COSTS AND BENEFITS OF DRINKING-WATER FLUORIDATION

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ABSTRACT

Despite considerable improvements in oral health over the last decades, oral health remains a major issue in New Zealand. Dental decay accounts for approximately 1 percent of all health loss due to early death, illness or disability. This burden exists despite public provision of dental services for children and widespread use of fluoride toothpaste. In 2015 the Ministry of Health separately commissioned CH2M Beca and Sapere to examine the costs and benefits of fluoridating community drinking-water supplies in New Zealand.

The study describes how cost estimates were derived to reflect the diversity of treatment plant types and capacities, as well as how the level of existing treatment plant infrastructure impacts the costs of adding fluoridation. It examines capital cost estimates for small to medium sized treatment plant capacities, and undertakes four case studies on larger supplies. It also includes estimates of the costs required for existing fluoridation plants to achieve compliance with the *Code of Practice: Fluoridation of Drinking-Water Supplies in New Zealand* (Fluoridation CoP), published by Water New Zealand in 2014.

The study finds that, over a twenty year period, the discounted net saving from adding fluoride to community water supplies (supplying water to more than 500 people) would be $1.4 billion, which is nine times the estimated costs. We also conclude that fluoridating community water supplies that supply less than 500 people is unlikely to be cost-effective. Furthermore, the study concludes that between 8,800 and 13,700 quality adjusted life years would be gained.

Overall, this study shows that fluoridation is highly cost-effective. The health benefits, while on average only marginal per person, add up to a substantial reduction in New Zealand's disease burden across all ethnic and socioeconomic groups. This study concludes that fluoridation is far more cost-effective than most other health interventions across New Zealand, and the likelihood that the benefits are distributed equitably across society provides a further reason for water fluoridation to be maintained and extended.

The paper concludes with a discussion on how the findings of the study fed into the policy-making process, which resulted in the announcement of legislative changes that will allow District Health Boards, rather than local authorities, to decide on which community water supplies should be fluoridated.

KEYWORDS

fluoridation, drinking-water, costs, health benefits

1 INTRODUCTION

In 2015 the Ministry of Health separately commissioned Sapere Research Group and CH2M Beca to provide an evaluation of the benefits and costs of water fluoridation in New Zealand. Since that analysis was concluded the Minister of Health has proposed transferring decision making powers for fluoridating public water supplies away from City and District Councils (as water suppliers) to District Health Boards (DHBs).

DHBs under the New Zealand Public Health and Disability Act 2000 are required to "improve, promote, and protect the health of people and communities" and as such they are responsible for their population's oral health. The evidence has shown that children with access to fluoridated water experience 40 per cent reduction in dental decay, while adults experience 20-30 per cent reduction in dental decay. There has been little increase in the population coverage of water fluoridation in the last 15 years.

The decision to keep or start water fluoridation is equally important; there are significant health gains from both continuing and starting water fluoridation. Dental decay accounts for approximately one per cent of all health loss in New Zealand due to early death, illness or disability. The 'burden' of the disease from dental decay is a similar magnitude to other diseases that attract significant public interest.

Transferring responsibility for the fluoridation of water to DHBs aligns with their responsibilities as set out in the Public Health and Disability Act. It will allow each DHB to consider the health related evidence for its district, and align the positive and negative effects of fluoride into their overall responsibility for their population. The cost of maintaining public water supplies including fluoridation will remain with Councils, however the decision and any associated costs with making the decision will sit with the DHBs.

The purpose of this paper is to provide a summary of two reports: *Review of the benefits and costs of water fluoridation in New Zealand* (Moore & Poynton, 2015), and the costing report that underpinned the cost of fluoridation estimates, *Water Fluoridation Engineering Costs* (CH2M Beca Ltd, 2015).

2 CONTEXT

2.1.1 FLUORIDATION IN NEW ZEALAND

Water fluoridation involves the controlled addition of fluoride to a public drinking supply in order to improve oral health.[1] Fluoride occurs naturally in water but at a level of generally less than 0.2 parts per million. New Zealand's naturally occurring levels of fluoride are low compared to other countries. The optimum level of fluoridation is between 0.7 and 1.0 parts per million according to Ministry of Health recommendations.

