SCIENTIFIC RESEARCH REPORT

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A 4-year assessment of a new water-fluoridation scheme in New South Wales, Australia

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Objective: To monitor the changes in dental caries prevalence of 5- to 7-year-old children living in a fluoridated area, a newly fluoridated area and in an area without water fluoridation, in NSW, Australia. **Methods:** Dental caries prevalence was recorded for 5- to 7-year-old children, living in the three study locations, by six trained and calibrated examiners in 2008, 2010 and 2012. A questionnaire recorded demographic data, toothbrushing behaviour and sugary drink consumption. Caries experience was measured using the decayed, missing, and filled teeth (dmft) index for primary teeth, the percentage of children who were caries free and the significant caries index. Univariate analysis was undertaken to determine independent predictors of caries. **Results:** The caries prevalence changed over time. In 2008, the mean dmft index was 1.40 for the fluoridated area, 2.02 for the area about to fluoridate and 2.09 for the unfluoridated control. By 2012, these mean dmft scores were 0.69, 0.72 and 1.21, respectively. In the two areas where children received fluoridated water, the significant caries index was 2.30 for the fluoridated area and 2.40 for the newly fluoridated area. The significant caries score for children in the unfluoridated location was 3.93. Multivariate analysis showed that over time the differences in dental caries prevalence between the established fluoride area and the newly fluoridated area diminished. However, children in the unfluoridated control area continued to demonstrate significant differences in the mean number of decayed teeth compared with children in the fluoridated comparator sites, and the proportions of children free from decay were significantly higher in the fluoridated areas than in the unfluoridated area. **Conclusion:** Fluoridation of public water supplies in Gosford and Wyong offers young children better dental health than those children who do not have access to this public health measure.

Key words: *Water fluoridation, dental caries, primary school children, trends over time, Australia*

INTRODUCTION

The State of New South Wales (NSW) in Australia has a long history of implementing water-fluoridation schemes. The first town to be fluoridated in NSW was Yass, in 1956, followed by the City of Sydney, in 1963. The coverage of the population serviced by fluoridated water supplies increased over the next 45 years, such that the only highly populated Local Government Areas (LGA) not covered were Ballina Shire, Byron Shire and Gosford City. It is NSW Health's policy to extend the coverage of water fluoridation to as many people as possible living in unfluoridated areas[1]. In 2007, Gosford City Council voted to fluoridate the water supply, and the scheme was gazetted to be implemented in December 2008. The NSW Centre for Oral Health Strategy decided to monitor the Oral Health of Children living in Gosford City just before fluoridation began and to continue surveillance over a 4-year period. The rationale for this decision was threefold. First, to compare the oral health of children from Gosford City with those living in an LGA in NSW that had been fluoridated for over 40 years and with those in the Shires of Ballina and Byron that had no immediate plans to fluoridate. In this way, useful data would be obtained to give advice to other Councils considering water-fluoridation schemes to counter opposition from a small, but determined, group of people who believe that fluoridation is no longer necessary. The second objective was to determine whether the oral health of children living in Gosford City improved over time. The third was that a systematic review of water fluoridation by researchers at York University (UK) had commented on the lack of research undertaken on the topic in recent years since fluoride toothpaste became widely available[2].The baseline data[3] collected as the first part

of the surveillance programme showed that children of Wyong (fluoridated) had much better dental health than children from the non-fluoridated comparator sites.

Therefore, this paper moves on from the baseline study[3] and reports on the changes in dental health from 2008 to 2012 of 5- to 7-year-old children living in Gosford City (newly fluoridated), Wyong Shire (fluoridated) and the Shires of Ballina and Byron (unfluoridated).

METHODOLOGY

Gosford City LGA, on the Central Coast of NSW, implemented a new water-fluoridation scheme in December 2008. A comparator LGA, Wyong Shire, which has been fluoridated for over 40 years, and is also on the Central Coast, was the active control, whereas the Shires of Ballina and Byron, in Northern NSW, were the water non-fluoridation controls.

The non-fluoride comparison sites were more difficult to identify given the widespread coverage of fluoridation in NSW[4]. The Shires of Ballina and Byron are somewhat more rural and less industrialised than Wyong Shire and Gosford City.

