https://pubmed.ncbi.nlm.nih.gov/39318180/

Chondur R, Raymond KJ, Zhao Y, Bailie R, Burgess P.

# Effects of community water fluoridation on child dental caries in remote Northern Territory, Australia: a difference-in-difference analysis.

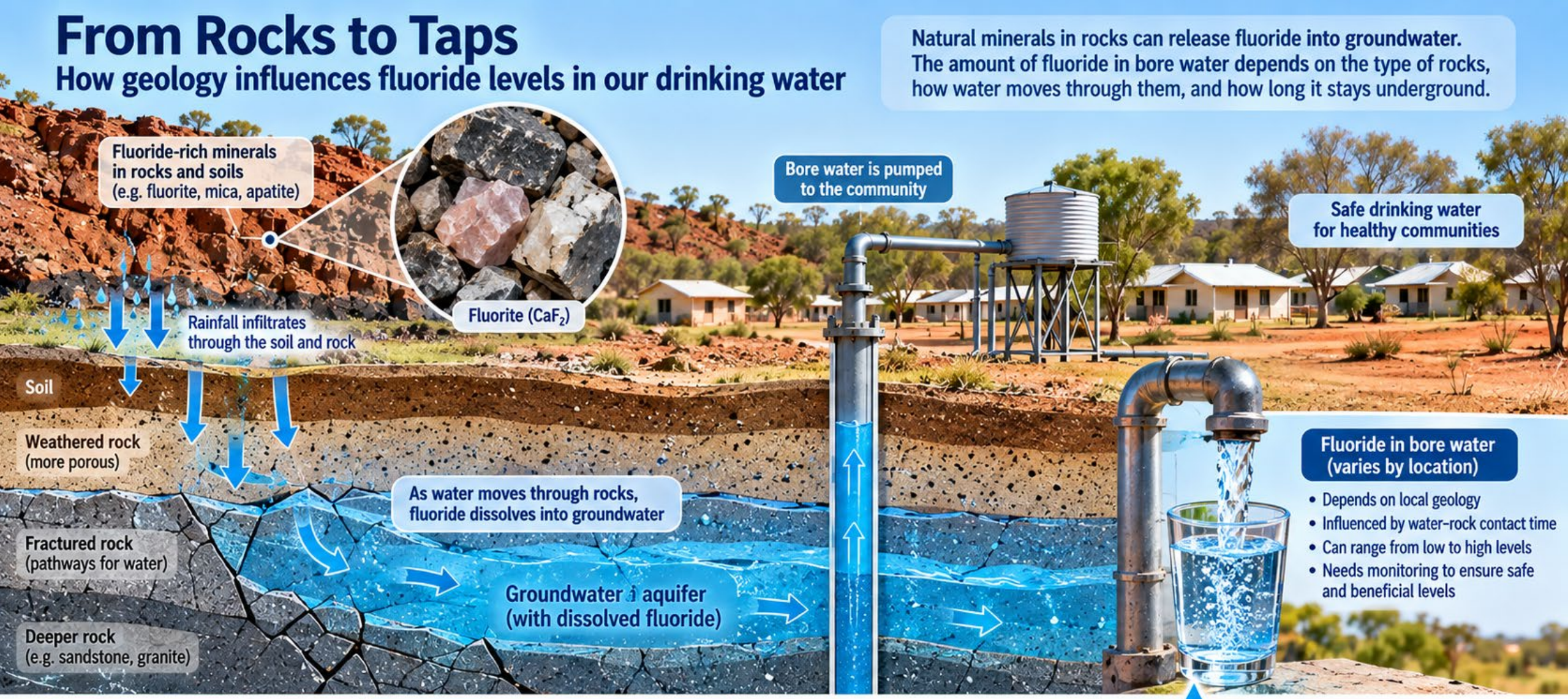
**Published in Rural Remote Health. 2024.**

The aim of this project is to understand long-term impact of community drinking water fluoridation on dental caries in remote communities of Northern Territory.

# From Rocks to Taps

## How geology influences fluoride levels in our drinking water

Natural minerals in rocks can release fluoride into groundwater. The amount of fluoride in bore water depends on the type of rocks, how water moves through them, and how long it stays underground.




