

The Oireachtas (Joint Irish Houses of Parliament) Draft report on Water Fluoridation in Ireland

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1 Introductory Note

Extracted from: Irish Times, Thursday 15th March 2007. The publication of a report on fluoridation to the Oireachtas Health and Children Committee written by Green Party Dublin South East TD, John Gormley, is expected to be strongly opposed by some other committee members in the coming weeks. Rejecting the Green's opposition to fluoridation, the Fianna Fáil TD, Jimmy Devins, vice-chair of the committee, said water fluoridation "is in the interests of public health and should not be discontinued. All the evidence available has indicated to us that water fluoridation is in the interests of public health. It prevents dental caries and has no negative side effects aside from a slight staining of teeth in a small number of cases which can be easily treatable." Mr Devins said he would oppose Mr Gormley's report getting the official sanction of the committee.

Here is the report which was suppressed by certain committee members. This report was never put to the vote.

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2 Executive Summary

I am very pleased to present my Report on Water Fluoridation to the Joint Oireachtas Committee on Health and Children. I was appointed first to undertake this work in 1999 during the last Dáil. Unfortunately, I was advised by the Committee Chairman to interrupt my work when the then Minister for Health and Children, Micheal Martin, set up the Fluoridation Forum to conduct a similar investigation into the action of fluoride. Following the completion of the Forum Report, the Health Committee recommenced its own investigation. Given that sufficient time has now elapsed since the publication of the Forum Report and that not a single recommendation out of 33 has been implemented, it is timely to publish our deliberations on the subject.

Having agreed to become the rapporteur, I quickly discovered that I faced a complex and mammoth task. Not only did I have to analyse the testimony of those who appeared before the Committee, I also had to wade through the often contradictory scientific evidence and the endless archive material.

I have tried to distill the essential elements of my research into this report. As well as looking at why water fluoridation was introduced into this country, the report seeks to answer two fundamental questions — (1) how effective is water fluoridation in fighting tooth decay? (2) what are the side effects of water fluoridation?

Those who came before the committee had often diametrically opposed views on the subject. There is no doubting the sincerity and dedication of both sides in this debate. It is worth noting however, that whereas there was almost unanimity in the dental community when water fluoridation was introduced as to its effectiveness, there are now clear differences of opinion among dentists on the subject. One only has to contrast the testimony of Dr. O'Mullane and Dr. Clarkson with Dr. MacAuley and Dr. Limeback to understand how greatly views diverge on water fluoridation. But there is some common ground. And it's worth reflecting on these points of agreement at the very outset. When fluoride was first introduced it was thought generally to act systemically i.e. it had to be ingested. We now know it acts topically i.e. in the mouth and on the surface of the tooth. We also know that there are increased sources of fluoride now compared to fifty years ago. All sides admit - and the evidence points to - a huge increase in the incidence of fluorosis, a condition which indicates an excess of fluoride. Both sides also took the view that fluoride in toothpaste did reduce the rate of dental caries. They also agree that children who use fluoride toothpaste require supervision and proper instruction.

The crucial question for the committee was whether the perceived benefits of water fluoridation outweighed the negative side effects. The contribution of international expert, Dr. Hardy Limeback was persuasive in this regard when he commented that using the most authoritative international data, the risk of fluorosis far outweighed the benefits of fluoride. Dr. Limeback was also very clear in his recommendation that fluoridated water should not be used to bottle feed babies. Indeed, his advice seemed to have been accepted by the Food Safety Authority until it changed its mind in circumstances that have not been explained to the satisfaction of the committee. The committee has also noted the latest advice of the American Dental Association which states:

“If using a product that needs to be reconstituted, parents and caregivers should consider using water that has no or low levels of fluoride”. (ADA 9th November 2006)

Given that it is extremely impractical for mothers who are bottle feeding to source non-fluoridated water supplies and that fluorosis rates continue to rise, our central recommendation - based on the precautionary principle - is that the practice of water fluoridation should end immediately. All of the available evidence suggests that not only will this lead to a marked reduction in fluorosis but that there would not be a significant rise in dental caries.

The evidence presented by Dr O'Mullane showed that Ireland had a very serious dental health problem in the 1950s and early 60s. All of the available historical records confirm this to be the case. They also show that Ireland had a real shortage of dentists at the time. The committee fully appreciates why a prophylactic measure such as water fluoridation seemed like a sensible approach at the time. However, we have had to base our conclusions and recommendations on all of the data now available to us. Quantifying

the effectiveness of fluoridation was our most difficult task. In our view, the most accurate measurement of this is contained in the York Review, undoubtedly, the most comprehensive study ever to be carried out on water fluoridation. Similarly, we have referred to York Review in quantifying fluorosis rates.

A key recommendation of the Fluoridation Forum was the reduction in the level of fluoride in our water supplies. Significantly, this recommendation has not been implemented, and even if the fluoride levels in the water were slightly reduced, we could not recommend that this water be used to bottle feed babies.

The Ireland of 2006 is a very different place with very different standards of general and oral hygiene. We are a modern European state with dental caries rates, equal to, and sometimes below other EU states which do not fluoridate their water supplies. We do, however, continue to consume too much confectionery, and our snacking habits are leading to continued dental caries problems as well as higher rates of obesity. The Department for Health and Children should tackle this problem by concentrating its efforts on education in relation to better oral hygiene, banning junk food vending machines and using fiscal means to change these poor eating habits.

If our recommendations are implemented we are convinced that not only will we see a reduction in fluorosis rates but that there will also be a drop in dental caries rates.

3 Conclusions

1. The rates of dental decay and the lack of dentists justified the introduction of a prophylactic measure such as water fluoridation.
2. Those who advocated water fluoridation were motivated by concern about the serious decline in dental health standards.
3. We believe that basic health and hygiene habits in Irish society have changed dramatically in the intervening period.
4. We note that dental health has improved to the same degree in countries where there is no water fluoridation.
5. The Department of Health's assessment of the overwhelming benefits of water fluoridation is not justified.
6. While positive aspects of fluoridation have been over-stated, the growing negative impact has not been properly recognised. The Committee views the officially reported sevenfold increase in fluorosis since 1984, as completely unacceptable, requiring immediate action.
7. The Committee is disappointed and alarmed that no general health studies, as provided for in S.6 of the 1960 Fluoridation Act have ever been carried out, particularly considering that four in ten 15 year olds are now affected by fluorosis. By disregarding this provision of the Act, the Department of Health has left itself liable for the harmful effects of fluoridation of Irish drinking water.

8. It is the view of the committee that the Department of Health has failed to offer a coherent scientific justification for continuing the policy of water fluoridation and has notably failed to deal with Dr Connett's *50 Reasons to oppose fluoridation* either in the Fluoridation Forum or since.
9. Despite emphasising the expertise of its membership, the Fluoridation Forum failed to apply key principles of toxicology, for example the toxic dosage for Irish children. Another failure was to overlook the synergistic effects of fluoride chemicals with other substances (e.g. aluminium) that are ever-present in many Irish drinking water supplies.
10. The Committee notes that the recommendation of FSAI advising against the use of fluoridated water for the bottle feeding of babies was changed subsequently following representations from a minority of members in 2001.
11. The Committee believes that the manner this was done was both irregular and suspect and represented a "process mess". The replies given to the former Chair by Dr Wayne Anderson in this regard were unsatisfactory. The Committee notes a similar change in advice on using non-fluoridated water in infant formula by Prof John Clarkson.
12. The committee notes that the vast of majority of those on the Forum for fluoridation had records of being strongly in favour of water fluoridation.
13. It is clear and, indeed, accepted by both the pro- and anti-fluoridation sides that the action of fluoride is topical and not systemic.
14. We note that of the 33 recommendations of the Fluoride forum, not one has been implemented to date.
15. We believe on the basis of the international studies there would be no long-term increase in dental decay if fluoride were not added to Irish drinking water.
16. There is no evidence to suggest that Irish people are fluoride deficient, in fact, the evidence at hand suggests that we have too much fluoride in our systems.
17. On the basis of the available archive material the Committee believes that the original Fluorine consultative council did not approach its task with an open mind. It would appear to have had a very strong pro water fluoridation bias.
18. We are disappointed that only the minutes of one of the meetings of the Fluorine consultative Council survive, the others having been destroyed in a flood.
19. It is now accepted by all sides that the sources of fluoride in our diet have increased dramatically since the introduction of water fluoridation.
20. The Committee believes that fluoride toothpastes have contributed to a decline in dental caries in this country and other states.

21. Fluoride toothpastes should carry a warning about the dangers of children swallowing fluoride toothpastes, and children properly supervised when brushing their teeth using fluoride toothpaste.
22. The increase in membership of Irish Dentists Opposing Fluoridation from single figures when the Forum reported, to over 120 dental practitioners today reflects the growing professional opposition to the policy.
23. There is sufficient scientific evidence in relation to health effects - albeit contradictory - to justify the application of the precautionary principle. We also note the latest advice from the American Dental Association which advises parents to choose non-fluoridated water for the bottle feeding babies.
24. We note that the fluoridating agent hydrofluorosalicic acid has not been sanctioned by the Irish Medicines Board.

4 Recommendations

1. Fluoridated water should not be used to bottle feed babies;
2. Given the impracticality of sourcing non-fluoridated water for the bottle feeding of babies, the committee – on the basis of the precautionary principle – believes the practice of water fluoridation should cease immediately;
3. The savings accruing from the policy change must be assessed in each HSE region. They should be ring-fenced before being re-allocated to educational programmes aimed at the socially deprived, in line with best practice in other European countries;
4. Independent research into general health effects should be undertaken in order to assess the full impact of lifetime fluoride exposure in the population. Particular attention should be given to effects on infants and children of exposure to fluoride from all sources;
5. The Minister for Health should not permit indiscriminate medication measures to treat the whole population via water or food because of the inability to control dosage and monitor individual reaction, evidenced by the forty year experience of water fluoridation;
6. The Government should undertake a major educational programme to encourage healthy eating in order to tackle the twin problems of dental caries and obesity;
7. More public dentists need to be employed and more regular check ups encouraged;
8. Parents should be given advice about teeth brushing and the use of fluoridated toothpaste. Along with imaginative education programmes on regular tooth brushing, existing nutritional programmes already underway should continue to target

sugary diets of children from 5 yr olds to 15 yr olds. Special emphasis should be laid on initiatives that target the socially disadvantaged where dental decay linked to poor diet is most prevalent; and

9. Fluoride toothpastes should carry warnings similar to those in the United States about the dangers of swallowing fluoride toothpaste.

5 Historical Background

5.1 Water Fluoridation in Ireland

Much of the information contained in this account is taken from Paul Beirne's *Ireland's mandatory fluoridation policy: an historical analysis of the policy process*. Other sources include Dáil debates and the National Archives.

The Department for Health was headed by five different Ministers between 1948 and 1960. During that period, however, the senior civil servants in the Department remained unchanged. The Secretary of the Department, Padraig O'Cinnéide and the Assistant Secretary, Paddy Murray played pivotal roles in the water fluoridation policy-making process.

The public dental services had never been a major priority for the Department, but this changed in July 1951 when the Minister for Health, Dr Jim Ryan (Fianna Fail), appointed a dental consultative council to advise him on "the improvement and extension of the dental services at present provided by Local Authorities".[2] The Council noted that there were 624 names on the dental register in Ireland. Of these, only 560 dentists were in active practice, which gave a dentist to population ratio of 1:5,300. The Council noted that this dentist-to-population ratio did not compare favourably with other countries – Norway 1:1,600, Sweden 1: 2,300, Denmark 1: 2,300, Scotland 1: 4,100, England & Wales 1: 4,600.

The Council did express the view that the dentist/population ratio in other countries might not be necessarily fully comparable with this country, as there were

"too many unknown factors involved, such as, the relative incidence of dental caries and the extent to which persons would seek treatment".[2]

Nevertheless, they recommended that 325 dentists would be required in the Local Authority Dental Services to cater for four priority groups:

1. Pupils of National Schools;
2. Children attending Welfare Clinics and women in respect of motherhood;
3. Adolescent 14-19 yrs. Group 3[2];
4. Adults eligible for treatment under the Public Assistance Act 1939.[2]

The first investigation into dental caries in Ireland was undertaken in 1952 by the Medical Research Council of Ireland at the request of the Minister for Health, Dr Ryan, in order

”to ascertain whether there are significant differences in dental conditions amongst school children living in different areas of the country and whether such differences, if they existed, could be related to the dietary intake of the children”.⁵

It was later correlated with the Irish National Nutrition Survey, which was first undertaken in 1956.⁶ The dental survey related to three age groups:

1. Children aged five and six years;
2. Children aged seven and eight years;
3. Children aged twelve and thirteen years.

Overall, 2,000 children were examined. In the first age group, decayed or missing teeth represented 35.7% of the total number of teeth. In the second group, 41% was decayed and 6% missing. In the cases of children aged twelve and thirteen, 45% of the first teeth were decayed or missing, and 25% of the permanent teeth were decayed.

The above statistics would seem to correspond to the account given by Dr O’Mullane to the Committee:

“I worked in the School Dental Service in West Cork for a number of years in the mid 1960s. Children constantly had gum boils and toothaches and I spent all of my time travelling from town to town-extracting teeth. That was all I could do. There was a general anaesthetic session almost every day of the week in City Hall in Cork to extract the teeth of frightened children of frightened mothers; in other words we are talking about children with bad teeth in the 1960”.^[2]

The results from the dental caries survey indicated that the recommendation for an extra 325 dentists was very wide of the mark. Nor was the recommendation practicable. In 1953, only 70 dentists were employed in the Local Authority Services. This had increased to a mere 74 by 1960. According to figures from the National Archives, the combined total of dental graduates from universities in the Republic came to 53. Of these, the majority emigrated as soon as they qualified.^[2] Clearly, the Department was faced with an impossible situation and could not deal with the problem of dental caries on a treatment basis alone.

One of the recommendations of the Dental Consultative Council’s Report was the appointment of a full-time dental surgeon to the staff of the Department of Health “in order that the Minister may be adequately advised on dental matters and in particular on those relating to Local Authority Dental Services”.⁹ Seamus MacNeill was subsequently appointed to this key position. In outlining his new proposals for the Department, McNeil noted that:

“the prevalence of dental diseases, the problems involved and the cost of adequately controlling them appear on the face of it almost insurmountable in view of our limited resources. At the present time we are trying to move

from a position where the only resort is the mass extraction of diseased teeth due directly to a general state of neglect. The resort to such radical measures is not only incompatible with the function of public health but cannot be indefinitely tolerated by an enlightened administration".¹⁰

Two key elements of a new strategy were to be "prevention" and "prophylaxis".¹¹

These were entirely in keeping with the later proposals for fluoridation. Until 1955, fluoridation had not been properly investigated by the Department.¹²

In March 1955, the Assistant Secretary of the Department, Paddy Murray, began an examination of fluoridation following the publication of a statement on fluoridation in the British Medical Journal of 26th February, 1955.¹³ The statement concentrated on the main findings of the "United Kingdom Mission to report on the fluoridation of water supplies in North America".^{20 14}

"Epidemiological studies in America have demonstrated beyond doubt that among children and adults who have been born and brought up in areas where the drinking water contains fluoride at a level of 1ppm or more, there is much less dental caries than in areas where the water is free from fluoride. Compared with areas where the drinking water contains little or no fluoride there is 60% less dental caries among children aged 12 to 14 years and about six times as many children have permanent teeth which are free from caries. . . We consider that an artificially fluoridated water similar in its action to one containing naturally derived fluoride. . . We have found no scientific evidence that there is any danger to health from continual consumption of water containing fluoride at a low concentration. Many suggestions have been made that certain ill effects may nevertheless occur. We can only comment that the proving of a negative is extremely difficult".¹⁵

The first Departmental Memorandum on fluoridation was submitted in April 1955. In May 1956, a decision was taken by the Minister for Health to establish the Fluorine Consultative Council.¹⁶ In January 1957, Minister T.F. O'Higgins appointed the Fluorine Consultative Council to advise on the following matters:

"whether with a view to reducing the incidence of dental caries it is desirable to provide for an increased intake of fluorine, and, if the Council considers it so desirable, to advise as to the best method of securing such an increased intake and as to any safeguards and precautions necessary".¹⁷

The Fluorine Consultative Council had eighteen members. Its Chairman was Tom Murphy, Professor of Social and Preventative Medicine at UCD. There were five dentists on the Council, including Seamus MacNeill of the Department, three doctors, two engineers, two senior administrators, a vet, a geologist, a pharmaceutical chemist, the Chairman of a County Council who was also a Senator and a research chemist. Mr. Jim Ivers from the Department of Health was Secretary of the Council.