A sample-size calculation suggested that 500 children were required from each site to detect a difference in the mean decayed, missing and filled teeth (dmft) index for primary teeth in 5-year-old children of 0.3 with a power of 0.8 at a significance level of 0.05. Children were drawn from Catholic and State Schools in the three areas. Schools were randomly selected from a master list until the individual school rolls for primary school children, 5- to 7 years of age, added up to around 900, to allow for a non-response of around 35%. As part of the ethics process, written consent was obtained from the parents/guardians for their children to participate in the study. Those children in the appropriate classes with positive consent were invited to participate in the survey. The baseline study was undertaken in September to November 2008, just before the fluoridation plant became operational. Follow-up studies took place in the same months of 2010 and 2012.

The children were examined in the school, utilising portable dental equipment, including an illuminated mirror with a disposable mirror head, a mini compressor to dry the teeth and a lightweight dental chair.

The examiners – two dentists and four therapists – were trained and calibrated to use the same diagnostic system as that adopted in a 2007 statewide NSW Child Dental Health Survey[5], which consisted of the visual examination of an air-dried tooth under a bright light. Caries was diagnosed if there was a visible break in the enamel and/or a clearly delineated dark shadow under the enamel[6]. A probe was not used as a diagnostic tool, and bitewing radiographs were not taken.

As part of the consent process, the parents/carers were asked to record their education attainment (except in 2008); their child's toothbrushing frequency; and their child's sugary drink consumption (including sugar-sweetened fruit juices or cordial, cola and fizzy drinks). Aboriginal status was also collected on the questionnaires.

Before each new examination year, extensive examiner training took place to ensure consistency with the diagnostic criteria[7]. The same team of examiners participated in the 2008, 2010 and 2012 surveys. A gold standard examiner undertook five joint dental inspections with each of the six study examiners who also re-examined 10% of the participants. Data were collected in the 2008 baseline study on mark sense cards, were scanned utilising Tele Form software and were imported into Microsoft Access for data checking and cleaning. The surveys in 2010 and 2012 utilised direct entry of data into a customised Microsoft Access database on laptop computers. This was a far less labour-intensive system than used for the 2008 survey. Data were then imported into SAS software, Version 9.3 of the SAS System for Windows (SAS Institute Inc., Cary, NC, USA) for analysis. Caries experience was measured using the dmft index (primary dentition), the percentage of children who were caries free and the significant caries index, according to each geographical location. Univariate analysis was performed to determine independent predictors, using logistic regression for dichotomous caries outcomes and negative binomial regression for dmft and decayed teeth counts. All covariates with $P < 0.25$ were considered in the multivariate analysis. The backward selection method was used to derive the final model that included the following significant predictors: indigenous status; concession cardholder status; maternal country of birth; highest educational attainment; sugary drink consumption; and toothbrushing frequency. The final model also controlled for age and gender, but these were not significant.

The study was approved by the State Education Research Committee (SERAP) of the NSW Department of Education and Training. The Catholic Education Commission also gave permission to involve schools within their jurisdiction. (SERAP number 2008052) The South West Area Health Service (SWAHS) Human Research Ethics Committee granted ethical approval for the school-based surveys; HEREC 2008/314 18 (2758); All RED 08/WMEAD/57.The research was conducted in full accordance with the World Medical Association Declaration of Helsinki.

RESULTS

Children 5–7 years of age in Gosford City, Wyong Shire and the Shires of Ballina/Byron Bay received a

dental examination in 2008, 2010 and 2012. Minor differences in the mean age and gender distribution were observed across the three study sites over the examination years (*Table 1*). The response rates also varied slightly over time (*Table 1*). The unfluoridated Shires of Ballina and Byron consistently returned a lower number of positive consents compared with the other sites (*Table 1*). However, the response rate in Ballina and Byron Shires did rise to around 65% in 2010 and 2012. This may be partly because the study administrator sent out simple follow-up reminder letters and consent forms to schools in all the three areas.

A gold standard examiner completed five joint examinations with each of the six individuals. Each year, there were high levels of agreement for missing, decayed or filled primary teeth. Intraclass correlations (ICC) ranged from 0.79 to 0.91 in 2008, from 0.69 to 0.93 in 2010 and from 0.76 to 0.90 in 2012[8].

The caries prevalence changed over time (*Table 2*). In 2008, the mean dmft was 1.40 for the fluoridated area, 2.02 for the area about to be fluoridated and 2.09 for the Shires (which had no plans to fluoridate). The percentages of children free from dental caries are shown in *Table 2* and they differ markedly: 62.6% for the fluoridated area; 50.8% for the newly fluoridated area; and 48.6% for the unfluoridated area.