Fluoridation began in New Zealand in 1954 and expanded rapidly in the 1960s. Public supply of drinking water covers 3.8 million New Zealanders, or approximately 81 per cent of the current 4.69 million population. Approximately 56 per cent of people on public drinking water supply receive fluoridated water, meaning that overall less than 45.5% of all New Zealanders receive fluoridated water. This contrasts with Australia where currently over 90 per cent of the population receives fluoridated drinking water.

The cities of Auckland, Wellington and Dunedin comprise the greatest population coverage of water fluoridation. Currently, 39[2] of 66 councils do not adjust the fluoride level in their water supplies. As a means of promoting the practice, the Ministry of Health had a subsidy to assist Councils with the capital costs associated with setting up fluoridation infrastructure.

2.1.2 ORAL HEALTH IN NEW ZEALAND

Oral disease is more important than generally realised. Millions of school and work hours are lost to it globally (Kandelman et al, 2008). The World Health Organization states that it is the fourth most expensive disease category (Petersen, 2008).

The New Zealand Oral Health Survey 2009 (NZOHS) found a considerable improvement over the past 20-30 years (Ministry of Health, 2010). However, it also found that New Zealand continues to have a comparatively high rate of tooth decay.

Additionally, oral disease is a significant issue of health equity. The 2009 NZOHS found that although oral health in adults has continued to improve over the last three decades, Maori, Pacific peoples and people living in high deprivation areas experience worse oral health outcomes.

2.1.3 DRINKING WATER REGULATION

DHBs through their Public Health Units are already responsible for improving, promoting and protecting public health by access to safe drinking water. This is through surveillance monitoring of public water supplies, and

[1] Fluoride promotes oral health by decreasing de-mineralisation; increasing re-mineralisation in early cavities and inhibiting the process that metabolises sugar to produce acid (the cause of dental decay).

[2] We include three district councils fluoridating less than 10 per cent of their supply.

assessing compliance with the Health (Drinking Water) Amendment Act 2007 and the Drinking-water Standards for New Zealand (DWSNZ).

3 COSTS OF FLUORIDATION

3.1 CHEMICAL OPTIONS

Three fluoridation chemicals are available to fluoridate water in New Zealand. Details of each chemical including its form, supply options, the dosing system required, and indicative costs are presented in Table 1.

Table 1: Fluoridation Chemical Options

Detail	Unit	Fluorosilicic Acid (FSA)	Sodium Fluorosilicate (SFS)	Sodium Fluoride
Alternative Names	-	HFA	SSF	-
Chemical Form	-	Liquid	Powder	Powder or granular
Dosing System	-	Liquid dosing	Dry feed system/liquid dosing	Saturator/liquid dosing
Supplied purity/concentration	% (w/w)	22	98-99	97-99
Indicative Treated Water Chemical Cost	$/ML	Bulk: 2.11 IBC: 3.43	2.16	9.52
Chemical Supply	-	Bulk tanker IBC (Intermediate Bulk Container)	25 kg bag	25kg bag

3.2 CAPITAL COSTS

3.2.1 POPULATION CATEGORIES

The design flow for each population category had the following principles applied:

- For large water supplies (population >10,000) the design flow is based on capacity advised by the water supplier. In the absence of actual design capacity, a peak figure of 700 litres/person/day and an average figure of 460 litres/person/day was used.
- For supplies serving populations <10,000 a higher peak per capita water usage rate of 1000 litres/person/day and an average usage of 500 litres/person/day was used.
- For each population category the WTP design flow was based on the per capita flow times the mean population for that category.

The population design basis for each category is shown in Table 2.