### Fluoride in bore water (varies by location)

- Depends on local geology
- Influenced by water-rock contact time
- Can range from low to high levels
- Needs monitoring to ensure safe and beneficial levels

### Geology

Type of rocks and minerals influence fluoride availability

### Groundwater

Water dissolves fluoride as it moves through rocks

### Community

Bore water supplies homes, schools and community facilities

**Appropiate fluoride levels in drinking water help protect against dental caries and support healthier communities.**

**Healthy geology. Safe water. Stronger communities.**

World Health Organization

# Fluoride in Drinking Water

Safer Water. Healthier Smiles. Stronger Communities.

## Helps prevent dental caries

Fluoride strengthens tooth enamel and reduces tooth decay, especially in children.

## Safe at recommended levels

Fluoride in drinking water is safe when kept within WHO guideline value.

## Healthier communities

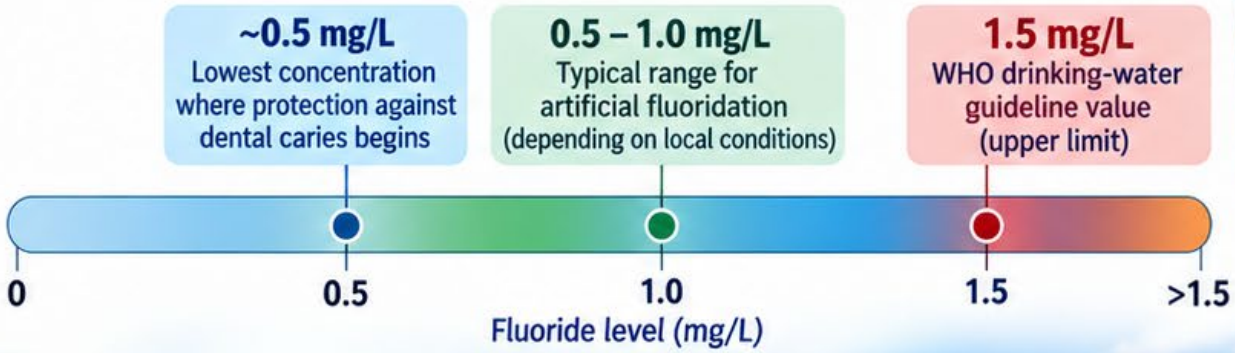
Fluoridated drinking water supports better oral health and reduces the burden of dental disease.

## WHO Guidance on Fluoride in Drinking Water

**~0.5 mg/L**
Lowest concentration where protection against dental caries begins

**0.5 – 1.0 mg/L**
Typical range for artificial fluoridation (depending on local conditions)

**1.5 mg/L**
WHO drinking-water guideline value (upper limit)







*Fluoride for healthier tomorrows*

**Appropriate fluoride levels lead to stronger teeth and fewer cavities**



- Stronger enamel
- Lower risk of dental caries
- Healthier smiles
- Better quality of life

## Northern Territory

Communities with Fluoridated Drinking Water (2019)




**7 locations with fluoride added in drinking water supply**

**5** remote communities

**2** urban/regional locations

**CLEAN WATER**
Foundation for healthy communities

**FLUORIDE**
A simple, effective public health measure

**STRONGER PEOPLE**
Healthier children, brighter futures

**Healthy People**
**Thriving Communities**
**A Stronger Northern Territory**


Geologist / Hydrogeologist
Data Scientist / Researcher
Fluoride levels
Dental caries
Community analysis
Dentist / Oral Health Professional
Strong
Teeth
Healthy
Communities
GIS / Spatial Data Analyst
Fluoride level
High
Moderate
Low
Dental caries rate
High
Moderate
Low
F⁻
Bore water
fluoride levels
Fluoride Treatment Specialist
Fluoride
Dosing System
Community Members
Improved oral health
Lower dental caries
Healthier communities
brighter futures
Different expertise. A shared goal. Better health for our communities.