By 2010, changes had occurred in the mean dmft scores for all the areas (*Table 2*): the dmft score for the unfluoridated area showed only a slight decrease, from 2.09 to 2.06 (1.4% reduction), whereas those for the fluoridated and newly fluoridated areas showed much greater decreases, from 1.40 to 0.96 (31.4% reduction) and from 2.02 to 1.13 (44.1% reduction), respectively. The proportions of children free from dental caries increased in all three areas. The two fluoridated areas (*Table 2*) had very similar proportions of caries-free children (68.2% and 68.1%), whilst the proportion of caries-free children in the unfluoridated area was 55.4%.

The examination undertaken in 2012 showed a marked fall in the mean dmft scores for all study areas; the dmft fell to 0.69 for the fluoridated area, to 0.72 for the newly fluoridated area and to 1.21 for the unfluoridated shires. There were also marked increases in the proportions of caries-free children in all study areas, to 75.8% in the fluoridated area, 74.9% in the newly fluoridated area and 67.3% in the unfluoridated area (*Table 2*). The percentage change in dmft scores from 2008 to 2012 was 50.7% for the fluoridated area, 64.3% for the newly fluoridated area and 42.1% for the two unfluoridated Shires. Caries rates decreased, irrespective of fluoridation status, but the mean dmft score in the unfluoridated area (1.21) was still almost double that in Gosford (0.72) and in Wyong (0.69), both with fluoridation of their public water supply.

The significant caries index highlights that for some children dental caries remains a major health problem. In both fluoridated areas the significant caries index dropped over the study period, from a baseline score of 4.42 to 2.30 for the fluoridated area, from 5.85 to 2.40 for the newly fluoridated area, whilst the unfluoridated Shires had a smaller reduction, from 5.97 to 3.93, which suggests a need for considerable restorative care.

Multivariate analysis showed that several factors are significantly associated with dental caries in children (*Tables 3–5*). In all three surveys, children of parents who were concession cardholders or whose mother was born in a non-English-speaking country, or children who drank more than one sugary drink a day, had significantly higher dmft and decayed teeth counts. Aboriginal status, educational attainment of parents and toothbrushing frequency were only significantly associated with dmft counts in 2012, and with

Table 1 Consent rates for the schools and characteristics of students from the three study areas in 2008, 2010 and 2012

Fluoridation status	Number of consents	Number of children examined	Response rate (%)	Mean age (years)	Proportion male (mean %)
2008					
Fluoridated	1065	825	77.5	6.1	50.8
Newly fluoridated	932	781	80.1	6.0	48.7
Unfluoridated	945	523	55.3	6.3	50.3
2010					
Fluoridated	1054	833	79.0	5.9	53.2
Newly fluoridated	1047	857	81.9	5.5	49.3
Unfluoridated	927	594	64.0	5.6	52.7
2012					
Fluoridated	1102	811	73.6	5.7	50.2
Newly fluoridated	1040	844	81.1	5.5	51.7
Unfluoridated	932	612	65.7	5.6	51.1

Table 2 Caries experience among junior primary school-age children (5–7 years old), according to fluoridation status, in 2008, 2010 and 2012

Fluoridation status	*n*	dmft					Caries free		SiC	
		d	m	f	Mean	95% CI	%	95% CI	Mean	95% CI
2008										
Fluoridated	825	0.92	0.20	0.29	1.40	1.22–1.58	62.6	59.2–65.9	4.42	4.04–4.81
Newly fluoridated	781	1.42	0.03	0.41	2.02	1.80–2.23	50.8	47.3–54.3	5.85	5.47–6.22
Unfluoridated	523	1.45	0.02	0.58	2.09	1.84–2.35	48.6	44.3–52.9	5.97	5.58–6.37
2010										
Fluoridated	833	0.75	0.05	0.16	0.96	0.83–1.09	68.2	65.0–71.4	3.12	2.84–3.41
Newly fluoridated	857	0.79	0.06	0.28	1.13	0.97–1.29	68.1	65.0–71.3	3.70	3.33–4.07
Unfluoridated	594	1.44	0.13	0.49	2.06	1.79–2.33	55.4	51.4–59.4	6.18	5.68–6.68
2012										
Fluoridated	811	0.51	0.04	0.14	0.69	0.57–0.81	75.8	72.9–78.8	2.30	1.97–2.62
Newly fluoridated	844	0.54	0.04	0.14	0.72	0.61–0.84	74.9	72.0–77.8	2.40	2.10–2.70
Unfluoridated	612	0.86	0.08	0.27	1.21	1.03–1.39	67.3	63.6–71.0	3.93	3.55–4.32

d, decayed primary teeth; dmft, decayed, missing or filled primary teeth index; f, filled primary teeth; m, missing primary teeth; SiC, significant caries index.

