obese (Hickie *et al.* 2013) and the prevalence of obesity among Aboriginal adults is 39% (Thurber *et al.* 2018). Being overweight or obese among Aboriginal people is linked to social and behavioural determinants of health, including poor nutrition, the limited availability of safe, clean drinking water and the overconsumption of SSBs (Avery *et al.* 2017). High consumption of SSBs also contributes to tooth decay, which affects many Aboriginal people across Australia (Australian Medical Association 2019).

Some Aboriginal communities in NSW have a long history of limited access to clean, filtered, refrigerated drinking water (Human Rights Australia 1988; Taylor 1999). One Aboriginal community in NSW only had their public water supply upgraded in 1998 as residents had complained about scaly, itchy skin due to poor-quality water supply (Taylor 1999). These complaints and instances of poor water infrastructure are not uncommon (Hall 2018). Furthermore, older plumbing infrastructure and poor water quality supply can often render the water unpalatable or unrefreshing, especially in summer months, when temperatures in many rural and remote communities can reach up to 45°C. These issues may increase reliance on SSBs (Hess *et al.* 2019), which are often the cheapest, most accessible drinks in rural communities, and highlight the important need for clean, safe and refreshing tap water in rural and remote communities.

Many health promotion programs implemented in schools have been successful in increasing the consumption of water and decreasing the consumption of sugary and processed food and beverages. However, the perceptions of many Aboriginal people living in rural and remote communities regarding the quality and safety of tap water, coupled with general distrust of government-led initiatives, can often serve as barriers to the implementation of safe water programs (Jaravani *et al.* 2016). This highlights the need for local governments to engage with local Aboriginal communities to determine the community's perception, availability and use of existing water supplies. Further to this, community-led health promotion activities are needed to increase the availability of safe, clean and refreshing tap water in Aboriginal communities and increase water uptake. One Australian program installed community and school water fountains in Aboriginal communities with limited access to publicly available filtered and refrigerated water (Dimitropoulos *et al.* 2018); when cold drinking water was available, and when teachers verbally encouraged their students to drink it, children drank more water and less SSBs (Dimitropoulos *et al.* 2020).

Data on access to publicly available refrigerated and filtered water in rural and remote communities and the physiological and social health outcomes in these communities are limited. The aim of this study was to determine the availability of filtered, refrigerated drinking water in rural and remote towns and communities NSW in order to inform future health promotion initiatives.

Methods

This cross-sectional study used a database from the ABS (2020) of all suburbs, towns and communities in NSW to identify towns or communities with a population of $<$5000 and an Aboriginal population of $>$3%. This database sourced from the ABS also included weekly household income, population size and the percentage of Aboriginal people in the town's population. All towns and communities that met these criteria were included in this study, and local council or Local Aboriginal Land Council information was sourced to contact representatives from each town or community.

Ethics approval for the study was granted by the New South Wales Aboriginal Health and Medical Research Council (Approval no. 1281/17).

A questionnaire comprising 10 questions was developed for this study (Appendix 1). The questionnaire included questions regarding the availability of potable water in a community and whether potable water was available in homes, businesses and schools, and publicly within the community, and whether this water was refrigerated and/or filtered. The questionnaire also

asked about the number of grocery or convenience stores in the town or community and the availability of and pricing information for various beverages. A question regarding the availability of public transportation to access the grocery or convenience stores was also included in the questionnaire.

Representatives from local councils or Local Aboriginal Land Councils were contacted via telephone to complete the interviewer-assisted questionnaire. In instances where representatives could not be reached via telephone, the questionnaire was emailed and returned completed. All questionnaires were completed between October and December 2019. Responses to the questionnaire, as well as weekly household income, population size and the percentage of Aboriginal people in the town's population, were entered into a Microsoft Excel database. Data were analysed by median weekly household income, population size, the proportion of Aboriginal people in the town and water fountain availability using IBM SPSS Statistics version 25.

Results

Forty-three towns in NSW met the inclusion criteria and were contacted to complete the questionnaire. Of these 43 towns, 33 representatives from local councils or Local Aboriginal Land Councils responded and completed the questionnaire, yielding a 77% response rate. Most towns (52%) were classified as outer regional using the Accessibility and Remoteness Index of Australia (ARIA+) classification index (Hugo Centre for Population and Housing 2020; Table 1).

Twenty-four towns (73%) had community water fountains and 27 towns (89%) had water fountains in schools. Twenty-one towns (64%) had water fountains available in both the wider community and schools. Of the 24 towns with community water fountains, only two (8%) towns had fountains with refrigerated water, and 13 (54%) towns had fountains with filtered water. Of the 27 towns with school water fountains, only four (15%) towns had fountains with refrigerated water and 12 (44%) towns had fountains with filtered water.

Within the study, towns with a higher population of Aboriginal people and lower median weekly income were less likely to have a community or school water fountain (Table 2). Larger communities were more likely to have a water fountain in the community; however, population size was not predictive of the availability of drinking water in schools.

Three towns did not have local grocery or convenience stores, nor did they have public transportation to access the closest store for bottled water. Two of these towns did not have a public community water fountain. Both towns were below the Australian national poverty line and had a large Aboriginal population (25% and 100%).