Table 2: Population Design Basis

Population category	Population band	Design population	Design Flow (m^3/d)
Large	>10,000	Varies	Varies
Medium	5001 – 10000	6900	6900
Minor	501 – 5000	2050	2050
Small	101 – 500	260	260
Neighbourhood	< 100	55	55

3.2.2 COST ASSUMPTIONS

In addition to the actual fluoridation equipment, ancillary work and equipment installation may be required to implement fluoridation at a WTP depending on the existing layout, equipment, services and operation of the WTP. The cost estimates allowed for the following ancillary equipment:

- Installation of a fluoride analyser.
- Construction of, or improvement to, the chemical delivery area.
- Construction of a new building to house equipment, or extension/refurbishment of an existing building.
- Construction of building services (ventilation/air con, lighting, power).
- Installation of a safety shower.
- Incorporation of fluoride dosing system control, monitoring and alarms into existing PLC, SCADA and/or telemetry systems.

There is a wide range of ancillary work that may be required at specific treatment plants but was not allowed for. This includes such things as engineering investigations, flow meter on the main process flow, upgrade to drainage systems, water softening (if using sodium fluoride or SFS), reconfiguration of piping and valving at the treatment plant, installation or upgrading of SCADA and/or telemetry systems, installation or upgrade to the PLC system, construction of amenities, gantry/forklift for handling requirements, installation or upgrade of security, construction of a laboratory complete with equipment, personal protective equipment (PPE), construction of or upgrade to power supply and switchboards, construction of new delivery vehicle access and roads, installation of a service water system, and land purchase.

3.2.3 ASSUMPTIONS FOR MEDIUM, MINOR, SMALL AND NEIGHBOURHOOD SUPPLIES

Sodium fluoride can be a good choice for smaller water supplies as the capital set up costs are generally lower than the other types of systems and the systems are relatively simple to operate. The chemical cost of sodium fluoride is relatively expensive in New Zealand compared to SFS and FSA, but because smaller supplies only use a small quantity of fluoride on a yearly basis the increase in operating costs is relatively minor.

For costing purposes we based the Neighbourhood, Small and Minor water supplies on a sodium fluoride system. At the higher flows associated with a Medium supply, the operating cost savings from using FSA are more significant and hence we based the medium supply on a FSA system.

For each category we provided a “low” and “high” cost estimate. The low cost estimate assumes there are already reasonable facilities onsite and the equipment installed will be a “low cost” option. Whilst a “low cost” option will be fit for purpose, it may require higher operator input, maintenance and have less robust control checks. The high cost estimate allows for a more robust system with better equipment, safety and controls.

3.2.4 COST ESTIMATES

The capital cost estimates (excl. GST) for the different sized water supplies are shown in Table 3. These costs are indicative only based on a generic plant of that size. More detailed information and design would be required in order to use the capital costs for capital budgeting purposes for a specific plant.

Table 3: Fluoridation Capital Cost Estimates for Different Sized Water Supplies

Design Parameters	Neighbourhood	Small	Minor	Medium
Population Served	<100	101-500	501-5000	5001-10000
Capacity (m^3/d)	55	260	2050	6900
Fluoride	NaF	NaF	NaF	FSA

Design Parameters	Neighbourhood		Small		Minor		Medium	
Chemical								
Costs	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**
Equipment + Install	15,000	45,000	20,000	45,000	20,000	82,500	50,000	70,000
EI&C	15,000	15,000	15,000	15,000	15,000	20,000	20,000	20,000
Fluoride Analyser	-	15,000	-	15,000	-	15,000	-	15,000
Building	10,000	30,000	12,000	30,000	15,000	30,000	15,000	30,000
Safety Shower, Chemical Handling	5,000	5,000	5,000	5,000	5,000	30,000	15,000	40,000
Design (12%) & P&G (15%)	13,000	30,000	14,000	30,000	15,000	48,000	27,000	47,000
Contingency and rounding	7,000	20,000	9,000	20,000	10,000	34,500	18,000	38,000
Total	**$65,000**	**$160,000**	**$75,000**	**$160,000**	**$80,000**	**$260,000**	**$145,000**	**$260,000**

3.3 OPERATIONAL COSTS

The estimated operational costs (excl. GST) for the various sized systems as shown in Table 4.

