

PERSONAL VIEW

Five enablers to deliver safe water and effective sewage treatment to remote Indigenous communities in Australia

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ETHICS APPROVAL

This research was a desktop review, so no primary data was gathered and therefore no ethics clearance was required.

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ABSTRACT:

Context: Safe drinking water and effective sanitation in remotely located Indigenous communities are essential services and their provision is a human right. Yet sustainable provision of these services can be challenging. Risks to human health from

inadequate provision include transmission of hygiene-related infections from microbial contamination, and toxic chemicals that may cause kidney damage or dysfunction. This narrative review is conducted in the current context of the United Nations Sustainable Development Goal 6, the 'refresh' of the National Agreement on Closing the Gap in Indigenous inequity, and the 2020 Inquiry of the Australian Productivity Commission into the National Water Reform.

Issues: Challenges to providing drinking water supplies in remote communities include biological contamination and chemical contamination from naturally occurring elements in groundwater. Monitoring regimes can be challenged by remote location, minimal and/or high turnover of staff and a lack of

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FULL ARTICLE:

Context

The provision of clean drinking water and sanitation was recognised as a human right by the United Nations in 2010^{1,2}. However, providing consistently safe drinking water and effective treatment of sewage (sanitation) in remotely located Aboriginal and Torres Strait Islander communities (hereafter respectfully referred to as Indigenous communities) can be challenging. The associated health and equity issues were highlighted in a 2019 statement by the Australian Medical Association³:

Safe drinking water ... is essential for good health and wellbeing ... It is an issue that demands immediate attention and action by all levels of government – without it, the health gap between Aboriginal and Torres Strait Islander people and their non-Indigenous peers will remain wide and intractable.

Through the use of a narrative review, intended to provide a comprehensive coverage of academic and grey literature on the topic⁴, and combined with the authors' recent years of dedicated applied research focused on remote water and sanitation services (2016–2020), this article identifies five key enablers to effectively and sustainably provide the essential water and sanitation services to remote Indigenous communities.

Remote Indigenous communities in Australia

The Aboriginal and Torres Strait Islander population was 727 500 in the 2016 national census, constituting just over 3% of the total Australian population⁵. Of that population, 91% identified as Aboriginal, 5% as Torres Strait Islander and 4.1% as both Aboriginal and Torres Strait Islander⁵. The majority of Indigenous Australians live in urban areas: 20% (148 700) live in remote and very remote areas, in comparison to only 2% of the non-Indigenous population⁶. Indigenous Australians living in remote areas of Australia live in a diversity of settlements, the majority of which are in the Northern Territory, Western Australia, Queensland and South Australia⁷.

Support for living on traditional country

ongoing maintenance. Unpalatable water can shift consumption to purchased drinks such as sugar-sweetened beverages, with flow-on health impacts of diet-related chronic conditions such as overweight and obesity, and type 2 diabetes.

Lessons learned: By analysing two effective programs from remote areas of New South Wales and the Torres Strait Islands in Queensland, Australia, five enablers were identified: people factors (support, training, cultural competence); cross-agency collaboration (regulators, funders, state and local government); technology that is fit for place, purpose and local people; funding that is sufficient and sustainable; and taking a systems view of water and sanitation.

This article is presented with the expectation that Indigenous Australians are entitled and supported to live on country (the land traditionally occupied by distinct Australian Indigenous language and cultural groups)^{8,9}. Country is central to Indigenous Australians as it informs identity, history, responsibilities, respect and cultural practices⁸. Living on country holds significant importance for many Indigenous Australians; previous government policies that resulted in forcible removal of Indigenous peoples from country adversely impacted their spiritual, psychological and physical health¹⁰⁻¹². This may be because if Indigenous people are unable to fulfil their responsibilities to country and it becomes 'sick', the custodians themselves can also become unwell^{13,14}.

Commitment to address water and sanitation

This narrative review was compiled in the context of four key initiatives that include a focus on the need for improved water and sanitation in remote communities. First, the Australian Government is a signatory to the United Nations Sustainable Development Goals (SDGs), particularly SDG 6, to 'ensure availability and sustainable management of water and sanitation for all'¹⁵. In the Australian Government's inaugural Voluntary National Review on progress against the goals, the disparity between urban and remote water and sanitation service access was described under SDG 6¹⁶ (p. 50):

Rural and remote communities ... may not have the same level of access to water and sanitation services as urban centres. This is particularly the case for remote Aboriginal and Torres Strait Islander communities and can have important flow on effects to health outcomes.

Second, the 'refresh' of the National Agreement on Closing the Gap in Indigenous equity specifically identifies a priority of community infrastructure, including 'essential service provision to Aboriginal and Torres Strait Islander communities, including water and sewerage, waste management...' (86b(i))¹⁷. Third, the 2020 Inquiry by the Australian Productivity Commission into the National Water Reform included a dedicated call for input on the links between safe water and human health, especially in remote

communities¹⁸. Finally, the Safe Water Summit held at the University of Queensland in late 2018 brought together Indigenous community residents with researchers, clinicians, government representatives and community organisations to hear from those with lived experience of inadequate or insufficient water and sewage management and to identify options for action¹⁹.