Drinking water fluoride levels monitoring during 2002-2020 collected for
50 communities

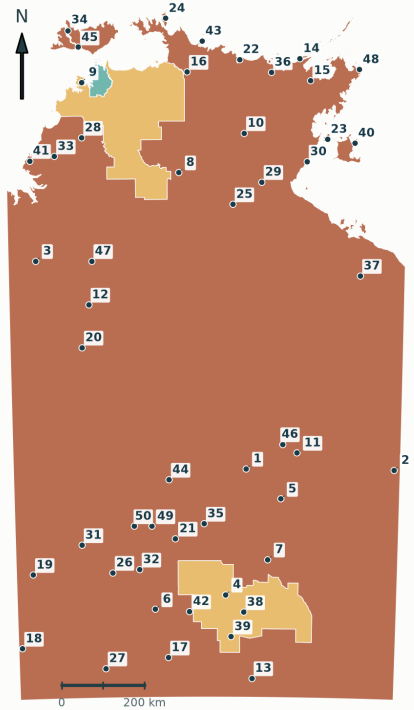



Dental caries for children living in 50 communities aged 1-17 years monitoring during 2002-2020.

# NORTHERN TERRITORY

Remoteness Areas | ABS ASGS Edition 3 (2021)

50 selected remote Aboriginal communities




**COMMUNITY KEY**

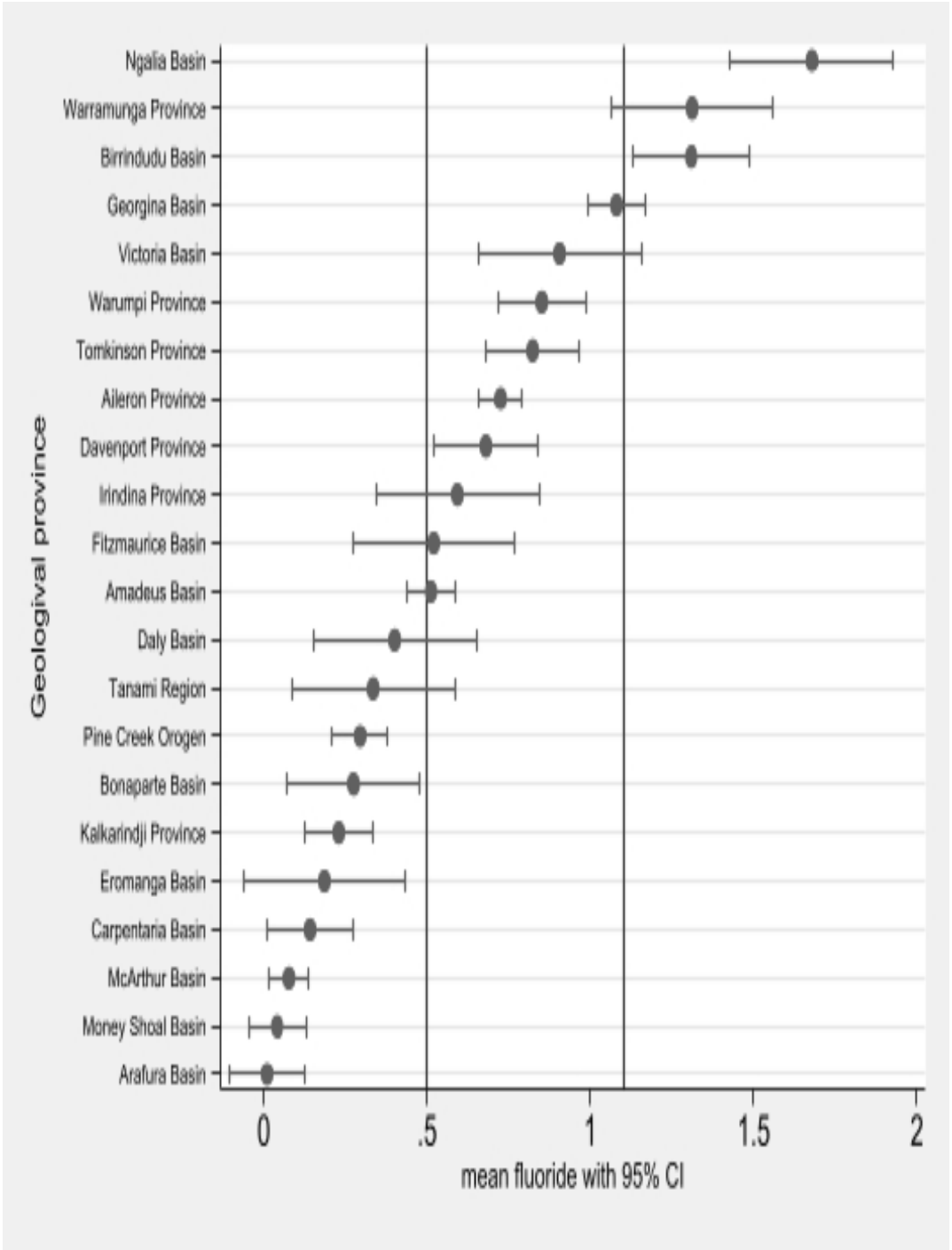
| | | | |
|---|---|---|---|
| 01 | Ali Curung | 26 | Mount Liebig |
| 02 | Alpurrurulam | 27 | Mutitjulu |
| 03 | Amanbidji | 28 | Nauiyu |
| 04 | Amoonguna | 29 | Ngukurr |
| 05 | Ampilatwatja | 30 | Numbulwar |
| 06 | Areyonga | 31 | Nyirripi |
| 07 | Atitjere | 32 | Papunya |
| 08 | Barunga | 33 | Peppimenarti |
| 09 | Belyuen | 34 | Pirlangimpi |
| 10 | Bulman | 35 | Pmara Jutunta |
| 11 | Canteen Creek | 36 | Ramingining |
| 12 | Daguragu | 37 | Robinson River |
| 13 | Finke | 38 | Santa Teresa |
| 14 | Galiwinku | 39 | Titjikala |
| 15 | Gapuwiyak | 40 | Umbakumba |
| 16 | Gunbalanya | 41 | Wadeye |
| 17 | Imanpa | 42 | Wallace Rockhole |
| 18 | Kaltukatjara | 43 | Warruwi |
| 19 | Kintore | 44 | Willowra |
| 20 | Lajamanu | 45 | Wurrumiyanga |
| 21 | Laramba | 46 | Wutunugurra |
| 22 | Maningrida | 47 | Yarralin |
| 23 | Milyakburra | 48 | Yirrkala |
| 24 | Minjilang | 49 | Yuelamu |
| 25 | Minyerri | 50 | Yuendumu |

