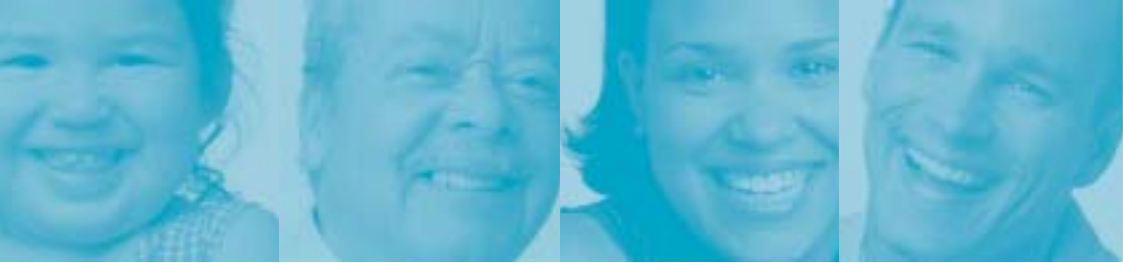


Water fluoridation

Information for health professionals



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NOTE:

- References to information contained within the highlighted boxes can be found within the main body of the text.
- In this booklet, 'water fluoridation' refers to the addition of fluoride to drinking water of 1 mg/L, defined as optimal by the National Health and Medical Research Council. It also refers to those drinking water supplies which naturally contain optimal fluoride levels.

Fluoridation overview

- Water fluoridation reduces the prevalence of dental caries within the community. Australian children living in optimally-fluoridated areas experience significantly less dental caries than those in areas without optimal water fluoridation.
- By helping to prevent dental caries, water fluoridation limits associated pain, suffering and economic losses including costs of dental treatment.
- Water fluoridation benefits individuals of all ages with natural teeth.
- Water fluoridation reduces the socioeconomic inequities in dental caries experience.
- The beneficial effect of water fluoridation is additional to that of fluoridated toothpaste.
- The overwhelming weight of scientific studies has not found any credible links between water fluoridation and adverse effects, with the exception of dental fluorosis (with over 98 per cent of dental fluorosis being very mild or mild).
- Maximal dental health benefits are obtained through a combination of water fluoridation, regular tooth brushing, appropriate use of fluoridated toothpaste, healthy diet and regular examinations by a dental professional.

1. Introduction

Fluoride plays a crucial role in the prevention of dental caries.¹ While some water supplies in Victoria have adequate levels of natural fluoride, most do not.² The adjustment of fluoride in community water supplies has long been recognised as an effective method of preventing dental caries and is a major factor responsible for the decline in the disease during the latter half of the 20th Century.^{3,4,5,6}

The overwhelming weight of scientific evidence supports the safety and effectiveness of water fluoridation: it has been endorsed worldwide by numerous organisations including the World Health Organization, World Dental Federation, National Health and Medical Research Council, Australian Dental Association, Australian Medical Association and the Public Health Association of Australia.^{7,8,9,10,11,12}

Within Australia, water fluoridation is the main public health strategy for dental caries prevention.¹ More than three-quarters of Victorians have access to fluoridated drinking water.² The map on pages 18–19 shows Victorian towns with water fluoridation. People living in areas without optimal fluoridation experience significantly greater levels of dental caries compared with people living in optimally-fluoridated areas.¹³

This booklet has been published by the Victorian Department of Human Services, in consultation with dental experts and leading dental organisations. It aims to present a broad overview of the value of water fluoridation, based on the overall weight of scientific evidence. The information presented here is based on findings from the National Health and Medical Research Council, the Australian Research Centre for Population Oral Health, the United Kingdom National Health Service Review (referred to as ‘The York Review’), the World Health Organization and other sources as referenced.



Key statements and endorsements

The Centers for Disease Control and Prevention, in the United States of America, has rated water fluoridation as one of the top ten public health achievements of the 20th Century, alongside motor vehicle safety, recognition of the dangers of tobacco and control of infectious diseases.⁶

In 2006, the World Health Organization, the World Dental Federation and the International Association for Dental Research urged governments to develop effective legislation and programs to ensure access to fluoride for dental health in all countries.⁷ They also stated:

...universal access to fluoride for dental health is a part of the basic human right to health.

In 2007, Australia's National Health and Medical Research Council released a *Statement on the Efficacy and Safety of Fluoridation*.⁹

Fluoridation of drinking water remains the most effective and socially equitable means of achieving community-wide exposure to the caries prevention effects of fluoride.

Also in 2007, the Australian Dental Association stated:¹⁰

Our Federal Body recognises that the fluoridation of public water supplies has proven to be one of the most significant public health initiatives in Australia.