Issues

Challenges for drinking water and sanitation services

Drinking water supplies in remote communities include biological contamination from microbes, chemical contamination from naturally occurring elements in groundwater, and pollution from industrial and agricultural chemicals²⁰. Monitoring regimes in remote areas can be negatively impacted by the remote location and long distance to laboratories for testing, low staff numbers, and a high turnover of on-ground, skilled water and wastewater management staff. The 'hardness' of specific chemicals and minerals can damage appliances associated with health benefits such as taps, kettles and washing machines²⁰.

Sanitation challenges include a lack of ongoing maintenance in wastewater treatment facilities, and wastewater output monitoring regimes lacking rigour and regularity²⁰. A lack of waste bins or regular emptying can result in non-flushable items (eg clothing, nappies, sanitary pads and tampons) being flushed down the toilet. This causes blockages and the risk of damage to treatment plants²⁰.

Human health impacts from water and sanitation

The link between water and sanitation status and human health is well documented. A Productivity Commission report stated that the health of residents requires action to ensure safe drinking water and functional wastewater (sewage) management in many remote Indigenous communities²¹. Insufficient access to these essential services can increase the transmission risk of hygiene-related infections; this has been identified as a contributing factor to preventable hygiene-related skin, eye and diarrhoeal illnesses²²⁻²⁴. If repeated infection occurs in the longer term, chronic diseases of malnutrition, as well as blindness, rheumatic heart disease, renal failure and anaemia, can occur²⁵⁻²⁸. A further risk exists in communities with high naturally occurring chemicals in groundwater sources, which make them unsafe for drinking; of these, cadmium, nitrates and arsenic are known renal toxicants and are risk factors for chronic kidney disease²⁹.

Furthermore, treated groundwater can meet safety guidelines for drinking, but can have an unacceptable taste, odour and colour. This can have implications on consumption, including dehydration and an increase in the consumption of purchased drinks^{25,26}. Indigenous Australians report intake of sugar-sweetened beverages (predominantly as soft drinks) up to 180% higher than non-Indigenous Australians^{30,31}. A high consumption of sugar-sweetened beverages can contribute to high rates of diet-related conditions in Indigenous communities, including dental caries and gum disease, overweight/obesity, type 2 diabetes, cardiovascular

disease and some cancers³². Unpalatable groundwater can also lead to an increased preference for bottled water, impacting on food security, finances and environmental sustainability³³.

Case studies of effective remote water and sanitation service delivery

The following two case studies provide examples of efforts that effectively meet the aims of SDG 6 regarding 'availability and sustainable management of water and sanitation for all'¹⁵. The two cases respond to the Australian Government's stated concern regarding access to water and sanitation services in remote Aboriginal and Torres Strait Islander communities, and the implications of this on health outcomes³⁴.

Case study 1: The NSW Aboriginal Communities Water and Sewerage Program is a partnership between the New South Wales (NSW) Government and the NSW Aboriginal Land Council to support water and sewerage infrastructure operation, maintenance and monitoring to a population of 6000 people living in remote NSW communities³⁵. It is a A\$200 million program for 25 years, and was established in 2008³⁵. A partnership between the NSW Aboriginal Land Council and local council provides financial and technical expertise. Local water utilities implement maintenance, repairs and emergency work³⁵. An initial evaluation has identified that all 61 remote NSW communities have increased and/or improved water and sewage services²⁰.

Case study 2: The Safe and Healthy Drinking Water initiative is a partnership between the Tropical Public Health Services and Water units of Queensland Health with the Indigenous local government, the Torres Strait Islands Regional Council. Also involved are Queensland Government agencies with responsibility for infrastructure and local government^{36,37}. The initiative was developed in response to many remote communities in the outer Torres Strait Islands being exposed to water contaminated with harmful microbes, detected as the presence of *E. coli*. The resulting pilot program included an audit of existing water treatment and appropriateness for use with the available water source, upgrades to drinking water treatment infrastructure, tailored competency training in water monitoring, development of tailored standard operating procedures and resources, promotion of the importance of water management in supporting the health of the community, and onsite and remote mentoring and support to local water operators. The government agency staff received cultural competency training prior to engaging with the communities^{36,37}. Following the pilot, the number of microbial drinking water contamination incidents reduced from 16 incidents in 2016 (pre-pilot) to two incidents in 2018. The evaluation also revealed a greater community awareness of safe drinking water, and an increased recognition and valuing of the uniformed water operators in their communities³⁸. The program has been adapted and introduced to seven Indigenous community water supply systems across the Northern Peninsula Area of the Australian mainland. The training for this expansion has been delivered in part by the Torres Strait Islander water operators from the pilot program^{36,39}.

Enabling aspects to improve remote water and sanitation

Five enabling aspects to improve remote water and sanitation services have been identified by drawing on the authors' research in remote water and sanitation delivery and from an analysis of the two case studies of effective water and sanitation programs, then augmented with relevant additional literature.