Table 4: Operating Cost Estimates

Design Parameters	Neighbourhood	Small	Minor	Medium
Population Served	<100	101-500	501-5,000	5,001-10,000
Average Capacity (m^3/d)	28	130	1,025	3,450
Fluoride Chemical	NaF	NaF	NaF	FSA
Costs/annum				
Chemical	$100	$450	$3,500	$4,300
Operator Input	$5,200	$5,200	$5,200	$5,200
Maintenance	$1,500	$1,900	$3,000	$3,700
Total (per annum)	**$6,800**	**$7,600**	**$11,700**	**$13,200**

The operating costs are based on the following assumptions:

- Chemical costs are based on indicative prices received from suppliers.
- Operator input is based on 2 hours/week at an operator hourly rate of $50/hour. The hourly rate may be lower for some supplies.
- Maintenance costs have been estimated as 2% of capital costs of the plant.

- Monitoring and compliance costs have been excluded.

3.4 LARGE WATER SUPPLIES

It is difficult to prepare a generic cost estimate for the "Large" plant category as these are likely to require very specific designs. There are over 20 large supplies in NZ that are not currently fluoridating. To get an initial understanding of the likely order of costs for large supplies, we prepared cost estimates for four case studies.

The estimated capital costs (excl. GST) for the four case study large supplies are shown in Table 5. These costs are indicative only based on preliminary information for each plant. More detailed information and design would be required in order to use the capital costs for capital budgeting purposes.

Table 5: Summary of Capital Costs to provide Fluoridation to Large Water Supplies

Design Parameters	Whangarei	Levin	Napier	Blenheim
Population Served[3]	48,000	20,000	49,910	24,000
Peak Capacity (m^3/d)	36,000	13,000	50,000	34,000
Average Capacity (m^3/d)	23,000	8,500	29,000	13,000
Fluoride Chemical	FSA	SFS	FSA	FSA
Treatment Plants	Whau Valley Poroti Ruddles	Levin WTP	Ten wells	Central WTP Middle Renwick Road WTP
Capital Cost	**$725,000**	**$400,000**	**$2,250,000**	**$580,000**

3.5 EXISTING FLUORIDATION PLANTS

Five case studies were undertaken on a range of plants that have existing fluoridation systems to estimate the cost required for each plant to meet the Fluoridation Code of Practice (CoP). Existing plants must comply with the code by 2020. These cost estimates are indicative only based on limited information gathered from the water supplier. A more detailed assessment of each plant would be required in order to more accurately assess and cost the upgrades required to meet the CoP.

A summary of the estimated capital costs for each plant to meet the CoP is shown in Table 6.

Table 6: Summary of Upgrade Costs to meet the Code of Practice

	Waterloo	Waikanae	Hamilton	Balclutha	Milton
Population Category	Large	Large	Large	Minor	Minor
Fluoride Chemical	SFS	SFS	FSA	NaF	NaF
Upgrade Cost	$15,000	$10,000	$50,000	$25,000	$20,000

[3] From WINZ database.

3.6 COSTS USED IN THE SAPERE ANALYSIS

3.6.1 ASSUMPTIONS

A number of assumptions were made when incorporating the estimated costs of adding fluoride into the cost benefit analysis:

- The mid-point of the range of the capital cost estimate was used. For example, the range of capital costs for a medium-sized plant is $145,000 to $260,000, so the mid-point figure of $202,500 was used.
- For large plants, costs supplied by Councils were used, resulting in an estimated capital cost of $347,004.
- In terms of operating costs we assume the costs would be the same for large and medium-sized plants, differing only by volume of water. The estimates for medium-sized plants were also used for the large plants.
- We assume the lowest cost combination of capital and fluoride type for each plant. However, we are aware that some councils will not take this approach, usually for operating reasons. For instance, councils may decide to use the same type of fluoride across all their plants to simplify stockholding and optimise operational costs.
- The chemical cost of fluoride is made up of the average amount of water used for each water plant and the price of fluoride. The price of fluoride differs by the type of fluoride used. The type of fluoride used is determined by the size of the water treatment plant.