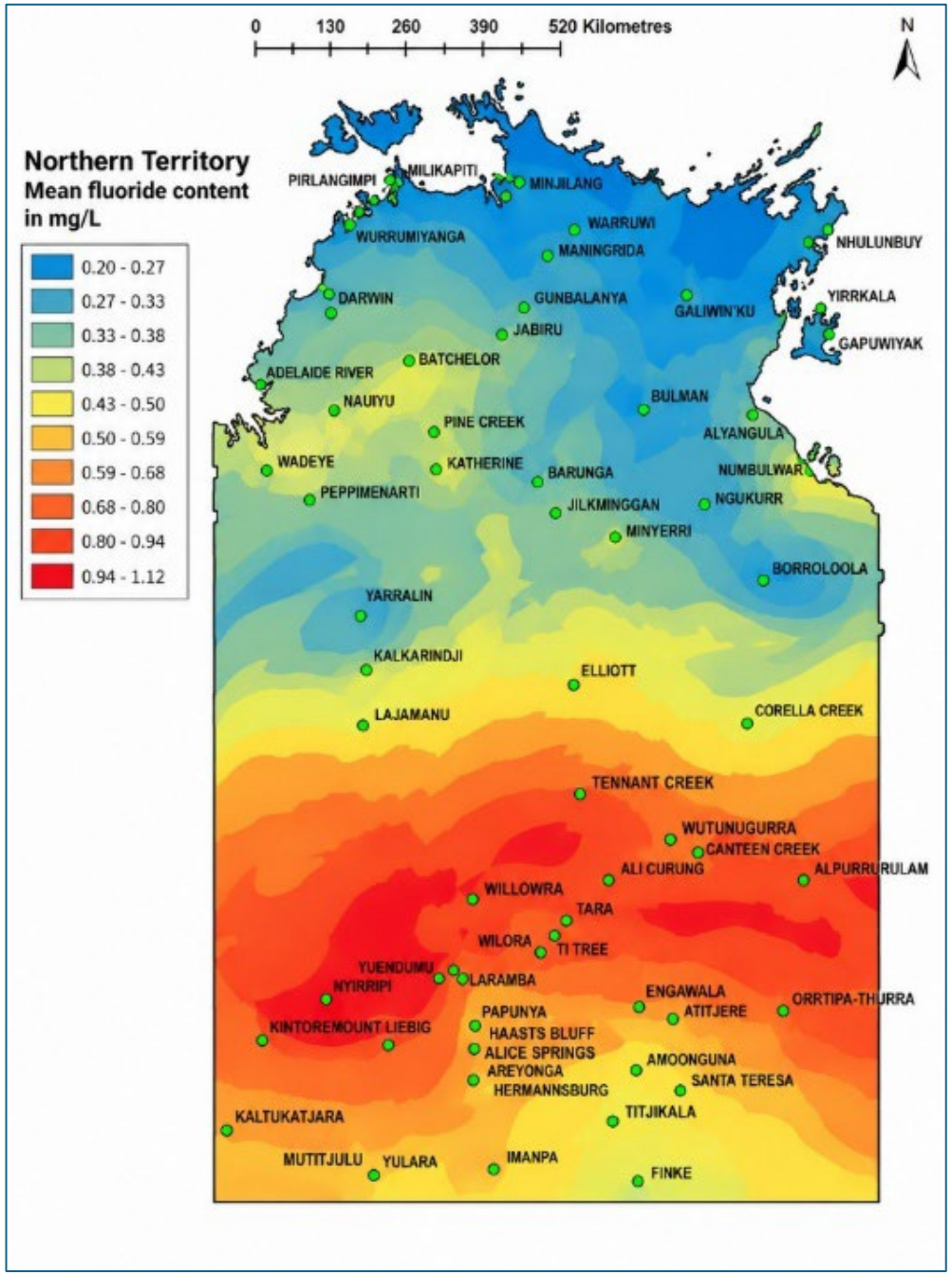
Outer Regional Australia  Remote Australia  Very Remote Australia