- 1. People factors: support, training, cultural competence:** The social infrastructure of water and sanitation services is central to effective outcomes. Key aspects of success have been founded on genuine and authentic engagement of local Indigenous peoples and organisations to identify the core challenges and propose culturally appropriate responses, and to determine the effectiveness of initiatives⁴⁰. Further dimensions of success involve appointing water operators in remote communities from the local Indigenous community and then ensuring they are well supported, have appropriate training on the equipment they operate, and that all external stakeholders engaging with the community have been trained in and achieve cultural awareness and competence. This focus is demonstrated in the Safe and Healthy Drinking Water initiative in the Torres Strait Islands. The Torres Strait Islander staff received tailored technical training, were mentored in a collegial manner by Queensland Health environmental health officers and engaged with partners who had received training in understanding and respecting how to work on traditional Torres Strait country^{36,39}.
- 2. Cross-agency collaboration: regulators, funders, state and local government:** Cross-agency and transparent collaboration of water and sewerage service delivery by relevant organisations can lead to gains in efficiency, skills, understanding and responsibilities. Such collaboration involves participation by government agencies with responsibility for regulation, funding and monitoring, local government and water utilities with responsibility for delivery, and local Indigenous community organisations. Both the NSW Aboriginal Communities' Water and Sewerage Program and the Safe and Healthy Drinking Water initiative display such collaboration^{2,35,37}. In the evaluation of the Torres Strait pilot, the government collaborators described the benefits of this collaboration, and noted that establishing a common vision and ensuring information exchange were essential to providing an effective service³⁹.
- 3. Technologies that are fit for place, purpose and local people:** Government agencies and water utilities are increasingly identifying that a 'one size fits all' approach to remote water and sewage treatment cannot adequately address the diversity of water sources and other challenges. Evaluations of water treatment efforts in remote communities have previously identified compromised and/or inappropriate infrastructure. For example, chlorine pumps may not be sufficiently large or regularly serviced for the required treatment. This can result in pump failures and inaccurate chlorine dosing³⁹. More advanced technologies may be difficult to repair and operate or not sufficiently robust for locations with climatic extremes²⁹. Instead, water and sewage treatment technologies that are 'fit for place, purpose and people' can be more appropriate and sustainable for each community⁴¹. An example is provided by the Safe and Healthy Drinking Water initiative. This initiative evaluated the existing water treatment technology against the water source and contamination risks on each island. Following the evaluation, technology was upgraded or

installed, with local water operators engaged at each stage. Training was delivered to the water operators onsite, with ongoing support provided by phone and in person³⁷.

4. **Funding that is sufficient and sustainable:** Water and sewage treatment requires funding for both the capital expenditure for treatment technology as well as long-term funding for repairs, maintenance and staff support. In Queensland, the 16 Indigenous councils are responsible for managing and delivering a range of essential services for energy, water and health, yet the state legislation prohibits rates to be raised on Indigenous land held in trust^{42,43}. Without a rates base, Queensland Indigenous councils such as Torres Strait Islands Regional Council rely on sporadic government grants³⁹. A contrasting situation is the recent commitment by the Western Australian Government of to an A\$38.9 million WA Recovery Plan to upgrade, deliver and maintain water and sewerage services in four Indigenous communities⁴⁴.
5. **Taking a systems view of water and sanitation:** The regulatory requirements of safe water and sewerage services are often only detailed to the property boundary. Monitoring occurs at this property boundary, yet health outcomes can be affected by additional behaviours and activities within a property or household, such as the installation of water tanks. Furthermore, the physical setting beyond the property boundary is important to consider as the treatment technologies may be unintentionally impacted, such as animal interaction with the water source. A systems view of water and sewerage services can provide a more holistic perspective to coordinate prevention, planning and evaluation approaches by responsible agencies and organisations^{45,46}. An example of this systems approach can be viewed in the Safe and Healthy Drinking Water initiative.

Before the initiative, regular stoppages in mains water delivery had prompted residents to install water tanks to ensure water for later consumption. However, this storage was unmonitored and untreated, thus increasing the risk of consumption of microbe-contaminated water. Outside of the property boundary, a treated water storage pond was installed. However, this pond subsequently attracted migratory birds, which roosted on the pond covers and their faeces contaminated the source water. The Safe and Healthy Drinking Water initiative has examined the broader 'system' of water collection, treatment, delivery and ultimate consumption to prevent further unintended contamination^{36,39}.

Lessons learned

Indigenous Australians seeking to live on their traditional country hold a human right to clean drinking water and sanitation. However, these essential services are not always provided in a safe and sustainable manner in remote communities and can thus expose residents to potential negative health impacts in terms of acute infections and chronic diseases. This review was conducted to identify issues for future analysis and reveals the extent of the current risks to residents from a lack of services, as well as current initiatives to improve the situation. Analysis of the situation reveals five achievable changes that can enable improved remote water and sanitation services: support for the 'people factors'; collaboration between agencies; technology that is fit for place, purpose and local people; sufficient and sustainable funding; and understanding water and sanitation within a systems perspective to avoid unintended negative consequences. Ideally, this is achieved by the current agencies responsible in collaboration with local community representatives and with sufficient funding and timelines to create this long-term system change.

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