And the World Health Organization restated its support for fluoridation of drinking water in its *Global Policy for improvement of oral health*.⁸

The full list of endorsing organisations can be found on page 29.

1.1 Background to research and reports

In 2006, the World Health Organization, the International Association for Dental Research and the World Dental Federation released a *Call to Action to promote dental health using fluoride*.⁷ The statement reaffirmed the 'efficiency, cost effectiveness and safety of the daily use of optimal fluoride'.⁷

The National Health and Medical Research Council (NHMRC) is Australia's peak health body for the achievement of the best possible standards for individual and public health.¹⁴ In 2007, the NHMRC commissioned a systematic review to evaluate scientific data on fluoridation.¹⁵ The review affirms that 'water fluoridation remains the most effective and socially equitable means of achieving community-wide exposure to the caries prevention effects of fluoride'.⁹

In 2008, researchers from the Australian Research Centre for Population Oral Health presented results from a study which examined the effectiveness of water fluoridation on children's dental health across four Australian states.¹³ More than 16,800 children were examined.¹³ The study found children from optimally-fluoridated areas had significantly less dental caries than those from areas without optimal water fluoridation.¹³

The overwhelming weight of scientific evidence examined in the reviews and reports supports the effectiveness of water fluoridation as a means of helping to protect teeth against dental caries. The World Health Organization states that daily use of optimal fluoride is both safe and effective.^{7,8}

Given the benefits provided by water fluoridation, in 2004, all Australian Health Ministers endorsed *Healthy mouths healthy lives: Australia's National Oral Health Plan 2004-2013*.¹⁶ This Plan includes a recommendation to extend water fluoridation around Australia.¹⁶



2. Dental caries

Dental caries can have an adverse impact on appearance, self-esteem, social interaction and the ability to speak and chew.^{16,17} Dental caries develops when sugars from food and drinks are metabolised by bacteria in the mouth, resulting in acid production at the tooth surface.¹⁸ The acid removes calcium and phosphates from the tooth enamel into the plaque and saliva surrounding the tooth, leading to cavitation of the tooth (see Figure 1).¹⁸

Pain may result from dental caries, which if left untreated may progress to a dental abscess, facial swelling or other spreading infection.¹⁹ These can have serious and potentially life-threatening consequences.¹⁹ Treating dental caries in children sometimes requires a general anaesthetic, with its attendant risks.^{19,20} In 2007–08 across Victoria, there were more than 4,400 children under the age of ten, including 207 two-year olds and 835 four-year olds, who required a general anaesthetic for treatment of dental caries.²⁰ Children under the age of ten in non-optimally fluoridated areas were two times more likely to require a general anaesthetic in hospital for treatment of dental caries than children in optimally-fluoridated areas.²⁰

The consequences of dental caries are costly, in terms of time, money and personal pain and suffering.^{16,17} Once a tooth is filled, it becomes structurally weaker and may require further treatment in the future.²¹ Water fluoridation reduces the prevalence of dental caries in children and adults, regardless of socioeconomic status, access to dental care or individual motivation.¹ It is recognised therefore as one of the top ten public health achievements of the 20th Century.⁶

Figure 1: Comparison of healthy teeth and those affected by dental caries



Healthy deciduous teeth



Deciduous teeth with significant dental caries



Healthy permanent teeth



Permanent teeth with dental caries

Pictures provided by Prof M Morgan, The University of Melbourne.

3. Fluoride

3.1 Fluoride metabolism and excretion^{22, 23}

Most ingested fluoride is absorbed into the bloodstream, predominantly from the stomach and intestine. Minimal absorption occurs across the oral mucosa. Rapid distribution to the intra- and extracellular fluid of tissues occurs, with approximately 50 per cent of absorbed fluoride excreted and the remainder stored—almost all (99 per cent) of the stored fluoride is retained in teeth and bones, where it becomes incorporated into the mineral structure. Fluoride is also redistributed into saliva. Elimination from the body is primarily by urinary excretion.

Table 1: Fluoride's modes of action

Destination	Source	Main action	Pre/post eruption	Effect type
Incorporation into developing tooth structure	Absorption from gut	Structural alteration of mineral—tooth more resistant to acid attack	Pre-eruption	Structural
Redistribution into saliva	Absorption from gut	Fluoride repairs damage	Post-eruption	Topical
Washes over teeth during eating and drinking	Pre-absorption	Fluoride repairs damage	Post-eruption	Topical

WHO, 1994; WHO, 2002a

3.2 Role of fluoride in dental health

- Fluoride plays a key role in the prevention of dental caries.

