Volume 58 Number 3 (Supplement) June/July 2012



Journal of the Irish Dental Association

Iris Cumainn Déadach na hÉireann



Fluoridation in Ireland

The dental profession looks back over 50 years

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Elucidation supplement JOURNAL OF THE IRISH DENTAL ASSOCIATION

Foresight and courage rewarded

A key responsibility for the Association as the only scientific, advocacy and educational body for the dental profession in Ireland is to promote better oral health and to highlight advances in professional practice.

Publication of the *Journal of the Irish Dental Association* is an essential part of our strategy to disseminate key oral health messages and this is now supplemented by the publication of position papers by the Association (thus far we have published position papers on children's oral health and on the links between oral health and diet – others are set to follow).

The decision to commission this special fluoride supplement arose after a symposium was organised in UCC in February, 2011, where a series of eminent speakers made compelling presentations around the general theme of introducing a policy of fluoridation in Ireland 50 years ago.

It is often overlooked, but Ireland has played a huge role in promoting major public health initiatives, and while much deserved attention is paid to the introduction of the workplace smoking ban, comparatively little attention is paid to the great foresight, courage and reward which are evident with the introduction of a universal fluoridation policy here in Ireland 50 years ago. In fact, the first statutory instrument giving effect to this policy was signed in May, 1962 – just a fraction over 50 years ago.

The idea for this publication was first mooted at the symposium held in UCC and we are particularly delighted to see finally the fruits of the labours of a small but committed team. We wish to thank in particular Dr Mairéad Harding who, along with Professor Helen Whelton, was instrumental in organising the initial symposium and pivotal in sourcing the authors.

Obviously, we also wish to thank the authors who submitted some outstanding contributions, the *Journal's* Editor and Editorial Board for their support, our publishing company, Think Media, and the Department of Health for generously supporting the publication of this supplement.

We are hopeful that this publication will provide a useful reference for those interested in promoting evidence-based decision making generally and specifically in evaluating the effects of the policy of fluoridation, which was pioneered in Ireland 50 years ago.



Andrew Bolas President



Fintan Hourihan *Chief Executive*



In the public good

Dr Paul Beirne of UCC studied the origins and politics of fluoridating public drinking water supplies in Ireland. He spoke to PAUL O'GRADY and outlined that story for the *Journal*.

One of the earliest mentions of fluoride in the Department of Health was a 1948 report carried out by a research chemist employed by Guinness by the name of James Drum. Drum concluded, after analysing water from 42 sources, that Irish people were not exposed to a fluoride hazard. He did, however, note that the therapeutic addition of fluoride to drinking water could not be advocated until long-term studies in the USA showed the wisdom of such a procedure.

In 1952, the Medical Research Council (MRC) carried out the first dental caries research survey in Ireland. It formally documented the appalling state of the dental health of Irish school children. At this point there were fewer than 70 dentists working in the Local Authority Health Services in Ireland, even though an earlier Dental Consultative Council report had stated that 325 dentists were required to cater for all persons that were eligible for treatment under the Health Acts. After the publication of the MRC report, it was considered that 325 might be an underestimate.

Interestingly, all thought at that point was geared towards treatment. Prevention was not being considered. Dr Paul Beirne states: "A change in the Department's approach materialised with the arrival of Seamus MacNeill as the first full-time dental adviser to the Department of Health in June 1953. Seamus MacNeill is also notable for the fact that in the period 1948-53 he edited the Irish Dental Assocation (IDA) publication – the *Irish Dental Review* – which subsequently became this publication: the *Journal of the Irish Dental Association*. In his new role, Dr MacNeill conducted a review of policy on dental services. He felt that the problems initially seemed insurmountable and that mass extraction seemed the only viable policy. However, he also felt that this was incompatible with the function of public health and that therefore, the best hope of bringing dental disease under control lay in prevention. He had read reviews of fluoridation in his work as editor of the Irish Dental Review and he was convinced of its benefits. At around the same time, an Assistant Secretary in the Department, Paddy Murray, read a report that suggested that fluoridation reduced the level of dental caries by about 40-60% in the youngest age groups. He requested a review of the literature and Jim Ivers (later to be a Secretary of the IDA) produced a 13-page review, which was circulated in the Department. It received favourable reviews and Dr MacNeill suggested that an expert body should be set up to examine the evidence and make formal recommendations. It took the Chief Medical Adviser of the time, Dr James Deeny, a little longer to make his mind up. Following a meeting with the Secretary of the American Dental Association, Harold Hillenbrand, who sent him the up-to-date US literature, Deeny became convinced about the benefits of fluoridation too.

Fluorine Consultative Council

That cleared the way for the setting up of the Fluorine Consultative Council, which held its first meeting in Dublin on February 6, 1957. It met 15 times and delivered its report to Minister for Health, Sean McEntee, in June 1958. The key passage was:

"The Council is satisfied that an increased intake of fluorine will reduce the incidence of dental caries, and that it is desirable to provide for such an increased intake... The Council is further satisfied that the increased intake



of fluorine can best be provided by the fluoridation of public water supplies to the level of 1.0 part per million F."

Immediately after the publication of the report, a body was formed to oppose fluoridation, which called itself the Pure Water Association (PWA). A number of the founding members of the PWA came from an environmental group called the Soil Association. In fact, the Soil Association had sought representation on the Fluorine Counsultative Council but the Department of Health had consulted the Department of Agriculture about the Association. An internal Department of Health memo stated: "As far as I can gather from the Department of Agriculture, they regard the Soil Association as a collection of cranks". Hence, the Minister refused representation on the Council to the Soil Association.

The opposition

The secretary of the Soil Association, James Ryan, joined forces with a number of individuals to form the Pure Water Association. These included Brian McCaffrey, President of An Rioghacht – The League of the Kingship of Christ – a body that was set up to try to ensure that Catholic social teaching was applied to all aspects of social policy. Catholic social teaching emphasised that the rights of the individual (and of the family) were sacrosanct and several members of the PWA felt that fluoridation was contrary to Catholic teaching. In Ireland in the 1950s, such a suggestion was taken very seriously.

However, the Department of Health was remarkably unworried because it had sought and received advice on the ethics of fluoridation prior to the publication of its report. The Minister defended the ethics of the legislation before the Dáil saying that the Department had received advice that there was no ethical objection to the fluoridation of water supplies within the margin of safety recommended in the report. Interestingly, the Minister never revealed where this advice had come from and it was only years later that Dr Paul Beirne revealed the source. It was received from the ethical committee of the Guild of St Luke, St Cosmos and St Damien. This was a

The Fluorine Consultative Council

Council Chairman

Thomas Murphy, Professor of Social and Preventive Medicine at UCD

Council Secretary Jim Ivers

Make-up of the Council

Five dentists; three doctors; two engineers; two Department of Health officials; one vet; one geologist; one pharmaceutical and one research chemist; and, one senator. guild of Catholic doctors set up in 1932. It had some very influential people involved, including the Archbishop of Dublin, Dr John Charles McQuaid, and Monsignor John Horgan, Professor of Metaphysics at UCD. The connection was simple: Professor Thomas Murphy, Chairman of the Fluorine Consultative Council, had at one time been Master of the Dublin branch of the Guild, and he knew that the Guild had an ethics committee. The four members of the ethical committee were: the aforementioned Monsignor John Horgan; the Rev. Dr Conor Martin, Professor of Ethics and Politics at UCD; the Rev. Dr Eamon O'Doherty, Professor of Logic and Psychology at UCD; and the Rev. Dr Jerome Curtin, Professor of Moral Theology at Clonliffe College. Professor Murphy had consulted this ethics committee and received a written judgement (as above - no objections) on the ethical aspects of water fluoridation. Hence, the members of the Council, the Minister and the Department all felt that they could withstand the considerable challenge on the grounds of ethics. The challenge when it came was through the courts, in a case taken in the name of Mrs Gladys Ryan, wife of James Ryan, secretary of the Soil Association and prime mover in the PWA.

To mandate or to enable?

Before that, however, there was one other major issue to be addressed. The Minister could choose to move enabling or mandatory legislation. Enabling legislation would allow each local authority to make its own decisions, while mandatory legislation, as the name suggests, would require all providers of public water supplies to fluoridate the water. After debate within the Department of Health, with consultation with the Department of Local Government, it was decided that two major problems with enabling legislation would rule against it. First of all, the engineers were concerned about overlapping supplies, particularly in the greater Dublin region. If Dublin decided in favour of fluoride, but say Wicklow and Kildare decided against, it might be impossible to separate the supplies. Secondly, the pressure that the PWA might apply on county councillors around the country could either delay or ultimately remove the likelihood of fluoridation happening in large areas. Therefore the Department and the Minister decided on mandatory legislation.

The challenge, which is well documented, went to the High Court and then to the Supreme Court, and in both instances lost.

The Bill, the Health (Fluoridation of Water Supplies) Act, 1960, had been signed into law in December 1960, but because of the court cases, it was not until July 15, 1964, that fluoride was added to public water supplies at Roundwood, Vartry and Poulaphouca.

Gladys Ryan never paid the \pm 32,000 trial costs and the State did not pursue the matter.



Monitoring the effectiveness of water fluoridation in the Republic of Ireland

Professors HELEN WHELTON and DENIS O'MULLANE review the many studies undertaken in Ireland into the effects of the decision to introduce water fluoridation of the public water system.