Minutes of the meetings of the Council indicate that it had less than an open mind on the question of fluoridation. In fact, the Council could be characterised as being avidly

pro-fluoridation. Arguments put forward by organisations and individuals opposing fluoridation were immediately dismissed. At a meeting of the Council on March 12th, 1957, Professor T Murphy, UCD,

“the Chairman, suggested that a letter such as that received from Mr. Gerry Nolan of 10 Albert Place East, Dublin, should be read in full to the Consultative Council as an example of the unreasoned arguments put forward by most individuals”.¹⁸

Referring to the letter from Firinne, he said that “their objections were based mainly on ‘spiras [sic]’ articles. He questioned the authenticity and the reliability of the writings. It was argued that no point was raised in any of the letters, which the Committee could not answer”.

The Chair suggested that all points could be answered under the following headings:

1. Harmful effects of fluoride as a poison. Arguments under this heading could be answered on the grounds that no proof is offered in their support.
2. Different consumption of water by individuals make the calculation of a safe dose impossible. Individual consumption does not vary widely in this country and anyway a wide safety gap is allowed when deciding the dose.
3. Fluoridation of water supplies causes teeth to harden and makes their treatment impossible. There is no evidence to support this argument.
4. Fluoridation only postpones dental decay. This is good in itself.
5. Arguments that fluoridation can have a harmful effect on the brain, etc. can be dismissed as unfounded.
6. The point regarding the benefits going to the aluminium industry does not affect the question to be decided by the Committee.
7. The administration of fluoride in tablet form is considered impracticable.
8. Hazards to operators, these can be overcome.

It is claimed that the Fluorine Consultative Council met on fifteen occasions, yet only the minutes of the above cited meeting survive. According to the Department of Health and Children, the other minutes and documentation relating to the Fluorine Consultative Council meetings were destroyed by floods.¹⁹

The Fluorine Consultative Council came to the following conclusions:

1. Having considered all the information available to it on the relation between fluoride and dental decay the Council is satisfied that 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 fluoridation of public water supplies to the level of 1 part per million F.

In so recommending the Council is aware that quite 50% of the community would thereby benefit at present even if all public water supplies in the country were fluoridated but the percentage will increase according as public water supplies are extended.

2. Before any public water supply is fluoridated the Council considers that steps should be taken to assess the incidence of dental caries in children resident in the area served by that water supply. The Council also considers that subsequent to fluoridation adequate steps should be taken to permit a proper evaluation of the results.
3. Insofar as the engineering aspects of the fluoridation of public water supplies are concerned, the Council sees no particular difficulty in the procedure as the methods employed in the addition of fluoride to a water supply are similar to those in common use for the addition of other chemicals to water. The methods used in the protection of public water workers handling fluoride salts are similar to those used in the handling of other chemicals which may have harmful effects and do not need special description here.
4. The Council is in doubt as to whether local authorities have the necessary statutory authority to add fluoride to public water supplies. It recommends the introduction of any legislation, which may be necessary to enable Local Authorities to discharge this function.

On the 8th October, 1958, the report from the Fluorine Consultative Council was published, together with a statement that the Government had accepted, in principle, the recommendations of the Council.

The Government now wished to proceed as quickly as possible with a fluoridation policy, as it was a far more attractive economic option than dealing with dental caries on a treatment basis. A "Memorandum for the Government's Information" outlined the facts:

"Some indication of the dental manpower and financial problems which would arise if it were decided to attempt to cope with dental caries by treatment methods alone may be gained from the fact that in order to match Norway's dentist to population ratio, this country would need a further 1,250 dentists, in addition to the present 625, at an extra cost to the community of about £2.5 millions per annum. Present public authority expenditure on dental services here is under £0.5 million pounds per annum. The shortage of dentists in Great Britain and the attraction of highly paid employment for newly qualified dentists there have already caused much difficulty in filling of Local Authority Dental Posts. Even if there were no emigration of graduates it would take many decades to increase dental manpower to the extent indicated."²⁰

The initial capital costs were estimated at £100,000, which would involve no charge to the Exchequer. As a preventive health measure, fluoridation promised value for money.

The central concern of the Department was how to put the recommendation of the Council into legislative form. Although Local Authorities had the power and duty to provide “pure and wholesome” water to members of the public, the addition of a substance like fluoride would require new legal powers.

Discussions in the Department centred on whether the new legislation would be “enabling” or “mandatory”. Initially, an Assistant Principal Officer in the Department, in a memorandum submitted on the 2nd December, 1958 to Mr. Paddy Murray, Assistant Secretary, recommended enabling legislation. He was of the view that mandatory legislation would be unconstitutional. However, Mr. Murray took a different view and recommended mandatory legislation to the Secretary of the Department, Mr. O’Cinnéide, who in turn recommended mandatory legislation to the Minister, Mr. McEntee. On the 8th December, 1958, the Minister approved the recommendation for mandatory legislation by his senior civil servants.²¹

Two key factors influenced the decision to opt for mandatory legislation. One was the problem of overlapping boundaries, for example, if Kildare decided to fluoridate while Dublin decided against, Dubliners would still have to drink fluoridated water if the supplies came from Kildare. These practical difficulties were alluded to by Dr Gavin when he came before the Committee.²²

The second reason for opting for mandatory legislation was international evidence that allowing local communities to decide on this issue would result in long, drawn-out debates, making its introduction far more difficult. Mr. McEntee himself believed that Councillors simply did not have the competence to deal with “complicated questions of public health policy” (Dáil debates 9.11.60).

Dáil Debate of the Fluoridation Bill & High Court Case On the 5th April, 1960 the Second Stage Debate on the Fluoridation of Water Supplies Bill 1959 began. In introducing the Bill, Minister McEntee stated:

“This measure is intended to curb and reduce the incidence of disease which not only caused suffering, but also, because the damage it does may lead to grave disorders and prolonged ill health. The disease in question is dental caries”.²³ The Minister claimed that, “the incidence of dental caries in the country is probably amongst the highest in the World”.²⁴ The Minister went on to claim that “dental decay ... is not only a virulent source of suffering and mental strain but often the root cause of economic hardship and financial loss”.²⁵

The Minister also concentrated on the effects of this disease, dental caries, on children.

“For the past 40 years research into the problem of finding a prophylactic against dental caries has been intensively pursued in many countries. All results indicate that, if piped water supplies are available to the community, it is possible and easily practicable to build up in young children a high degree of immunity from it”.²⁶

The use of the word “immunity” suggests that the Minister believed that fluoride through ingestion somehow prevented this disease.

He rightly pointed out that fluoride occurred naturally as a trace element, not only in drinking waters but also in the “majority of foods, in vegetables, meats, cereals, fruit, fish and notably in tea”.²⁷ It is a normal constituent of bones and teeth. In relation to the prevention of dental caries he was quite explicit in saying that

“it would appear that an adequate intake of fluoride has a strongly inhibiting effect on its development”.²⁸

Again, this suggests that the Minister was of the belief that the ingestion of fluoride was necessary in preventing dental caries.

Much of the evidence cited by Minister McEntee came from the New Zealand Commission on the Fluoridation of Public Water Supplies. He quotes their report:

“fluoride is a natural component of all teeth and by hardening their mineral structure it makes them more resistance by acids”.²⁹

Interestingly, their report also states that the regular ingestion of a substantial excess of fluoride (more than 1.9 parts per million) in the drinking water may cause dental fluorosis. This is the only mention of dental fluorosis by the Minister. Part 3 of this report also dismissed as absurd and entirely misleading the arguments contained in anti-fluoridation literature. In particular, Part 5 of the Commission’s Report rejects the view that fluoride is harmful to health. The Minister also stated that the American Medical Association, the American Dental Association, the National Council, the College of American pathologists and the commission on chronic illness all sponsored and recommended fluoridation. To bolster his arguments the Minister quoted from the Pure Water Association, which opposed fluoridation. In their submission to the Minister they stated unequivocally:

“it would be idle to deny that good grounds exist for believing that the presence of fluorine in the diet, in some ways as yet unexplained, renders the teeth of young children resistant to decay”.

On the question of whether water fluoridation represented mass medication, he declared it was not a medication but rather a nutrient. He also dismissed arguments that this represented a grievous infringement of the rights of the individual. Public water supplies, he argued, did not belong to the individual but belonged to the community. Throughout the debate he studiously avoided the word “state”, which under the circumstances would have been more appropriate, and continued to use the word “community”. The Minister sought to placate those with health concerns by stating that section 6 of the Bill would enable the Minister for Health to carry out health studies on a particular area.

In the Senate on the 14th December, 1960 the Minister also dismissed the argument that the problem of dental caries be tackled by expanding the facilities for treating the disease. According to the Minister there were only 620 dentists in the country and proportionately only one third of countries like Sweden and the USA. Even then countries

with the highest ratio of dentists to population could only treat properly one third of the people. We would therefore it seemed have to increase the number of dentists here nine fold to be able to tackle the problem adequately on a treatment basis.

Most opposition Deputies accepted the merits of water fluoridation. They could hardly do otherwise, as it was the main opposition party, Fine Gael, who had in fact set up the Fluorine Consultative Council. Instead, they objected to the mandatory nature of the Bill, saying that it flew in the face of the Fluorine Consultative Council's recommendation that enabling legislation be used. Many of the speakers drew attention to Recommendation 41 of the report, which explicitly provided for such enabling measures.

The leader of the opposition, James Dillon, put it in these terms:

“if there is a principle involved at all here it is the principal of excessive bureaucratic control. We have Local Authorities, we maintain them and I think it is true to say that in general principle we should avoid transferring the powers of these Local Authorities to the Custom House. As I would have understood it, that was the general philosophy of all Deputies here in so far as this should be quoted as a precedent for further actions, I think it is a bad precedent”.³⁰

He was fully supported by other Fine Gael Deputies. T.F. O'Higgins said,

“we must accord to Local Authorities the liberty which our democracy has given to them, that is freedom of action”.

“this Bill has the same sense of compulsion, the same smell of dictatorship about it as any that might be produced by a person who fails to recognise the integrity of the individual, who believes in the communist doctrine or the fascist doctrine that a person must be sub-ordinate to the interests of the State and not that the State is there to serve the interests of the individual if one believes in democracy, in Christian principles, in fair play, one must reject as improper this proposed mass medication without the consent of the people . . . what has become of this country's professed ideal of the voluntary society?”³¹

The Seanad Debate took a similar direction. When challenged to name another country in the world that has introduced fluoridation nationally, the Minister was forced to concede that none existed:

“in relation to the question as to whether the parliament of any other country than ours has accepted responsibility for empowering a Minister to secure that the public piped water supply will be fluoridated, I am not aware of any, but then if other countries do not carry their responsibilities, that is no justification for our failing to accept them and if it happened that for one reason or another the Swedish Parliament failed to live up to these responsibilities, I hope the Irish Parliament will live up to them . . . as you know somewhere, sometime by some person, a beginning must be made”.³²

At the end of the Dáil Debate, Richie Ryan, frustrated by the lack of engagement with the subject in the Dáil remarked,

“...I feel this House has not yet properly debated this radical proposal. Of its one hundred and forty-seven members, I believe only ten members have yet spoken their minds in public on this very important matter”.³³

A number of Local Authorities refused to obey the provisions of the Fluoridation of Water Supplies Act 1960. Leitrim and Tipperary Urban District Councils adopted resolutions protesting against water fluoridation. In April 1962, Cork Corporation passed a motion

“informing the Minister for Health that it wished to take no part in the proposed scheme of fluoridation of the public water supplies of Cork”.³⁴

Following extensive lobbying by the Irish Dental Association, the Councillors reversed their decision. Also in 1962, Dublin Corporation withheld approval for the expenditure of £1,100 to purchase fluoridation equipment. Minister McEntee responded by issuing an ultimatum to the Corporation to fluoridate the water supplies by the 1st April, 1963. He threatened to abolish the Council and set up an enquiry, the cost of which would be borne by those members who objected to the measure.³⁵ At the beginning of the meeting, a letter from the Minister was read out by Mr Robert Briscoe, urging the Corporation to “fulfil its obligations” and “obey the law”. A decision on the issue had been deferred from the previous meeting pending the outcome of a High Court action protesting the constitutionality of the Health Act by Mrs Gladys Ryan. The solicitor acting for Mrs. Ryan was Richie Ryan, T.D. who spoke vigorously against Mr. Briscoe’s motion.

Under such enormous pressure from Central Government, Dublin City Council eventually voted 25 votes to 15 to authorise the necessary expenditure, following an acrimonious debate.

5.2 The High Court Case

There is little doubt that much of official certainty about the policy of water fluoridation can be explained by the High Court Case presided over by Judge John Kenny, and the Supreme Court challenge which followed it.

While the High Court case has been subjected to interminable legal study and has been quoted in Fluoridation Forum report, the Committee has not occupied itself with the details of the case for a number of important reasons.

Firstly, the Committee is dealing with a health policy today that should and can be scrutinised by the Oireachtas just as for any other health policy that is being implemented today.

Secondly, Judge Kenny’s support for the conclusions of the Fluorine Consultative Council was based on the Council’s assertion that “no other vehicle or techniques for the prophylactic application of fluorides can at present replace the fluoridation of drinking water as a public health measure” (Kenny J. 1963). The addition of fluoride to

toothpastes from the 1970s onwards allied to other equally effective dental interventions have shown how unwise it was to be guided so completely by this assertion.

Thirdly and of crucial significance in this matter, the decision of the High Court relied on judicial interpretation of the scientific evidence by the learned judge. On the key issue of “whether fluoridation of water is or may be dangerous to the citizens of the State” (ibid), Judge Kenny’s self-acknowledged reliance on one apparently expert witness has since been shown to have been extremely unwise. In *The Fluoride Deception* by Christopher Bryson, 2003, the evidence of Prof Hodge of the US PHS is revealed to have been less than reliable not to say entirely disingenuous, because of his undeclared role to protect US government strategic interests in fluorides.

Following the legal verdict that “there is no reasonable possibility that it (fluoridation) may involve an element of danger or risk to life or health to any of the citizens of this country” (Kenny J 1963) it was all the more imperative for the Department of Health should apply the key provision of the legislation to investigate the other health effects that opponents had pointed to. But for the next forty years this crucial intervention was simply overlooked. The Kenny judgement which has been quoted so often since can now be seen to have been fundamentally flawed. Nevertheless it had profound social and political significance because it has effectively silenced any proper media debate on fluoridation since that time.

5.3 The Fluoridation Forum

The then Minister for Health, Micheal Martin, set up the Fluoridation Forum in 1999. The Forum was to investigate all aspects of the Water Fluoridation Policy, dating back forty years, and the report was to be completed within a year.