Fluoride benefits individuals of all ages with natural teeth.¹ In the pre-eruptive phase, fluoride is incorporated into developing tooth structure where it renders the tooth more resistant to later acid attack.¹⁸

In the post-eruptive phase, fluoride acts as a constant 'repair kit' for teeth, after its redistribution into saliva.^{18, 24, 25} Following acid attack and the subsequent removal of calcium and phosphate from the tooth surface (the process known as demineralisation), the fluoride in saliva interacts with these minerals and salts at the tooth surface to remineralise the damaged enamel.¹⁸ A constant supply of a low level of fluoride within the saliva is beneficial for replacement of lost minerals and therefore reduction of dental caries.¹⁸

Another mode of action in the post-eruptive phase occurs as fluoride washes over teeth during consumption of fluoride-containing foods and drinks.¹⁸ Table 1 on the previous page summarises the modes of action of fluoride.

4. Water fluoridation

- Water fluoridation is the adjustment of the natural amount of fluoride in the water supply to a level recommended for optimal dental health benefits. In Victoria, the optimal fluoride level in water is 1mg/L (also known as 1 part per million).

Fluoride is present in water, plants and animals (and therefore in most foods).^{22,23} It is also present in rocks, soil and air, both naturally and as a result of human practices such as agriculture and industry.²³

Natural levels of fluoride in water supplies in Australia tend to be lower than the optimal level recommended for the prevention of dental caries.²⁶ Water fluoridation therefore increases water fluoride levels to optimise dental health benefits.²⁶ Within Victoria, however, five towns—Portland, Nhill, Port Fairy, Barnawartha and Kaniva—have naturally-occurring optimal amounts of fluoride in their water supplies.²⁶

Optimal levels of fluoride will not change the taste or smell of drinking water.²⁷

Sourcing, adding and monitoring fluoride levels

- As fluoride is found naturally in rocks and soils, all water sources—both fresh and sea water—contain some fluoride.²⁸ Sea water typically contains fluoride at approximately the same level as used in community fluoridation programs.²⁸
- When rocks and soils are crushed to make fertiliser, the fluoride is extracted for use in water fluoridation programs.⁵
- The optimal fluoride level in water fluoridation programs has been determined by the National Health and Medical Research Council and is based on average maximum daily air temperature.¹⁵ For Victoria, the optimal fluoride level is 1mg/L (also known as 1 part per million).¹⁵ This level has been determined assuming fluoride intake from other sources such as foods, drinks and dental products.²⁸
- Fluoride is added to drinking water in carefully controlled amounts.⁵ The total amount of fluoride is monitored regularly both at the fluoridation plant and at household taps.² The Victorian *Safe Drinking Water Act* 2003 requires all drinking water to be safe.²⁹ Safe

levels of chemicals are set out in the *2004 Australian Drinking Water Guidelines* published by the National Health and Medical Research Council.³⁰

4.1 Geographical overview of water fluoridation

Internationally

- The first water fluoridation scheme was implemented in the United States of America in 1945.³¹
- In 2006, in the United States almost 70 per cent of the population served by community water systems received optimally-fluoridated water, including residents in 46 of the nation's 50 largest cities.³²
- Other countries have also introduced water fluoridation including Canada, New Zealand, Hong Kong, Singapore, the United Kingdom and Ireland.³³
- In 2008, the United Kingdom's Department of Health provided £42 million to extend water fluoridation over the next three years.³⁴
- In some European countries water fluoridation is not practical because of very complex water systems that lack a central point to add fluoride.³³ Therefore, other fluoride delivery systems exist in parts of Europe—such as salt and milk fluoridation.³³
- Some European countries have ceased water fluoridation against Health Department advice.³³

Australia

Australia has more than 50 years' experience with water fluoridation, following the introduction of the first program in 1953 at Beaconsfield, Tasmania.³⁵ Currently, more than 80 per cent of Australians have access to fluoridated drinking water, including residents of all capital cities—with Brisbane commencing water fluoridation in late 2008.^{36,37} This proportion of Australians with fluoridated drinking water will increase further in 2009 as significant extension occurs in Victoria and Queensland.³⁷

Victoria

The first water fluoridation scheme in Victoria was implemented in Bachus Marsh in 1962, with Melbourne commencing water fluoridation in 1977.³⁵ Since 2004, the following towns have commenced water fluoridation:

- Robinvale, Horsham, Moe, Sale, Morwell, Traralgon, Warragul, Wangaratta, Wodonga, Castlemaine and Warrnambool.

By late 2008, more than three-quarters of Victorians received fluoridated drinking water. More recently a decision has been made to commence water fluoridation in Geelong, Ballarat, Colac, Hamilton, Yarrowonga, Swan Hill, Kerang and Mildura. These towns should commence water fluoridation by the end of 2009.

The map on pages 18–19 shows water fluoridation in Victoria.