The Health (Fluoridation of Water Supplies) Act 1960 (Stationery Office, Dublin) included provisions that a baseline survey of caries levels among children and adolescents would be undertaken prior to the implementation of the Act [Section 2, Subsection 4(a)(i)]. The Act also stipulated that regular caries surveys be undertaken "whenever and so often as the Minister requires" in order to monitor the effectiveness of fluoridation of water supplies in controlling dental caries. In this paper, some examples of the studies undertaken to comply with these welcome provisions are provided.

The baseline National Caries Study - 1961-1963

During the years 1961 to 1963, representative samples of five- to 16-year-olds were examined in each of the 26 counties in the Republic of Ireland. The diagnostic criteria adopted were those used in similar large-scale surveys in the UK during the 1950s. The clinical field workers were trained and calibrated by Dr Lucy Keniffe, who had participated in these earlier UK studies. The results were published in a series of reports (Stationery Office, Dublin, 1961, 1963). Following a lengthy legal challenge, water fluoridation was first introduced to Dublin City in July 1964, and Cork City in May 1965. By 1970 most of the major cities and towns in the Republic had fluoridated water supplies. High caries levels were recorded (**Table 1**), e.g., the mean decayed/missing/filled teeth (DMFT) for 15-year-old children was 8.2.

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Cork City Study - 1970

To comply with the provisions of the Act, the Department of Health established a special unit in University Dental School, Cork, in 1965. This unit conducted a number of studies on dental caries and fluorides in the late '60s and early '70s. For example, a survey was conducted of a random sample of four- to 11-year-old school children in Cork City in 1969 and published in 1970. The children selected were those who had resided continuously in Cork City since May 1965 when water fluoridation was introduced. The clinical examiner was Dr Chris Collins, Director of the special unit and a member of the examining team that had previously conducted the baseline survey in 1961-'63. The results of the Cork City Study showed that the caries levels among children in 1969 were substantially lower than those recorded in the baseline studies in the same population in 1961 (Collins and O'Mullane, 1970). The authors concluded that there was a substantial reduction in dental caries among children in Cork City in the period 1961 to 1970. While the timing of the baseline study and the introduction of water fluoridation to Cork City did not allow a conclusion that the reduction was due to water fluoridation; nevertheless, the results were encouraging. In this regard it is worth noting that fluoride toothpastes were not available in Cork City until 1970. The hypothesis that water fluoridation could have a topical effect on those children whose permanent teeth had erupted at the time of the introduction of water fluoridation in 1965 prompted the

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TABLE 1: Mean dmft in five-year-olds, and DMFT in 15-year-olds,
in fluoridated communities (full FI) in the Republic of Ireland
in 1984 and 2002, and in non-fluoridated communities (non FI)
in the Republic of Ireland and Northern Ireland in the 1960s,
1984 (Rol), 1983 (NI) and 2002.

	FIVE-YEAR-OLDS			15-YEAR-OLDS				
	Full FI Non FI Non FI			Full FI	Non FI	Non FI		
	Rol	Rol	NI		Rol	Rol	NI	
1960	-	5.6	4.8		-	8.2	10.6	
1983/'84	1.8	3.0	4.5		4.1	5.4	9.2	
2002	1.3	1.7	1.8		2.1	3.2	3.6	

authors to suggest that water fluoridation might also be having a topical effect, a relatively new concept at the time, having been noted on only one previous occasion (Ast *et al.*, 1950).

The Fermoy Mouth Rinse Study - 1970-1974

The special unit in the Cork Dental School was also charged with investigating other methods of bringing the benefits of fluoride to populations where water fluoridation was not feasible. The Fermoy mouth rinse study commenced in 1970 (Collins and O'Mullane, 1972). It was designed to test the hypothesis that a fortnightly two-and-a-half minute rinse with a 0.2% solution of sodium fluoride would reduce the incidences of dental caries in children aged seven, eight, nine and 10 attending primary schools in Fermoy, Co. Cork, which was a non-fluoridated area at the time.

A pre-baseline dental status examination of the consenting children was carried out in April 1970, in which the teeth present were recorded. Caries was not recorded at this examination. Four months after this examination a similar examination was carried out on the same children, in which newly erupted teeth, i.e. teeth that erupted during the four-month period, were recorded. Clinical and radiographic caries examinations were undertaken using criteria based on those described by Backer Dirks *et al.* (1950). Children were then allocated to study and control groups on the basis of these newly

TABLE 2: Dean's Index of Fluorosis – % of eight-year-olds affected
according to fluoridation status in the Republic of Ireland and
Northern Ireland in 2002 and 1984.

EIGHT-YEAR-OLDS	Full FI Rol 2002	Non Fl Rol 2002	Full FI Rol 1984	Non FI Rol 1984	Non Fl NI 2002
Normal	76	90	94	98	90
Questionable	11	7	5	2	6
Very mild	8	2	1	0	3
Mild	4	0	0	0	0
Moderate	0	0	0	0	0
Severe	0	0	0	0	0
	P<0.	0001	P<0.0001		P<0.0001

erupted teeth so that an equal number of comparable teeth were included in each group. Teeth erupting during the trial were also noted and the incidence of caries in these teeth was also compared. A total of 74 rinsing sessions were conducted during the four-year period of the study. The rinsing sessions and subsequent examinations were double blind. Children in the study group rinsed with 10ccs of a 0.2% solution of sodium fluoride and children in the control group rinsed with 10ccs of distilled water.

The results showed a highly significant reduction in the incidence of dental caries in newly erupted teeth in the study group over the control group over the four-year period of the study (Mageean and Holland, 1977).

The National Survey of Children's Oral Health - 1984

In 1982 the Department of Health commissioned a National Survey of Children's Dental Health, the primary aim of which was to measure the effectiveness of water fluoridation on a countrywide basis (O'Mullane *et al.*, 1986). Random samples of children who were lifetime residents of either fluoridated or non-fluoridated areas and aged five, eight, 12 and 15 years were examined by 10 examiner/recorder teams. The criteria adopted were similar to those used in the baseline studies of 1961-'63. It was also decided that levels of enamel fluorosis would be recorded, using internationally accepted

indices, in this 1984 study. The teams were trained and calibrated in the different indices by Dr Ingof Muller of the World Health Organisation (WHO).

Overall, the results showed that there had been substantial decline in the prevalence of dental caries between 1961-'63 and 1984, both in fluoridated and non-fluoridated communities, and the reduction was considerably greater in the fluoridated communities. In the case of 15-year-olds, for example, the mean DMFT in 1960 in the Republic of Ireland was 8.2, while in 1983/'84 it was 4.1 in lifetime residents of fluoridated communities, and 5.4 in residents of non-fluoridated communities (**Table 1**). The prevalence of fluorosis was low, with 94% of children in fully fluoridated communities having normal enamel according to Dean's Index, compared with 98% among eight-year-old children in non-fluoridated communities (**Table 2**). Only fluorosis grades 'questionable' and 'very mild' were recorded in this 1984 survey.

The North South Survey of Children's Oral Health – 2002

In 2000 the Department of Health commissioned another National Survey of Children's Dental Health, again with the main aim of monitoring the effectiveness of water fluoridation (Whelton et al., 2006). This study included a contemporaneous survey of children's dental health in Northern Ireland, where water fluoridation has not been introduced (Whelton et al., 2006). The diagnostic criteria for both caries and dental fluorosis are the same as those used in the 1984 study. It was seen that in the period 1983/'84 to 2002 there has been a substantial reduction in dental caries in both fluoridated and non-fluoridated communities in the Republic of Ireland, and in the non-fluoridated population of Northern Ireland. The decline in the period 1983/'84 to 2002, however, is considerably greater in the fluoridated community. For example, in the five-year-old age group, the mean dmft among children who had been lifetime residents of fluoridated communities in the Republic of Ireland declined from 1.8 in 1983/'84 to 1.3 in 2002, whereas the corresponding figures for five-year-old children in nonfluoridated areas in the Republic of Ireland were 3.0 and 1.7, and in Northern Ireland were 4.5 and 1.8. Similar trends are apparent in the figures recorded for caries among 15-year-olds in the two jurisdictions.

The prevalence of dental fluorosis increased substantially in the Republic of Ireland between 1984 and 2002, particularly in lifetime residents of fluoridated communities. In 1984, 94% of children residing in fluoridated communities in the Republic of Ireland had normal enamel; this figure had reduced to 76% in 2002 (**Table 2**). The figures for 'questionable', 'very mild' and 'mild' fluorosis in 1984

were 5%, 1% and 0%, respectively; these figures had increased to 11%, 8% and 4%, respectively, in 2002. These results for fluorosis were interpreted to indicate that ingestion of fluoride among children during the period when the enamel in permanent teeth is being formed needed to be reduced. As a result of these findings the level of fluoride in drinking water in the Republic of Ireland was reduced in 2007 from a level of 0.8 to 1.0 parts per million (ppm), with a target of 0.9ppm, to a level of 0.6 to 0.8ppm, with a target of 0.7ppm. In addition, recommendations regarding the use of fluoride toothpaste by infants and young children were introduced, as previous studies had indicated that infants and young children were prone to swallow toothpaste, leading to excessive intake of fluoride (www.fluoridationforum.ie, 2002).

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Defending fluoridation

DR JOE MULLEN counters the main arguments against fluoridation.

