Received: 19 May 2023 | Revised: 20 July 2023 | Accepted: 22 August 2023

DOI: 10.1111/ajr.13037

AJRH National Rural Health Alliance WILEY

ORIGINAL RESEARCH

Costs and benefits of community water fluoridation in remote Aboriginal communities of the Northern Territory

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Abstract

Objective: To undertake an economic evaluation of community water fluoridation (CWF) in remote communities of the Northern Territory (NT).

Design: Dental caries experiences were compared between CWF and non-CWF communities before and after intervention. Costs and benefits of CWF are ascertained from the health sector perspective using water quality, accounting, oral health, dental care and hospitalisation datasets.

Setting and Participants: Remote Aboriginal population in the NT between 1 January 2008 and 31 December 2020.

Intervention: CWF.

Main Outcome Measures: Potential economic benefits were estimated by changes in caries scores valued at the NT average dental service costs.

Results: Given the total 20-year life span of a fluoridation plant ($1.77 million), the net present benefit of introducing CWF in a typical community of 300–499 population was $3.79 million. For each $1 invested in CWF by government, the estimated long-term economic value of savings to health services ranged from $1.1 (population ≤300) to $16 (population ≥2000) due to reductions in treating dental caries and associated hospitalisations. The payback period ranged from 15 years (population ≤300) to 2.2 years (population ≥2000).

Conclusions: The economic benefits of expanding CWF in remote Aboriginal communities of NT outweigh the costs of installation, operation and maintenance of fluoridation plants over the lifespan of CWF infrastructure for population of 300 or more.

KEYWORDS

cost–benefit analysis, dental caries, environmental health, rural and remote health, water fluoridation

1 | INTRODUCTION

Community water fluoridation (CWF) is a cost-effective and socially equitable public health intervention to reduce the prevalence and severity of dental caries (tooth decay), endorsed by the World Health Organisation and the National Health and Medical Research Council (NHMRC).[1,2] NHMRC recommends optimal fluoride concentrations 0.6–1.1 mg/L. Yet, the benefits of CWF have not been made available to many parts of the Australian population that experience high levels of dental caries. Aboriginal and Torres Strait Islander (respectfully referred to as Aboriginal hereafter) peoples in the Northern Territory (NT) experience some of the highest prevalence and severity of dental caries and socioeconomic disadvantage in Australia.[3,4] The NT is the most remote jurisdiction in Australia (see map in Figure S1), occupying 18% of the continent with only 1% of the Australian population, but with the highest proportion of Aboriginal people (26.3% in 2021 compared with the Australian average of 3.2%).[5] In 2017, the NHMRC estimated that 89% of the Australian population had access to adequately fluoridated drinking water.[6] By contrast, 65% of the remote NT Aboriginal population now still access drinking water with <0.3 mg/L fluoride.[7] Government-funded CWF currently occurs in Darwin (introduced in 1971). CWF was introduced in Katherine in 2013 together with five remote communities: Angurugu, Maningrida, Umbakumba, Wadeye and Nguiu.[8,9] Most remote communities in the NT do not receive CWF. The NT Government manages drinking water in 72 remote communities and 15 outstations, overseen by the Power and Water Corporation (PWC) and Indigenous Essential Services. The majority of NT remote Aboriginal communities have a population <1000.[8] Aboriginal people in the NT remote communities experience twice the national average burden of dental caries, with lower dentist visits and higher levels of untreated dental disease.[10,11] In Australia, dental care is mainly funded privately (79%). In remote areas where there are very few private dentists (<1%), the NT Department of Health (DOH) provides oral health services to these communities. Unlike other Australian states and territories, CWF is not regulated in the NT. Universal child health programs and targeted oral health programs in NT incorporated topical application of fluoride to children's teeth, but overall have been limited in ongoing reach and effectiveness at a population level.[12]