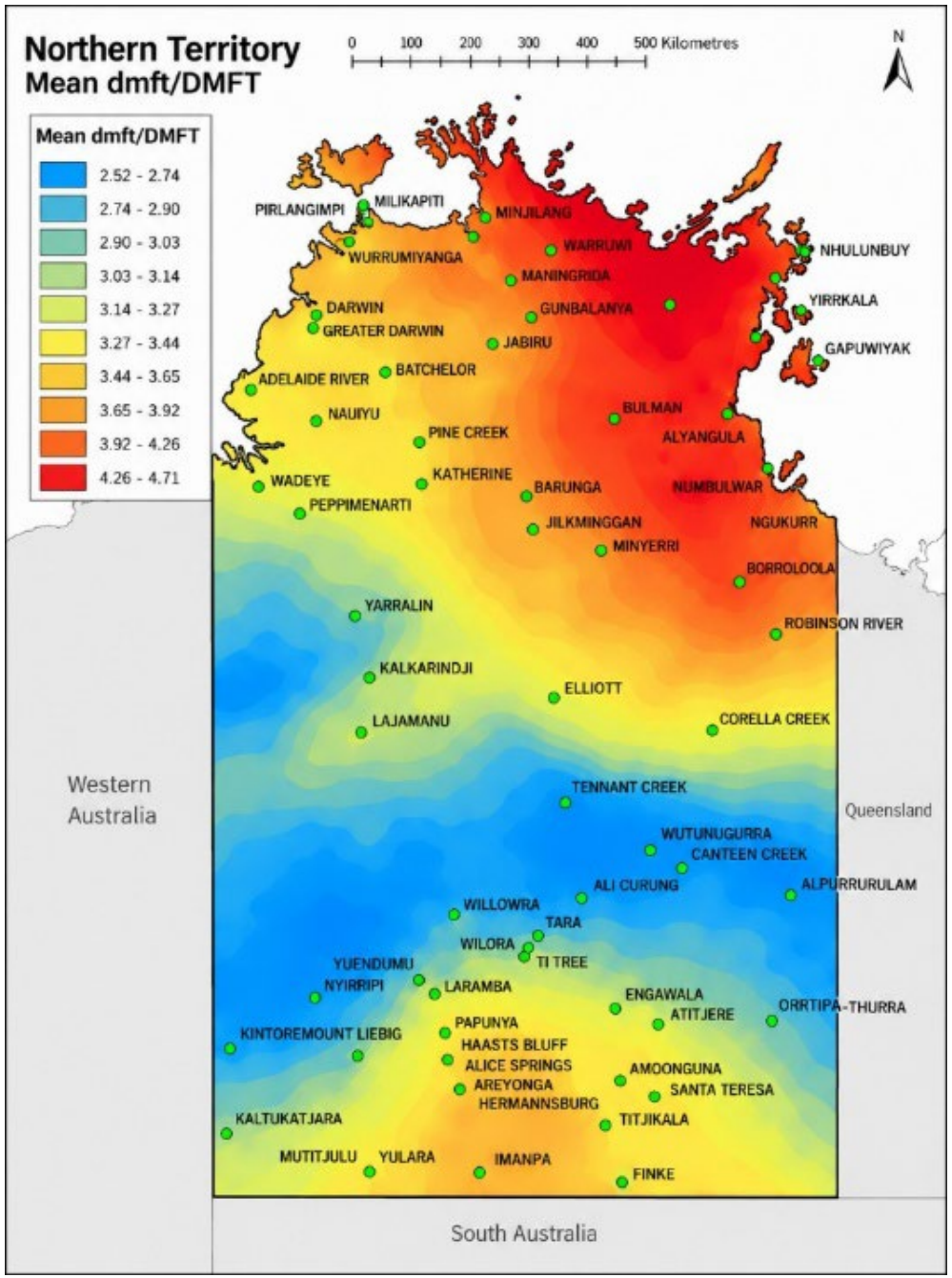
Boundaries: ABS ASGS Edition 3 (2021), unchanged • Community coordinates: NT Government BushTel (GDA94), accessed 16 Sep 2026