Reasons offered against fluoridation can be grouped into four main headings:

- (a) fluoridation does not reduce the burden of dental caries;
- (b) fluoridation causes harm;
- (c) politico-legal considerations; and,
- (d) fluoridation causes environmental damage.

In this article it will be possible only to touch briefly on each of these issues.

Claims that fluoridation does not reduce the burden of dental caries:

- tend to focus on the occasional study that appears to show little benefit, ignoring the volume of studies that show the opposite;
- state that the clinical significance of the benefit seen in studies is undermined; and,
- state that the quality of studies on fluoridation is low.

The first two points are evidently incorrect. The third point is technically valid in that it is impossible to conduct the highest quality type of study, a randomised controlled trial (RCT), for water fluoridation. However, all of the evidence taken together provides more than enough evidence of benefit.

Claims that fluoridation causes harm are based on two issues, namely enamel fluorosis and claims of effects on general health. The enamel fluorosis issue has been studied since the early 1900s at least, involving the work of Frederic McKay in Colorado Springs, USA, and JM Eager in Naples, Italy.¹ Fluorosis, if deemed to be aesthetically unacceptable, can be managed with painless microabrasion, and the type of fluorosis seen in Ireland tends to be very mild, and not necessarily in need of treatment. However, the argument goes: "if fluoride causes this damage on teeth where we can see it, what's it doing to the bones and other tissues we can't see?" Frequently, the claim is made that fluorosis is a sign of systemic poisoning. Current theory is that the main cause of enamel fluorosis is the reduction of calcium levels in the developing enamel matrix, thereby impairing crystal formation.²

Ill health claims

Claims of ill health effects are based in the main on laboratory studies. Such claims have not been substantiated in human health studies. The York Systematic Review,³ one of the major systematic reviews of recent years, explains the issue very well on its website. Major governmental and independent reviews in a number of countries in recent years have all concluded that the evidence to date does not indicate that community water fluoridation causes any ill health effects.

Politics

For dentists, the politico-legal and environmental arguments may be less familiar than those on oral and general health, but these are crucial issues. The Forum on Fluoridation of Ireland⁴ addressed the ethical and legal issues in some detail, and the matter was also considered in a report from the Nuffield Council on Bioethics in the UK.⁵ The Environmental issues have been addressed in the recent report of the European Commission's Scientific Committee on Health and Environmental Risks (SCHER).⁶ This committee did not find any evidence of negative environmental impacts from community water fluoridation.

While recognising the benefits of fluorides to oral health, it is equally important to consider, investigate and remain informed, and to be able to address the concerns that may be raised.

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Enamel fluorosis: a cause for concern?

DR DEIRDRE BROWNE looks at recent research into enamel fluorosis rates and levels of acceptance in Ireland.

Précis

The impact of the increase in prevalence of enamel fluorosis in Ireland was examined among Irish adolescents. The most common levels of fluorosis seen in Ireland did not represent an aesthetic problem.

The benefits of water fluoridation and fluoridated oral care products in controlling dental decay are well documented. The only proven risk associated with the use of fluorides in dentistry is enamel fluorosis.^{1,2,3} Enamel fluorosis has been defined as 'a dose-response effect caused by excess fluoride ingestion during the pre-eruptive development of teeth'. The ingestion of excessive fluoride during tooth development

TABLE 1: Percentage of eight- and 15-year-old children andadolescents with a grade of 'Normal', 'Questionable', 'Very mild','Mild', 'Moderate' or 'Severe' fluorosis on their permanentdentition in the Republic of Ireland in 1984 and in 2002, byfluoridation status.6

	EIGHT-YEAR-OLDS					
	1984 1984 2002 2002					
	Full Fl	Non Fl	Full Fl	Non Fl		
Normal	94.0	98.1	76.7	90.2		
Questionable	5.0	1.9	11.6	6.6		
Very mild	1.0	0.0	7.8	2.6		
Mild	0.0	0.0	3.6	0.3		
Moderate	0.0	0.0	0.4	0.4		
Severe	0.0	0.0	0.0	0.0		

	15-YEAR-OLDS						
	1984 1984 2002 2002						
	Full Fl	Non Fl	Full Fl	Non Fl			
Normal	94.7	99.4	63.1	83.0			
Questionable	4.0	0.6	19.7	10.5			
Very mild	0.9	0.0	10.6	3.6			
Mild	0.4	0.0	5.4	2.6			
Moderate	0.0	0.0	1.4	0.3			
Severe	0.0	0.0	0.6	0.0			

may result in enamel fluorosis, which has a range of clinical signs. At its mildest, fluorosed enamel is fully functional and may present as barely detectable, whitish surface striations, whereas severely fluorosed enamel is more prone to wear and fracture, and may present as pitted, stained and porous enamel (**Figure 1**).^{4,5} Recent reviews in Ireland (**Table 1**)⁶ and internationally^{7,8} have reported an increase in fluorosis prevalence in fluoridated and non-fluoridated communities. These reports have highlighted the importance of investigating the trade-off between the benefits and risks of fluoride ingestion among the population.

An aesthetic problem?

Several international studies have addressed the issue of whether or not enamel fluorosis is perceived to be an aesthetic problem by those children and adolescents affected, and by their parents.⁹⁻¹⁶ There is general international agreement that only cases with Dean's 'mild' fluorosis or more may be of aesthetic concern. Currently, 38% of 15year-olds in fluoridated communities in the Republic of Ireland have signs of enamel fluorosis⁶ with 7.4% having mild or more severe fluorosis (Table 1). Recently, the aesthetic impact of fluorosis on Irish adolescents was investigated using broadly similar categories to the 'questionable', 'very mild' and 'mild' categories in the illustrations in Figure 1.^{17,18} One hundred and fifty adolescents rated the aesthetic acceptability of six identical template photographs of an attractive dental smile displaying varying levels of enamel fluorosis (Figure 2: photograph 1 – 'very white or bleached teeth'; photograph 2 – 'no fluorosis'; photograph 3 - 'questionable' fluorosis; photograph 4 -'very mild' fluorosis; photograph 5 – 'mild' fluorosis; and, photograph 6 - 'dental caries'). Low grades of fluorosis, (photographs 3 and 4) were rated similarly to photograph 2, which depicted no fluorosis. 'Mild fluorosis' (photograph 5) represented the 'break-point' at which fluorosis became aesthetically objectionable to these adolescents. This ranking of images of teeth with fluorosis means that low levels of fluorosis were not considered aesthetically objectionable to this sample of 15-year-olds. In fact, this is consistent with the findings of other researchers.^{11,16,19}

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FIGURE 1: Categories of enamel fluorosis according to Dean's Index.^{4,5}



FIGURE 2: Template dental photographs examined by adolescents in the study on the aesthetic impact of fluorosis.

In conclusion, fluoride has had an important impact on caries prevention in the Irish population. The goal of fluoridation is to maximise the caries preventive benefits, while minimising the risks of fluorosis at a level that has an aesthetic impact. Considering the sequelae to both conditions, caries proves to be a greater threat to the dentition and studies suggest that low levels of enamel fluorosis do not represent an aesthetic problem. Common treatment for fluorosis is removal of the outermost more porous enamel using hydrochloric acid-pumice microabrasion.^{20,21} This technique works well, removing approximately 100μ of enamel. In the rare cases where it is requested, treatment for fluorosis at the levels seen in Ireland removes less tooth structure, and does not necessitate the use of local anaesthetic, making it likely to be less traumatic to children and adults than conventional caries removal (especially if extraction of grossly decayed teeth is necessitated). The recent reduction of fluoride in the Irish water supplies to 0.6-0.8ppm needs to be monitored in terms of its impact on caries levels and fluorosis prevalence.

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Acknowledgements

Health Research Board Colgate Palmolive for the dental images M Mc Donnell BDS MDPH BBS HSE-South (North Lee)

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Milestones in oral health services in the Republic of Ireland

With the many changes occurring in Ireland it would seem an opportune time to review the body of research conducted and policy enacted in the Republic of Ireland on oral health services and oral health. The dental health of the nation prior to water fluoridation, the legislation and policy decisions impacting on oral health up to budgetary changes, and the production of evidence-based guidelines will be discussed.