Feasibility and costs of CWF have been assessed previously in remote NT,[13] although costings of CWF were based on large scale CWF in urban areas.[14] Previous modelling suggests that cost-effectiveness of CWF can be significant for populations >1000 people, with up to 60% improvement in oral health gains, but not for smaller populations under this threshold.[14,15] Cost–benefit studies provide important information for the allocation of public resources, especially in rural and remote areas where health needs and infrastructure costs can be high. Economic analysis also allows costs and benefits to be considered across multiple sectors, which is important as CWF implementation involves multiple agencies within Government. CWF is an important public health strategy with proven effectiveness in improving oral health outcomes.[14] Two previous unpublished studies investigated costs and benefits of CWF in NT. In 2000, DOH evaluated the costs and benefits of CWF. The study found that the payback period at which health system savings exceeded upfront capital investment was 12 years, with a net present value of $94 469 and internal rate of return of 9.6%. A subsequent 2008 cost–benefit analysis of CWF in the NT determined that the introduction of CWF to remote communities of 600 or more people where natural fluoride concentration <0.5 mg/L was still cost-effective in terms of saving public resources through reduced disease.[16] These findings informed the current policy position of DOH on CWF.

Previous economic analyses were largely based on Oral Health expenditure by DOH and patient travel cost was not properly remunerated.[16] Due to poor access to oral health, dentist services and higher patient travel costs in the NT, the potential benefits are likely to be underestimated by using Oral Health expenditure data. Dental caries treatments will be saved if CWF is extended to other communities with fluoride level <0.6 mg/L. Dental caries is linked to other dental and chronic diseases in later life, causing enormous health costs.[17–20] Poor oral health also shares environmental, behavioural (particularly sugar

What is already known on this subject?

- Community water fluoridation is cost-effective for preventing dental caries for large remote communities.
- The majority of remote Aboriginal population in the NT now still access drinking water with <0.3 mg/L fluoride.

What does this paper add?

- This study evaluates costs and benefits of community water fluoridation for small remote communities by using real-world intervention data.
- The economic benefits of expanding community water fluoridation in remote Aboriginal communities with a population over 300 outweigh the costs of water fluoridation.

consumption) and socio-economic risk factors with many preventable chronic diseases.[21] Since the 2008 analysis,[16] reductions in rates of dental caries in some NT child populations have been observed.[12] It is unclear if the current CWF is associated with the dental caries reduction and if expanding CWF into more remote Aboriginal communities is still cost beneficial in the current NT context. This study aimed to provide a current economic cost–benefit analysis on extending CWF coverage in remote communities of NT. In doing so, findings of an updated cost–benefit analysis may inform an updated policy position on investment in CWF in NT. CWF is a crucial part of safe and quality water supplies to remote communities supported by Aboriginal Community Controlled Health Organisations,[22] which is important to minimising the impact of racism, colonisation and socio-economic disadvantage experienced by Aboriginal people in the NT.

2 | METHODS

We described CWF health impacts using historical oral health data collected between 2008 and 2020. Caries experience data were gathered from the DOH oral health patient information system (Titanium). The study included all children aged 1–17 years during 2008 to 2020. DOH is the sole provider of oral health services to remote and very remote communities in the NT and the Titanium system was the best source of caries experience data for remote communities over the timeframe. Caries experience was measured in accordance with the dmft/DMFT score, indicating the sum of decayed (d/D), missing (m/M) and filled (f/F) teeth in deciduous and permanent teeth respectively. Dental caries reduction was estimated by birth cohort analysis to compare mean dmft/DMFT scores of children born in the same year and same community before and after CWF introduction. Data were stratified and compared for three groups: (1) communities without CWF and levels of naturally occurring fluoride <0.6 mg/L, (2) communities with CWF implemented in 2013 and (3) communities with naturally fluoridated water supplies (≥0.6 mg/L) (see the three groups in the map in Figure S1. Basic characteristics of the three community groups are shown in Table S1). Figure 1 illustrates the process of the cost-benefit analysis. Difference-in-difference (DiD) comparison was used with two control groups (Groups 1 and 3) by comparing outcome measures before and after 2013 for Group 2 in parallel with the same measures for Groups 1 and 3 to eliminate the non-CWF effect (such as topical and adjunctive fluoride supplements applied for all populations) and statistical noise.[23]

Costs and benefits were assessed from the health sector perspective by comparing the costs of CWF (implementation and maintenance) and the potential value of dental