3.6.2 SUMMARY OF COSTS USED

The cost of fluoridating water supplies is made up of capital, maintenance and fluoride costs. The cost structure differs by plant size, with small plants having higher capital costs relative to supply volume and using the more expensive chemical.

Capital and operating costs change with the number of plants servicing any one population; i.e. a high number of treatment plants increases the average cost per capita. The contribution of the capital and operating costs differs greatly depending on the size of the plant; capital and operating costs account for:

- approximately half the total cost for a large plant;
- up to 99% of the total costs for neighbourhood-sized plant plants.

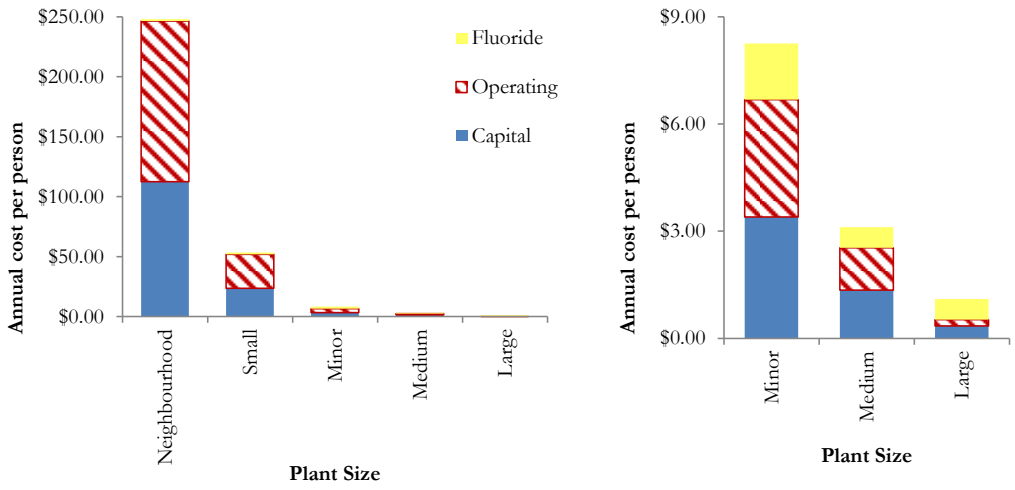
The costs used in the cost model are summarised in Table 7 below. Using these costs, the 20-year cost (undiscounted) of a medium-sized plant with a production of 3,450 m^3/day is $466,500. This cost is made up of:

- $202,500 in capital costs;
- $178,000 in operating costs; and
- $86,000 in fluoride chemical.

Table 7: Estimated cost of water fluoridation by plant size

Plant size	Population	Fluoride Chemical	Capital Cost	Annual Operating Cost	Annual Fluoride Supply Cost (per m^3/day)
Neighbourhood	<100	Sodium fluoride	$112,500	$6,700	$3.57
Small	101–500		$117,500	$7,100	$3.46
Minor	501–5,000		$170,000	$8,200	$3.41
Medium	5,001–10,000	Fluorosilicic acid	$202,500	$8,900	$1.25
Large	10,001+		$347,004	$8,900	$1.25

Figure 1 Breakdown of fluoridation costs by size of water plant (note the graph on the left has five plant classifications and the graph on the right is an expansion of the three larger plant sizes)*



** Population sizes used in figure are: Neighbourhood 50; Small 250; Minor 2,500; Medium 7,500; Large 50,000. Water usage estimated to be 0.46 m³/day per person.*

For one supply, there might be more than one treatment plant and possibly as many as ten. Therefore, we have applied size definitions to the water treatment plant rather than at the supply level for the purpose of estimating costs.

4 BENEFITS OF FLUORIDATION

4.1 EVIDENCE FOR THE HEALTH BENEFITS

A large body of epidemiological evidence accumulated over 60 years, including thorough systematic reviews, confirms water fluoridation prevents and reduces dental decay across the lifespan. The evidence for this benefit is found in numerous New Zealand and international studies and reports. However, the precise amount that dental decay is reduced by is difficult to estimate.