The first national survey of dental health was conducted in Ireland in 1952 – 'Dental Caries in Ireland'.¹ In the intervening 60 years, further surveys of the oral health of people in Ireland have been carried out. Legislation, surveys and policy documents that have shaped dentistry and the oral health of the population are set out in **Tables 1** and **2**. A more comprehensive description of the policies can be found in the thesis submitted in fulfilment of Masters in Dental Public Health (MDPH) by the lead author.²

Pre water fluoridation - 1952-1958

- Dental Caries in Ireland, 1952
- Health Act, 1952
- Water fluoridation internationally
- Fluorine Consultative Committee

Dental Caries in Ireland, 1952

The first dental survey was conducted in Ireland in 1952 under the Nutrition Committee of the Medical Research Council of Ireland. School children in different areas of Ireland were examined to see if differences in decay levels could be identified. At the time there was a theory that the quality of food had an impact on the level of dental decay. The research did not support the hypothesis, as no correlation was found between dietary intake and caries. Very high levels of decay were found, with only 1% of children in the 12-13 years age group caries free, and the mean decayed/missing/filled teeth (DMFT) was 6.9. The examiners concluded that there was little restorative treatment provided and little done to arrest dental decay.¹

Health Act, 1953

Legislation introduced in 1953 gave the health authorities responsibility for the dental care of a large proportion of the population.³ Under the Act the health authority was given the responsibility to make available dental treatment and the provision of dental appliances to children attending national schools and children less than six years of age. Dental treatment and dental appliances were to be provided free of charge to this group of patients, with the exception of replacement appliances in certain circumstances. Health authorities were also given the responsibility to provide dental treatment to adults, and their dependants who could not afford treatment, and to those who were insured under the Social Welfare Act, 1952.⁴

TABLE 1: Some milestones in oral health services in the Republic of Ireland. Time period Reports commissioned Legislation enacted 1952-1970 Health Act, 1952 Fluorine Consultative Committee, 1958 Health (Fluoridation of Water Supplies) Act, 1960 'Kaim-Caudle Report', 1969 Health Act, 1970 1979-1985 'Working party' Report 1979 1985 criteria for orthodontic treatment Dentists Act, 1985 1988-1994 'The Leyden Report', 1988 Shaping a Healthier Future, 1994 Dental Health Action Plan, 1994 Dental Treatment Services Scheme 2000-2012 Health (Dental Services for Children) Regulations, 2000 Forum on Fluoridation, 2002 Health Act. 2004 Disability Act, 2005 Modified Index Of Treatment Need, 2007 Fluoridation of Water Supplies Regulations, 2007 Clinical Practice Guidelines, 2005-2012

Water fluoridation internationally

Budget 2010

Internationally, independent studies of water fluoridation were carried out in the 1940s and 1950s. Five studies were carried out across America, Canada and Finland. Each of these studies, some lasting over 15 years, showed a reduction in dental caries in the towns with fluoridated water compared to the non-fluoridated control towns.⁵

Fluorine Consultative Council

Appointed in 1956 by TF O'Higgins, the Fluorine Consultative Council in Ireland reported in 1958.⁶ The Council was to establish if an increased intake of fluorine (F) was desirable to reduce the incidence of dental caries, and to examine how best to provide it. Safety precautions were also to be considered. The Council found that the association between F and reductions in dental decay made the increased intake of F desirable. They advised that the increased intake of F would be best provided by the fluoridation of public water supplies at a level of 1 part per million F (1ppm F).⁶

Water fluoridation in Ireland

The Health (Fluoridation of Water Supplies) Act, 1960⁷ was enacted to

TABLE 2: National surveys.^{1,8,12-1}

Group

Survey

Adults

Adult dental survey, 1979 Oral Health of Irish Adults, 1989-1990 Oral Health of Irish Adults, 2000-2002

Children

Dental Caries in Ireland, 1952

Reports on the Incidence of Dental Caries in Schoolchildren and on the Analyses of Public Piped Water Supplies in the Different Counties, 1961-1965 Children's Dental Heath in Ireland, 1984 Children's Oral Health in Ireland, 2002

Special needs

Oral Health of Adults with an Intellectual Disability in Residential Care in Ireland, 2003

Oral health of children attending special needs schools and day care centres

make water fluoridation possible in response to the recommendations of the Fluorine Consultative Council. Fluoridating public water supplies was a contentious issue. Much opposition to the Act existed. One area of contention was whether water fluoridation should be compulsory or voluntary. The Act was delayed in its implementation by court actions that were taken by Gladys Ryan. The case was heard in the High Court and appealed to the Supreme Court. Ultimately the Supreme Court decided that the Act was constitutional, and compulsory water fluoridation commenced in July 1964.

Dental surveys prior to water fluoridation

Legislation requires that figures of dental caries prevalence would be provided by health authorities before and "whenever and so often as the Minister so requires" after water fluoridation.⁷ The baseline surveys were carried out from 1961-'65. They found high levels of decay in children.⁸ A more in-depth discussion of these and other surveys can be found in the paper in this supplement by Whelton and O'Mullane.⁹

Health service structural reform

- Establishment of health boards, 1970
- Establishment of the Health Service Executive (HSE), 2005

In 1970 a new health act was enacted, establishing the health boards. Health boards were given the responsibility to make dental treatment and appliances available as in the previous legislation.¹⁰ The Health Board structure lasted until the introduction of the Health Service Executive (HSE) on January 1, 2005. The HSE is a separate entity to the

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 TABLE 3: The proportion of edentulous adults

 by age group in Ireland.¹²⁻¹⁴

Year	35-44 age group	Over 65 years
1979	12%	72%
1989-1990	4%	48%
2002	0.9%	40.9%

Department of Health. The purpose of the HSE is "to use the resources available to it in the most beneficial, effective and efficient manner to improve, promote and protect the health and welfare of the public".¹¹ The same responsibility in relation to dental care was given to the HSE as in the preceding health acts.

Surveys post water fluoridation

Adult

- Adult dental survey, 1979
- Oral Health of Irish Adults, 1989-1990
- Oral Health of Irish Adults, 2000-2002

The first national survey of adult dental health was a questionnaire survey conducted in 1979.¹² The next survey of Irish adults was conducted in 1989-1990 and was both a clinical and sociological survey.¹³ The most recent survey of adult dental health was conducted in 2000-2001.¹⁴ The surveys, which were carried out in compliance with the water fluoridation legislation,⁷ measured many factors, including edentulousness (**Table 3**). All the surveys demonstrated that adults with medical cards had lower retention of teeth. The surveys also showed that people eligible under the Dental Treatment Benefits Scheme (DTBS) had less unmet need than those not eligible and higher levels of tooth retention.¹²⁻¹⁴ The two clinical surveys demonstrated that those resident in fluoridated areas.^{13,14}

Children

- Children's Dental Heath in Ireland, 1984
- Children's Oral Health in Ireland, 2002

Two national surveys of children's dental health have been conducted since water fluoridation was introduced. The first was conducted in the Republic of Ireland only, while the second examined children on the entire island. Examining children north and south of the border allowed comparisons between Irish fluoridated and non-fluoridated areas, and the non-fluoridated Northern Ireland.^{15,16} **Table 4** shows caries free percentages across the surveys.

TABLE 4: The proportion of children caries free by age and fluoridation status.^{1,15,16}

Year	Country	Fluoridation status	12- to 13- year-olds	15- year-olds
1952	Ireland	Non-fluoridated	1%	
1961-1965	Ireland	Non-fluoridated		2%
1984	Ireland	Non-fluoridated		8%
1984	Ireland	Fluoridated		12%
2002	Northern Ireland	Non-fluoridated		18.9%
2002	Ireland	Non-fluoridated		20.7%
2002	Ireland	Fluoridated		27%

People with special needs

- Oral Health of Adults with an Intellectual Disability in Residential Care in Ireland, 2003
- Oral health of children attending special needs schools and day care centres

The 1979 working party report highlighted that the dental service for people with special needs should be placed higher on the oral health agenda.¹⁷ Health and disability in Ireland began to be examined in the 2000s. Surveys were carried out of people with special needs attending special needs schools and day centres, as well as those in residential centres, during 2002 and 2003. These surveys highlighted inadequate dental service provision for these groups of patients with high treatment needs.^{18,19} The Disability Act, 2005, outlines the rights of people with disabilities and the responsibilities of service providers.²⁰ 'Oral Health and Disability: the way forward' was published in 2005.²¹

Reports and strategies

1960s-late 1980s

- Dental Services in Ireland, 1969
- Dental Services Report, 1979
- 'The Leyden Report', 1988
- Dentists Act, 1985

In 1969 The Economic and Social Research Institute (ESRI) examined the dental service in Ireland, as well as looking at the services in Northern Ireland, Denmark, New Zealand and the USA. The report is commonly referred to as the Kaim-Caudle report. The author praised water fluoridation, saying that it "is possibly the most outstanding measure in the public health field undertaken since the foundation of the State".²² In the late 1970s a joint working party was formed

between the Department of Health, the Irish Dental Association and the health boards. In the assessment of the services being provided the joint working party found that "it is clear that the health board dental service is not at present capable of providing an acceptable level of service for all eligible persons".¹⁷ In 1988 Dr Rory O'Hanlon TD, Minister for Health, requested a working group report on improvements that could be made to dental services. Terry Leyden TD chaired the working group and so the report is commonly referred to as 'the Leyden Report'. One recommendation of the Leyden Report was the development of national guidelines for the children's dental service.²³

Each of these reports made a number of recommendations based on the knowledge and resources available. All highlighted the need for changes to the service being provided for those eligible for medical cards. The recommendation made by them all was that a system similar to the DTBS should be introduced to allow people with medical cards to receive dental care in private practices rather than from public salaried dentists. Another common thread across these reports was that the public salaried dentists should care for children, with a strong emphasis on prevention. The introduction of dental auxiliary workers was also recommended. The type of worker discussed most frequently was the dental hygienist.^{17,22,23}

Dentists Act, 1985

Many reports and surveys published following the Dentists Act, 1928, made suggestions that the legislation should be amended.^{15,17,22} It was finally updated with the Dentists Act, 1985, which in 2012 is still current legislation.²⁴ The ability to create classes of dental auxiliary workers was given to the Dental Council, and in 1990 dental hygienists were given legal recognition.²⁵

1990s

- Shaping a Healthier Future, 1994
- Dental Health Action Plan, 1994
- Dental Treatment Services Scheme

A healthcare strategy and the Dental Health Action Plan were introduced in 1994 by the then Minister for Health, Brendan Howlin TD. Key aims were highlighted for oral health:

- 1. Reduce the level of dental disease in children.
- 2. Improve the level of oral health in the population overall.
- 3. Provide adequate treatment services to children and to all medical card holders.