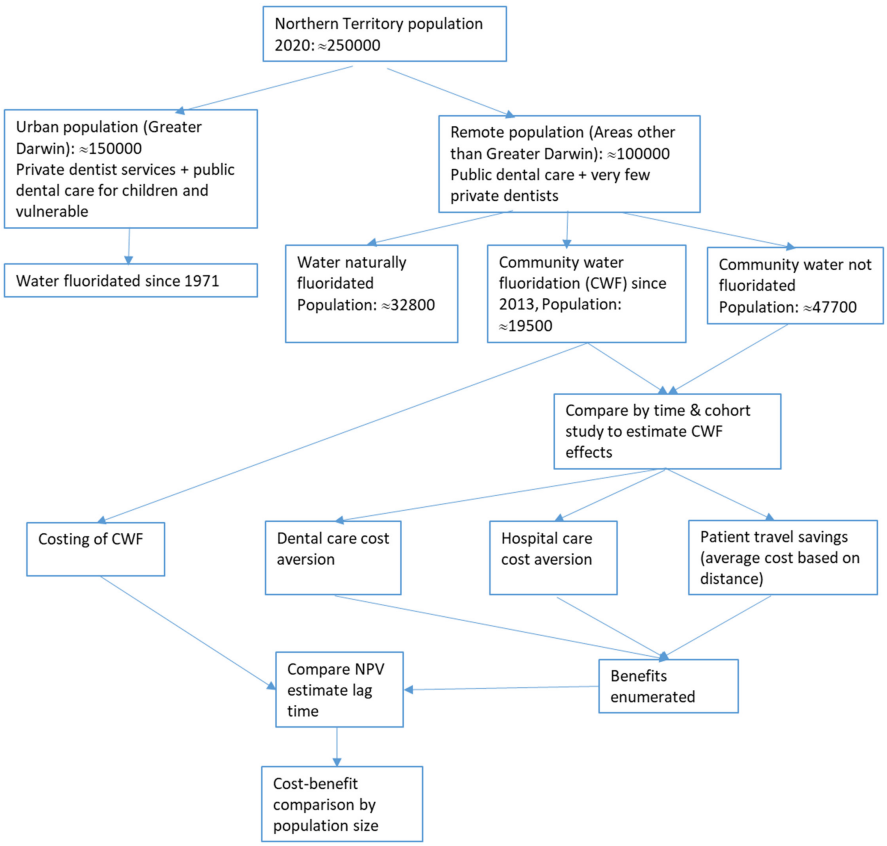

FIGURE 1 Framework of cost–benefit analysis of community water fluoridation in remote Aboriginal communities, Northern Territory.

caries treatments averted. The health sector perspective was used for costing, because dental care, hospitalisation and patient travel are currently delivered and paid by the Government for remote Aboriginal residents in the NT. Both costs and benefits were evaluated in 2021 Australian dollars ($).[24] The analysis was categorised by population size (<300, 300–499, 500–999, 1000–1999 and ≥2000) to investigate the effect of economy of scale on the cost–benefit outcome.[15]

Costs and benefits data were collated using PWC and DOH expenditure from 2016/17 to 2020/21. Past and future costs and benefits were adjusted by using the national consumer price index (average general inflation 2.1% and health inflation 3.4%) up to a 20-year lifetime horizon.[25] The costs of CWF were modelled using current operational expenses and procurement contracts provided by PWC for existing plants. Assumptions about ongoing maintenance costs were based on the requirements specified by the New South Wales and Queensland codes of practice for water fluoridation (whichever was the more costly of the two).[26,27] We assumed a water demand upper quartile of 1.9 mL/day for an average remote community and NT personnel costs incorporating current salary levels and standard pay progression (2.5%). We utilised the Hunter Water Australia cost assessment method using a sodium fluoride 25 kg saturator configuration, which was suitable for all NT remote communities.[28] We estimated travel distances to Darwin or Alice Springs (whichever was closer). Travel costs were based on a return trip, by multiplying the distance with an average taxi fare ($2 per kilometre) as a benchmark. PWC staff validated all cost estimates based on industry expertise.

The potential health gains were based on the actual reduction in dental caries observed for children arising from the introduction of CWF to remote communities. Dental treatment costs were estimated by following a standard methodology of estimating the benefits using the schedule fee published by the Australian Dental Association for average cost of two surface restorations of $397 plus travel costs ($474 on average based on the return trip from each community to nearest hospital).[15,29] Dental caries related preventable hospitalisations were identified by Australian Refined Diagnosis Related Groups code D40Z (Dental extractions and restorations) and cost at $4839 per hospitalisation (National Hospital Cost Data Collection Round 24)[30] plus travel costs.