Numbers identify selected communities; positions follow published coordinates. Selection provides geographic spread, not a complete community inventory.


GEOLOGICAL REGIONS OF THE NORTHERN TERRITORY
Money Shoal Basin
Carpentaria Basin
Arafura Basin
Arnhem Inlier
Pine Creek Orogen
Bonaparte Basin
McArthur Basin
Daly Basin
Victoria-Birrindudu Basin
Halls Creek Orogen
Wolfe Creek Basin
Dunmarra Basin
Carpentaria Basin
Ord Basin
Murphy Inlier
Wiso Basin
TANAMI
TENNANT
South Nicholson Basin
Lawn Hill Platform
Tomkinson Creek Province
Victoria-Birrindudu Basin
Warramunga Province
REGION
Murraba Basin
Georgina Basin
Canning Basin
Davenport Province
ARUNTA
REGION
Murraba Basin
Aileron Province
Ngalia Basin
Aileron Province
REGION
Irindina Province
Warumpi Province
Amadeus Basin
Aileron Province
Amadeus Basin
Amadeus Basin
Eromanga Basin
Eromanga Basin
Pedirka Basin
Musgrave Province
September 2006
Younger basins
Central Australian platform cover
North Australian platform cover
Orogenic domains
Archaean basement inliers


Ngalia Basin
Warramunga Province
Birrindudu Basin
Georgina Basin
Victoria Basin
Warumpi Province
Tomkinson Province
Aileron Province
Davenport Province
Irindina Province
Fitzmaurice Basin
Amadeus Basin
Daly Basin
Tanami Region
Pine Creek Orogen
Bonaparte Basin
Kalkarindji Province
Eromanga Basin
Carpentaria Basin
McArthur Basin
Money Shoal Basin
Arafura Basin
Geological province
0
.5
1
1.5
2
mean fluoride with 95% CI