The main theme of the Health Strategy was the reorientation of the

system by reshaping service planning and delivery.²⁶ The Dental Health Action Plan was the first to articulate a strategy for the dental service. It stated that the aim of the public dental service is "To improve the level of oral health of the whole population". The plan aimed to extend dental services to children up to their 16th birthday, and at the same time phase in a scheme that would enable adult medical card holders to be treated by private dental practitioners. Prevention of dental disease was an important part of this action plan.²⁷

The Dental Treatment Services Scheme (DTSS) was established following on from the Dental Health Action Plan.²⁷ The treatment of individuals holding a medical card was transferred from salaried public dentists to contracted private practice in a phased manner. Patients with medical cards were then able to attend any participating dentist to receive basic dental treatments including the provision of dentures. The age limit for receipt of services through the salaried service was extended to 15 years, i.e., up to the 16th birthday.²⁸ These were two recommendations that had been consistently made since the 1979 working group.¹⁷

2000 onwards

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- Forum on Fluoridation, 2002
- Clinical Practice Guidelines, 2005-2012
- Budget 2010

Water fluoridation was a contentious issue in the early 2000s. Opponents of water fluoridation questioned the need for it, its safety and increasing fluorosis. Micheál Martin TD, Minister for Health and Children, established the Forum on Fluoridation Ireland, which reported in 2002. The Forum's remit was to examine water fluoridation effectiveness and safety, and to make recommendations on the information examined. The Forum concluded that water fluoridation was having a beneficial effect on the oral health of the population. It recommended continuing water fluoridation in Ireland at a reduced level of between 0.6ppm and 0.8ppm F with a target value of 0.7ppm F.²⁹ The reason given for the reduction is that higher use of fluoride from other sources such as toothpaste since the 1970s meant that less fluoride in the water would produce a similar benefit and minimise fluorosis. Legislation making this change was signed into effect in July 2007.³⁰ An expert body on fluorides was established to implement the recommendations of the Forum on Fluoridation report and to evaluate ongoing research in all aspects of fluoride.³¹

One of the recommendations of the 'Leyden Report' was the development of national guidelines for the children's dental service.²³

The Irish Oral Health Services Guideline Initiative was established, a collaboration between University College Cork, the HSE and The Cochrane Collaboration, and commenced work in 2005. The project funding came from the Health Research Board as part of its strategic development and research development awards. The Irish Oral Health Services Guideline Initiative published four guidelines between 2008 and 2012:³²⁻³⁵

- 'Topical Fluorides: Evidence-based guidance on the use of topical fluorides for caries prevention in children and adolescents in Ireland', 2008.³²
- 'Strategies to prevent dental caries in children and adolescents: Evidence-based guidance on identifying high caries risk children and developing preventive strategies for high caries risk children in Ireland', 2009.³³
- 'Pit and Fissure Sealants: Evidence-based guidance on the use of sealants for the prevention and management of pit and fissure caries', 2010.³⁴
- 'Oral Health Assessment: Best practice guidance for providing an oral health assessment programme for school-aged children in Ireland', 2012.³⁵

The guidelines are evidence based and cover important preventive strategies of relevance to public and private dentists in Ireland. Evidence-based practice is an essential component of modern dentistry and quality guidelines such as those mentioned are essential in the provision of quality care to the dental public.

Budget 2010

Since the first survey of dental caries in Ireland, many changes have occurred in the dental service. Adults with medical cards were being treated in private practice contracted under the DTSS. The children's service provided by the salaried public dental service was extended to the 16th birthday.²⁸ As Ireland faced great economic challenges, the national budget for 2010 changed the schemes for eligible dental patients under both the DTBS and the DTSS:³⁶

- DTBS: insured workers are entitled to only one dental examination a year and all other treatment has to be paid in full by the patient. (This is a dramatic change from the previous benefits that insured workers enjoyed for their PRSI contributions, which previously included biannual cleanings and subsidised restorative treatment.)
- 2. The budget for the DTSS was reduced in the 2010 national budget. (The reduction in budget led to the Scheme being reduced dramatically mid year to examination, limited restorative

treatment and emergency treatments, also with no cleanings for eligible patients.)

 The 2010 national budget reduced tax relief on dental expenses to the standard rate of relief: 20%.³⁶

Orthodontic care in the dental public service

- 1985 criteria
- Modified Index Of Treatment Need, 2007

In 1985 criteria were issued by the Department of Health to "be applied in assessing degrees of priority of need for specialist orthodontic treatment on the basis of degree of handicap and severity of malocclusion".³⁷ Three categories of patients were identified: A, B, and C. The Health Board appointed the first consultant orthodontist in 1985. In response to demands to improve access to orthodontic care a review group was established, and the Orthodontic Review Group reported in 2007.³⁸ New eligibility guidelines were chosen, a modified Index Of Treatment Need (IOTN), which they acknowledged would result in higher numbers of patients being eligible for public orthodontic treatment. For this reason the report recommended that the impact of this increase on resources should be measured. These guidelines are currently being used to assess eligibility in the HSE.

Conclusion

On this brief journey through our surveys and reports, it is clear that many changes have taken place. Some of the changes have taken a long time to occur and to be accepted. The introduction of dental hygienists was called for in many reports before it was legislated for and finally introduced.^{15,17,22,24,25} Moving adults from the public dental service into contracted private practice is another example of something that took many years to happen.^{17,22,23,26,27} The profession pushed for these changes and the research carried out on the oral health of the population demonstrated why they were necessary.^{12-16,18,19} This link between public policy and research makes us stronger as a profession. I hope that planning for the future of our dental service will continue to be supported by research such as the current evidence-based guidelines.³²⁻³⁵

Ireland was pioneering when it introduced water fluoridation. It was and still is an efficient and effective public health measure against dental decay. The work of the Fluorine Consultative Council in the mid 1950s and the Forum on Fluoridation in 2002 shows how working with a wider group of people can be successful when formulating healthy public policy for populations. There may come a day when it

is replaced by another strategy but for now it is crucial in our armamentarium.

The PA Consulting Group report commissioned by the HSE produced the Strategic Review of the Delivery and Management of HSE Dental Services.³⁹ Some of its recommendations are currently being implemented in the HSE. It is too soon to say what the outcome will be but it is an exciting time for the Public Dental Service, as much change is planned.

Acknowledgements

I would like to thank Dr M Harding and Professor D O'Mullane for their support and assistance in producing this article. I would also like to thank Professor Whelton, the staff of the Oral Health Services Research Centre and the visiting lecturers from UCC for their support and assistance while studying for the MDPH in UCC.

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Oral health policy – time to broaden our perspective?

DR CARMEL PARNELL argues that fluoridation alone is not enough to provide equitable oral health.



In line with trends in many developed countries, the prevalence and severity of dental caries among children in the Republic of Ireland has declined dramatically since the 1960s. Much of this decline has been attributed to the availability of fluoride, through water fluoridation and also through the home use of fluoride toothpastes.^{1,2} However, in spite of the overall improvement in dental health, caries remains a very common disease among Irish children, affecting between 37% and 55% of five-year-olds in fluoridated and non-fluoridated areas, respectively, approximately one-fifth of eight-year-olds, half of all 12-year-olds and threeguarters of all 15-year-olds.¹

While water fluoridation has been the cornerstone of caries prevention for decades in the Republic of Ireland, it is important to highlight that Government reports,³⁻⁵ national health and health

promotion strategies⁶⁻⁸ and, more recently, the evidence-based guideline 'Strategies to prevent dental caries in children and adolescents'⁹ clearly recommend that water fluoridation should be supplemented by oral health promotion initiatives, targeted caries-preventive interventions involving the use of topical fluorides, and improved access to dental services. That these other measures have not been implemented in any structured manner nationally perhaps reflects an unrealistic expectation on the part of decision-makers and budget holders that water fluoridation alone is sufficient to solve all our oral health problems, in spite of evidence to the contrary.

The 'Strategies' guideline was developed in accordance with international best practice for guideline development¹⁰ and is the core of a suite of evidence-based guidelines for the prevention of

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TABLE 1: Caries Risk Assessment Checklist.