Table 3 Multivariate analysis of decayed, missing or filled primary teeth (dmft) according to year, fluoridation status and socio-economic characteristics[‡]

Variable	2008		2010		2012	
	IRR	95% CI	IRR	95% CI	IRR	95% CI
Fluoridation status						
Fluoridated	1.00[†]		1.00[†]		1.00[†]	
Newly fluoridated	1.47***	1.20–1.80	1.41**	1.10–1.80	1.11[NS]	0.85–1.45
Unfluoridated	2.06***	1.48–2.85	2.81***	2.16–3.64	2.23***	1.66–2.98
Indigenous status						
Non-Aboriginal	1.00[†]		1.00[†]		1.00[†]	
Aboriginal	1.29[NS]	0.88–1.89	1.38[NS]	0.96–1.97	1.83**	1.24–2.71
Cardholder status						
Non-cardholder	1.00[†]		1.00[†]		1.00[†]	
Cardholder	1.57***	1.29–1.91	1.74***	1.41–2.13	1.73***	1.37–2.18
Maternal country of birth						
English speaking	1.00[†]		1.00[†]		1.00[†]	
Non-English speaking	1.70**	1.17–2.45	2.07***	1.43–3.00	1.58*	1.06–2.36
Highest educational attainment of parent(s)[§]						
Bachelor's and higher	–	–	1.00[†]		1.00[†]	
Certificate/Diploma	–	–	1.28*	1.01–1.63	1.20[NS]	0.92–1.57
Year 12 or below	–	–	1.51**	1.14–1.99	1.61**	1.17–2.22
Toothbrushing behaviour						
Twice or more a day	1.00[†]		1.00[†]		1.00[†]	
Once or less a day	1.01[NS]	0.83–1.24	1.12[NS]	0.91–1.38	1.31*	1.04–1.65
Sugary drink consumption						
None	1.00[†]		1.00[†]		1.00[†]	
One or more a day	1.50***	1.22–1.84	1.50***	1.23–1.83	1.47**	1.17–1.86

IRR, incidence rate ratio; NS, not significant.
*$P < 0.05$.
**$P < 0.01$.
***$P < 0.001$.
[†]Referent.
[‡]Adjusted for age and gender.
[§]Highest educational attainment of parents was not asked in 2008.

decayed teeth counts in 2010 and 2012. Similarly, being Aboriginal and/or Torres Strait Islander, drinking more than one sugary drink a day and having parents who hold a concession card were significantly associated with an increased odds of ever experiencing caries in all three surveys. Maternal country of birth and highest educational attainment of parent(s) were significantly associated with caries experience in 2010 and 2012, respectively.

Controlling for these factors, the mean dmft scores were significantly higher for children in newly fluoridated (47% and 41% higher in 2008 and 2010, respectively) and unfluoridated (106% and 181% higher in 2008 and 2010, respectively) areas than the

mean dmft score of children residing in the fluoridated area (*Table 3*). However, by 2012, there were no significant differences in the mean dmft score between children residing in the fluoridated and newly fluoridated areas for those years. The mean dmft score of children in the unfluoridated area remained significantly higher (123% higher dmft) than for children residing in the fluoridated area (*Table 3*). A similar pattern was observed in the counts of untreated decayed teeth (*Table 4*) and with the proportion of children who were caries free (*Table 5*). However, the significant differences that existed between the fluoridated and newly fluoridated areas before water fluoridation began, were reduced more quickly, with no significant differences detected between the two areas, by 2010, in the mean counts of untreated decayed teeth and in the proportion of children who were caries free. Significant differences were still observed between children in unfluoridated areas and children in fluoridated areas in the mean number of decayed teeth and in the proportion of children who were caries free (*Tables 4* and *5*). Information on the frequencies for each of the variables used in the regression models is presented in Table S1 as it may be of value to other researchers.