Net present benefits (NPB) are defined as the costs averted in dental treatments attributable to CWF, less CWF costs. Costs and benefits were compared by the benefit–cost ratio (BCR) and NPB, together with application of payback period and break-even point. BCR was measured by annual CWF health benefits per person divided by the annual CWF costs per person. Sensitivity analysis was undertaken to assess uncertainty of the economic evaluation as well as one-way testing of the discounting rates assumed. We received ethics approval from the Human Research Ethics Committee of the NT Department of Health and Menzies School of Health Research (2021-3988) including Aboriginal Ethics Sub-Committee to safeguard this project.

3 | RESULTS

The cost of CWF plant installation and maintenance is high in NT remote communities. It is estimated that the total cost to implement a dosing plant using 25 kg sodium fluoride bags amounted to $710 021 (Table 1) in the first year of implementation, including annual operation ($56 451) and maintenance ($22 487) costs. The total life cycle cost of a fluoridation plant amounted to $1.77 million over an expected 20-year infrastructure lifespan in 2021 dollars.

Between 2008 and 2020, a total of 91 044 visits by DOH dental practitioners were recorded for 27 979 remote residents aged 1–17 years at the time of visit (0.36 visits per person, per year), of whom 67% (18 705) were Aboriginal

TABLE 1 Fluoridation plant, operational and maintenance cost estimates, remote communities, Northern Territory, 2021.

	Costs
Items	
Develop risk management	$6667
Design of package plants	$99628
Documentation	$9926
Package plant equipment and fit-out	$296 424
Building site civil works	$100 000
Factory testing	$42 011
Package plant delivery to site	$9926
Site commissioning, inspections and testing	$42 531
Site training	$23 970
Fluoridation plant	**$631 083**
Transport	$2213
Personnel costs of daily water treatment	$22 839
Supplies (including chemicals)	$6820
Daily monitoring and laboratory costs, safety measures	$11 477
Power & water cost	$13 102
Operational annual total	**$56 451**
Repairs and spare parts	$22 487
Maintenance annual total	**$22 487**
First year total costs	**$710 021**

Note: Boldface indicates total.

and 46% (12 872) lived in non-fluoridated areas with 0.53 oral health visits per person annually.

Figure 2 shows the mean dmft/DMFT score for children aged 1–17 years by community groups for each year before and after CWF. There was a clear and significant reduction ($p < 0.01$) over the study period in mean dmft/DMFT score for the group that received the CWF intervention in 2013. The lag effect of CWF was likely 1 year (Figure 2). Mean dmft/DMFT was further analysed by birth cohorts (children born in the same year) to control for the effects of differential caries experience with age.

The dmft/DMFT was higher for the cohort that did not receive CWF (Group 1 in Figure 3). There was a clear decrease in mean dmft/DMFT scores for Group 2 that received the CWF intervention in comparison with Group 1, between the pre-2013 and post-2013 periods aligning with the introduction of CWF. This same effect was not observed for Group 3. There was a 7% annual reduction in mean dmft/DMFT after intervention for the CWF group, taking into account age and time trends in non-intervention groups. The annual reduction in dental caries related hospitalisations in the CWF group between the pre and post intervention periods was 10% (Table 2).

Over the 20-year lifespan of a CWF plant, the average annual CWF cost per person ranged from $37 for large communities with a population ≥2000 to $552 for small communities with a population <300 people (Table 3). Given the total costs of a fluoridation plant ($1.77 million) over the expected 20 year infrastructure lifespan, the NPB in a typical remote community with 300–499 population was $2.02 million over 20 years with a BCR of 2.1 and a payback period of 4.1 years. Large remote communities with ≥2000 population had a NPB of $26.63 million with a BCR of 16.0 and payback period of 2.2 years. For each $1 invested, the benefits to health services ranged from $1.1 (population ≤300) to $16 (population ≥2000), arising from diverting direct costs of dental caries treatment (Table 3). One-way testing of the discounting rates by altering both health and general inflation from 2.1% (general inflation) to 3.4% (health inflation) did not change our conclusions, which indicated the cost of a fluoridation plant grew to $2.09 million with slightly increased benefits and BCR remained above unity (BCR = 1.8 for 300–499 population group).