Risk factors/indicators	Please appro	e circle the most opriate answer
A TES in the shaded section indicates that the child is likely to be at high risk of or from carles	Vee	Nie
Age 0-5 with carles (cavitated or hon-cavitated)	Yes	No
Age 4-6 with diffit/2 of DMF1>0 Age 7 and support to the active except surface covice (covitated on one covitated) on one surface covice (covitated on one covitated) on one covice (covitated on one covice (covitated)) on one covice (covitated) on one covice (covitated)).	res	NI-
Age 7 and over with active smooth surface carles (cavitated or non-cavitated) on one or more permanent teetn	res	No.
New cares lesions in last 12 months	Yes	No
Hypomineralised permanent molars	Yes	No
Medical or other conditions where dental caries could put the patient's general health at increased risk	Yes	No
Medical or other conditions that could increase the patient's risk of developing dental caries	Yes	No
Medical or other conditions that may reduce the patient's ability to maintain their oral health, or that may complicate dental treatment	Yes	No
The following indicators should also be considered when assessing the child's risk of developing caries		
Age 7-10 with dmft>3 or DMFT>0	Yes	No
Age 11-13 with DMFT>2	Yes	No
Age 14-15 with DMFT>4	Yes	No
Deep pits and fissures in permanent teeth	Yes	No
Full medical card	Yes	No
Sweet snacks or drinks between meals more than twice a day	Yes	No
Protective factors A "NO" in this section indicates the absence of protective factors that may increase the child's risk of developing caries		
Fissure sealants	Yes	No
Brushes twice a day or more	Yes	No
Uses toothpaste containing 1,000ppm F or more	Yes	No
Fluoridated water supply	Yes	No/Don't know
Is this child at high risk of or from caries?	YES	NO

caries in children and adolescents in Ireland.¹¹⁻¹³ It sets out a new framework for caries prevention that operates at population level, targeted population level, and at the level of the individual, in recognition of the fact that a combination of preventive approaches is required to reduce disease levels.¹⁴

The focus of the guideline is on early identification of high caries risk children from infancy onwards, so that effective preventive measures can be initiated in a timely manner. This approach involves integrating oral health assessment and oral health promotion into child developmental visits and into the wider primary care setting, and developing referral pathways into dental services from primary, secondary and social care services, to ensure that children who are at greatest risk have improved access to oral health services.

Social inequalities in oral health

Although water fluoridation has been shown to reduce caries levels across the social divide in Ireland, children who are disadvantaged still bear a greater burden of disease than children who are not disadvantaged. The North South Survey of Children's Dental Health¹ showed that the impact of disadvantage on caries levels was greatest in the younger age groups (aged five and eight), where, with the exception of five-year-old children in non-fluoridated areas, the percentage difference in caries scores between disadvantaged and non-disadvantaged groups was just over 40%. Findings such as these highlight the need to reconsider how caries prevention should be approached in this country, since substantial inequality in oral health exists within fluoridated and non-fluoridated areas, and not just between them.

Oral health inequalities are socially determined, i.e., those who are at the top of the social hierarchy tend to have better oral health than those at the bottom.¹⁵ To reduce the steepness of the social gradient in oral health, actions must be universal, but with a scale and intensity that is proportionate to the level of disadvantage.¹⁶ This is called proportionate universalism, and is represented in the 'Strategies' guideline by its population, targeted population and individual approach. The recommendations for targeted population strategies include the community-based use of topical fluorides such as fluoride toothpaste, varnish and mouthrinse in high caries risk groups or populations. Arising from these recommendations, a supervised pre-school toothbrushing programme has recently commenced on the north side of Cork city. The toothbrushing programme is part of the Health Research Board-funded pilot project 'Happy Teeth', which aims to improve the oral health of pre-school children in disadvantaged areas.

Caries risk assessment

While preventive strategies reduce disease levels in the population, adequate treatment services must also be available to deal with cases of existing disease. The provision of dental services to children based on the age of emergence of the permanent molar teeth has been enshrined in public dental service policy and practice since the 1980s.⁴ Even with water fluoridation in the background, this level of access to care is inadequate to cater for the oral health needs of school-aged children and adolescents, and ignores the oral health needs of preschool children. It also reflects a tooth-centred, medical model approach to oral health rather than a child-centred, empowering approach.

As part of its framework for identifying high caries risk children, the 'Strategies' guideline recommends that all children should be offered a dental assessment, including a formal caries risk assessment, during their first year in primary school. The rationale for caries risk assessment is that the treatment and preventive measures received by the patient will be tailored to their individual needs, thus directing appropriate caries management and preventive care towards those at 'high' risk, and avoiding unnecessary treatments for those at 'low' risk. An example of the latter would be the 'blanket' application of fissure sealant in a low caries population to all children in a specific age group or class, without consideration of the caries risk status of the individual. With formal caries risk assessment, the factors that contribute to a child having caries are identified, and modifiable risk factors can be addressed. Recording caries risk status also allows changes over time to be monitored, and treatment and recall to be

adjusted accordingly, with more intensive intervention provided for those with greatest needs. Ultimately, the clinician hopes to see the patient's caries risk status improve over time. Caries risk assessment recognises that, just as the caries process itself is dynamic, so too is an individual's caries risk status. This means that caries risk assessment is an ongoing process, and consequently, regular oral health assessment during childhood and adolescence is required.

The Caries Risk Assessment Checklist (CRAC) has been developed for the Irish population based on a review of the literature on risk factors for caries, consideration of existing oral health risk assessment tools, knowledge of the caries profile of children and adolescents in Ireland, and the clinical experience of the 'Strategies' Guideline Development Group. High caries risk status is assigned based on the dentist's assessment of the balance between risk factors and protective factors for a particular patient. The CRAC is shown in **Table 1**. Further information on the development and application of the CRAC can be found in the full 'Strategies' guideline at http://ohsrc.ucc.ie/html/ guidelines.html.

Caries prevention

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The caries preventive strategies recommended for high caries risk children, based on the 'Strategies' and other guidelines in the suite, include:

- Twice daily brushing with a small pea-sized amount* of toothpaste containing at least 1,000ppm F, at bedtime and at one other time during the day. Spit out toothpaste and do not rinse after brushing.
 - This recommendation applies to children under the age of two years who have been assessed as high caries risk, and to all children over the age of two years.

* Over the age of seven years, the risk of ingesting toothpaste is greatly reduced and a pea-sized amount of toothpaste or more can be used.

- Children under the age of seven should be supervised by an adult when brushing their teeth.
- Application of resin-based fluoride varnish containing 22,600ppm
 F at intervals of six months or three months, depending on assessment of caries risk.
- Application and maintenance of fissure sealants to vulnerable pits and fissures of permanent teeth, with priority given to sealing first and second permanent molars.
- Oral health education to encourage healthy eating in line with national guidelines.

- Use of sugar-free medicines when available.
- Recall interval based on clinician's assessment of caries risk and not exceeding 12 months.

Monitoring and evaluation

In the UK, monitoring of children's oral health is undertaken regularly. This allows trends in oral health to be measured, and also allows evaluation of the impact of large-scale oral health interventions. Data from the UK show that caries levels in children have continued to decline in England¹⁷ and Scotland¹⁸⁻²⁰ in the last 10 years. Both countries have actively promoted preventive care through the implementation of evidence-based guidelines^{21,22} and in the case of Scotland, through Childsmile, a nationwide, multi-faceted and multi-sectoral oral health promotion programme to improve the oral health of young children.¹⁸ While our nearest neighbours make advances in improving children's oral health, the impact of social, economic and political changes in this country in the last five years could potentially undermine the improvements in oral health achieved in recent decades for both children and adults.

The environment in which existing oral health policy such as water fluoridation operates has changed radically. In 2002, the Forum on Fluoridation recommended reducing fluoride levels in water from 0.8-1ppm F to 0.6-0.8ppm F with a target of 0.7.⁵ This change was made in response to the evidence of increasing levels of fluorosis in both fluoridated and non-fluoridated areas, and declining caries levels,⁵ and was supported by international evidence,²³ which suggested that the revised level of 0.7ppm F was a suitable trade-off between caries and fluorosis. The reduction in water fluoride levels came into effect in 2007 (SI No 42/2007 Fluoridation of water supplies). In a further step to minimise the risk of fluorosis, the Forum recommended that toothpaste should not be used for children until the age of two years, and that professional advice on the use of fluoride toothpaste should be sought if a child under the age of two years was considered at high risk of developing caries. These recommendations were made at a time when Public Dental Service staff numbers were at a peak,⁹ but prior to the development of the suite of evidence-based guidelines, which reinforced the need for early intervention and additional caries prevention strategies to improve children's oral health. They were also made in the context of reasonable access to dental services for adult medical card holders and insured workers. Since these recommendations came into effect, access to dental services for both adults and children has been severely curtailed, and the opportunity to implement the guidelines is still awaited. We also know more about the dietary habits of people in Ireland, and that foods high in fat and sugars are consumed at twice the recommended level,²⁴ putting both oral health and general health at risk. Given that water fluoridation is the cornerstone of caries control and prevention in this country, it is critical to determine if the reduced level of fluoride that now pertains is sufficient to control caries in the current climate. The impact of the recommendation not to use toothpaste under the age of two also needs to be evaluated. In light of the evidence-based guidelines developed in Ireland, new policy must focus on reducing oral health inequalities. This can only be done by looking beyond the four walls of the dental surgery and taking an integrated, common risk factor approach to improving and maintaining the oral health of the Irish population.

Acknowledgements

My thanks to Professor Denis O'Mullane and Drs Mairead Harding, Patrice James and Mary O'Farrell for their helpful comments on drafts of this paper.

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My 50 years plus with fluoride

As well as positive effects for the public, fluoridation has also had an impact on dentists, says DR SEAMUS O'HICKEY.

Water fluoridation has undoubtedly had a greatly beneficial effect on dental health in Ireland. This fact has been scientifically validated several times over. What has not been at all recognised is the effect that it has had on dentists. The established patterns of dental practice, prior and subsequent to the introduction of fluoride into our public water supplies were, and are, very different. Of course, this didn't happen overnight, but dentistry and dentists were greatly changed as a result. The marked reduction in dental caries meant fewer tooth extractions, more restorative and conservative treatment, and a reduced need for artificial dentures.

The scope of treatment options for both patients and dentists was very much increased to the satisfaction of both.