The Sapere estimates for the health benefits of water fluoridation are as follows:

- In children and adolescents, a 40 per cent lower lifetime incidence of dental decay (on average) for those living in areas with water fluoridation. This estimate is based on the New Zealand Oral Health Survey (NZOHS).
- For adults, a 21 per cent reduction in dental decay for those aged 18 to 44 years and a 30 per cent reduction for those aged 45+ (as measured by tooth surfaces affected). This estimate is based on the Australian National Survey of Adult Oral Health (NSAOH).[4]
- 48 per cent reduction in hospital admissions for treatment of tooth decay, for children up the age of four years. This estimate is based on the findings of the Public Health England Monitoring Report 2014.

4.2 SIGNIFICANT REDUCTION IN DENTAL DECAY

In our analysis, the benefits of fluoridation are represented by an estimate of the dental treatment costs averted as a result of reduced decay. Dental care benefits are made up of a combination of reduced fillings (initial and

[4] We selected this study rather than the 2009 NZOHS findings for adults because, unlike the 2009 NZOHS, the Australian study took into account lifetime exposure to water fluoridation.

replacements), fewer tooth extractions, and a reduction in childhood hospitalisations for treatment of dental decay. We estimate water fluoridation results in 8 million fewer teeth affected by decay, which is an average of 2 per person over 20 years. This represents a 22 per cent reduction in the number of teeth affected by decay, combined across the total population. We also assumed a 30 per cent reduction in decayed tooth surfaces. Our estimates of dental care costs are conservative meaning that the benefits are likely larger than estimated.

4.3 COST SAVINGS

Our estimates suggest a surprisingly large gain from fluoridation in costs avoided. We set out our estimates of net cost in this section.

The cost of fluoridating water differs largely because of the size of the plant. The net cost of water fluoridation per capita reduces as the plant size increases, assuming the per-person benefits of fluoridation are the same for areas supplied by neighbourhood through to large water plants. The table below sets out costs. Cost offsets are over 20 years and are discounted at 3.5% per annum. The break-even point on costs avoided would appear to be reached by 'minor' plants supplying a population greater than 500.

For neighbourhood and small plants the cost of water fluoridation is greater than the estimated cost offsets from reduced dental costs. For minor through to large plants, the cost offsets are greater than the cost of fluoridation, resulting in a net cost saving. For a large plant supplying 50,000 people, the cost offsets are over 20 times the cost of fluoridation; that is, for every dollar invested there is a return of 20 dollars. We note costs are borne by councils and benefits accrue largely to those suffering dental decay.

Table 8: Net present value of water fluoridation by plant size

Plant size	Population Used for Estimates	Fluoridation Cost (NPV)*	Dental Care Cost Savings (NPV)*	Net Cost (a Negative is a Net Saving)*
Neighbourhood	<100	$212,000	$19,000	$193,000
Small	101–500	$228,000	$94,000	$134,000
Minor	501–5,000	$348,000	$939,000	-$591,000
Medium	5,001–10,000	$397,000	$2,818,000	-$2,421,000
Large	10,001+	$900,000	$18,785,000	-$17,885,000

* Over 20 years, discounted at a rate of 3.5%

We estimate that fluoridation results in a net saving of over $1.4 billion over 20 years (discounted at a rate of 3.5 per cent p.a.). This estimate is made up of a cost of fluoridation of $177 million and cost offsets of $1,578 million from reduced dental decay. This net saving is based on providing water fluoridation to plants supplying populations over 500. At an individual level, the net saving of water fluoridation is $334 per person, made up of $42 for the cost of fluoridation and $376 savings in reduced dental care.

Our estimates are based on adding fluoride at 415 water treatment plants across New Zealand, the size and population served of the water treatment plants are:

- Minor, 501 5,000: 277 water treatment plants
- Medium, 5001 – 10,000: 44 water treatment plants
- Large, 10,001+: 94 water treatment plants

Our results demonstrate that fluoridation is a health intervention which provides improved health outcomes for a net saving. This is a rare result among health interventions which generally require a net increase in spending in order to achieve improved health outcomes. This positive result is robust to significant changes in assumptions.