4 | DISCUSSION

Our CWF cost for remote communities with population 2000 or more was estimated at $37 per person, in line with key literature.[15] Our CWF per-capita costs for small communities with population <2000 ranged from $74 to $552, 2–15 times higher than the costs in larger communities on a per-capita basis. However, due to high levels of dental caries and high costs associated with providing dental services in remote communities, our economic analysis found that CWF is cost beneficial for small remote communities with low natural fluoride levels (<0.6 mg/L) and resident populations of 300 people. From the health care perspective, the economic value of averted dental disease in remote communities of the NT exceeds the costs to government for infrastructure installation, service operation and maintenance of small-scale fluoridation plants over a 20 year life cycle, even in small communities. These findings are comparable with results from previous studies undertaken in the NT.[13,16]

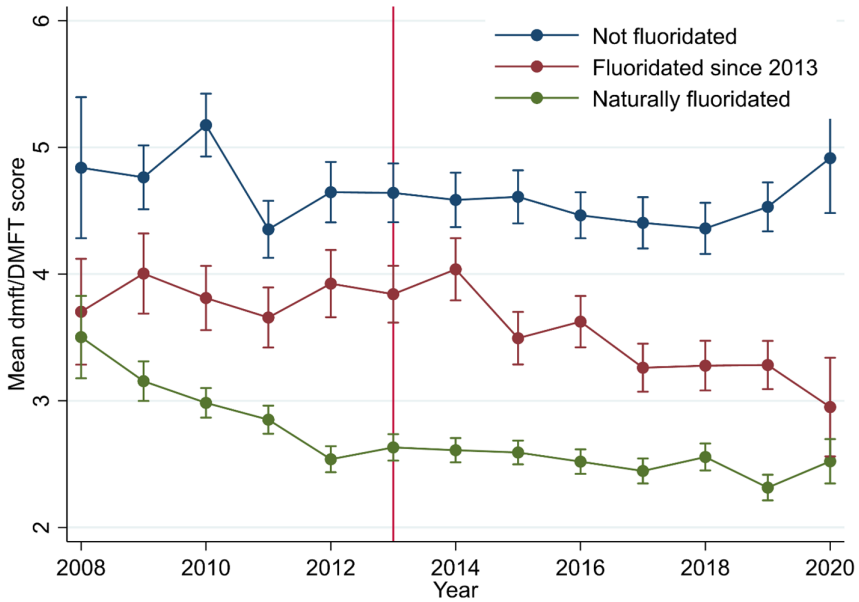

FIGURE 2 Mean dmft/DMFT with 95% confidence interval by community groups before and after intervention (Group 1 = Not fluoridated, Group 2 = Fluoridated since 2013, Group 3 = Naturally fluoridated; Red vertical line = Community water fluoridation), remote children aged 1–17 years, Northern Territory, 2008–2020.