Table 1. Accessibility Remoteness Index of Australia (ARIA) classification of towns included in this study

ARIA	No. (%) towns
Inner regional	4 (12.5)
Outer regional	17 (53)
Remote	8 (25)
Very remote	3 (9)
Total	32[A] (99.5)

[A]No data available for one town included in study.

Table 2. Characteristics of towns with water fountains available in the wider community or schools

	Water fountain available in wider community		Water fountain available in schools	
	Yes	No	Yes	No
Mean population	1712	1223	1542	2027
Mean Aboriginal population (%)	23	32	29	7
Mean weekly household income (A$)	1005	874	971	534

Discussion

Towns and communities with a higher population of Aboriginal people and lower median weekly income were less likely to have a community or school water fountain. There was no significant effect of population size on the availability of water fountains in schools. Such a concerning finding widens the health inequalities and compounds the socioeconomic disadvantage experienced by Aboriginal people, especially those living in rural and remote communities. Having to purchase cold, safe water poses an additional stressor to community members with low or limited income. The Australian national poverty line is A$457 per week for an individual and A$960 per week for a couple with two children (Davidson *et al*. 2020). Approximately 72% of the towns that participated in this study had a median household weekly income below the national poverty line for a four-person family. Further, the towns without community water fountains had no public transportation available for residents to access the nearest store. A lack of public transport makes accessing and transporting potable water or travelling to the nearest store to purchase water even more challenging. In communities with such limited income, purchasing water can be expensive, increasing reliance on cheaper beverage options, such as SSBs. Health inequality experienced by Aboriginal people in Australia is serious and worsening (Commonwealth of Australia and Department of the Prime Minister and Cabinet 2019). Poor health outcomes for Aboriginal people may be compounded by reliance on SSBs when free, refreshing water is unavailable or inaccessible. The high consumption of SSBs has been linked to detrimental health outcomes, including chronic non-communicable diseases. The results of the present study suggest that the limited availability of refrigerated, filtered drinking water in towns is particularly harmful to low-income Aboriginal families and communities due to the socioeconomic burden of transportation and purchasing water.

Given the concerning results of this study, health promotion initiatives that include the installation of refrigerated and filtered water fountains is urgently needed, especially in towns or communities with lower income levels and higher proportions of Aboriginal people. The availability of filtered and refrigerated water fountains in the community and school does not necessarily lead to higher water consumption. Many variables within the towns themselves can alter the availability of drinking water and the success of implementing health promotion initiatives, including hardness, taste and colour of the water. Even after water goes

through a treatment process, mistrust of government's involvement with public water supplies, particularly among Aboriginal communities (Jaravani *et al.* 2016), can still serve as a barrier. Therefore, community engagement in the planning and implementation of health promotion initiatives to promote water availability and uptake is crucial. Such engagement, involving a range of stakeholders, such as families, community leaders or groups, schools, stores, local governments and policy makers, would also ensure the water fountains are located in appropriate places and that their use and care is endorsed by the community. Recent public debate in Australia about the introduction of a sugar tax has centred on the public health benefits, including obesity and tooth decay (Eykelenboom *et al.* 2019). These debates have paid scant attention to the compounding disadvantage of increasing the cost of SSBs, particularly in communities without community drinking water (Allen and Allen 2020). Free, clean, cold water must be available and accessible to all Australians regardless of income or geographical location before implementing special taxes on SSBs, such as a 'sugar tax'.

A limitation of this study is the potential for reporting biases because the questionnaire relied on self-reported data (Choi and Pak 2005). Furthermore, a large proportion of towns with the highest Aboriginal population (close to 100%) did not respond to telephone calls or emails to complete the questionnaire. Because many of these towns had below-average median weekly household income, the data may be slightly skewed. Further research is needed to assess the availability of refrigerated and filtered water in towns or communities with a 100% Aboriginal population. This study is a cross-sectional study of towns and communities in NSW with a population of <5000 people and a proportion of Aboriginal people of $>3\%$; therefore, is not generalisable across Australia. This would require research into the availability of refrigerated, filtered water across all Australian states and territories.

Conclusion

Towns and communities with a higher population of Aboriginal people and lower median weekly income were less likely to have a community or school water fountain. This widens the health inequalities and compounds the socioeconomic disadvantage experienced by many Aboriginal people, especially those living in rural and remote communities. Future health promotion initiatives to increase the consumption of water and decrease reliance on SSBs, particularly among Aboriginal people, must involve Aboriginal community members and leaders in the planning, implementation and evaluation stages to increase availability and consumption of free, filtered, refrigerated water.

Conflicts of interest

The authors declare no conflicts of interest.

Declaration of funding

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Appendix 1 Questionnaire

1. Do the houses and businesses in [your community] have direct access to drinking water?
2. Are there any public water bubblers in the community (e.g. in parks, sporting areas etc.)?
3. If yes, how many? Are they refrigerated? Filtered?
4. Do the schools in the community have water bubblers?
5. If yes, how many? Are they refrigerated? Filtered?
6. Is there a store (e.g. service station, supermarket) in your community?
7. If no, how far is the closest one (km)?
8. If yes, what is the cheapest beverage sold?
9. What is the price for bottled water?
10. Lastly, is there any public transportation available in [your community] for individuals without private transport to access the community stores?