The investment in fluoridation made by district councils ($177m) results in savings at a rate of $9 dollars per dollar invested. The majority of the savings ($1,428m) are from reduced dental costs for adults; these savings represent the avoided costs of fillings and extractions. There are also savings to the health budget ($149m) from reduced dental care costs for children; these savings represent avoided dental procedures and some reduction in hospital admissions. Table 9 below shows where the costs and savings fall.

Table 9: Net present value of costs by provider

Stakeholder	Cost (NPV)*	Saving (NPV)*	Net Cost*
Health budget		-$149m	-$149m
District council	$177m		$177m
Private		-$1,428m	-$1,428m
Total	$177m	-$1,578m	-$1,401m

* Over 20 years, discounted at a rate of 3.5%

5 EXPECTED PUBLIC HEALTH OUTCOMES

5.1 QUALITY ADJUSTED LIFE YEARS GAINED

We estimate provision of fluoridated water to all of New Zealand reticulated water supplies over 20 years would result in between 8,800 and 13,700 quality adjusted life years (QALYs) gained. At an individual level, the average health benefit per person due to a reduction in dental decay is expected to be between 0.002 and 0.003 QALYs (discounted, i.e. approximately equivalent to an additional 1 to 1.5 days of life at full quality of life). In comparison to almost all other health spending, these quality benefits are from a cost-saving intervention rather than being paid for.

5.2 POSITIVE EFFECT ON DISPARITIES IN ORAL HEALTH

Equally important in health interventions to overall efficiency of the intervention are the distributional effects. There is strong evidence water fluoridation reduces dental decay regardless of ethnicity, socioeconomic status and age. We expect the relative impact of water fluoridation is the same across ethnic groups and deprivation. Because of the greater prevalence of dental decay among Maori and those who are most deprived, we expect these groups to have a greater absolute benefit from water fluoridation.

6 POLICY MAKING PROCESS AND LEGISLATIVE CHANGES

In 1999 the Ministry of Health commissioned the Institute of Environmental Science and Research (ESR) to complete a cost-benefit analysis of drinking-water fluoridation. ESR found water fluoridation reduced dental decay in children and the cost savings from reduced dental care outweighed the cost of water fluoridation in towns with over 1,000 people. The 2015 Sapere report (supported by CH2M Beca costs) has confirmed this finding and has concluded that fluoridation of community water supplies supplying more than 500 people is likely to be cost effective.

Local authorities fund drinking-water supplies from rates and are responsible for decisions on fluoridation. The Ministry of Health has no direct role in the decision-making process on water fluoridation. A number of local authorities have decided not to fluoridate, or have introduced fluoridation, then reversed their decision.

Fluoridation has become an increasingly contentious issue for local authorities, with active lobbying and court action against councils by anti-fluoridation groups as well as controversy and referenda at local body elections. The view of Local Government New Zealand (LGNZ) is that fluoridation decisions should be made in the health sector, rather than by local government which is simply the owner and operator of the water assets and does not have fluoridation expertise. At the 2014 conference of LGNZ, local authorities called for either the Director-General of Health or District Health Boards (DHBs) to take responsibility for decisions on fluoridation.

After considering a range of options for increasing access to fluoridated water supplies, from the status quo (local authority decision making) to a legislative requirement to fluoridate drinking-water supplies, the Ministry of Health recommended transferring decision-making on fluoridation to DHBs. In April 2016 the Health Minister Jonathan Coleman and Associate Health Minister Peter Dunne announced proposed legislative changes to allow DHBs, rather than local authorities, to decide which community water supplies are fluoridated in their areas.

Each DHB will:

- Collect and review local data on community oral health
- Apply national tools developed by the Ministry of Health to generate information about water supplies and affected population groups and communities, and
- Consider this information and direct water suppliers to fluoridate or not to fluoridate community water supplies as appropriate.