The fundamental problem for the Forum however soon emerged – how to meet the minister’s wide terms of reference when virtually all previous research used to justify fluoridation had been done by dentists. As had already been noted by the UK York Review, even this research whether of UK, Irish or international origin, could not be relied upon to inform policy because of its poor quality. And as for non-dental or general research into fluoridation, the Minister himself confirmed it was needed when he referred at the launch of the report to “the absence of scientific risk assessment of the risks” of fluoridation. Below are some of the reasons why the public had cause to be worried and why the Forum *did not* produce, contrary to the Minister’s assertion at its launch, “a credible and valuable report”.

From the outset, the Forum’s membership was subjected to serious criticism. Opponents questioned the overwhelming representation of government employees and dentists with very limited independent medical or toxicological expertise. Moreover the only medical group involved, Irish Doctors Environment Association, subsequently criticised the Forum for publishing its report without answering their own and other health-related questions, in particular the *50 Reasons to Oppose Fluoridation* that were submitted in person by Dr Paul Connett to leading Forum members. The issue of bias was raised at the Committee by Dr Don MacAuley of Irish Dentists opposed to fluoridation:

“One of my reasons for refusing to attend the Forum in January 2001 was

that it was pro-fluoride and, therefore, it was not a serious, independent or fair assessment of fluoridation in Ireland.

The Minister referred to the open nature of the Forum but how open was it? If we look at the Forum we can see it as another of the international fluoridation promoters. Professor O'Mullane is on a leaflet of the British Fluoridation Society where he is promoting fluoridation to the elderly.

Other connections include the British Nutrition Foundation. Professor O'Mullane presented at a 1999 conference. Their advice on improving oral health placed fluoridation at No. 2 and sugar reduction moved to No. 5.

Irish Dentists Opposing Fluoridation believe that tooth decay is not due to lack of fluoride but a sugary diet is a major factor. This member appears to favour fluoridation before diet education.

Professor John Clarkson is past president of the International Association of Dental Research which fully endorses and strongly recommends the practice of water fluoridation. Therefore, he would also not appear to be open on this subject. National fluoridation supporters include Dr. Gerard Gavin. These people have made their position on fluoride clear to the media, in publications and at conferences. Dr. Gerard Gavin has stated that 'we consider fluoridation safe at the levels it is being used in Ireland'.

Dr. Maire O'Connor and Dr. Howard Johnson co-authored a report which strongly supported the continuation of fluoridation. Dr. Joe Mullen was reported in the *Irish Medical News* as saying "fluoridation benefits dental health and adverse medical effects are unproven". (Health Committee, 10 July 2003)

The failure to answer the fundamental questions about fluoridation has undermined both the Forum and the Minister's promise that it would allay the fears of all those who were worried about fluoridation. Even those aspects which the report did address such as the public perception of fluoridation, were not clearly reported in order to downplay the finding that over 90% of public submissions were opposed to fluoridation.

The report's failings were further compounded by the Minister when he claimed that it was based only on scientific and not anecdotal evidence. Within two months this claim was rejected by international scientists (*Scientific Critique of the Fluoridation Forum Report, October 2002*) who exposed the lack of scientific scrutiny in the report. The Minister was specifically criticised for *not addressing the scientific evidence available in the published literature* and in particular that evidence that had been directly raised by Dr. Connett and Dr. Limeback in their submissions to the Forum in Cork in October 2000. Worse still the Forum was accused of not even being familiar with the international science on the subject. (UK NHS York Review, September 2000)

Other criticism of the Forum was made to the Committee in relation to matters arising in the Food Safety Authority of Ireland in 2001 when it investigated fluoridated water used in making up infant formula. The Committee was disquieted to learn that the minutes of a meeting of its Scientific Committee, which recommended that parents not use fluoridated tap-water to make up infant formula, were subsequently changed to

state almost the exact opposite. The explanations given by Dr. Wayne Anderson in this regard were unconvincing:

“At the meeting, nine of the 15 members of the committee were present and six were absent. The nine members in attendance read through the report, listened to the discussions and accepted the report on behalf of the scientific committee, at which point I was correctly under the impression that the report was passed by it.”

The meeting of the Fluoridation Forum was held a day or two after the scientific committee meeting and so I presented the report as the conclusions of the scientific committee. In the preceding few days, some of the members who were not present at the scientific committee meeting contacted the Food Safety Authority of Ireland and the chairman of the scientific committee and basically said they felt that, having now read the report, it contained some errors and that it did not necessarily take account of all the available scientific evidence. At that point the chairman said that, effectively, the report was no longer supported by the majority of the scientific committee and I had to withdraw the report at the next meeting of the Fluoridation Forum. (July 20, 2003)

The former chairman of the Committee, Batt O’Keefe TD, reacted to this explanation thus:

Chairman: “It sounds like a real process mess. How many scientists of the overall group were present when this was first adopted?”

Dr. Anderson: “Nine out of 15; there were six absent.”

Chairman: “Was it the six people who were not present who subsequently made the objections to the scientific analysis and basis of it, or did members who adopted the report make objections subsequently?”

Dr. Anderson: “It was some of the absent members.” (10 July 2003) The Committee believes that the Forum Report’s subsequent Risk Assessment on fluoride intake of Irish infants consuming infant formula re-constituted with fluoridated water was an attempt to put scientific respectability on this volte-face by the FSAI. The manner in which this key recommendation was changed was both irregular and suspect.

There were other contradictions between what the Forum recommended and what individual members stated on a particular issue, in this case once again relating to fluoridated water in infant feed. One of its most prominent members, Dr. John Clarkson, Professor of Dental Health & Dean of Dublin Dental School & Hospital, further undermined the credibility of the Forum on the issue of tap water and infant formula when he published a paper (with his colleague Dr. Jacinta McLoughlin) “Role of Fluoride in oral health promotion” in the International Dental Journal (2000) in the same year as the Forum was at work. http://www.fdiworldental.org/assets/pdf/commission/97_6_1.pdf.

It contained the following advice:

“Fluorosis and infant formulas – The risk of fluorosis resulting from the use of infant formulas has been reduced considerably as a result of the action of manufacturers in reducing the amount of fluoride in these products. However, infant formulas should still be prepared using non-fluoridated water”.

Recommendation 5 of the Report of the Forum of which Prof Clarkson was a leading member, advised something completely contrary –

“Infant formula should continue to be reconstituted with boiled tap water in accordance with manufacturers’ instructions. Alternatively ready-to-feed formula can be used”.

The Forum website elaborates as follows but nowhere does it advise, as does Professor Clarkson, using non-fluoridated water.

Question 3: Should I use fluoridated water to make up my baby’s feeds? Answer: Yes. The Forum recommends that parents continue to prepare baby feeds with boiled tap water and to follow the manufacturers’ instructions. “It should be noted that no manufacturer issues instructions to use fluoridated water.

Question 4: Is it okay to use bottled water to make up feeds? Answer: The Forum recommends that you do not use bottled water to make up your baby’s feeds. Bottled water on sale in Ireland may contain salt which is not recommended for babies.” (was at <http://www.doh.ie/publications/fluoridation/faqpar.html>; full report at http://www.dohc.ie/publications/fluoridation_forum.html)

While the Forum and its report have been regularly referred to in subsequent ministerial statements, none of its thirty three conclusions have been implemented. This raises fundamental questions about fluoridation policy within the Department. And as admitted by Forum member and Principal Dental Surgeon on 10th July, 2003, it is not acceptable that Health Boards have been left in limbo. Health Boards (HSE) still have no new legal guidance on what concentration fluoride should be dosed at. Even at the most basic level of public approval, the Forum report clearly demonstrated that fluoridation is extremely unpopular with the individual members of the public– for a whole variety of reasons– who the Forum simply dismissed as poorly informed.

5.4 Aftermath of the Fluoridation Forum

While the Forum fell far short of expectation and achievement there is evidence to suggest that as a proper investigation of policy, it was compromised from the outset. The minister appointed his most senior adviser on dental policy, the Chief Dental Officer, to the Forum. How could an objective assessment of policy be achieved if the prime and long-time exponent of that policy was a leading player on the investigation? Fluoridation has been so central to Irish dental policy for many years that it would have been inconceivable for any forum to conduct a fair investigation with the prime advocate for the policy being an integral member of the review.

Several members of the Committee expressed their reservations at the time the Forum was announced, however it was not until the Forum released the report a full year later that its limitations were fully revealed. Its key recommendation — to reduce the fluoride concentration from 1 ppm to 0.7 ppm in response to the increase in dental fluorosis — was a totally inadequate response to the over-exposure to fluoride in children. Equally inexplicable was the eighteen month delay before the body that was set up to implement

the far-reaching recommendations of this “credible and valuable” report, first met in April 2004.

There was another explanation for the policy drift following the Forum report. Some eight months after its publication, in May 2003, the same Chief Dental Officer and departmental spokesman on fluoridation policy, resigned to take up a position in the private sector. At the same time that the allegedly far-reaching recommendations of the Forum were to be implemented, the top government adviser on dental policy resigned. The Committee finds this further compelling evidence to question the wisdom of the Minister to have appointed the Chief Dental Officer to membership of the Forum.

Whatever the reasons for its failure, the Forum did consult experts from the UK, Canada and the United States. It started work just after the publication of the York Review. This Review revealed alarming results of fluorosis in a population exposed to drinking water fluoridated at the concentration legally enforced in Ireland. Almost half (48%) of people in a fluoridated area such as Ireland showed some form of dental fluorosis and the Review found a clear dose response relationship between the concentration of fluoride in water and fluorosis. Dr. Don MacAuley of IDOF is of the view that this key finding was not addressed properly by the Forum. Dr. Paul Connett has also made it clear that the Forum did not answer the scientific evidence presented to it. His fifty questions about fluoridation were not addressed in the Forum Report.

6 Water Fluoridation and Dental Caries

It is frequently suggested that water fluoridation has revolutionised dental health in Ireland, helping reduce the incidence of decay by about 70%. According to the Department of Health, “in Ireland the critical factor which led to improvement of dental health was the decision to fluoridate public water supplies in the 1960s”.³⁶ The former Minister for Health Micheal Martin TD stated;

“The impact on oral health has been dramatic in Ireland since that decision back in the 60s to have mandatory fluoridation of public water supplies. And we shouldn’t underestimate the dramatic impact on dental health in Ireland, it has really transformed the quality of teeth of Irish people in those intervening 30-odd years”.³⁷

When the concept of adding fluoride to the water supplies was proposed in the USA in the 1940s, it was suggested by its promoters, such as the American Dental Association, that it would help reduce dental decay by about 60–70%. However, recent reviews have cast considerable doubt on the accuracy of these claims and have suggested that the benefit is much less.³⁸ This section will detail the evidence presented to the Committee on the effectiveness of water fluoridation in Ireland, and will be supplemented by additional national and international research.

6.1 What is Dental Caries, and How Can Fluoride Help?

‘Dental caries’, which is measured scientifically as ‘decayed, missing or filled teeth’ (DMFT). According to the Oral Health Research Centre, dental caries, or dental decay,

“begins with a small patch of demineralised (softened) enamel at the tooth surface, often hidden from sight in the fissures (grooves) or in between teeth. The destruction spreads into the dentine (the softer, sensitive part of the tooth beneath the enamel). The weakened enamel then collapses to form a cavity and the tooth is progressively destroyed”.³⁹

The cause of dental caries is the action of acids on the enamel surface, produced when sugars react with bacteria present in the plaque or soft film on the teeth. This results in demineralisation, which is a loss of calcium and phosphate from the enamel. When there is consistent breakdown of the enamel surface, this leads to a cavity.

Fluoride has been proposed as a solution in helping slow down the process whereby the enamel loses calcium and phosphate when exposed to acid, following ingestion of food and drinks which contain sugars. It is suggested that it also helps to ‘heal’ surfaces which show early signs of calcium or phosphate loss.⁴⁰ According to Dr. Gerard Gavin, the former Chief Dental Officer for the Department of Health,

“Our knowledge about how fluoride works is that the key thing is having fluoride consistently present in the saliva, available for the tooth surface so that when you eat sweet food you get the deposition of the fluoride into the tooth surface and it makes the tooth surface very hard”.⁴¹

In the 1950s and 1960s, before fluoride was added to toothpastes and other oral care products, the level of fluoride in the diet was very low. A programme to add it to the drinking water supplies was commenced. This section will take a number of perspectives in looking at the evidence in assessing the success of this programme.

The first section will look at the reduction in dental decay as it stands today versus the 1950s and 1960s in Ireland, before water fluoridation commenced. A number of sections will look at the evidence of the impact of water fluoridation by comparing the decay levels in fluoridated and non-fluoridated areas. In addition to assessing the continuing need for water fluoridation in Ireland, there will also be an analysis of the possible impact on oral health of discontinuing water fluoridation.

6.2 Water Fluoridation and Dental Caries in Ireland

The evidence on the effectiveness of water fluoridation in reducing dental caries in Ireland is complex, and needs to be supplemented by additional information from an international perspective. Professor Denis O’Mullane of University College Cork informed the Committee that:

Table 1: Dublin Region; dmft 1963 versus 1997.⁴³

Dublin City	1963	1993	1997
dmft 12 Year Olds	6.1	1.2	1.1

“There have been ongoing studies in Ireland since the commencement of water fluoridation in Dublin in 1964, all of which, as Dr. Gavin pointed out, have shown that water fluoridation is highly effective in reducing the level of dental decay in children. . .”

(See Table 6.2 on page 23)

“... table 3 in enclosure contains the figure 6.4. This is the mean number of decayed, missing and filled teeth (dmft) among five year old children in the Southern Health Board area in 1963 ...

... The figures for 1995 were 1.2 and 2.5. This indicates a dramatic improvement. The figure of 1.2 applies to children living in communities served with fluoridated water supplies”.⁴²

Statistics from the Department of Health also highlight the decrease in dental decay in Dublin in the period since fluoridation was introduced.

Statistics from the Southern Health Board and the Department of Health (see Table 2 on page 25) highlight a reduction in decay between the 1960s and the 1990s in the SHB region of 81%, and in Dublin also of 81 % in 12-year old children.

Studies from various health boards also attest to improvements in oral health since the introduction of water fluoridation in the 1960s. Statistics from the Western Health Board region in 1991 show a decrease in rates of dental decay in fluoridated communities of 80% for 5 year olds, 70% for 8 year olds and 61% for 12 years olds”.

The Mid-Western Health Board Survey of Oral Health of Children and Adolescents 1997 (see figure 1 on page 24) quantified the reduction in dental caries between 1961 and 1997⁴⁵. Assessing the reduction in dental caries between periods before water fluoridation commenced (1961/63) and 1997, there can be seen dramatic decreases in the number of decayed, missing and filled teeth, as in the chart below.

There were significant reductions in DMFT in all four age groups between 1961 and 1997: 73% among five year olds, 68% among eight year olds, 71% among twelve year olds and 63% among fifteen year olds. The study concludes, “this improvement is due to the introduction of water fluoridation following the Health (Fluoridation of Water Supplies) Act 1960 and to the introduction of fluoridated toothpastes in the early 1970s”⁴⁶.