4.2 Benefits of water fluoridation

- By reducing the prevalence of dental caries, water fluoridation limits associated pain, suffering and economic losses including costs of dental treatment.
- Since the fluoridation of Melbourne's water supplies over 30 years ago, the dental caries prevalence within Victoria has markedly decreased.
- Water fluoridation benefits individuals regardless of age or education, and reduces the socioeconomic inequities in dental caries experience.
- The beneficial effect of water fluoridation is additional to that of fluoridated toothpaste.
- Maximal dental health benefits are obtained through a combination of water fluoridation, regular tooth brushing with appropriate use of fluoridated toothpaste, healthy diet and regular examinations by a dental professional.

4.2.1 Reduction of dental caries in children

Since the introduction of water fluoridation to Melbourne in 1977, the dental caries prevalence within Victoria has markedly decreased, as shown in Figure 2.³⁸

Figure 2: Dental caries experience in 12-year olds in Victoria and Australia, 1955–2005

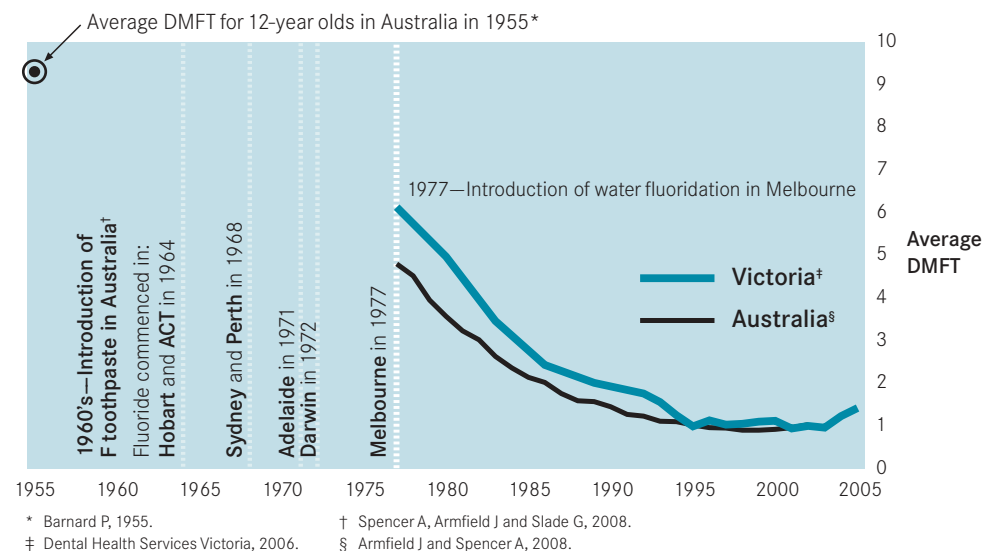


Figure 2 shows average DMFT scores in Victorian 12-year olds when compared with the national average, following the introduction of fluoridated toothpastes and the commencement of water fluoridation in Australian capital cities.

Victorian children had significantly higher average DMFT when water fluoridation commenced in Melbourne in 1977 compared to the national average.^{38,41} Following the introduction of water fluoridation in Melbourne, the average Victorian DMFT fell to the national average by 1995.³⁸

Numerous studies and subsequent reviews have confirmed the effectiveness of water fluoridation on dental caries reduction.^{6, 7, 13, 15, 41, 42}

- In 2008, researchers from the Australian Research Centre for Population Oral Health presented results from a study which examined the effectiveness of water fluoridation on children's dental health across four Australian States—Queensland, Victoria, Tasmania and South Australia.¹³ The study also considered a number of other factors: toothbrushing history, use of other fluoride products, water and food consumption, use of infant formula and socioeconomic status. Over 16,800 children, including more than 4,000 Victorian children, were examined. The study found:¹³
 - 5 and 6-year old children who had lived for more than half their lives in areas with optimal water fluoridation had 50 per cent less dental caries in their deciduous teeth than children who had lived in areas without optimal water fluoridation.
 - 12 and 13-year old children who had lived for more than half their lives in areas with optimal water fluoridation had 38 per cent less dental caries in their permanent teeth than children who had lived in areas without optimal water fluoridation.
- In 2007, the Australian Institute of Health and Welfare report, *Australia's dental generations: the National Survey of Adult Oral Health 2004–06*, showed members of the fluoride generation (born after 1970) had about half the level of dental caries that their parents' generation had developed by the time they were young adults.¹⁷

4.2.2 Reduction of dental caries in adults

Water fluoridation also helps protect against dental caries in adults, with studies demonstrating beneficial effects in young children and adults up to 75 years of age.^{1, 5, 6, 33, 43} In addition, adults are susceptible to dental caries in the root surfaces of their teeth, which can become exposed due to periodontal (gum) diseases.⁵ Adults living in optimally-fluoridated areas have considerably less root surface dental caries than those living in areas without optimal water fluoridation.^{44, 45}