Local authorities will still be responsible for supplying drinking water. A local authority will be required to fluoridate a water supply if it is directed to do so by the DHB. It will also not be able to stop fluoridation unless the DHB directs it to.

Local authorities will continue to be responsible for the costs of fluoridating community water supplies, while the cost of making decisions on fluoridation will be met by DHBs.

Changing the decision-making process for water fluoridation will require an amendment to Part 2A (Drinking-water) of the Health Act 1956 and amendments to the New Zealand Public Health and Disability Act 2000. It is anticipated that a Bill will be developed for initial consideration by Parliament by the end of 2016. The Bill will describe the:

- Powers and duties of DHBs in relation to decisions about water fluoridation
- Powers and duties of water suppliers (including local authorities) in relation to implementing DHB directives about water fluoridation
- Information that DHBs must consider when determining whether to fluoridate a water supply.

Once drafted, the Bill will pass through the normal Parliamentary processes. Other interested parties (including communities and individuals) will be able to comment on the Bill as it is considered by the Health Select Committee.

If the amendments are passed before the end of the Parliamentary term in 2017, it is likely that legislation will come into force from mid-2018.

7 CONCLUSIONS

The base equipment for a fluoridation system can be installed relatively inexpensively. However, in order for fluoridation to be safe for consumers, operators and the environment; proper controls must be in place regardless of system size. These additional controls add cost, which can be significant.

The cost estimates show that the infrastructure that exists at a treatment plant has a big impact on the costs of adding fluoridation. Typically smaller plants have less infrastructure than larger ones. Some Small and Neighbourhood supplies may not even have a treatment plant.

The existing configuration of a supply can also affect the costs. The Napier supply with ten wells feeding directly into the network is an example of a system that would cost significantly more to implement than a similar size city with just one or two water treatment plants. Whilst this type of supply is not the norm, it is not unique either. The Christchurch water supply also consists of a network of wells that separately supply the city.

While we estimated a range of capital costs, the “High” estimate is not likely to be enough to cover the situation for all plants in a particular size category. For plants with little or no infrastructure, or supplies with multiple sources, the capital costs will be higher than the “High” estimate.

The net cost of water fluoridation reduces as the plant size increases. The study shows that the break-even point on costs avoided is reached by Mino’ plants supplying a population greater than 500.

For neighbourhood and small plants the cost of water fluoridation is greater than the estimated cost offsets from reduced dental costs. For minor through to large plants, the cost offsets are greater than the cost of fluoridation, resulting in a net cost saving.

We estimate that fluoridation results in a net saving of more than $1.4 billion over 20 years. This estimate is made up of a fluoridation cost of $177 million and cost offsets of $1,578 million from reduced dental decay. This net saving is based on providing water fluoridation to plants supplying populations over 500.

We note that the costs are borne by water suppliers, and benefits accrue largely to those suffering dental decay.

Our results demonstrate that fluoridation is a health intervention which provides improved health outcomes for a net saving. This is a rare result among health interventions which generally require a net increase in spending in order to achieve improved health outcomes.

The investment in fluoridation made by district councils ($177m) results in savings at a rate of $9 dollars per dollar invested. The majority of the savings ($1,428m) are from reduced dental costs for adults; these savings represent the avoided costs of fillings and extractions. There are also savings to the health budget ($149m) from

reduced dental care costs for children; these savings represent avoided dental procedures and some reduction in hospital admissions.

The provision of fluoridated water to all of New Zealand reticulated water supplies with populations greater than 500 over 20 years is estimated to result in between 8,800 and 13,700 quality adjusted life years gained. Equally important to the overall efficiency of the intervention are the distributional effects - there is strong evidence water fluoridation reduces dental decay regardless of ethnicity, socioeconomic status and age.

The work described in the paper formed part of the evidence used in the decision making process for increasing access to fluoridated water supplies. This led to the announcement in April 2016 by the Health Minister Jonathan Coleman and Associate Health Minister Peter Dunne of proposed legislative changes to allow DHBs, rather than local authorities, to decide which community water supplies are fluoridated.

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