DISCUSSION

Fluoridation of public water supplies is a population-based strategy to control dental caries. Many studies and systematic reviews in both rural and metropolitan areas show that water fluoridation is an equitable and cost-effective measure to reduce dental caries in adults and children[9–11]. It has been adopted as policy in NSW because the dental caries problem is widespread, has a greater prevalence in disadvantaged groups and its effectiveness is still evident despite the widespread use of fluoride toothpaste[3,12–15]. Our study has shown that, over time, the children in the newly fluoridated area had improved oral health, with an increasing proportion of children free from dental caries and a reduction in dmft and decayed teeth counts. The impact of water fluoridation on the oral health of children living in Gosford City LGA was clear 2 years after the scheme began, such that the mean dmft was 1.13, close to the level (0.96) of the LGA, which had been fluoridated for many years. By the third examination in 2012, the mean dmft scores (0.72 and 0.69) were almost the same. The children in the sample from Gosford City in 2012 would have had almost a lifetime exposure to fluoridated water, so the

Table 4 Multivariate analysis of decayed teeth, according to year, fluoridation status and socio-economic characteristics[‡]

Variable	2008		2010		2012	
	IRR	95% CI	IRR	95% CI	IRR	95% CI
Fluoridation status						
Fluoridated	1.00[†]		1.00[†]		1.00[†]	
Newly fluoridated	1.64***	1.33–2.03	1.19[NS]	0.92–1.53	1.15[NS]	0.87–1.52
Unfluoridated	2.29***	1.64–3.21	2.40***	1.83–3.14	2.29***	1.68–3.11
Indigenous status						
Non-Aboriginal	1.00[†]		1.00[†]		1.00[†]	
Aboriginal	1.30[NS]	0.88–1.92	1.47*	1.02–2.10	1.89**	1.27–2.83
Cardholder status						
Non-cardholder	1.00[†]		1.00[†]		1.00[†]	
Cardholder	1.55***	1.26–1.89	1.91***	1.55–2.36	1.73***	1.35–2.20
Maternal country of birth						
English speaking	1.00[†]		1.00[†]		1.00[†]	
Non-English speaking	1.74**	1.19–2.55	2.21***	1.52–3.21	1.68*	1.11–2.54
Highest educational attainment of parent(s)[§]						
Bachelor's and higher	–	–	1.00[†]		1.00[†]	
Certificate/Diploma	–	–	1.21[NS]	0.94–1.55	1.14[NS]	0.86–1.51
Year 12 or below	–	–	1.35*	1.01–1.80	1.70**	1.22–2.37
Toothbrushing behaviour						
Twice or more a day	1.00[†]		1.00[†]		1.00[†]	
Once or less a day	1.14[NS]	0.92–1.40	1.26*	1.02–1.56	1.48**	1.16–1.88
Sugary drink consumption						
None	1.00[†]		1.00[†]		1.00[†]	
One or more a day	1.60***	1.29–1.99	1.56***	1.27–1.92	1.58***	1.23–2.01

IRR, incidence rate ratio; NS, not significant.
*$P < 0.05$.
**$P < 0.01$.
***$P < 0.001$.
[†]Referent.
[‡]Adjusted for age and gender.
[§]Highest educational attainment of parents was not asked in 2008.

Table 5 Multivariate analysis of caries experience [percentage with decayed, missing or filled primary teeth (dmft) > 0] according to year, fluoridation status and socio-economic characteristics[‡]

Variables	2008		2010		2012	
	OR	95% CI	OR	95% CI	OR	95% CI
Fluoridation status						
Fluoridated	1.00[†]		1.00[†]		1.00[†]	
Newly fluoridated	1.72***	1.37–2.16	1.26[NS]	0.97–1.61	1.22[NS]	0.95–1.57
Unfluoridated	2.93***	2.01–4.27	2.40***	1.84–3.15	1.96***	1.49–2.57
Indigenous status						
Non-Aboriginal	1.00[†]		1.00[†]		1.00[†]	
Aboriginal	1.67*	1.07–2.59	1.85***	1.29–2.65	2.20***	1.54–3.12
Cardholder status						
Non-cardholder	1.00[†]		1.00[†]		1.00[†]	
Cardholder	1.73***	1.39–2.15	1.65***	1.34–2.03	1.34**	1.08–1.67
Maternal country of birth						
English speaking	1.00[†]		1.00[†]		1.00[†]	
Non-English speaking	1.32[NS]	0.86–2.02	1.73**	1.19–2.51	1.33[NS]	0.91–19.5
Highest educational attainment of parent(s)[§]						
Bachelor's and higher	–	–	1.00[†]		1.00[†]	
Certificate/Diploma	–	–	1.15[NS]	0.91–1.47	1.22[NS]	0.95–1.57
Year 12 or below	–	–	1.29[NS]	0.98–1.70	1.84***	1.38–2.47
Toothbrushing behaviour						
Twice or more a day	1.00[†]		1.00[†]		1.00[†]	
Once or less a day	1.00[NS]	0.80–1.25	1.09[NS]	0.88–1.35	1.22[NS]	0.98–1.52
Sugary drink consumption						
None	1.00[†]		1.00[†]		1.00[†]	
One or more a day	1.77***	1.40–2.22	1.55***	1.26–1.90	1.37**	1.11–1.71