A personal perspective

As an individual dentist, my own professional career was greatly influenced by fluorides and their beneficial health effects. As an undergraduate dental student in the Dublin Dental Hospital and School in the 1950s, I had hardly heard of fluoride. Coming up to the final examinations, there was some mention if it. Almost uniquely in my class, but for no particular reason, I followed it up by reading about it in various contemporary publications mainly American. And lo, believe it or not, a whole question on it appeared in the final examination paper. Of course, I answered it with gusto! But water fluoridation in Ireland was not to happen for another decade. As is well known, towards the late 1950s and early 1960s, a lot began to happen; mainly, a committed Minister for Health, Sean McEntee, took decisive political action, which culminated in the passing of the necessary Act in 1960. The actual process of adding fluoride to tap water began in July 1964. This process began in the large Dublin piped public water supply reservoirs. Oddly enough, there was no publicity about it at the time maybe purposely? In or around January 1965 it became public knowledge and, of course, the usual 'knee-jerk' type of reaction occurred - some of it quite humourous. Of course, there was the famous legal and constitutional case against the fluoridation of the public water supply, brought against the State by Gladys Ryan from Dublin, represented by the famous jurist and politician, Sean McBride. This case, which the State won in the Dublin High Court, and thereafter in the Supreme Court, set records for the time it took, and for the costs incurred, which Mrs Ryan succeeded in not paying and which, as usual, were eventually paid by the Irish taxpayer. While I am commenting on these legal aspects of the fluoridation of the public water supply, it is worth mentioning that I personally added to my education in

public health dentistry by attending, as frequently as I could manage to, the High Court hearings on the case in question, to see and hear as many as was possible of the world's then leading academics and researchers. Hearing these experts giving their evidence (quite a privilege) was possible for me at that time, as I was employed, in a part-time capacity, within the public dental service.

Ongoing progress

During the years and decades that followed its introduction, the process of adding fluoride to our tap water at the public reservoirs and waterworks continued until about 70% plus of all public water supplies were fluoridated. Strangely enough, there was little or no opposition expressed during this time. The process continued to be monitored on a regular and routine basis, and reported on in accordance with the provisions and regulations defined in the Act.

Also, during this time there were several surveys to measure the effects of water fluoridation on dental caries levels in the population of the State.

The surveys were local and national in scope, the national surveys being of most crucial importance. Such surveys continue to be carried out and are conducted and analysed by University College Cork. All have shown, and continue to show, the success of the nation's public water fluoridation scheme. These surveys continue to more than justify the expectations of those who had advocated the introduction of the measure, and have not only proved scientifically valid, but have provided an extremely cost-effective means to improve the dental health of the nation.

In or about the early part of this century, the anti-fluoridationists began in earnest to mount a serious campaign opposing the fluoridation of public tap water. As a result, the then Minister for Health, Micheál Martin TD, set up the Forum on Fluoridation, to re-examine the whole idea of statutory fluoridation of the public water supplies. The Forum reported in 2002, and made a number of recommendations, among which was the formation of the Expert Body on Fluorides and Health, in order to implement the recommendations of the Forum's report. By this time I had retired, and was flattered to receive a telephone call on the then Minister's behalf, inviting me to chair the Expert Body. Of course, I accepted the position, and remain in that role. Fluoridation, therefore, continues to play an active part in my life!

Dr Seamus O'Hickey is a former Chief Dental Officer and current Chairman of the Expert Body on Fluorides and Health.



The fluoridation case: a milestone in Irish constitutional law

DR PATRICK QUINN explains how the case taken to prevent fluoridation of the Irish water supply had far-reaching constitutional consequences.

The case of *Ryan v. Attorney General* involved a challenge to the constitutional validity of the Health (Fluoridation of Water Supplies) Act, 1960, which provided the legislative basis for the fluoridation of the public water supply. While the importance of this case in the history of water fluoridation is well known, its contribution to constitutional law in this country may not be as widely appreciated.

Gladys Ryan, at the time a mother of five children residing in Dublin, and whose house was connected to the public water supply, challenged the Act of 1960, claiming that certain provisions of the Act were void on the grounds that they were in violation of her rights and those of her children under Article 40.3 of the Constitution. Mrs Ryan also claimed that said provisions were a violation of the authority of the family under Article 41, and the family's right to physical education of the children under Article 42 of the Constitution. The case first came before Mr Justice Kenny in the High Court. In summary, the Court held that legislation involving the contents of food and drink did not in any way affect the authority of the family, and the Act was therefore not in contravention of Article 41 of the Constitution. Mrs Ryan's claim that the Act violated the family's right to physical education of the children under Article 42 was also rejected, as the Court considered education as referred to in the relevant Article as being scholastic in nature. Mr Justice Kenny considered the scientific evidence and concluded that fluoridation at a concentration of one part per million (ppm) would not be dangerous to anybody in our temperate climate. The Court also held that Mrs Ryan had no legal right to a piped water supply. However, the Court did recognise Mrs Ryan's claimed right to bodily integrity (the key constitutional point) but concluded that fluoridation of the water supply, even if dangerous, would not be an infringement of this right. Therefore, even though the case established the right to bodily integrity, the case was lost on the facts and the action was dismissed. Mrs Ryan subsequently appealed to the Supreme Court, but the High Court judgment was upheld.

Bodily integrity

Before considering the significance of the plaintiff's right to bodily integrity in detail, it is necessary to examine the wording of Article 40.3 of the Constitution:

1° The State guarantees in its laws to respect, and, as far as practicable, by

its laws to defend and vindicate the personal rights of the citizen; 2° The State shall, in particular, by its laws protect as best it may from unjust attack and, in the case of injustice done, vindicate the life, person, good name, and property rights of every citizen.

It is clear from the wording of Article 40.3.2° that the life, person, good name and property rights of the citizen are expressly specified in and protected by the Constitution. However, what gives the case of Ryan v. Attorney General its enormous importance in Irish constitutional law is that the case represents the first time that somebody claimed a right as latent in the expression "personal rights" in Article 40.3.1° and not deduced from the rights actually specified in Article 40.3.2°. Gladys Ryan claimed that to oblige her and her family to use fluoridated water through the public water supply was an infringement of their rights under Article 40.3, specifically their right to bodily integrity. In the High Court, Mr Justice Kenny concluded that the rights guarantee was not confined to those specified in Article 40.3 but extended to other personal rights of the citizen. The judge focused on the use of the words "in particular" in Article 40.3.2° and deduced that because these words were used, Article 40.3.2° was a detailed statement of the more general guarantee contained in Article 40.3.1°, and therefore the general guarantee must extend to rights not specified in Article 40.3. This legal principle was supported in the subsequent Supreme Court appeal. Mr Justice Kenny in the High Court also stated that many personal rights of the citizen follow from the Christian and democratic nature of the State, and this also led to the conclusion that the general rights guarantee extended beyond those specified in Article 40. The Court therefore upheld Mrs Ryan's claim to a right of bodily integrity (although concluding that fluoridation did not infringe upon this right), and this represented the first declaration of an unspecified right latent in the general guarantee of Article 40.3. This constitutional milestone led to the expansion of the scope of Article 40.3 and established the doctrine of unspecified rights in Irish constitutional law. As she challenged the constitutionality of the Act allowing for water fluoridation, little did Mrs Ryan know that even though she would lose her case on the facts, it would become one of the most important milestones in Irish constitutional law.

Dr Patrick Quinn, A/Principal Dental Surgeon, HSE-South Dental Clinic, Primary Care Centre, Mallow, Co. Cork.

Water fluoridation: a patient-centred overview

JENNIFER CARMODY offers suggestions on how to deal with patient concerns regarding fluoridation.

Patients will have heard many different stories about water fluoridation – some true, some false. These stories may leave patients frightened, alarmed and possibly confused. A quick glance at some of the anti-fluoridation websites (e.g., http://www.fluoridefreewater.ie/ or http://www.fluoridealert.org/) will show that water fluoridation can be attributed to everything from early mortality to low IQ rates, to Ireland being a docile nation.

As dental professionals, we must have a clear message that we can present to patients to address any concerns that they might have regarding water fluoridation. We should also endeavour to supply patients with the most up-to-date information available.

Background

Water fluoridation is one of the most researched topics in science. The topic has been heavily researched by the Center for Disease Control and Prevention of the United States Public Health Service (CDC), the American Dental Association and the World Health Organisation. In a comprehensive study referred to as the 'York Report' in 2000, McDonagh et al. concluded that there is no association between water fluoridation and mortality or any other adverse effects on general health.¹ McDonagh *et al.* concluded that the only negative effect of water fluoridation is fluorosis. They also commented that the prevalence of fluorosis is overestimated, because other enamel opacities not caused by fluoride were being included in reports. The report indicates that poor quality studies have given insufficient evidence on the possible negative effects of water fluoridation, leading to a high risk of bias. McDonagh stated that water fluoridation reduces the prevalence of dental caries and reduces the inequalities in dental health across social classes. Furthermore, this study concluded that water fluoridation should continue and should be promoted unless evidence indicates otherwise.

The Irish situation

In 2000 the Minister for Health and Children, Micheál Martin TD, launched the Forum on Fluoridation. This was established in order to independently review the fluoridation of public piped water supplies and make recommendations to the

Minister. Following its final report in 2002, the Forum on Fluoridation recommended that the Expert Body on Fluorides and Health be established to oversee the implementation of the recommendations.