4.2.3 Reduction of socioeconomic inequities

Water fluoridation is of particular benefit to communities of low socioeconomic status, which tend to have higher rates of dental caries and less access to other forms of fluoride exposure and dental treatment.^{1, 6} Water fluoridation reduces the socioeconomic inequities in dental caries experience, and remains the most socially equitable means of achieving community-wide exposure to the caries-preventive effects of fluoride.^{1, 6, 9, 25}

4.2.4 Maximising dental health benefits

Maximal dental health benefits are obtained through a combination of water fluoridation, regular tooth brushing with appropriate use of fluoridated toothpaste, healthy diet and regular examinations by a dental professional.²⁴ Until very recently, dental caries prevalence in children had decreased in areas with and without optimal fluoridation.¹ This decrease is thought to be due to wider exposure to other fluoride sources, such as fluoridated toothpaste, and a 'diffusion' effect with fluoridated foods and beverages being distributed to areas without optimal water fluoridation.⁶

Very recent research has indicated that dental caries prevalence may be increasing in Australian children.⁴¹ This increase may result from the same factors associated with increasing obesity levels.⁴¹ This points to an even greater need for water fluoridation, which has been found to have an effect over and above that of other fluoride sources, providing additional fluoride to teeth throughout the day.⁵

4.4 Risk of excess fluoride ingestion: dental fluorosis

- Dental fluorosis is mottling of tooth enamel which results from excessive ingestion of fluoride while teeth are developing, and may be of aesthetic concern.
- In Australia, if dental fluorosis does occur, over 98 per cent of cases will be very mild or mild—and will be barely noticeable.
- In areas with optimal water fluoridation, the risk of dental fluorosis can be minimised by limiting the exposure of young children to fluoride from other sources.
- Many teeth show altered formation and have a different appearance due to a variety of causes unrelated to fluoride.

Dental fluorosis is the altered formation of tooth enamel resulting from excessive fluoride ingestion during the period of tooth development, usually from birth to approximately six to eight years of age.²³ In its mildest (and most common) form it may manifest as barely noticeable whitish striations, while more severe forms involve confluent pitting and staining of the dental enamel.^{5,46} Determining the exact level of dental fluorosis within a community is difficult, as there are numerous other causes of enamel defects that may resemble dental fluorosis.^{5,47,48} In Australia, if dental fluorosis does occur, over 98 per cent of cases will be very mild or mild—and will be barely noticeable.^{1,46} Figure 3 shows teeth with very mild and mild dental fluorosis.

Dental fluorosis can also occur in areas without water fluoridation programs.⁵ Since the mid 1990s, however, the prevalence of dental fluorosis in Australia has markedly reduced, mainly attributable to the use of low-fluoride toothpastes in young children, and awareness raising of appropriate toothpaste use by children (use under supervision, use of a pea-sized amount smeared over the brush, spitting out and not swallowing).^{1,49}

Figure 3: Comparison of very mild and mild dental fluorosis



Very mild dental fluorosis along the lower edge of the upper anterior teeth



Mild dental fluorosis predominantly on the upper third of the upper anterior teeth

Pictures provided by Drs W Evans and Bal, The University of Sydney.

The risk of dental fluorosis occurring can be minimised by reducing exposure to fluoride in children with developing teeth, through measures such as⁴⁹:

- discouraging ingestion of toothpaste
- cleaning children's teeth without toothpaste until the age of 18 months, unless otherwise recommended by a health professional
- using only a pea-sized amount of low-fluoride toothpaste, smeared over the toothbrush, between 18 months and five years of age (inclusive), unless otherwise recommended by a health professional
- only using fluoride mouthrinses in children six years of age and older
- spitting out and not swallowing toothpaste and not rinsing.

Dental professionals will determine suitability for additional fluoride therapies. Importantly, fluoride drops and tablets should not be used at all whether the drinking water is fluoridated or not.

4.5 Safety of water fluoridation

- With the exception of dental fluorosis, scientific studies have not found any credible link between water fluoridation and adverse effects.

The National Health and Medical Research Council 2007 *Statement on the Efficacy and Safety of Fluoridation* said:⁹

Fluoridation of drinking water supplies remains the most effective and socially equitable means of achieving community-wide exposure to the caries prevention effects of fluoride. It is recommended that water be fluoridated in the target range of 0.6 to 1.1 mg/L, depending on climate, to balance reduction of dental caries and occurrence of dental fluorosis.