According to the Dental Health Foundation Ireland:

“The introduction of water fluoridation in Ireland nearly 40 years ago is largely responsible for the 70% falls in levels of tooth decay. Dental Health surveys carried out by the state in 1963, 1984, 1989 and 1990 confirm that water fluoridation has had a major impact on the oral health of Irish children and adults”.⁴⁷

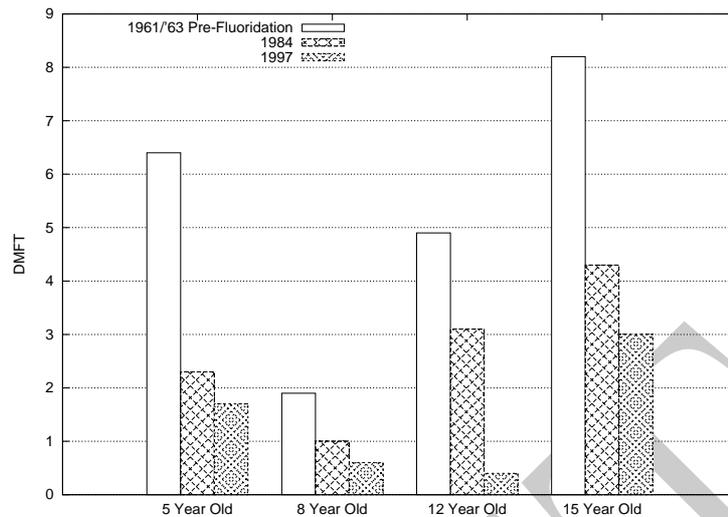


Figure 1: Change in Tooth Decay 1961/'63–1984–1997 in 5, 8, 12 and 15 Year Olds in Fluoridated Area in MWHB Region

The former Minister for Health, Micheal Martin T.D. has also commented that

“we have had fluoridation for 40 years, it has proven its worth. It has reduced dental decay by 70%, a staggering achievement... and the results are there in terms of dental health, they cannot be challenged”.⁴⁸

6.3 *The Reduction of Dental Caries in Developed Countries*

In analysing the statistics from Ireland, it is necessary to quantify the contribution that water fluoridation has made in achieving improvements in oral health. In relation to the overall reduction in dental decay, it is necessary to go beyond correlations that show reductions in decay since the introduction of water fluoridation. It is necessary to compare with cases in which there have been no water fluoridation programmes. According to Dr. Hardy Limeback, Head of Preventive Dentistry in the University of Toronto, and past President of the Canadian Dental Association, “dental decay has declined worldwide, even in the non-fluoridated areas dental decay rates are low”.⁴⁹

Statistics from the World Health Organisation’s (WHO) Oral Health Country/Area Profile Programme confirms this fact, highlighting that decay rates have been decreasing in all countries.⁵⁰ The comparison below is made between European countries that have a WHO decayed, missing, filled teeth (DMFT) statistic for both the 1970s and 1990s.

As seen in table 3 on page 26 between the 1970s and 1990’s, commencing with DMFT rates largely similar to Ireland’s, the average percentage reduction in DMFT in European countries has been 68%. Mostly this has been achieved without water fluoridation programmes (only 10% of UK water supply is fluoridated, 3% in Spain, and the city of Basel in Switzerland). This average percentage reduction in DMFT scores mirrors the

Table 2: Mean dmft in the Western Health Board Region 1961–1991

Age Group	1961–1963	1991
5 Years	5.0	1.0
8 Years	1.4	0.4
12 Years	4.2	1.6

reduction that has taken place here in Ireland, where 73% of the population consume fluoridated water.

In Ireland, reductions in the occurrence of dental caries took place at near equal rates in both the fluoridated and non-fluoridated areas. Table 4 on page 26 using statistics also from the World Health Organisation, shows the reduction in DMFT for 12 year olds in fluoridated and non-fluoridated regions in Ireland between the 1980s and 1990s.⁵¹ The level of dental caries is decreasing at near similar rates in both fluoridated and non-fluoridated areas for 12 year olds.

It has been suggested by various Health Boards in Ireland that the reduction in decay in non-fluoridated areas is probably a result of fluoride. The 1997 Mid-Western Health Board study suggests that the reduction in decay in non-fluoridated areas may possibly be because of the “almost universal use of fluoride toothpaste by children in 1997”, and also due to the “consumption in non-fluoridated areas of foods and drinks which contain fluoride due to their being processed with fluoridated water in urban areas.”⁵²

In 1986, a review of research into the effectiveness of water fluoridation in eight countries cited a large number of studies which indicated that there were large reductions in dental caries occurring in numerous non-fluoridated areas in Australia, Denmark, Holland, New Zealand, Norway, Sweden, the UK and the US. Author Mark Diesendorf stressed that “the magnitudes of these reductions are generally comparable with those observed in fluoridated areas over similar periods of time”.⁵³ The review concluded that:

1. There have been large temporal reductions in caries in non-fluoridated areas of at least eight countries.
2. There have been large temporal reductions in several “fluoridated” areas which cannot be attributed to fluoridation.
3. The absolute values of caries prevalence in several fluoridated areas are comparable with those in several non-fluoridated regions of the same country.

Research published as far back as 1981 in the US also highlighted that there was significant reductions in dental caries in non-fluoridated areas. Between 1958 and 1978, Dr. Robert Glass, a researcher at the Forsyth Dental Centre in Boston studied tooth decay in two non-fluoridated Boston suburbs, Norwood and Dedham. Dr. Glass examined the teeth of 1776 children in the school systems of these two communities and discovered, over the course of 20 years, a 50 percent drop in DMFT.⁵⁴

Table 3: WHO Oral Health Country /Area Profile Programme

Country	Year	DMFT	% Decrease
Austria	1973	3.5	51%
	1997	1.7	
Belgium	1972	3.1	15%
	1991	2.7	
Denmark	1978	6.4	81%
	1995	1.2	
Finland	1975	7.5	8%
	1994	1.2	
France	1975	3.5	46%
	1998	1.9	
Germany	1973	6.0	56%
	1994	2.6	
Ireland	1972	5.4	72%
	1993	1.4	
Italy	1978	6.9	69%
	1996	2.1	
Netherlands	1974	8.2	89%
	1992	0.9	
Norway	1973	8.4	75%
	1993	2.1	
Portugal	1979	4.6	67%
	1999	1.5	
Sweden	1977	6.3	85%
	1999	0.9	
Switzerland	1975	9.9	88%
	1992	1.1	
UK (GB & NI)	1973	4.7	76%
	1996-97	1.1	

Table 4: DMFT 12 Year olds - Ireland-WHO Oral Health Country -Area Profile Programme

Region	Year	DMFT	% Reduction
Fluoridated	1984	2.2	36 %
	1993	1.4	
Non-Fluoridated	1984	3.0	30 %
	1992	2.1	

In explaining the general decline in the prevalence of dental caries in both fluoridated and non-fluoridated countries world-wide, the Royal College of Physicians of Ireland proposes that this may have resulted from “factors such as the changing patterns of sugar consumption, changes in oral hygiene practices, dental screening and increasing awareness of the importance of oral health”, as well as “the widespread use of fluoride supplementation, especially fluoride toothpastes”.⁵⁵ It must be acknowledged that Ireland has also benefited from these dietary and oral health advances attributed to reducing dental caries in other European countries, whilst at the same time carrying out the programme of adding fluoride to the public piped water supplies. This makes it difficult to identify the benefits derived solely from water fluoridation.

Reinforcing the rationale put forward by the Royal College of Physicians of Ireland, Diesendorf’s 1986 review paper also affirms that:

“The main causes of the observed reductions in caries are changes in dietary patterns, possible changes in the immune status of the populations and, topical fluorides. Indeed, a promising explanation is that the apparent benefit from fluorides is derived from their topical action.”⁵⁶

A number of other studies have also assessed the reduction in dental caries occurring across the industrialised world, and concluded that the decline ‘cannot be all attributed to the work of fluoride.’^{57 58 59}

A significant international perspective on the trend of reducing dental caries and the contribution from water fluoridation has come from New Zealand. In New Zealand the National Health Service Plan examines the teeth of every child (98 per cent of 5–13 year olds, and 68% of pre-school children).⁶⁰ Therefore available to researchers is a complete data bank rather than surveys. Whilst for a number of decades the reduction in dental caries had been attributed solely to water fluoridation, in the 1980’s, Dr. John Colquhoun, then Chief Dental Officer of Auckland, graphed the downward trend in dental caries over a 50 year period, whilst simultaneously graphing the introduction of fluorides (water and fluoridated toothpastes) to the New Zealand population (see figure 2 on page 28).⁶¹ According to Dr. Colquhoun it shows “that tooth decay had started to decline well before we had started to use fluorides. Also, the decline has continued after all children had received fluorides all their lives, so the continuing decline could not be because of fluoride”, and therefore occurred independently of the introduction of water fluoridation. Dr. Colquhoun concluded that “fluorides (*water and toothpastes*), while possibly contributing, could not be the main cause of the reduction in tooth decay”.⁶²

Again, Dr. Colquhoun proposes that the reduction in decay is due to a rise in the standard of living of most people in industrialised countries, signified by changes such as improvements in diet, and increased oral health awareness. In 1998 de Liefde also analysed the decline in tooth decay in New Zealand, and also concluded that “an explanation of the convergence of caries prevalence in fluoridated and non-fluoridated areas since the 1970s may require a re-assessment of the fluoride effect. This convergence, and the overall decline during the last decade without known additional fluoride supplementation, suggest that factors other than fluoride, such as food additives and antibiotics, may have contributed”.⁶³

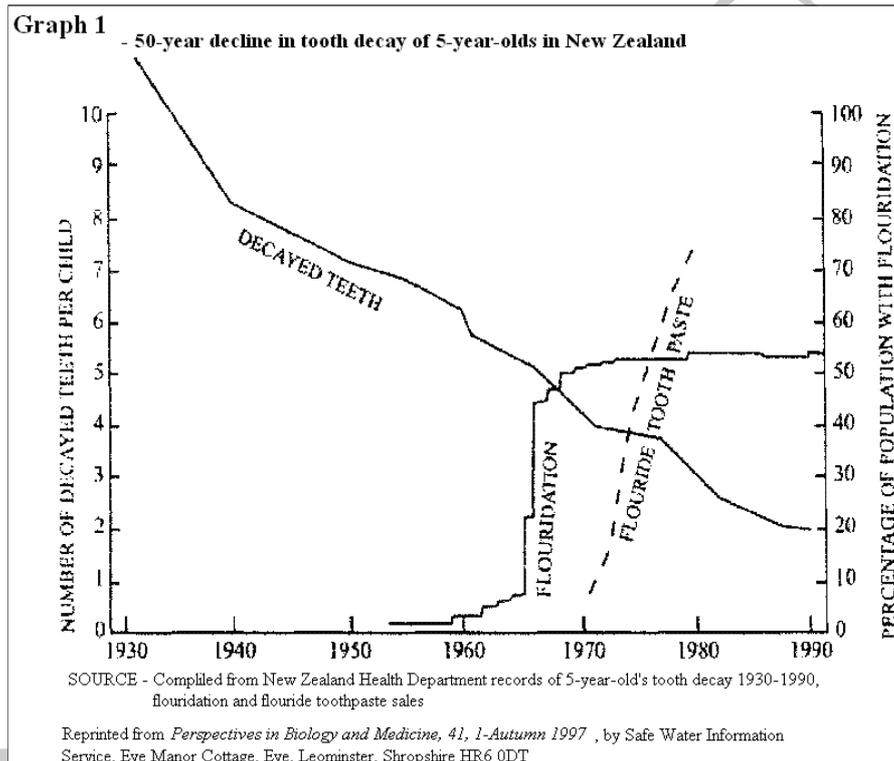


Figure 2: 50 year decline in tooth decay of 5 year olds in New Zealand

Dr. Hardy Limeback, addressing the Committee, referred to the possible reasons for the decline in tooth decay in both fluoridated and non-fluoridated areas:

“We know that dental decay rates have decreased world-wide without fluoride intervention, because of many factors, including better general health, antibiotics, preservatives, better diets, sugar substitutes in the diet. There are many good reasons why dental decay has declined throughout the world”.⁶⁴

6.4 Water Fluoridation and a High Sugar Diet

Although most of Europe has achieved similar oral health gains to Ireland without water fluoridation, it has been pointed out by the Department of Health that Ireland’s need for a ‘water’ fluoridation programme, above the benefits derived from fluoridated toothpaste, is due to Ireland’s high consumption of snacks and confectionery, where water fluoridation can offer additional benefits to counteract the high consumption of sugar in our diet. According to the Department of Health, the main reason for the decrease in dental decay in areas and countries where there is no water fluoridation is the “widespread availability of fluoridated toothpastes”. Addressing Ireland’s need for water fluoridation due to dietary reasons (in addition to the use of fluoridated toothpastes), the Department has also stated:

“However, in areas where the level of risk is high with high frequency consumption of sweets and confectionery the use of fluoridated toothpastes alone is insufficient to prevent dental decay. A recent survey of adolescent snacking patterns in 19 European countries revealed that Irish and Scottish children were the worst”.⁶⁵

However, statistics from the World Health Organisation appear to offer an alternative perspective on this dietary rationale. Looking at the same countries (see table 5 on page 30) as detailed above for DMFT scores, Ireland ranks only joint 8th in relation to the amount of ‘sugar consumed per capita’. That is, there are 8 European countries above Ireland that consume a ‘higher’ per capita volume of sugar annually, with countries such as Austria and Sweden consuming over 35% more sugar per capita than Ireland.⁶⁶ However, significantly, compared to other European countries, dmft figures for 12 year olds place Ireland only sixth for tooth quality,⁶⁷ despite Ireland being the only European country operating extensive water fluoridation programmes

Dr. Liz Cullen from the Irish Doctors Environmental Association has stated that the groups opposition to water fluoridation was grounded in a number of principles, one being that “decay was not caused by a lack of fluoride, rather the presence of sugar”:

“We are not fluoride deficient. We support the practice of giving iron to people who are anaemic or to women who are pregnant because their iron stores are depleted, but we are not fluoride deficient and dental decay is not caused by an absence of fluoride”.⁶⁸

As mentioned above by Dr. Limeback, one the possible explanations for the reduction of dental caries in Ireland over the 30 years of fluoridation (and in other developed

Table 5: Sugar Consumption Kg/Capita/ Annual - WHO Oral Health Country/ Area Profile Programme

Rank	Country	Sugar Consumption (Kg/Capita/Year)
1	Sweden	52
2	Austria	50.1
3	Switzerland	44.1
4	Norway	41.7
5	France	41.2
6	Belgium	40
7	Finland	39
	Netherlands	39
8	Denmark	37
	Germany	37
	Ireland	37
9	UK	35
10	Portugal	29
11	Italy	26

countries) is due to an improvement in diet, with just one of the measurements of this dietary improvement being a general decrease in sugar consumption. The Department of Health has confirmed that the cause of dental caries is directly related to factors in the diet such as sugar:

“Ireland like many other developed countries suffered from an epidemic of dental disease which began in the mid 19th century and which has only recently come under control. The main reason for the epidemic was the widespread availability of refined sugars which occurred at the time”.⁶⁹

Extrapolating the argument put forward by Dr. Limeback, an improvement in the diet in industrialised countries should result in a corresponding decrease in the consumption of sugar, resulting in a decrease in dental caries. As mentioned above, The Royal College of Physicians have also concurred that the reduction in dental caries in both fluoridated and non-fluoridated communities is due to a number of factors, such as ‘the changing patterns of sugar consumption’.⁷⁰ However, a report in 1996 by O’Mullane et al⁷¹ suggested that the reduction in consumption in sugar by Irish people between the 1960s and 1990s cannot totally explain the reduction in dental caries over the same period of time;

“Annual sugar disappearance figures for the period 1963 to 1979 were approximately 46 kilogrammes per person per year, declining to approximately 40 kilogrammes per person per year between 1986 and 1988. Between 1989

and 1993 a further small decline to approximately 37 kilogrammes per person per year occurred".⁷²

The report concludes

“these sugar disappearance figures do not account for the large decline in the prevalence of dental caries among children and adolescents in the Republic of Ireland over the last 30 years”.

Therefore it can be concluded that the reduction in sugar consumption cannot be the ‘sole’ reason for the reduction in dental decay in Ireland (70% reductions). However with an overall 20% reduction in sugar consumption in Ireland occurring over the period of the water fluoridation programme, it is probable that this 20% reduction accounts for at least 20% of the total 70% reduction in dental decay as evidenced in Ireland over this period.