0 130 260 390 520 Kilometres
N
Northern Territory
Mean fluoride content in mg/L
0.20 - 0.27
0.27 - 0.33
0.33 - 0.38
0.38 - 0.43
0.43 - 0.50
0.50 - 0.59
0.59 - 0.68
0.68 - 0.80
0.80 - 0.94
0.94 - 1.12
PIRLANGIMPI
MILIKAPITI
MINJILANG
WARRUWI
WURRUMIYANGA
MANINGRIDA
NHULUNBUY
DARWIN
GUNBALANYA
GALIWIN'KU
YIRRKALA
JABIRU
GAPUWIYAK
BATCHELOR
ADELAIDE RIVER
NAUIYU
BULMAN
PINE CREEK
ALYANGULA
WADEYE
KATHERINE
BARUNGA
NUMBULWAR
PEPPIMENARTI
JILKMINGGAN
NGUKURR
MINYERRI
BORROLOOLA
YARRALIN
KALKARINDJI
ELLIOTT
LAJAMANU
CORELLA CREEK
TENNANT CREEK
WUTUNUGURRA
CANTEEN CREEK
ALI CURUNG
ALPURRURULAM
WILLOWRA
TARA
WILORA
TI TREE
YUENDUMU
NYIRRIPI
LARAMBA
ENGAWALA
ATITJERE
ORRTIPA-THURRA
KINTOREMOUNT LIEBIG
PAPUNYA
HAASTS BLUFF
ALICE SPRINGS
AREYONGA
HERMANNSBURG
AMOONGUNA
SANTA TERESA
KALTUKATJARA
TITJIKALA
MUTITJULU
YULARA
IMANPA
FINKE


Northern Territory
Mean dmft/DMFT
0 100 200 300 400 500 Kilometres
N
Mean dmft/DMFT
2.52 - 2.74
2.74 - 2.90
2.90 - 3.03
3.03 - 3.14
3.14 - 3.27
3.27 - 3.44
3.44 - 3.65
3.65 - 3.92
3.92 - 4.26
4.26 - 4.71
PIRLANGIMPI
MILIKAPITI
MINJILANG
WARRUWI
WURRUMIYANGA
MANINGRIDA
NHULUNBUY
DARWIN
GREATER DARWIN
GUNBALANYA
YIRRKALA
JABIRU
GAPUWIYAK
ADELAIDE RIVER
BATCHELOR
NAUIYU
BULMAN
PINE CREEK
ALYANGULA
WADEYE
KATHERINE
BARUNGA
NUMBULWAR
PEPPIMENARTI
JILKMINGGAN
NGUKURR
MINYERRI
BORROLOOLA
YARRALIN
ROBINSON RIVER
KALKARINDJI
ELLIOTT
LAJAMANU
CORELLA CREEK
Western Australia
TENNANT CREEK
Queensland
WUTUNUGURRA
CANTEEN CREEK
ALI CURUNG
ALPURRURULAM
WILLOWRA
TARA
WILORA
TI TREE
YUENDUMU
NYIRRIPI
LARAMBA
ENGAWALA
ATITJERE
ORRTIPA-THURRA
KINTOREMOUNT LIEBIG
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AMOONGUNA
SANTA TERESA
KALTUKATJARA
TITJIKALA
MUTITJULU
YULARA
IMANPA
FINKE
South Australia




In both – Treatment starts at 3.80 and ends at 3.37
Change in Graph 1 - Control 1 starts at 2.61 and ends at 2.25
Change in Graph 2 - Control 1 starts at 4.70 and ends at 4.50

# Results

- CWF produced a greater reduction in childhood dental caries than both control groups.
- Treatment-group children had **0.28 fewer affected teeth on average** (p=0.001).
- Children aged **7–10 years** had **0.32 fewer affected teeth** (p=0.051; borderline significance).
- Children aged **11–17 years** had **0.40 fewer affected teeth** (p=0.012).

# Limitation

- Didn’t examined effects of fluoride from other sources

  - dietary and behavioural confounders,
  - water consumption, .
  - fluoride level during warm periods, and
  - excess consumption of drinking water during hot days

# Conclusion

CWF produces population-level reductions in overall dental caries for these populations.

Additionally, our study demonstrates the application of the DiD method in a public health policy evaluation.

Our findings suggest that the longstanding policy position of the NT Department of Health

# What next?

We need more community water fluoridation treatment plants in remote aboriginal communities and continue oral health programs