With the exception of dental fluorosis, scientific studies have not found any credible link between water fluoridation and adverse effects.^{15, 23, 42} In 2006, the World Health Organization, the World Dental Federation and the International Association for Dental Research concluded that water fluoridation is safe and effective and urged governments to develop effective legislation and programs to ensure access to fluoride for dental health in all countries.⁷

While the safety of water fluoridation has been confirmed by the World Health Organization and National Health and Medical Research Council, some community members raise concerns about water fluoridation impacting upon general health (discussed below).

4.5.1 Bones

Research on the potential effects of fluoride on bone has focused on the areas of skeletal fluorosis, osteoporosis, arthritis and fractures, and cancer.

Skeletal fluorosis

Skeletal fluorosis occurs only in individuals with excessively high levels of fluoride exposure, and is endemic in several parts of the world including India, China, parts of the Middle East and Africa, where water supplies have fluoride levels naturally higher than

those recommended by the World Health Organization.²⁸ Skeletal fluorosis can also occur in workers with occupational exposure.²⁸ It is a condition characterised by bone pain, joint stiffness and other arthritic symptoms, as a result of excessive incorporation of fluoride into bone.²⁸

While it is common in some developing countries, it is extremely rare in the developed world.³³

Osteoporosis, arthritis and fractures

Fluoride has been used to treat osteoporosis.⁵⁰ However, studies specifically examining the effectiveness of water fluoridation on increasing bone mineral density or decreasing fractures have yielded conflicting results.²⁵

The York Review found no clear association between water fluoridation and hip fractures or all fractures.⁴² The National Health and Medical Research Council in 2007 reached the same conclusion.¹⁵

Optimal water fluoridation is safe in terms of bone mineral density and is also endorsed by Osteoporosis Australia and Arthritis Australia, which states:^{51, 52}

*There is no credible evidence, or even theory, to implicate water fluoridation in the cause of any type of arthritis.*²⁷

Bone cancer

There is no established link between water fluoridation and the risk of bone cancer.^{15, 42, 43}

The York Review found no clear association between water fluoridation and osteosarcoma and bone/joint cancers.⁴²

In 2007, the National Health and Medical Research Council reviewed three new studies which had been published after the York Review.¹⁵ One study⁵³ showed an association between bone cancer in males and water fluoridation, however the NHMRC Review stated: 'given the low level of evidence in this study the results should be interpreted with extreme caution.'¹⁵

Another study found no association between water fluoridation and bone cancer, although again, the level of evidence was low.⁵⁴

In 2006, a paper by Elise Bassin et al, 'Age-specific fluoride exposure in drinking water and osteosarcoma (United States)' was published in the journal *Cancer Causes Control*.⁵⁵ The paper presented partial findings of a 15-year study of fluoride and osteosarcoma. Bassin et al concluded that their exploratory analysis found an association between osteosarcoma and fluoride in drinking water in males, but not in females.⁵⁵ They also concluded that further studies were required to confirm or refute the findings.⁵⁵ The senior researcher involved with the study, Professor Chester Douglass, advised readers to be cautious when interpreting the findings, noting that the full findings of the study (yet to be published) did not show an association between osteosarcoma and fluoride in drinking water.⁵⁶ Other limitations of the study were also identified by the authors—these are summarised in the document *Osteosarcoma and fluoride* published by the Department of Human Services and The Cancer Council Victoria, available from the Department of Human Services' water fluoridation website (details on page 35).⁵⁷

4.5.2 Other cancers

The published reviews have stated that there is no consistent evidence of an association between water fluoridation and morbidity or mortality due to cancer in general.^{15, 23, 42} The York Review concluded this after considering ten studies including separate analyses.⁴² The two studies of statistical significance suggested an association in different directions.⁴²

In 2007, the National Health and Medical Research Council reviewed three new studies which had been published after the York Review.¹⁵ These were ecologic studies which provide one of the weakest sources of evidence due to an inability to control for confounding factors. One study demonstrated no association between water fluoridation and 11 different cancer types.⁵⁴ It did find an association between bladder cancer in women and water fluoridation, but stated: 'It seems biologically implausible for fluoride to affect cancer rates for one sex only. Therefore, the possibility that this is a chance result should be considered...'⁵⁴

Another study found an association between fluoridation and increased cancer incidence in 23 of the 36 bodily sites investigated.⁵³ It also found decreased cancer incidence in four of the 36 bodily sites, and no association between water fluoridation and cancer incidence in nine of the 36 sites.⁵³

Another study found that fluoride concentration in drinking water was inversely correlated with cancer incidence—ie: the lower the fluoride, the higher the cancer incidence—yet again, the level of evidence was low.⁵⁸

In 2007, the National Health and Medical Research Council Review concluded that the results of these three recent cancer studies should be interpreted with extreme caution or were subject to chance findings.¹⁵