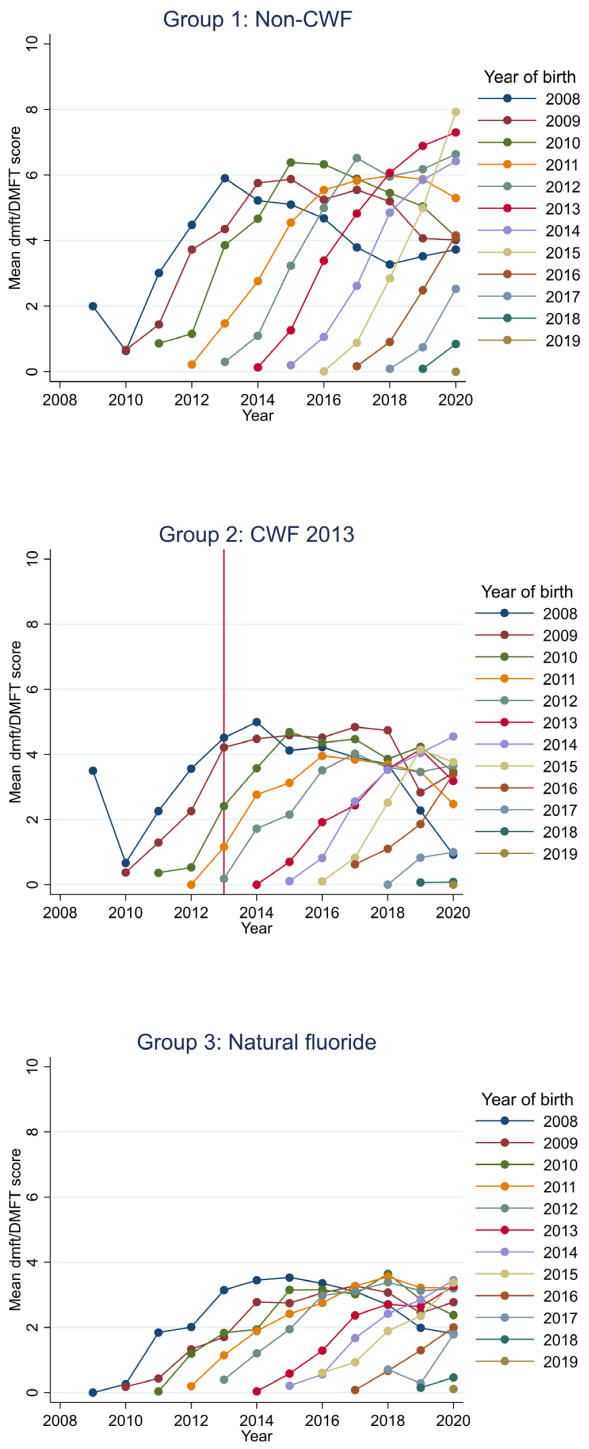

FIGURE 3 Mean dmft/DMFT by birth cohorts for community groups (CWF = Community water fluoridation, Group 1 = Non-CWF, Group 2 = CWF since 2013, Group 3 = Naturally fluoridated; Red vertical line = CWF), remote children aged 1–17 years, Northern Territory Australia, 2008–2020.

In small remote communities of NT, CWF is still cost-effective with a BCR 1.1 and NPB of $0.12 million over a 20-year horizon. Our data indicated that CWF was associated with a 7% reduction in dental caries and a 10% reduction in dental caries related preventable hospitalisations within 1 year of the CWF intervention. The degree of remoteness, economies of scale and inflation do not appear to significantly shift the BCR of CWF, as they are largely cancelled out between the numerator of benefits and denominator of costs when the benefits are measured by savings in remote oral health services and hospitalisations. The finding that BCR increases with population size suggests that CWF infrastructure expansion would have maximum effectiveness if prioritised to larger remote communities in the first instance. The payback period of 2.2 years for larger communities (≥2000 population) demonstrates that economic benefits of CWF could occur within a single policy cycle or term of government. Thus, a scalable approach may be appropriate for implementing CWF in larger communities with low levels of natural fluoride in water supplies initially, with gradual rollout to all communities with public water supplies, except those with natural fluoride levels in drinking water within the optimal range. NT Aboriginal Community Controlled Health Organisations have supported this approach.[22] CWF in the NT is a whole of government issue. Essential services, including infrastructure, for people living in remote communities are managed by the NT Department of Territory Families, Housing and Communities. Drinking water is managed for the 72 remote and very remote communities through an interagency agreement with Indigenous Essential Services, with water quality oversighted by the PWC.[8]

This study compared remote communities with and without CWF, before and after CWF introduction, based on the current data available on dental caries, dentist service costs, historical water fluoride levels, costs of CWF, remoteness and service-related expenditure. This analysis updates previous research and provides strong economic grounds for the continued public provision of CWF in remote Aboriginal communities. This study adds valuable literature to existing national and international economic evaluation research on CWF for small population in remote settings.

The limitations of this study should also be noted. Firstly, the benefits were valued at the cost aversion on the assumption we provide dentist services for treating dental caries (extractions and restorations) at the national standard price and cost. This is a limited assessment. The actual benefits of dental caries prevention extend far beyond dental caries treatments ranging from reducing other oral disease (such as periodontitis and gingivitis)[31] to reducing the related impacts of other chronic diseases (such as rheumatic heart disease and diabetes).[19,20] Multiple diseases are indirectly linked with dental caries through periodontitis, such as hypertension,[32] renal disease,[33]

TABLE 2 Hospitalisations and rate per 1000 population (in parenthesis) for dental extractions and restorations by community groups.