It should be stated that ‘reduced sugar consumption’ is only one measurement of an improvement in a population’s diet, and many factors possibly aiding the reduction the dental caries have been cited above. Considering that the reduction in dental caries in Ireland is commensurate to a reduction in sugar consumption (a 20% reduction), and sugar is the main cause of dental caries, this should add credibility to the various arguments proposing alternative reasons for reduced caries other than water fluoridation, rather than water fluoridation being the sole or main agent of change.

6.5 A Comparison in DMFT between Ireland and Scotland - Countries with Similar Dietary Patterns.

To gain a further understanding of the possible impact of water fluoridation, it is necessary to focus on the differences in rates of decay in fluoridated areas compared to non-fluoridated areas. As diet, and specifically sugar consumption, is the main cause of dental caries, in making comparisons with other “non-fluoridated” countries, it is advisable to compare Ireland’s DMFT to countries with similar dietary patterns to establish if there are any differences, which could subsequently be attributed to the effect of water fluoridation.

Dr. Gerard Gavin, in his presentation to the Committee chose a number of studies “which demonstrate that fluoridation is still very effective in Ireland”, one of them being a study showing the difference between DMFT scores in Dublin (fluoridated) versus Glasgow (non-fluoridated);⁷³

“In a recent European study looking at 19 European countries, the snacking and confectionery eating habits of children in Ireland and in Scotland are almost identical. They are the worst in Europe. We are ‘top of the chocs’ in that regard.

The only difference between the two cities was that Dublin was fluoridated and Glasgow was not. When we look at the statistics for 12 year old children we, find that in Dublin the average number of decayed, missing or filled teeth

Table 6: Indicators of dental caries in four cities in Ireland and the United Kingdom

City	Mean DMFT	Caries Free Children
London	1.27	50%
Edinburgh	1.39	47%
Dublin	1.48	43%
Glasgow	2.7	50%
Edinburgh	1.39	24%

was 1.48, in Glasgow 2.7, giving a 45% difference in the decay levels between the two places".⁷⁴

The Department of Health has cited this study as "a good indication of the additional benefit provided by water fluoridation when other risk factors are similar".⁷⁵ However, this study cannot be taken to act as conclusive evidence of water fluoridation's effectiveness, as it conflicts with the results of an extension of this study carried out two years later; which was not brought to the attention of the Committee by the Department of Health. In 1994, Downer et al extended the study to 12-year old children in North London and Edinburgh.⁷⁶ Apart from Dublin, none of the other three cities had artificial water fluoridation. The results of this study (see table 6.5 on page 32) show that both Edinburgh and London had 'lower' decay rates than Dublin, achieved without water fluoridation. Whereas Dublin had a DMFT of 1.48, Edinburgh and London, non-fluoridated cities had DMFT rates of 1.39 and 1.27 respectively.

Specifically addressing these results, the Royal College of Physicians of Ireland has said;

"The findings that children in Dublin which had fluoridated drinking water supplies had a higher DMFT than their counterparts in non-fluoridated London and Edinburgh appeared paradoxical, and effects other than water fluoridation were considered. The comparatively low caries level found in London and Edinburgh was considered to reflect in part the effect arising from the use of dentifrices containing fluoride".⁷⁷

On comparing the number of 12 year old children in these studies who had 'no' dental decay, it should be noted that Dublin's percentage of caries free children of 43%, compares closely with Edinburgh's 50%. In Glasgow however, only 24% of the children had no dental decay. These comparisons could indicate that Edinburgh provides a more suitable benchmark for Dublin than Glasgow. If Dr. Gavin's 1992 study acted as a 'good indication of the additional benefit of water fluoridation', the evidence of the subsequent 1994 study must thereby cast serious doubt over this proposed 'additional benefit'.

Further comparisons are made in later sections between 'fluoridated Ireland' and a comparable non-fluoridated country. However before fully investigating the effect of water fluoridation by comparing studies in fluoridated communities versus non-fluoridated,

it is necessary to take note of the findings of the Review from the York University NHS Centre for Reviews and Dissemination, perhaps the most comprehensive review of the effectiveness of water fluoridation, (Known elsewhere in this report as the York Review.)

6.6 The York Review

In September 2000 the review team at York University presented its report 'Fluoridation of Drinking Water: A Systematic Review of its Efficacy and Safety'.⁷⁸ Commissioned and funded by the UK Department of Health, the 'York Review' set out to establish a number of perspectives in relation to water fluoridation. Three of these objectives related to the effectiveness of water fluoridation, with the objectives stated as follows;

1. Does Fluoridation of Drinking water supplies prevent caries?
2. If Fluoridation is shown to have beneficial effects, what is the effect over and above that offered by the use of alternative interventions and strategies?
3. Does Fluoridation result in a reduction of caries across social groups and between geographical locations?

The York Reviews findings, as stated in the British Medical Journal were that "a systematic review of water fluoridation reveals that the quality of the evidence is low. Overall, reductions in the incidence of caries were found, but they were smaller than previously reported".⁷⁹ According to the review team "the studies were of moderate quality (level B), but of limited quantity".⁸⁰ There was said to be serious shortcomings in the research proving the dental benefits of water fluoridation. The results highlight that: "The most serious defect of these studies was the lack of appropriate analysis. Many studies did not present an analysis at all, while others only did simple analysis without attempting to control for potentially confounding factors. While some of these studies were conducted in the 1940s and 50's, prior to the common use of such analysis, studies conducted much later also failed to use methods that were commonplace at the time of the study".⁸¹ The review also stated:

"To have clear confidence in the ability to answer the question in this objective, the quality of the evidence would need to be higher. The failure of these studies to deal with potential confounding factors or to provide standard error data means that the ability to answer the objective is limited"⁸²

However the York Report did conclude that there was some benefit from water fluoridation, however this benefit was smaller than previously believed.

The main findings in relation to reduced dental caries, as stated in the report were as follows;

"The degree to which caries is reduced, however, is not clear from the data available. The range of the mean difference in the proportion (%) of caries free children is -5.0 to 64%, with a median of 14.6% (inter-quartile range 5.05, 22.1%). The range of mean change in dmft/DMFT score was from 0.5 to

4.4, median 2.25 teeth (inter-quartile range 1.28, 3.63 teeth). It is estimated that a median of six people need to receive fluoridated water for one extra person to be caries-free".⁸³

The findings of the York report will be addressed further in this chapter.

It should be pointed out that there has been serious constructive criticism levelled at the review team for numerous omissions that are claimed would have offered a more complete and rounded perspective on the effects of water fluoridation.

An example of this criticism comes from Paul Connett, Ph.D.⁸⁴ (who was a peer reviewer of the report). One of the examples of the omissions outlined by Professor Connett in relation to the benefit to teeth was as follows:

"I am extremely surprised that the York team included the early studies from Newburg versus Kingston Ast (1951)", (which proved the dental benefits of water fluoridation), "however, if it was deemed appropriate to use Ast (1951) data, then it is important to note that analysis of the teeth of the children in Newburg (still fluoridated) and Kingston (still unfluoridated) was repeated in 1986⁸⁵ and 1995.⁸⁶ In 1985 there was little difference in the DMFT values among the children in the two communities and in 1995 the average DMFT's in Kingston (unfluoridated) were slightly better than Newburg".⁸⁷

Professor Connett highlighted that had the review included certain research papers that were actually omitted, it would have further lowered the resulting effectiveness of water fluoridation, which as mentioned above concluded a 14.6% benefit.

Although the results of the York Review suggested a benefit from fluoridation much lower than previously heralded, John Hunt, Chief Executive of the British Dental Association commented: "The compelling evidence provided by the review gives Ministers an opportunity to improve the quality of life of many thousands of young children."⁸⁸ On publication of the York Review in the British Medical Journal, the Associate Editor of the journal, Douglas Carnall, expressed his personal viewpoint as follows; "Previously neutral on the issue, I am now persuaded by the arguments that those who wish to take fluoride (like me) had better get it from toothpaste rather than the water supply".⁸⁹

6.7 Studies in Ireland Assessing the Difference in Decay levels between Fluoridated and Non-Fluoridated Areas.

Section 6 of the Health (Fluoridation of Water Supplies) Act, 1960 requires the Minister for Health to conduct surveys into aspects of health of persons who receive fluoridated water. There have been numerous 'dental' health studies conducted in Ireland by the various health boards in conjunction with University College Cork since the 1960's, which mostly indicate a lower DMFT score in areas with water fluoridation programmes than in non-fluoridated areas.

In 1984 the Minister initiated such a survey of *Children's Dental Health in Ireland*. This comprehensive study investigated the level of decay, missing and filled teeth and surfaces in 5, 8, 12 and 15 year olds, and found statistically significant differences in decay rates

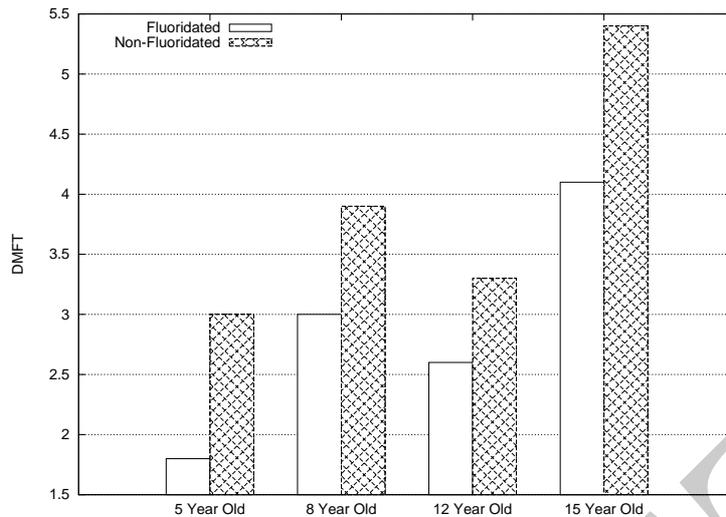


Figure 3: Mean DMFT for 5, 8, 12 & 15 year olds in 8 Health Boards, 1984

in fluoridated versus non-fluoridated (F versus NF) areas. The sample looked at children in the Eastern, Midland, Mid-Western, North-Eastern, North-Western, South-Eastern, Southern, and Western health board regions.⁹⁰

As evidenced in figure 6.7 on page 35), the percentage difference in dmft scores in fluoridated areas versus non-fluoridated areas in the 1984 study is as follows; for 5 Year olds (40% difference), for 8 year olds (23% difference), for 12 year olds (21% difference), and for 15 year olds (24% difference). In his presentation to the committee, Dr. Gerard Gavin, Chief Dental Officer for the Department of Health discussed the results of the Eastern Health Board study of 1997:

“The Eastern Health Board study of 1997 on page six, again examining five year olds, shows that, in fluoridated areas, there is an average of one decayed, missing or filled tooth and, in non fluoridated areas, an average of 1.7 decayed, missing or filled teeth, giving a difference of 41% more decay in the non-fluoridated areas”.⁹¹

There have been a number of studies conducted by the various health boards in the 1990s, which show varying benefits from water fluoridation. *The Mid-Western Health Board Survey of Oral Health of Children and Adolescents 1997*, directed by Oral Health Services Research Centre, University College Cork, where 67% of the area is fluoridated, also shows benefits from water fluoridation.⁹² Over the four age groups assessed, 5, 8, 12 and 15 year olds, the average difference in decay rates between fluoridated communities and non-fluoridated communities was 30%. Figure 4 on page 36 below shows statistics for each individual age group for the total results from the three areas, Clare, Limerick and Tipperary, showing overall differences in DMFT between fluoridated and non-fluoridated areas.

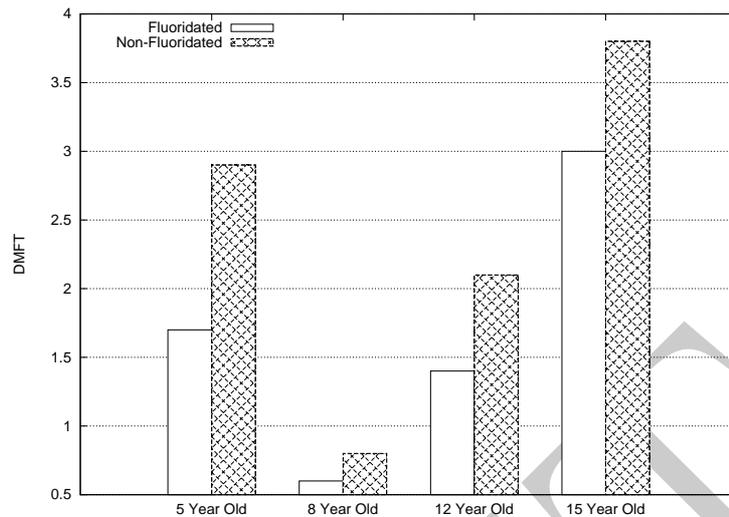


Figure 4: Mean DMFT for 5, 8, 12 & 15 year olds in MWHB, 1987

However, it needs to be pointed out that when the results from the three regions are assessed individually, an alternative perspective on the benefit of water fluoridation can be ascertained. Assessing the three areas separately, it can be seen that the most significant statistical differences in fluoridated and non-fluoridated areas can be seen in one of the three areas, Limerick, (see figure 5 on page 37).

Of significance are the results from Clare, where according to the study “the levels of tooth decay are similar in both fluoridated and non-fluoridated areas”. As mentioned in the report, figure 6 on page 38 highlights that there is little or no difference in tooth decay levels in Clare in fluoridated (F) versus non-fluoridated (NF) areas. (Of the three areas in the study, Clare was the most heavily fluoridated, 73% of the population, compared to Limerick (67%), and North Tipperary (49%))

In relation to Tipperary, although there are differences in ages 5, 8, and 12, the difference in DMFT for 15 year olds differs very little in fluoridated versus non-fluoridated areas (about a 7% difference), as can be seen in figure 7 on page 38.

The report notes that a fluoride mouth-rinse programme was undertaken extensively in some of the non-fluoridated areas of Clare and North Tipperary, and therefore this may explain, for example, the little or no difference in F versus NF areas in Clare, and smaller differences in North Tipperary. However the report also mentions that the mouth rinse was not offered to 5 year olds.⁹³ Considering that there is very little difference in DMFT for 5 year olds in F Versus NF in Clare (a trend which as mentioned also characterises 8, 12 and 15 in Clare), and there is a statistically significant difference in 5 year old DMFT in Limerick and Tipperary, the fluoride mouth-rinse programme does not seem to offer a convincing explanation for the general trend in Clare of no difference in F vs NF, which can be seen clearly from age 5, where no mouth-rinse benefits had taken place.

The *Mid-Western Health Board study of 1997* concludes that:

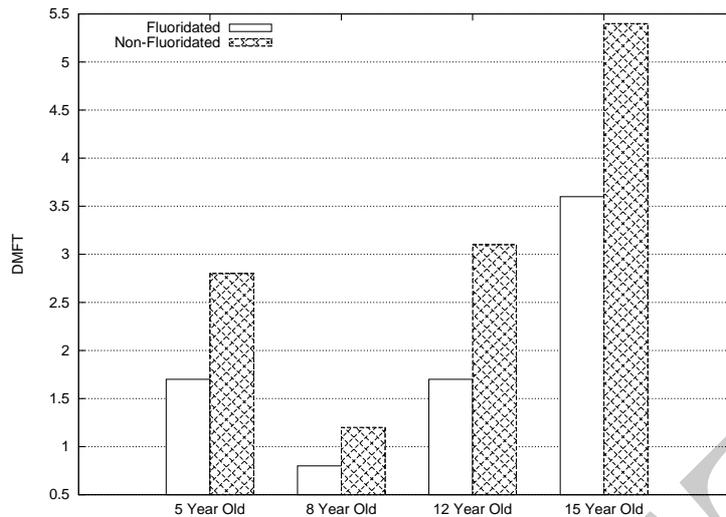


Figure 5: Mean DMFT for 5, 8, 12 & 15 year olds in Limerick, 1997

“An even greater improvement in oral health could be achieved across the Mid-Western Board region by improving the effectiveness of existing water fluoridation schemes, as well as ensuring that, where feasible, other schemes are fluoridate.”⁹⁴

The North Eastern Health Board Oral Health of Children and Adolescents 1995 study, directed by the Oral Health Service Research Centre, University College Cork, also highlighted dramatic improvements in decay reduction, “due to the introduction of water fluoridation following the Health (Fluoridation of Water Supplies) Act 1960”.⁹⁵ Combined results for the three areas, Cavan & Monaghan, Louth, and Meath, highlight differences between the F versus NF areas, across all four age groups (5, 8, 12, 15 year olds) of, on average 19%, as can be seen below in figure 8 on page 39.