NS, not significant; OR, odds ratio.
*$P < 0.05$.
**$P < 0.01$.
***$P < 0.001$.
[†]Referent.
[‡]Adjusted for age and gender.
[§]Highest educational attainment of parents was not asked in 2008.

similarity in dmft scores with participants living in the well-established fluoridated area could be expected. Such a finding is of value to councils in other parts of NSW without fluoridation as we have shown that new schemes will bring oral health benefits that are tangible within a short time frame, and counter the views of anti-fluoridationists[16] who argue that water fluoridation is no longer necessary[17].

It was intriguing to see that the caries rates fell in the unfluoridated area between 2010 and 2012. This is not unusual, as the caries rates in the two fluoridated areas also reduced and other countries are still reporting falls in dental caries. However, the presence of fluoride in the water certainly adds an extra bonus of caries reductions for young children when compared with their counterparts living in areas without fluoridation. This finding is supported by other researchers who reported similar differences in dental caries between fluoridated and unfluoridated communities[18–21]. The counter argument is that the reductions in dental caries found in this study are caused by a change in the sample characteristics. This is possible, but the reductions in caries were evident in all the participating areas. Besides, any potential effect of population characteristics or confounders, such as toothbrushing and cardholder status, on observed decay experiences were minimised in the multivariate analysis. The change could also be attributed to the examiners, but we were fortunate to have a group of examiners who participated in every survey, were happy to undertake examiner training before each survey and demonstrated a good level of agreement with the gold standard examiner over time.

The significant associations with childhood dental caries from the multivariate analysis support what is currently known about the multifactorial causes of childhood caries[22]. Consistent with the large body of evidence that shows an inverse relationship between socio-economic status (SES) and oral disease, this study showed that children who are disadvantaged by SES, measured by concession cardholder status and parent(s) highest educational attainment, experienced a higher burden of dental decay than those from more affluent backgrounds. Aboriginal children and children whose mother is from a non-English-speaking background also experienced worse oral health than the general population. Excessive consumption of sugary drinks is a well-known risk factor for caries[23], and children who consume more than one sugary drink a day were found to have a 47–50% increase in

dmft counts compared with children who did not regularly consume sugary drinks. Importantly, after controlling for all these potential confounders, access to fluoridated water is consistently shown to be significantly associated with improved oral health, with children residing in the Shires of Ballina and Byron experiencing more dental decay (106–181% higher dmft; almost two to three times the odds of ever experiencing decay) than children residing in Wyong Shire.

Fluoridation does seem to arouse strong and vehement opposition from a small, but well-organised, group of protesters[24]. Public Health England has just published a report highlighting the medical safety and efficacy of water fluoridation, which refutes many of the arguments promulgated by the anti-fluoridationists[25]. In addition, this study has shown that water fluoridation greatly reduces dental caries over and above that achieved in a unfluoridated control site. The results were particularly positive among children for whom the disease has a major health impact. The significant caries index showed marked falls in dental caries, indicating that fluoridation can greatly reduce the burden of oral ill health. Changes in behaviour conducive to good oral health are often difficult for individuals to implement. Fluoridation delivers a low level of fluoride in the mouth on a frequent basis and this may well account for the reduction in the significant caries index among the children living in Gosford City and Wyong Shire. The authors of the York Review[2] also noted that inequalities in dental health across social classes were reduced by fluoridation.

CONCLUSION

The results show that water fluoridation had far-reaching oral health benefits over time for young children living in Gosford and Wyong when compared with children living in unfluoridated communities.

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Conflict of interest

The authors declare they have no competing interests.

Authors contribution

Anthony Blinkhorn prepared the manuscript and made changes as appropriate. Roy Byun undertook statistical analysis and assisted with preparation of the manuscript. Pathik Mehta assisted with the data collection and the organisation of the research findings. Meredith Kay commented on the manuscript and assisted with the analysis.

SUPPORTING INFORMATION

Additional Supporting Information may be found in the online version of this article:

Table S1 Frequencies for each of the variables used in the regression models

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