A more recent study published after the National Health and Medical Research Council Review, conducted in developed countries, found that there is a significant body of evidence demonstrating that the consumption of optimally-fluoridated water is not associated with carcinogenic risk.⁵⁹ The Cancer Council Victoria endorses the water fluoridation program in Victoria.⁶⁰

4.5.3 Hypersensitivity/allergy

Concerns about hypersensitivity and allergic reactions to fluoride in community water supplies have been raised. Fluoride is an inevitable component of all diets.^{23, 61} Individuals believing that symptoms are related to fluoridated water are essentially claiming an effect from an incremental increase of fluoride, not its presence versus its absence.⁶²

According to medical specialists from the Department of Allergy, Immunology and Respiratory Medicine at the Alfred Hospital in Melbourne, no clinical or scientific evidence exists in the peer-reviewed scientific literature to confirm water fluoridation causes allergies or alters immunity at the optimal level of 1 mg/L.⁶³ Specifically, they state:

... during the past 25 years, whether in Melbourne or in the UK, we have never seen a patient with any respiratory symptoms nor any allergy-like symptoms that could be attributed to fluoride 1ppm [1mg/L] as in our fluoridated water.

4.5.4 Kidney disease

Kidney Health Australia has a position statement on water fluoridation which reads:⁶⁴

There is no evidence that consumption of optimally fluoridated water poses any health risks to people with chronic kidney disease, although only limited studies addressing this issue are available.

Furthermore, the organisation recommends water as the fluid of choice to satisfy thirst.⁶⁵

Importantly, Kidney Health Australia has not called for the cessation of water fluoridation programs.

4.5.5 Thyroid disease

Endocrinologists confirm there is no credible evidence of a link between water fluoridation and thyroid disease.⁶⁶ They state:

There is no scientifically acceptable evidence that fluoridation increases the incidence of thyroid disease.

4.5.6 Miscellaneous

Epidemiological studies of occupational exposure to fluoride (with higher exposure levels than obtained through optimally fluoridated drinking water) have provided no reasonable evidence of effects upon the respiratory, reproductive, haematopoietic or hepatic systems attributable to fluoride per se.²⁸

4.6 Cost-effectiveness of water fluoridation

- Water fluoridation is a cost-effective means of reducing the prevalence of dental caries.

The World Health Organization concludes that water fluoridation is one of the most cost-effective means of delivering fluoride to a large number of individuals.⁷ A study assessing the cost savings resulting from water fluoridation found that the reduction in

costs of restorative treatment due to averted dental caries exceeded the cost of water fluoridation in communities of any size.⁶⁷ Likewise, a separate study concluded that fluoridation is highly cost-effective, especially for communities with high proportions of children, indigenous people or people of low socioeconomic status.⁶⁸ An economic study conducted in 2003 found that in the 25-year period following its introduction, water fluoridation had resulted in benefits to the Victorian community of around \$1 billion, through avoided dental costs, days away from work/school and associated costs.⁶⁹

4.7 Ethics of water fluoridation

Most health professionals have regarded the benefits of water fluoridation in terms of beneficence (doing good) and justice (equity), as outweighing the reduction in individual autonomy and the low risk of adverse effects.⁷⁰

We should ask not are we entitled to impose fluoridation on unwilling people, but are the unwilling people entitled to impose the risks, damage and costs of failure to fluoridate on the community at large.

John Harris (Professor of Applied Philosophy at the Centre for Social Ethics and Policy of the University of Manchester), 1989.⁷¹

In 2006, the World Health Organization, the World Dental Federation and the International Association for Dental Research confirmed that ‘universal access to fluoride for dental health is a part of the basic human right to health.’⁷²

Some people state that the practice of water fluoridation is not compatible with the Victorian *Charter of Human Rights and Responsibilities*. The rights in the Charter may be subject to reasonable limitation.⁷² This involves balancing the rights of the individual with the need for government departments to protect the broader public interest, such as public safety, health and order.⁷² Because of the public health importance of water fluoridation in reducing dental caries, the practice of fluoridation of drinking water supplies is consistent with the Charter.⁷³

5. Summary

Fluoride plays a crucial role in the prevention of dental caries throughout life. Fluoridation of community water supplies is an effective way to deliver fluoride to all members of the community, regardless of age, individual motivation, socioeconomic status or the availability of dental care. The overwhelming weight of scientific evidence supports water fluoridation as safe and effective in helping prevent dental caries.