However these DMFT differences are not distributed evenly across the four age groups. The percentage differences for the four age differences between F versus NF as per chart 7, are as follows; 5 year olds (33% difference), 8 year olds (No difference), 12 year olds (25% difference) and 15 year olds (18% difference).

And again, as per the Mid-Western Health Board study, the DMFT differences between F and NF areas are not distributed evenly across the 3 areas studied. Just as in the case of the County Clare anomaly in the Mid-Western study, the North Eastern study throws up significant anomalies that are not obvious when only the aggregated results are assessed. Of the three areas researched (Cavan/Monaghan, Louth and Meath), the difference in DMFT between F and NF is most pronounced in the Louth area, as can be see in figure 9 on page 39.

Smaller advantages between the F and NF areas are exhibited in the County Meath area, as per figure 10 on page 40, where the differences between the four age groups are as follows; 5 year olds (29%), 8 year olds (no difference), 12 year olds (12%), and 15 year

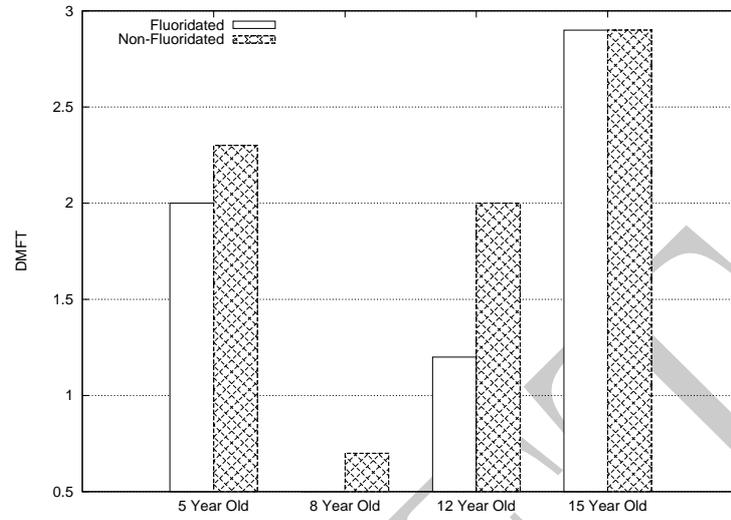


Figure 6: Mean DMFT for 5, 8, 12 & 15 year olds in Clare, 1997

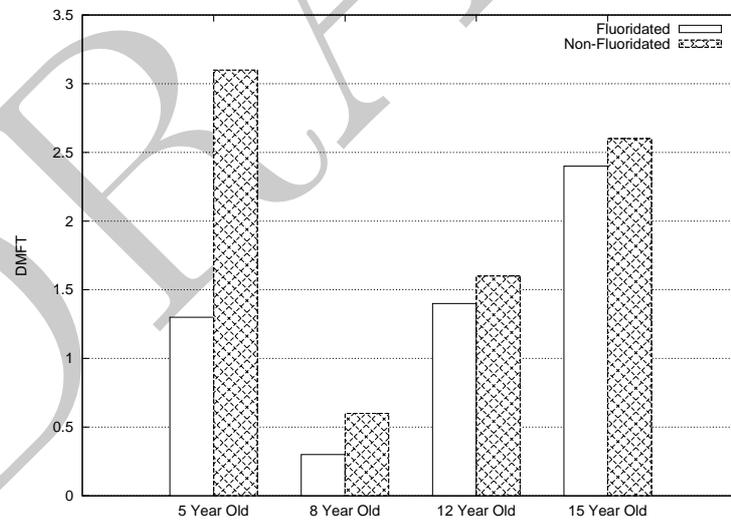


Figure 7: Mean DMFT for 5, 8, 12 & 15 year olds in Tipperary, 1997

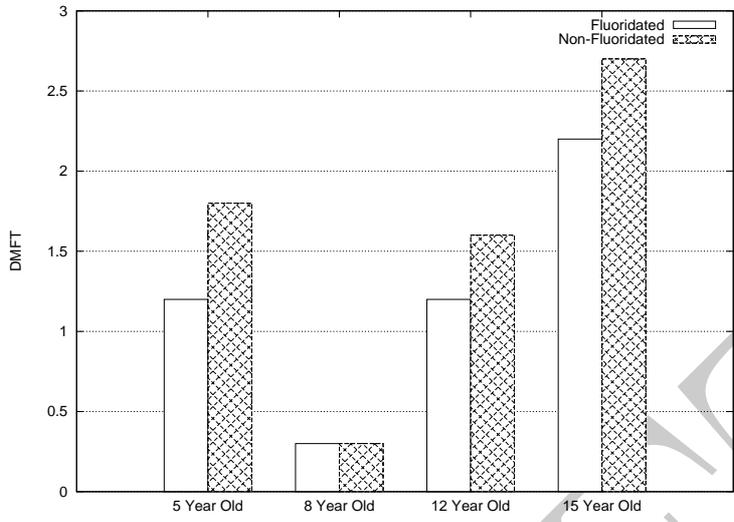


Figure 8: Mean DMFT for 5, 8, 12 & 15 year olds in the NEHB, 1995

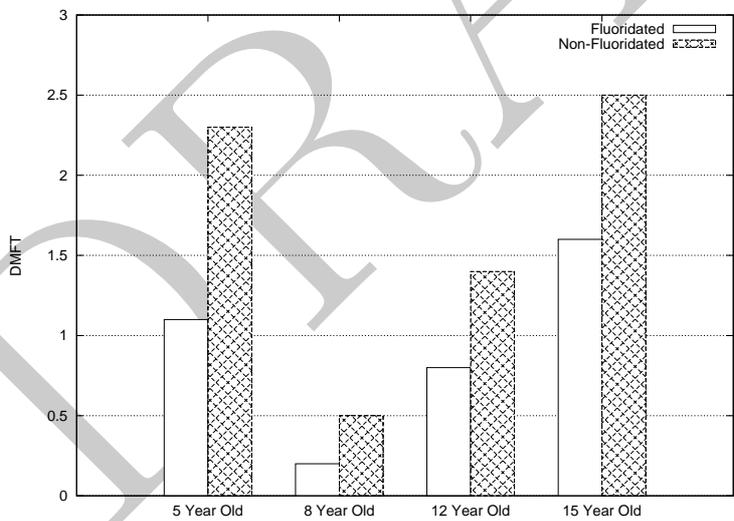


Figure 9: Mean DMFT for 5, 8, 12 & 15 year olds in Louth, 1995

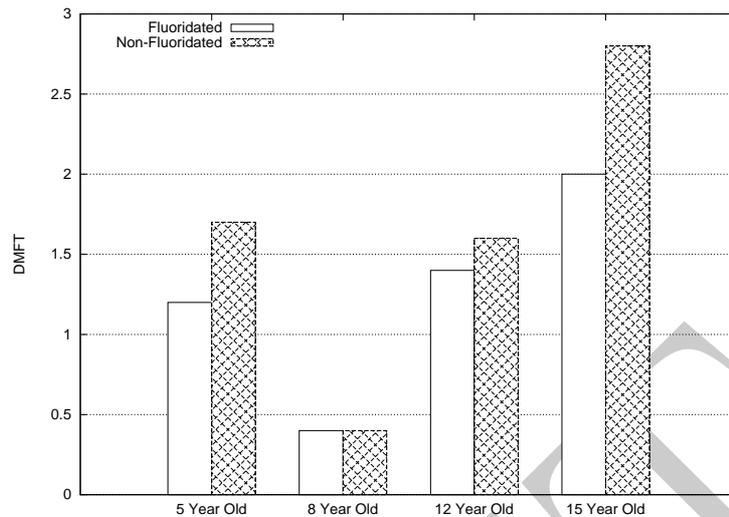


Figure 10: Tooth Decay in 5, 8, 12 & 15 year olds in fluoridated and non-fluoridated areas in Co. Meath

olds (28%).

However, in the Cavan & Monaghan statistics, it can be seen that there is no significant difference in the DMFT in F versus the NF areas, and in fact, the DMFT is LOWER in the non-fluoridated area for 15 year olds. (see figure 11 on page 41)

Surprisingly, the report fails to acknowledge this conflicting DMFT evidence, or address the reasons why these results may have been achieved. In addition to not acknowledging the results, the report actually states that “in all areas of the North Eastern Health Board tooth decay levels are lower in children with fluoridated domestic water supplies,”⁹⁶ which considering the results above for Cavan/Monaghan, is not a wholly accurate summation of the results, and without detailed knowledge of the individual area results, could be considered misleading.

The *North Eastern Health Board report of 1995* concludes that:

“An even greater improvement in oral health could be achieved across the whole region by improving the effectiveness of existing water fluoridation schemes, as well as ensuring that where feasible, other schemes are fluoridated”.⁹⁷

Differences in DMFT scores were also found in The Southern Health Board (SHB) Oral Health of Children and Adolescents 1995, directed by the Oral Health Service Research Centre, University College Cork.⁹⁸

The results from the SHB study, as displayed in figure 12 on page 42, show differences between F versus NF areas of 52% for 5 year olds, 40% for 8 year olds, 27% for 21 year olds and 34% for 15 year olds. The report concludes that:

“An even greater improvement in oral health could be achieved across the Southern Health Board region by improving the effectiveness of existing water

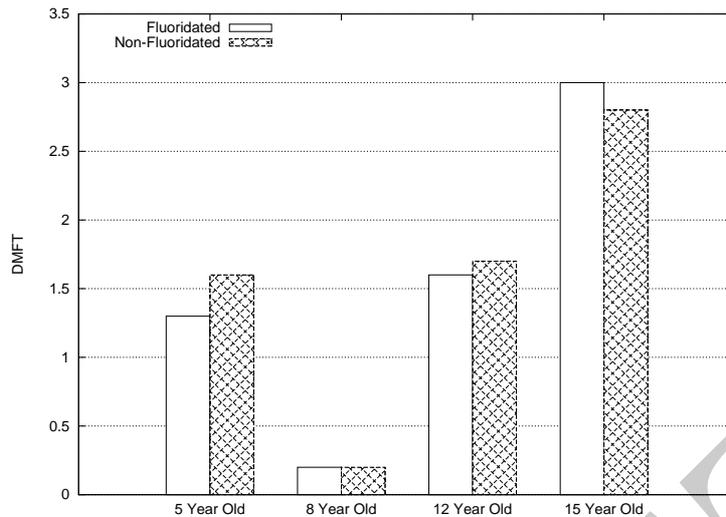


Figure 11: Tooth Decay in 5, 8, 12 & 15 year olds in fluoridated and non-fluoridated areas in counties Cavan and Monaghan

fluoridation schemes, as well as ensuring that where feasible, other schemes are fluoridated”.⁹⁹

In his presentation to the committee Dr. Gerard Gavin stated that there is a need to assess “are there valid comparisons we can make outside Ireland?” In addition to the results of the Dublin-Glasgow study of 1992 (which was analysed in a previous section), according to Dr.Gavin “one of the most telling studies of all... was that carried out between the North Western Health Board and the Health Board of Northern Ireland in 1998-9”¹⁰⁰

“What we find is that tooth-decay levels in 15 year olds in fluoridated area of Donegal was 2.2 and for 14 year olds in the Western Health Board in Northern Ireland (which is not fluoridated) was 4.52. These two were almost exactly adjacent to each other. That is a 51% difference in the decay levels between both areas.”

Given the difficulties already outlined with the Dublin-Glasgow 1992 study, and bearing in mind the variability of the results presented in comparing fluoridated and non-fluoridated areas in this section, we ought to be careful in using the above sample statistics as conclusive evidence of water fluoridation’s effectiveness. Also, a caveat entered by Dr. Whelton and Professor O’Mullane’s report on ‘The Effectiveness of Water Fluoridation in Ireland’,¹⁰¹ may indeed justify categorising these results as merely ‘tentative’, where the report claims that:

“The comparisons with Northern Ireland should be interpreted with caution as the examiners are trained and calibrated in a slightly different way to those in the Republic of Ireland”

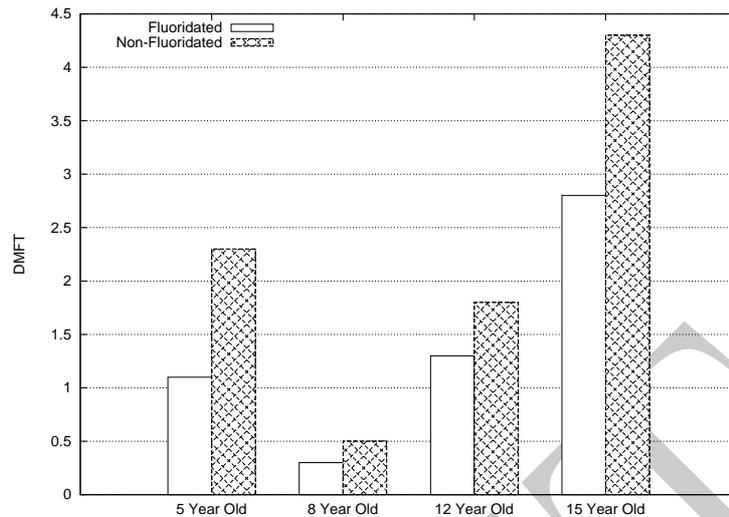


Figure 12: Tooth Decay in 5, 8, 12 & 15 year olds in fluoridated and non-fluoridated areas in the SHB 1995

Overall, the evidence presented in this section, based on research conducted by the various health boards in Ireland over the past 40 years, has shown statistical differences in decay in fluoridated areas **versus** non-fluoridated areas. However, there are varying results, with differences not evenly distributed in geographical areas, nor over age groups. In some areas, there is no statistical difference in decay in fluoridated and non-fluoridated areas, and there exist instances where the level of decay is lower in the non-fluoridated areas versus the fluoridated equivalent.

6.8 Decay Free Children in Fluoridated and Non-fluoridated Areas.

One of the statistics that acts as a measure of the differences in oral health in fluoridated versus non-fluoridated areas, and therefore needs a brief mention, is the percentage of the population with ‘no caries’ experience.

Just as in the various health board studies cited above, where there is generally lower levels of dental decay in fluoridated areas versus non-fluoridated areas, it follows that there should also be more people in the fluoridated areas without any traces of dental caries, than in non-fluoridated areas. That is, there should be a higher percentage of the age-group population who are “Decay-Free” in fluoridated areas.

The 1984 Children’s Dental Health in Ireland study compared the percentage of children with no known caries experience (caries free) in each of the four age groups, and found that in fluoridated areas there was a higher percentage of each age group who had “no known caries experience”, thereby indicating a statistical benefit from fluoridation. The results are displayed below in figure 13 on page 44.¹⁰²

Similar differences can be seen in the statistics from recent individual Health Board studies, such as the *Mid-Western Health Board Survey 1997*.¹⁰³ In this study for example,

it can be seen that for 5 year olds, 62% of these children in fluoridated areas have no known dental decay, versus 45% of the 5 year old children living in non-fluoridated areas. The percentage difference in fluoridated areas versus non-fluoridated appears to decrease as the children grow older, with 21% of the 15 year old children in fluoridated areas showing no decay, versus 18% in non-fluoridated areas as in figure 14 on page 44.