Year[a]	Group 1	Group 2	Group 3	Darwin	Northern Territory
2008	288 (6.3)	5 (0.3)	111 (3.5)	125 (1.0)	529 (2.4)
2009	249 (5.4)	26 (1.4)	103 (3.2)	103 (0.8)	481 (2.1)
2010	265 (5.7)	19 (1.0)	95 (3.0)	159 (1.2)	538 (2.3)
2011	294 (6.2)	5 (0.3)	115 (3.5)	122 (0.9)	536 (2.3)
2012	193 (4.1)	19 (1.0)	70 (2.2)	124 (0.9)	406 (1.7)
2013	280 (5.9)	12 (0.6)	57 (1.8)	168 (1.2)	517 (2.1)
2014	225 (4.8)	13 (0.7)	103 (3.2)	144 (1.0)	485 (2.0)
2015	200 (4.3)	7 (0.4)	95 (3.0)	131 (0.9)	433 (1.8)
2016	254 (5.6)	1 (0.1)	177 (5.6)	123 (0.8)	555 (2.3)
2017	193 (4.2)	5 (0.3)	148 (4.7)	134 (0.9)	480 (1.9)
2018	233 (5.1)	5 (0.3)	124 (3.9)	129 (0.9)	491 (2.0)
2019	276 (6.0)	8 (0.4)	105 (3.3)	100 (0.7)	489 (2.0)
2020	203 (4.5)	4 (0.2)	88 (2.8)	74 (0.5)	369 (1.5)
Total	3153 (5.2)	129 (0.5)	1391 (3.4)	1636 (0.9)	6309 (2.0)

Abbreviations: CWF, Community water fluoridation; Group 1, Non-CWF; Group 2, CWF since 2013; Group 3, Naturally fluoridated.

[a] Population was estimated using Indigenous profile for census years.

TABLE 3 Comparison between costs and benefits of water fluoridation by population numbers for remote communities, Northern Territory, 2021.

		Benefit				
Population size	**Costs**	**<300**	**300–499**	**500–999**	**1000–1999**	**≥2000**
Number of communities		36	10	18	5	3
Total 20 year benefits (million)	$1.77	$1.89	$3.79	$7.10	$14.20	$28.40
Average annual cost per person		$552	$276	$147	$74	$37
Benefit–cost ratio		1.1	2.1	4.0	8.0	16.0
NPB in 2021 price (million)		$0.12	$2.02	$5.33	$12.43	$26.63
Payback period		15.0	4.1	2.8	2.4	2.2
Break-even point (million)		$1.46	$0.54	$0.45	$0.41	$0.40
Internal rate of return		−8%	49%	121%	274%	582%

Abbreviations: CWF, Community water fluoridation; NPB, Net present benefit.

stroke,[34] ischaemic heart disease,[35] chronic obstructive pulmonary disease[36] and five types of cancers.[37] It is likely the actual benefits are much greater than the current estimates. The indirect benefits of dental caries prevention in productivity gains (time off school or work) and reduced pain and suffering by mitigating the negative effects of dental caries were also excluded in this study. Secondly, our analysis was confined to NT Government (DOH and PWC) datasets and service costs. We did not have access to private sector oral health data. However, the majority of the private dental workforce is located in the town of Darwin, not the remote and very remote communities. The cost estimate of travel was likely an underestimate of the true cost, as island communities and some inland remote communities during the wet season are only accessible via plane (DOH data indicated air-travel cost was $12.1 per kilometre, five times more expensive). The underestimation of travel costs more likely leads to a conservative measure of benefits, while both benefit and cost estimation are subject to travel. During time of high inflation (e.g. the post-Covid period), discounting may be influential to the remuneration of CWF costs, but also to the benefits. The BCR should be relatively stable, as the benefits were derived using the costs of providing dentist and hospital services for remote areas. Thirdly, our study did not quantify the impacts of topical and adjunctive fluoride supplements (such as toothpaste, mouthrinse, professionally applied gels, foams or fluoride varnish). Current fluoride varnish programs in NT are limited in their reach and effectiveness for the prevention of dental caries and