Endorsing organisations

The following organisations endorse the fluoridation of drinking water supplies:

- The World Health Organization^{7,8}
- Australia's National Health and Medical Research Council⁹
- The Australian Dental Association¹⁰
- The Australian Medical Association (Victorian Branch)¹¹
- The Public Health Association of Australia¹²
- The Australian Academy of Science⁷⁴
- General Practice Victoria⁷⁵
- The Pharmacy Guild of Australia (Victorian Branch)⁷⁶
- The Australian Centre for Human Health Risk Assessment⁷⁷
- Osteoporosis Australia⁵¹
- Arthritis Australia⁵²
- The Cancer Council Victoria⁶⁰
- VicHealth⁷⁸
- Dental Health Services Victoria⁷⁹
- The Victorian Dental & Oral Health Therapist Association⁸⁰
- Melbourne Dental School at The University of Melbourne⁸¹
- La Trobe University School of Dentistry and Oral Health⁸²
- The Royal Children's Hospital Department of Dentistry⁸³

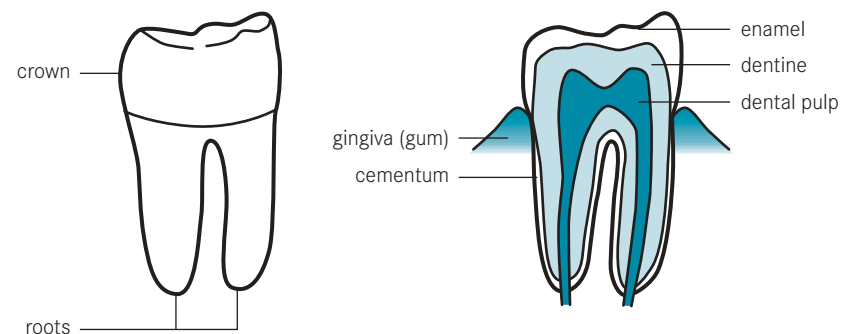
Glossary

caries experience	The extent and severity of dental caries within a population. This is usually assessed using indices such as the DMFT (see below).
deciduous teeth	Primary ('first', 'milk' or 'baby') teeth, which begin to erupt at about six months of age and which are finally shed at about 12 years of age.
demineralisation	Reduction of the mineral content (principally calcium and phosphate) of the enamel, dentine or cementum of teeth.
dental caries	Disease of the teeth resulting in the demineralisation, and possible cavitation and breakdown of calcified dental tissues (enamel, dentine or cementum) by microbial activity.
dental decay	See dental caries.
dental fluorosis	A disturbance of tooth enamel formation caused by excess fluoride being present in the tissue fluids over a prolonged period during tooth development. In very mild forms, it appears as small white flecks on the enamel surface; in mild forms, the flecks merge into larger areas of white patches on parts of the enamel surface. In moderate forms the entire surface of the tooth is whitened. In severe forms, pitting occurs which can also have brown staining. Other disorders of enamel can be difficult to distinguish from dental fluorosis.
dentine	The calcified tissue surrounding the dental pulp and comprising the bulk of the tooth (see Figure 4).
DMFT, dmft	Indices describing the dental caries experience of individuals or populations. The DMFT index is calculated by summing the number of permanent teeth that are D ecayed, M issing or F illed. The permanent teeth index ranges from zero to 32, which is the maximum number of teeth that can be affected, while the deciduous teeth index ranges from zero to 20. Upper-case lettering refers to permanent teeth, while lower-case lettering refers to the deciduous teeth.

enamel	The hard white calcified substance that covers the crown of each tooth (see Figure 4).
fluoride supplement	A form of fluoride used to increase overall levels of fluoride exposure, namely fluoride tablets and drops.
mg/L	Milligrams per litre. A measurement of the concentration of a substance. 1 mg/L = 1 ppm (part per million).
permanent teeth	Secondary ('adult') teeth, which begin to erupt around six years of age.
pre/post eruptive phases	The periods of time before/after a tooth erupts into the mouth
prevalence	The number of individual cases of a given disease or other condition in a defined population at a specified point in time.
remineralisation	The process whereby a demineralised tissue takes up minerals again.
water fluoridation	The adjustment of the natural amount of fluoride in water to a level recommended for optimal dental health benefits. In Victoria the optimal level is around 1 mg/L.

Figure 4: (A) Outside of a molar

(B) Cross-section of a molar



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Further information

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Department of Human Services

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www.health.vic.gov.au/dentistry/

National Health and Medical Research Council

www.nhmrc.gov.au

Australian Dental Association

www.ada.org.au

Dental Health Services Victoria

www.dhsv.org.au

Better Health Channel

www.betterhealth.vic.gov.au

World Health Organization

www.who.int/water_sanitation_health/oralhealth

American Dental Association

(includes a 56-page booklet *Fluoridation Facts*)

www.ada.org/public/topics/fluoride/facts/

British Fluoridation Society

www.bfsweb.org

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