However the consistency of these trends in Ireland comes into question when studying in World Health Organisation quoted statistics for Ireland from a study published in 1996.¹⁰⁴

It is clear from this WHO study that in 12 year old children in Ireland, there is a higher percentage of children in 'non'-fluoridated areas who have no known caries, than in the fluoridated area. In the fluoridated areas of the study, 42% of the 12 year old population had 'no decay', compared to 44% of the 12 year old population in the non-fluoridated area (figure 15 on page 45).

This reversed trend in percentage of decay free children in the 1996 study, where there are more children in *Non-fluoridated areas without dental caries, appear to contradict the results of the health board studies.*

6.9 International Studies which have Shown Little Benefit from Water Fluoridation

Although there are many international studies showing the benefits of water fluoridation, it must be acknowledged that research going back as far as the 1950s up to the present day, has presented contrary results, consistently highlighting that there is 'no benefit' to be derived from water fluoridation. In addition, the studies in the US in the 1945s, on which the rationale for water fluoridation was based, have been heavily criticised for containing serious flaws and inconsistencies in well documented monographs by the late Dr. Philip Sutton (1960, 1980, 1996)¹⁰⁵, Dr. Ziegelbecker (1981¹⁰⁶, 2000¹⁰⁷), Professor Paul Connett (2000)¹⁰⁸ and Dr. John Yiamouyiannis (1993).¹⁰⁹ These criticisms have been disputed by proponents of water fluoridation. In his presentation to the committee, Professor O'Mullane referred to the initial trials showing that water fluoridation was effective as "very carefully conducted controlled studies".¹¹⁰

Detailed below is just some of the much published international evidence that has led many to conclude that there is no oral health benefit to be derived from water fluoridation programmes:

In 1953 dentist Donald J. Galagan conducted a study in Arizona. The results as published in the Journal of the American Dental Association found no significant difference in tooth decay rates between high-and low fluoride areas.¹¹¹

In 1955 Dr Eugene Zimmerman from the National Institute of Dental Research in the US reported on a 10-year study of Barlett, Texas (8 parts per million) and Cameron, Texas (0.4 parts per million). The report published in the Journal of the American Dental Association stated that "no significant difference was found between the Barlett and Cameron residents".¹¹²

In 1962, Dr. Edward A. Sweeny and co-workers at the Harvard School of Dental Medicine reported that fluoride had little effect on tooth decay rates on laboratory

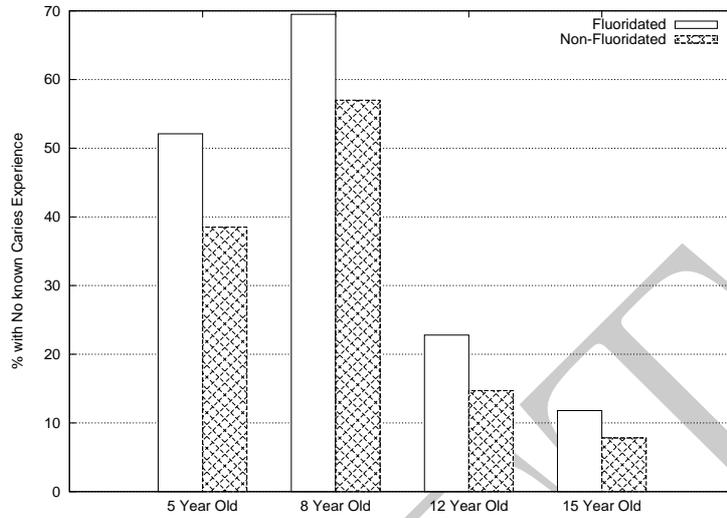


Figure 13: Percentage of Children with no known caries experience, 5, 8, 12, 15 year old - 1984

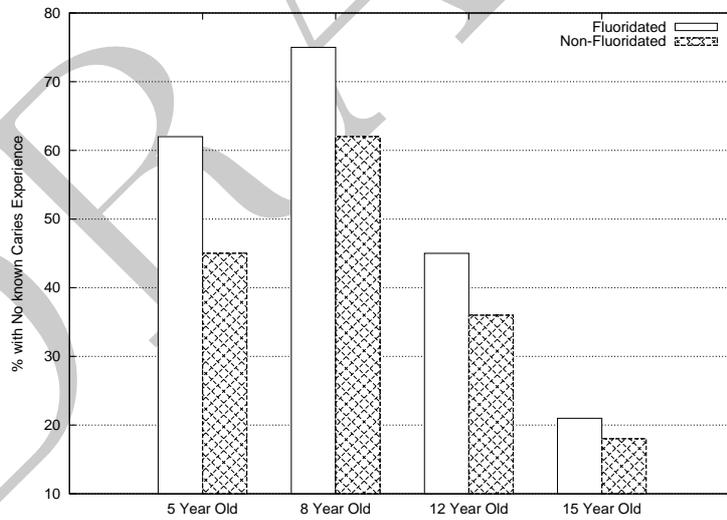


Figure 14: Percentage of Children with No known caries experience, 5, 8, 12, 15 year olds - MWHB 1997

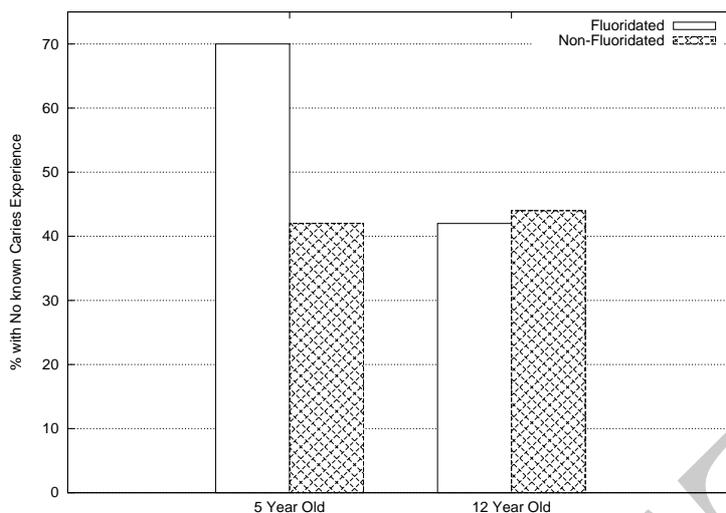


Figure 15: Percentage of Children with No Caries – 5 and 12 year olds – WHO 1996

rats.¹¹³ In 1971 Hardwick and Bunting of the Turner Dental School in Manchester studied the effect of fluoridation on tooth decay in rats. Their findings as published in the Journal of Dental Research said, “Changes in the number of lesions were not significant with 1 or 2 part per million fluoride supplementation”.¹¹⁴

In one of the largest studies investigating the effect of naturally occurring calcium fluoride in reducing tooth decay, in 1972 Dr. Yoshitsugu Imai of the Tokyo Medical and Dental University examined more than 20,000 students. The results of the study found a higher percentage of students with tooth decay in areas of fluoride levels of 0.4 parts per million or more in the drinking water than in areas with 0.2 to 0.39 parts per million in the drinking water.¹¹⁵

Research by Colquhoun (1987)¹¹⁶ in New Zealand concluded that child dental decay differences are not closely related to the presence or absence of water fluoridation. Official census information suggests that dental health differences could be related to *demographic, especially socio-economic factors*. There was no significant difference in tooth decay between fluoridated and non-fluoridated areas, as evidenced in the example below in Table 7 on page 46

In 1987 the Journal of the Canadian Dental Association published an article which suggested that that water fluoridation wasn’t doing the job that dentists had been claiming it could do. It pointed out that “survey results in British Columbia with only 11% of the population using fluoridated water show lower DMFT rates than provinces with 40–70 per cent of the population drinking water” and “school districts recently reporting the highest caries-free rates in the province were totally unfluoridated”.¹¹⁷

In 1989 Hildebolt *et. al* used caries data on 6,584 school children in a study of second and sixth graders drinking optimally and sub-optimally fluoridated water in Missouri. “In the total sample, there was no significant differences between those children drinking optimally fluoridated water and those drinking sub-optimally fluoridated water”.¹¹⁸

Table 7: New Zealand tooth decay in fluoridated and non-fluoridated areas

Area	Fluoridation Status	No. of Students	DMFT
Christchurch	Non-Fluoridated	14,166	3.05
Hamilton	Fluoridated	8,065	3.2 (Higher)
Dunedin	-	3,955	2.9 (Lower)
Palmerstown	Non-Fluoridated	3,771	3.15 (Higher)
Auckland	Fluoridated	39,404	2.95 (Lower)
Wellington	Fluoridated	17,368	2.8 (Lower)

The study by Yiamouyiannis (1990) was based on an analysis of the results of research conducted by the US National Institute of Dental Research (NIDR). This was one of the largest modern surveys of its kind. Data from 39,207 children aged five to seventeen years from 84 areas in the USA showed that the number of decayed, missing and filled teeth in children who had been fluoridated all their lives was no fewer than those who had been brought up in non-fluoridated. Of the 84 areas, 27 had been fluoridated for 17 years or more (F), 30 had never been fluoridated (NF), and 27 had only been partially fluoridated or fluoridated for less than 17 years (PF). The average number of decayed, filled, and missing teeth per child (DMFT) was 1.96 in the F areas, 2.18 in the PF areas, and 1.99 in the NF areas.¹¹⁹

A sub-set of this data was re-examined again by Carlos and Brunelle (1990) using a more sensitive barometer of tooth decay (DMFS, decayed, missing, filled surfaces) and found a 19% difference in the two communities. This is less than half a tooth.¹²⁰ A massive study conducted on 400,000 children in India by Teotia in 1994 was designed to investigate the essentially or otherwise of fluoride and calcium nutrition in the prevention and control of dental caries. The findings of this comprehensive epidemiological study, performed during the period 1963–1993, indicate that dental caries was ‘caused’ by high fluoride and low dietary calcium intakes, separately and through their intersections. Dental caries was most severe and complex in calcium-deficient children exposed to high intakes of endemic fluoride in drinking water. The report concluded that the only practical and effective public health measure for the prevention and control of dental caries is the limitation of the fluoride content of drinking water to <0.5ppm, and adequate calcium nutrition (dietary calcium > 1g/day).¹²¹

Assessing the studies proving the dental benefits of water fluoridation, Dr. John Yiamouyiannis acknowledges that there has never been a ‘double-blind’ study showing that fluoridation works. This type of study refers to research in which neither examiner nor patient know who is in the test group and who is in the control group. According to Dr. Yiamouyiannis “this type of study is necessary to eliminate examiner-patient bias”.¹²²

Echoing Dr. Yiamouyiannis’s claims, the recent York University Review (2000), stated that in their search for high quality studies showing the benefits of water fluoridation: “no randomised controlled trials of the effects of water fluoridation were found”.¹²³

6.10 Dental Decay in Adults and the Theory of ‘Delayed Eruption’

The evidence presented so far has been based on the effects of water fluoridation on children aged from 5 to 15. There has been no analysis of the effects of water fluoridation on adults. One of the reasons why it is necessary to at least acknowledge the decay rates in adults, is because it has been proposed by some researchers that the suggested dental benefits of water fluoridation disappears after the early teen years.¹²⁴ However according to O’Mullane *et. al* (1996):

“Because of the unreliability of assigning a cause for missing teeth among adults, particularly older adults, the DMFT index for caries is not as reliable a measure of dental caries as it is for children, hence, interpretation of DMFT data for adults is difficult”.¹²⁵

Making allowances for this difficulty with interpreting the DMFT results of older people, statistics quoted by the World Health Organisation in 1995 for 35–44 year old adults in Ireland show DMFT levels with no statistical difference for fluoridated versus non-fluoridated areas. Those 35–44 year olds living in fluoridated areas had a DMFT of 18.9, whilst those in the non-fluoridated area had a DMFT of 19.0, which is virtually identical.¹²⁶

In his presentation to the committee Dr. Limeback introduced the theory of “*delayed eruption*” as a possible reason why we see lower decay rates in children living in fluoridated areas, but these statistical differences dissipate, and even out over time resulting in no difference in F versus NF areas as the individuals moves into adulthood:

“One of the things that fluoridation studies failed to investigate years ago was the effect of fluoride ingestion. Now they have discovered, including work that I have done, that fluoride ingestion delays tooth eruption. It is quite evident that fluoride ingestion has an effect on the development of teeth. When tooth eruption is delayed, that delays decay. That means that about 20 to 30 per cent of the 50 per cent reduction that was claimed back in the 1950s could have been due to a simple delay in tooth eruption”.¹²⁷

A number of international studies have concluded that fluoride ingestion delays tooth eruption and may simply delay tooth decay in fluoridated areas, resulting in ‘temporary’ lower thrift results in these fluoridated areas.^{128 129 130 131}

6.11 What would happen if we stopped water fluoridation in Ireland?

In defining Ireland’s future policy in relation to water fluoridation, one of the most important variables that should be considered when shaping that policy, is an awareness of the possible oral health effects of stopping the fluoridation of the water supplies (i.e. a definite decrease in dental fluorosis versus a possible increase in dental caries). Although the consequences of discontinuation of water fluoridation was not addressed at the committee presentations by Dr. Gavin, or Professor O’Mullane, the American Dental Association has asserted that:

“Dental decay can be expected to increase if water fluoridation in a community is discontinued for one year or more, even if topical products such as fluoride toothpaste and fluoride rinses are widely used”.¹³²

Offering an opposing viewpoint however, in his presentation to the committee Dr. Limeback asserted that:

“Overall, world-wide, the numbers are so minor in comparison that stopping water fluoridation would make little difference. It has been done four or five times over the world. What is noticed is the decrease in dental fluorosis, but an increase in dental decay is not seen”.¹³³

The York report looked at the evidence in relation to the effect of discontinuing water fluoridation, with the evidence presented as follows:

“Of 22 analyses of stopping water fluoridation, 14 found the direction of association to be negative (that stopping water fluoridation led to an increase in caries in the previously fluoridated area compared to the never-fluoridated area). However only eight of these studies provided a measure of the significance of this association. Four of these analyses found that stopping water fluoridation had a statistically significant effect at the 5% level, while the other four did not. Eight analysis found the direction of association to be positive (that stopping had not led to increases in caries in the previously fluoridated areas)”.¹³⁴

Dr. Limeback suggested that if Ireland did stop fluoridating the water and there happened to be an increase in dental caries, it would not be measurable or statistically significant:

“In Ireland decay rates are very low, even in non-fluoridated areas. If the fluoridation equipment was shut down tomorrow in Ireland, at ‘most’ one would see one extra filling for every fourth person.”

“Turning off the fluoride taps’ would not cause massive decay. Even if it did increase decay rates, they could not be measured. The number of fillings that would result would be so minor that it could not be measured statistically.”

Dr. Limeback suggests that even if decay rates did increase, at most, it would result in a 0.25 increase in DMFT scores (one filling for every fourth person). As the possible health effects of discontinuing water fluoridation in Ireland is such an important issue, it is necessary to detail some of the research that has looked into this area, focusing on the results of studies in Finland, the Former East Germany, Cuba and Canada.