have not consistently reached individuals within therapeutically appropriate intervals.[12,38] Programs for regular application of topical fluoride in children at high risk of dental caries should continue to occur as part of current developmental screening and preventive services, irrespective of CWF. Additionally, like previous studies, this study did not consider impacts of potential dental fluorosis, which is a cosmetic condition caused by overexposure to high fluoride levels (>1 mg/L) during tooth formation. The water purification and filtration processes may serve as a defluoridation process adjusting fluoride and other mineral levels which minimise the likelihood of overexposure.[2] Defluoridation cost is not considered because the prevalence of definitive dental fluorosis is very low (<1%) in Australia.[39] Perhaps more importantly, this study used statistical association rather than causation, derived from observational data rather than randomised clinical trials. DiD is a quasi-experimental design, representing a feasible way to learn about causation.[23] However, the purpose of this study was not causal inference but cost–benefit analysis. A future study designed to further investigate lag effects and confounders of CWF using multivariate DiD design seems warranted. Finally, this study utilised codes of practice from other states for costing CWF, which were consistent with current management in NT. Developing a similar regulatory framework, with a detailed code of practice tailored for the NT context, would assist the implementation of expanded CWF. CWF in remote community will pay itself in a long run, as proper management of fluoride level will lead to reduction of rotten teeth, which further lead to less demand for dental care and patient travel and reduction in health care costs. The paper quantifies the oral health benefits, which does not mean a reduction in dental services in the NT remote areas as currently they are far below the national average (0.4 visits in this study compared with the average of ≈2 visits per dentate person nationally).[3]

Two important implications arise from this research: Firstly, economic benefits of CWF clearly outweigh CWF costs in remote and very remote settings where both water supply and health care are provided publicly. In the long run, one dollar invested in CWF can generate an average of $4 savings in oral health (ranging from $1.1 in communities with a population <300 people to $16 for communities with a population over 2000). Prioritising CWF for large communities is likely to produce favourable return on investment potentially within a single policy cycle or government term. There is good justification to extend CWF coverage to include small communities with public water and health care provision, given the substantial health disparities and inequalities in access to dental care.[15] Secondly, there is also an equity imperative across governments to systemically monitor the quality of public water supplies in remote and very remote communities to improve drinking water quality and close the gap in living standards between Aboriginal and non-Aboriginal peoples.[40]

CWF in the NT is not legislated. Effective CWF legislative and regulatory frameworks could be considered for development and implementation to achieve the potential savings illuminated by this study. Importantly, this framework would underpin a whole-of-government approach to optimising the value of CWF by balancing economic, public health, occupational safety and environmental aspects of CWF across government agencies.[34] The findings of this study may inform an updated whole of NT Government policy position on CWF and may potentially inform legislative and regulatory reforms to expand CWF coverage, reduce tooth caries and improve population health in remote Aboriginal communities.

AUTHOR CONTRIBUTIONS

Yuejen Zhao: Conceptualization; methodology; investigation; data curation; validation; supervision; formal analysis; writing – original draft; writing – review and editing. **Kate Raymond:** Conceptualization; data curation; investigation; supervision; writing – original draft; writing – review and editing; validation. **Ramakrishna Chondur:** Data curation; methodology; investigation; writing – original draft; writing – review and editing. **Wayne Sharp:** Data curation; investigation; validation; visualization; writing – original draft; writing – review and editing. **Elizabeth Gadd:** Visualization; supervision; writing – review and editing; writing – original draft; project administration; data curation. **Ross Bailie:** Conceptualization; writing – review and editing; writing – original draft; validation; methodology. **John Skinner:** Investigation; conceptualization; validation; writing – original draft; writing – review and editing. **Paul Burgess:** Writing – original draft; writing – review and editing; supervision; conceptualization; funding acquisition.

ACKNOWLEDGEMENTS

Northern Territory Department of Health initiated and sponsored this project.

FUNDING INFORMATION

No funding was received for this manuscript.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

ETHICS STATEMENT

We received ethics approval from the NT Department of Health and Menzies School of Health Research Human Research Ethics Committee (2021-3988).

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

How to cite this article: Zhao Y, Raymond K, Chondur R, Sharp W, Gadd E, Bailie R, et al. Costs and benefits of community water fluoridation in remote Aboriginal communities of the Northern Territory. Aust J Rural Health. 2023;31:1017–1026. https://doi.org/10.1111/ajr.13037