The Expert Body consists of a wide variety of members from different professions. The New and Emerging Issues Sub-Committee of the Expert Body monitors issues on fluoride and health, and related matters. The Expert Body is charged with informing the Minister for Health on ongoing research into fluoride. The Expert Body produced a Code of Practice on the Fluoridation of Drinking Water to ensure quality assurance in the delivery of water fluoridation.² The Code of Practice sets standards for water fluoridation and governs all quality systems and practices including storage, dosage and safety. The key objective of this Code of Practice is high-quality fluoridated water supplies that enhance the oral health of the public who receive fluoridated drinking water.

The topic of water fluoridation can raise questions about civil liberties. It highlights questions in the field of public health ethics that are concerned with balancing individual liberties and the advancement of positive health outcomes. There is a broader responsibility to secure a sufficient level of health for all, thus narrowing societal-based inequalities.³

Research into oral health promotion strategies (such as the Ottawa Charter) indicates that government interventions can have a profound beneficial impact on oral health. It is evident from much investigation into the area of oral health promotion that great divides in society can create a gap in equitable dental treatment for all.⁴ Water fluoridation is an equitable strategy for combating caries.⁵ The main advantage of water fluoridation is that it is available to everyone regardless of their socio-economic background.

Patients may have various questions that they want to ask you about fluoride. Here are a few suggestions as to how you can respond to their concerns:

Is fluoride safe?

Fluoride is perfectly safe. The water fluoride levels and quality are tested on a regular basis, when the fluoride is imported and on site. Water fluoridation is monitored by the Expert Body on Fluorides and Health.

At the water treatment plants, various tests are carried out and recorded, which are in turn forwarded to the local authorities on a monthly basis. These are also forwarded to a designated person, such as a Principal Environmental Health Officer or Principal Dental Surgeon, or both.²

Water fluoridation continues to be endorsed by a comprehensive collection of international bodies including the World Health Organisation, the CDC, the United States Surgeon General, the Federation Dentaire Internationale/World Dental Federation and the International Association for Dental Research.

The CDC has stated that: "Water fluoridation is one of the 10 greatest health achievements of the 20th century".⁶

Where does the fluoride added to our water come from?

The fluoride in our water comes from hydrofluorosilicic acid, which is derived from fluorspar. It is produced in Spain by a company called Derivados Del Fluor, S.A. Contrary to some beliefs, it is a primary product and not a waste product.

Is fluoride safe for my child?

Fluoride is safe for children. The use of fluoridated toothpaste is suggested after the age of two years. However, infants should be supervised while brushing so that they do not ingest the toothpaste. A recent study conducted by the HSE, 'Topical Fluorides',⁷ suggests that children in non-fluoridated areas over the age of seven years

should have access to weekly fluoride mouthrinses with 0.2% sodium fluoride. They do not recommend using these rinses in younger children because of the increased risk of the child swallowing the rinse.

How does fluoride work?

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Fluoride works by slowing down the demineralisation process or the pace at which minerals are removed from enamel,² and it can also reverse decay in its early stages. In developing teeth, it can also reduce the depth of pits and fissures.⁸ A low level of fluoride is beneficial for preventing dental caries. If fluoride is present at an acid attack it diffuses into the enamel and acts at the crystal surface to reduce mineral loss. Fluoride can then combine with minerals that have been dissolved (calcium and phosphate) to grow fluorapatite-like crystalline material within the tooth, which is more resistant to further acid attacks.

How much fluoride is in Irish drinking water?

At one stage the fluoride content in Irish drinking water was one part per million (ppm); however, to combat fluorosis, in 2007 the amount was reduced to between 0.6 and 0.8ppm. This level of fluoride in the water supply is deemed optimal for protecting oral health. In water treatment plants, colorimetric testing is carried out at the same time each day; this tests the concentration of fluoride in the water to ensure accuracy.²

What is fluorosis?

Dental fluorosis is an opacity that affects the first few microns of the enamel layer (**Figures 1-3**). It is superficial and can be polished away in your dental practice. I would recommend using visual aids here if possible to explain treatment options to patients. Fluorosis has been monitored regularly in Ireland in periodic dental surveys, most recently in the North South Survey of Children's Oral Health.⁹

Why do we need fluoride in the water when we use toothpaste as well?

The Forum on Fluoridation, alongside the WHO, has stated that optimal results are achieved when the two are used in conjunction with one another. The HSE study 'Topical Fluorides'⁷ investigated all aspects of fluoride use and intake, including water fluoridation, fluoride toothpaste, mouth rinses, etc. It advocated the use of fluoride toothpastes, rinses and varnishes in both fluoridated and non-fluoridated areas.

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FIGURE 1: Mild fluorosis.



FIGURE 2: Moderate fluorosis.



FIGURE 3: Severe fluorosis.

Why is fluoride in the water supply?

At this time, water fluoridation is the most equitable vehicle for supplying fluoride to the population. Also, the oral health behaviours of Irish children compare unfavourably with that in other countries.

A total of 45% of Irish five-year-olds brush twice a day, compared to 76% in the UK. Fewer than 60% of children aged eight or 15 brush twice a day, compared to 75% or more in the UK. In an international comparison of health behaviour in school-aged children in 35 countries (HBSC survey), Ireland ranked in the bottom half of all participating countries for the percentage of children brushing more than once a day ('Topical Fluorides').

These are merely a sample of the questions that may be asked. Certain queries may be more elaborate, but the message must remain clear: there is overwhelming evidence that water fluoridation is of great benefit to dental health and of no harm to your general health.

The introduction of water charges is sure to provoke interesting debate surrounding water fluoridation.

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DR MÁIRÉAD HARDING argues for a strong awareness of national and international research and policy in order to develop Ireland's oral health policy into the future and to promote oral health.

The dental profession and those allied with it are at present going through challenging times. The economic contraction and changes to both dental treatment benefit and dental treatment¹ make it difficult for providers and recipients of services. It is only with continued research – qualitative and quantitative – that we can measure the full impact these challenges have on the dental profession and on the oral health of the population. It is worth noting that in 2003, prior to any adjustments in the Dental Treatment Benefit Scheme (DTBS), just under one-quarter of those eligible under the DTBS availed of the service.² A similar figure is reported in 2003 for those availing of the Dental Treatment Service Scheme (DTSS); encouragingly, the DTSS figures also indicated a consistent downward trend in unmet treatment need in those attending.³

The philosopher George Santayana stated that: "Those who do not learn from the past are condemned to repeat it". It is essential that the dental profession does not fall into this trap. This emphasises the importance of understanding what has happened.

This article will take a brief look at how Ireland's dental services have endeavoured to keep pace with international evidence since the commencement of the time frequently referred to in public health and dental public health as 'the new public health' (NPH).⁴

International background

The period referred to as the NPH is generally agreed to have begun with the publication of the 'Lalonde Report' in Canada in 1974.⁵ The report expressed the need to consider more than a biomedical model of healthcare,⁶ and emphasised that the biomedical model alone is insufficient to manage an individual's health. Health is defined by the WHO as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity".⁷

This seminal work proposed a health field concept that can be broken up into four broad elements: human biology; environment; lifestyle; and, healthcare organisation, and identified that determinants of health existed outside healthcare systems. The Lalonde Report is also acknowledged as leading to the development and evolution of health promotion. Although almost 40 years have passed since the report, and changes in terminology, definitions and research methods have occurred,⁸ we are still building on these concepts.

The first international conference on health promotion was held in Ottawa, Canada, when the Ottawa Charter⁹ was presented for action to achieve health for all by the year 2000 and beyond. Health promotion is defined as the process of enabling people to increase control over, and to improve, their health, to reach a state of complete physical, mental and social well-being. Therefore, an individual or group must be able to identify and to realise aspirations, to satisfy needs, and to change or cope with the environment. It is evident therefore that health promotion, including oral health promotion, is not the responsibility of the health sector alone.

At home

While these movements were occurring internationally, Ireland was also moving forward, recognising the international discourse and the importance of changes to policy. The latter part of the 20th century saw the integration of questionnaire methodologies into oral health surveys.¹⁰⁻¹² Working groups identified the need for services to recognise high risk groups, that provision should be made for adult medical card holders to receive services, and that guidelines should be introduced for the delivery of services.¹³

The Dental Health Action Plan,¹⁴ published as part of Shaping a Healthier Future¹⁵ (which celebrated its 18th birthday on May 26, 2012), set out explicit goals for oral health, and is the current oral health policy; the action plan emphasised the central role of health promotion, disease prevention and support for water fluoridation. Water fluoridation is recognised by The Centres for Disease Control (CDC) in the United States as one of the top ten public health successes of the 21st century.¹⁷

The oral health surveys conducted in 2000 and 2002^{17,18} attest to the improvements in oral health. However, surveys of special needs

populations¹⁹ and research conducted with older populations²⁰ highlight the inequities that still exist in the oral health of some subgroups of the population.

Through this short article, the importance of acknowledging the past and the pace and influences with which change occurs is emphasised. At times it can be easier to zone in on particular elements rather than considering the whole. In these challenging times we ought to take stock of past efforts and to utilise available and effective evidence-based methods. We need to focus our efforts on equity – 'not equal shares, but fair shares'. Equally, we need to continue to actively promote oral health, employing a common risk factor approach,²¹ to continue working with and supporting the allied oral health professions and to continue making connections with other agencies beyond the health sector.

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