6.11.1 Former East Germany

In contrast to the anticipated increase in dental caries following the cessation of water fluoridation in the cities Chemnitz (formerly Karl-Marx-Stadt) and Plauen, a significant fall in caries prevalence was observed. This trend corresponded to the national caries decline.¹³⁵

6.11.2 Finland

Water fluoridation in Kuopio, Finland, was stopped in 1992. In one previous study, no increase in caries was found in Kuopio 3 years after the discontinuation of water fluoridation.¹³⁶ In 1992, 1995 and 1998 independent random samples of all children aged 3, 6, 9, 12 and 15 years were drawn in Kuopio and Jyvaskyla. Again in the study published in November 2000 no increase in caries was found, with the conclusion being that “the fact that no increase in caries was found in Kuopio despite discontinuation of water fluoridation and decrease in preventive procedures suggest that not all of these measures were necessary for each child”.¹³⁷

6.11.3 Canada

A study shows that caries rates did not increase when communities stopped fluoridating water in British Columbia, Canada, following a baseline survey after a period of three years. The prevalence of caries (assessed in 5,297 children, grades 2, 3, 8, 9) decreased over time in the fluoridation-ended community while remaining unchanged in the fluoridated community.¹³⁸

6.11.4 Michigan US

Those advocating water fluoridation have claimed that even a break of a year in water fluoridation will affect dental caries. However, a study from February 2000 suggests a contrary viewpoint. Durham, NC, fluoridated since 1962, had an 11 month cessation of fluoridation between September 1990 and August, 1991. It was concluded that there was no effect on caries (whilst concluding that dental fluorosis is sensitive to even small changes in fluoride exposure from drinking water).¹³⁹

6.11.5 Cuba

This study aimed to analyse the effect of cessation of water fluoridation in La Salud (Province of Hababa) in 1990. In contrast to an expected rise in caries prevalence, DMFT and DMFS values remained at a low level for the 6 to 9 year olds and appeared to decrease for the 10/11 year olds. In the 12/13 year olds there was a significant decrease, while the percentage of caries-free children of this age group had increased.¹⁴⁰

Although not specifically addressing the issue of what might happen to caries levels if the water fluoridation programme was halted, The Royal College of Physicians report on “Water Fluoridation and Public Health” suggests that when caries levels are already low, an intervention programme such as water fluoridation may be susceptible to decreasing marginal returns:

“The general decline in prevalence of dental caries in the past 20 years among children from all areas of Ireland could be a contributing factor to the apparent reduced effectiveness of water fluoridation when expressed in percentage terms.

Any preventive measure agent will be apparently less effective when the condition becomes less prevalent”.¹⁴¹

The final section will address some of the possible alternatives to water fluoridation in the fight against caries, as well as establishing who benefits from water fluoridation.

6.12 Who Benefits Most from Water Fluoridation, and what possible alternatives are there for oral health care?

When water fluoridation was introduced in the 1960s it offered a substantial increase in daily consumption of fluoride, where daily ingestion levels had previously been relatively low. However, total fluoride exposure has increased over recent years, particularly in industrialised nations.¹⁴² When water fluoridation was introduced in the 1960s, in addition to the low standards in general and oral health that existed at the time, there were no fluoridated toothpastes on the market (fluoridated toothpaste was only introduced to Ireland in the early 1970’s).

Today 95% of all toothpastes contain fluoride, and have been credited with reducing dental decay in non-fluoridated regions and countries.¹⁴³ In judging the effectiveness and efficiency of using the public piped water supplies to distribute fluoride to the entire population, we need to ask whether the whole population actually needs this additional fluoride source, above that derived from fluoridated toothpaste? Also, does the entire population actually derive a benefit from water fluoridation?

Recent comments from the Department of Health suggests that this additional source of fluoride, above that received in fluoridated toothpaste, is ‘not’ needed by a large part of the population. Dr Gerard Gavin recently commented on this issue:

“We would not deny that people in more affluent areas do not need to receive fluoride in their water because of the low levels of disease. But dental decay, like many illnesses, affects socially excluded people predominantly”.¹⁴⁴

Dr. Gavin has inferred that water fluoridation should be maintained to help the oral health of those in the lower socio-economic classes and socially-excluded classes, as these segments of the population do not participate in the oral health services, and use little toothpaste, if any at all:

Dr. Gavin: “The issue in relation to oral health for people who are socially excluded is that they do not participate. Whether one employs legions of dentists or not is immaterial as these people do not participate in health services.”

Chairman: “Or buy toothpaste?”

Dr. Gavin: “Or buy toothpaste, or at least practice low utilisation. This is why fluoridation is still very important for Ireland. We know from the Combat Poverty Agency that we still have quite a substantial number of our population, particularly of our children, living in poverty, despite the so-called ‘Celtic Tiger’. That is something worthy of significant reflection”.¹⁴⁵

It has not been ascertained whether there is unequivocal evidence that the lower socio-economic classes and socially excluded, do not use toothpaste. Also, regarding 'low utilisation', again it is not clear if this refers to the amount of toothpaste used, which should only be a pea-sized amount.

Speaking in response to the question by reporter Robert Jordan on TV3's 20/20, on "whether people who used toothpaste twice a day, and use an adequate amount of toothpaste, do they need water fluoridation?" Dr. Gavin also commented;

"Well that is the question right, but our evidence is that in this country/ that our tooth-brushing habits are way behind European norms, European standards, and you've also got the issue of compliance".¹⁴⁶

Therefore, the logic being extended by the Department of Health infers that anyone who brushes their teeth with fluoridated toothpaste twice a day does not need fluoridated water. However, due to low standards in oral care practices by some pockets of the Irish population, we should continue to fluoridate the water for the benefit of this population segment. Minister for Health Micheal Martin has pointed out that "surveys show for example that 50% of all adolescent boys in this country at this very point in time don't brush their teeth more than once a day, and in some cases not at all".¹⁴⁷

However, in their various oral health surveys, the health boards have investigated the brushing habits of children, with consistent results. For example The Mid-Western Health Board Survey of 1997 stated; "most 8 and 15 year olds brush their teeth at least twice a day".¹⁴⁸ Similar results were found in the North Eastern Health Board Survey 1995¹⁴⁹ where 70% of the 8 and 15 year olds brushed their teeth twice a day. Only 3% of 8 year olds, and 4% of 15 year olds brushed their teeth "less than once a day".

Dr. Limeback has acknowledged that dental decay afflicted the lower socio-economic classes to a greater extent, but suggested a simple solution to eradicating these low standards in oral care in pockets of the population:

"Obviously the money would be much better spent targeting the poor and the underprivileged who carry the burden of most dental decay".¹⁵⁰

Reports in Ireland have highlighted that the waiting lists for dental care via the public health service are excessively long. Many children have an average wait of five and a quarter years for an appointment for an orthodontist. Figures for other health board regions include a wait of between four and five years in the Midlands, Mid-Western and Southern Health Boards. According to the media report, "the waiting times relate to the time it takes for children whose parents' cannot afford treatment for their children's teeth".¹⁵¹ Therefore, waiting times such as these will obviously contribute significantly to the lack of 'participation' in the health services by the lower socio-economic classes/socially excluded mentioned above.

This issue of spending the resources currently being used to fluoridate, to target those who need it most by educational programmes has been addressed by Professor O'Mullane:

“The suggestion is, as I understand it, that if we manage to give good dental health education, advise our children to stop eating sweets and get them to brush their teeth more thoroughly twice a day, we would succeed. I have been involved in health promotion for 30 years. Unfortunately, the evidence is that it is singularly unsuccessful. The data now suggests that despite our efforts over many years with regard to diet and dental health education, we are not succeeding. *The sugar usage patterns in this country are now more carcinogenic [sic] than they were in the past.*”¹⁵² (*I think this should read ‘cariogenic’¹*)

The reasons why these oral health education programmes have not been successful in improving the oral health practices in their targeted audiences consistently over a 30 year period, or suggestions on how these educational programmes could be improved to achieve their goals in the future, were not discussed at the committee presentations.

However, it should be pointed out that the above reference to ‘sugar usage patterns’ now being more cariogenic than they were in the past, conflicts with the evidence from O’Mullane *et. al* 1996, and discussed in the previous section, where it was outlined that sugar consumption per capita has been decreasing in Ireland. Also, to re-iterate a point discussed in a previous section, comparative to our European neighbours, *Ireland’s per capita sugar consumption appear to be relatively low.*

Dr. Gavin mentioned to the committee that instead of water fluoridation, some European countries sell salt that has fluoride levels present, thereby inferring that this ‘systemic’ consumption of fluoridated salt acts as an alternative to the ‘systemic’ consumption of fluoride in Irish water. The Department of Health has added that “in Europe, the most common method for the distribution of fluoride to the population is through fluoridated salt”.¹⁵³

However, considering that 95% of toothpastes in Ireland are fluoridated, and we still appear to have problems of ‘compliance’ amongst certain pockets of the population in brushing their teeth, which is a standard common-place oral care procedure, it has not been made clear how fluoridated salt mimics water fluoridation (i.e. it was not made clear ‘if’ or ‘how’ ‘compliance’ is achieved in relation to consumption of fluoridated salt in these other countries). Therefore it must be presumed that compliance in the purchase or consumption of fluoridated salt is not mandated by the governments in these countries (France, Switzerland, Belgium and some parts of Germany), and fluoridated salt is merely an ‘extra option’, no different than the fluoridated mouthwashes readily available in the Irish market, available for anyone who wishes to purchase them.

Further to the above issues, there is a need to address some more fundamental aspects of the monitoring of this intervention programme from a dental caries perspective, with a need for an outline of what measures should be adopted in making a decision to continue, or not, the water fluoridation programme in Ireland.

One of the main questions that needs to be asked is: will Ireland always need water fluoridation? Also, if a decision to “terminate is based on oral health benchmarks, rather than general health grounds”, what should these oral health benchmarks be?

¹causing tooth decay

Dr. Maire O'Connor, co-author of the Royal College of Physicians report on "Water Fluoridation and Public Health" recently addressed the issue of when Ireland could stop fluoridating:

"I would hope in the future as I've said before, that we won't need such a programme because we won't have dental caries".¹⁵⁴

However no country has a situation of 'no caries'. Although Ireland does not rank top of the oral health charts in Europe, statistically there is little difference between the top countries (who don't fluoridate the water) and Ireland, with Ireland's dental caries levels already low.

As mentioned in a previous section, the Royal College of Physicians report claims that when caries levels are already low, as they are in Ireland, "any preventive measure agent will be apparently less effective when the condition becomes less prevalent".¹⁵⁵ This would suggest that having an objective of "no dental caries" as the main benchmark for deciding to cease the water fluoridation programme in Ireland is, quite simply, statistically unattainable, and will never be achieved.

Also speaking about Ireland's future need for water fluoridation, Dr. Gavin has stated that:

"Our evidence is that in this country that our tooth-brushing habits are way behind European norms, European standards, and you've also got the issue of compliance. As I was saying, at some time in the future if we can change both our eating habits and also our prevention habits in terms of how we look after our teeth, then we may not need water fluoridation in the future".

As we have seen in the above chapter, Ireland's diet *is* improving, and our sugar consumption patterns *are one of the lowest in Europe*. Considering the issue of improved brushing habits and "compliance", for example, the above chapter has also explored that the issue of 'compliance' for tooth brushing in Ireland is a statistically insignificant issue that could be addressed in a more targeted approach, considering that only a statistically small percentage of the population fall into this category.

What needs further clarification and exploration is whether 'significant' oral care improvements actually are still achievable in Ireland in the future. This has not been demonstrated unequivocally. Based on this knowledge, if there actually still is room for improvement, what is needed is a full understanding of whether water fluoridation can in any way aid this process. In addition, there needs to be a clear understanding of who should set, and what 'realistic' benchmarks should be adopted in this process.

6.13 Summary and Conclusions

Dental decay has been decreasing in both the fluoridated and non-fluoridated areas in Ireland, at similar rates to the general decrease in dental caries that can be seen in most industrialised countries around the world (both fluoridated and non-fluoridated countries). Many international studies and experts attest that this general world-wide

decrease in decay is due to the improvement in diet (such as reduction in sugar consumption as evidenced in Ireland), use of antibiotics, fluoridated toothpaste, improved awareness of oral health, etc.

The Royal College of Physicians of Ireland has also concurred that “the general decline in the prevalence of dental caries in both fluoridated and non-fluoridated areas may reflect the widespread use of fluoride supplementation, especially fluoride tooth-pastes together with factors such as the changing patterns of sugar consumption, changes in oral hygiene practices, dental screening and increasing awareness of the importance of oral health”.

As Ireland has also benefited from the same variables that non-fluoridated countries attribute to the success of their dental decay improvement, and Ireland’s rate of decay decrease has mirrored what has happened in other non-fluoridated countries, this makes quantifying the contribution made solely by water fluoridation in Ireland a very difficult task.

During the period of water fluoridation, Ireland’s consumption per capita of sugar has decreased by 20%. With sugar being the main cause of dental decay, this 20% decrease in sugar consumption must account for about 20% of the 70% reduction in dental decay seen since the reduction in dental decay.

Ireland ranks 8th in a table of highest consumption of sugar per capita from a sample of 14 European countries. Considering that we are the only country fluoridating the water supplies, and we do not have a high consumption of sugar per capita when compared to the rest of Europe, we rank 6th in tooth decay statistics in Europe.

The decrease in dental caries in Ireland can thus be attributed to many factors other than water fluoridation. Therefore water fluoridation *cannot* be credited as the ‘*sole*’ or ‘*main*’ factor in the improvement in oral health in Ireland.

The York review of the literature on dental benefits claims that the research proving the benefits of water fluoridation is not of high quality and limited quantity, and that the benefits have been overstated. It claims a 14.6% improvement in decay reduction from water fluoridation.

Many international peer reviewed studies have proven that there is no benefit to be derived from water fluoridation, with decay rates being similar in both fluoridated and non-fluoridated communities.

However, numerous studies conducted by the various health boards in Ireland on the age groups 5 year old, 8 year old, 12 year old, and 15 year old, show a difference in rates of decay in fluoridated communities versus non-fluoridated communities. However some of these results show no difference in decay between fluoridated and non-fluoridated areas, and some areas have lower decay in non-fluoridated areas.

The Department of Health have confirmed that most of the population of Ireland do not actually need water fluoridation (ie. anyone who brushes their teeth twice a day with fluoridated toothpaste does not need water fluoridation). However due to the fact that studies show that some children do not brush their teeth regularly, it has been proposed that we should continue to fluoridate the water for this niche audience.

Educational programmes in Ireland have been unsuccessful in helping this target audience improve their oral care habits (i.e. successive educational programmes have failed to succeed in getting a minority of children to brush their teeth twice a day). It has

been suggested that if the oral care habits of this target audience could somehow be improved there *would be no need to continue with the fluoridation of the public piped water supplies in Ireland.*

There is evidence that the difference in tooth decay in fluoridated and non-fluoridated areas may be due to the fact that fluoride has been shown to cause “delayed eruption” in teeth. Therefore it is possible that teeth in fluoridated areas in a certain age group may not have been exposed to sugar for the same duration as those of a similar age in non-fluoridated areas. This would naturally result in a lower DMFT result in the fluoridated area than the non-fluoridated area.

Studies show no difference in the decay rates in adults (35–44 year olds) in Ireland when comparing those living in fluoridated areas versus non-fluoridated areas.

The evidence suggests that there would be no significant increase in dental caries if the practice of water fluoridation ceased. Numerous international studies have shown that there is

- An increase in dental caries,
- A decrease in caries
- No change—no increase in dental caries.

In comparison to countries with a similar diet to Ireland, such as Scotland, where there is no water fluoridation, there is little evidence to conclude that there would be an increase in the dental decay rates in Ireland if water fluoridation was to be stopped in Ireland.

7 Health Effects

7.1 The Legitimate Scientific Controversy

Fluoridation became mandatory in Ireland in the early 1960s and an investigation then by the Fluorine Consultative Council declared that fluoride was safe and had no adverse health effects. However, nearly forty years on, the scientific climate has changed considerably. Since then, there have been innumerable studies, investigations and developments in artificial water fluoridation. The conclusions in many cases are contradictory but it is important to consider all aspects of these developments, both pro and anti-fluoridation. A most comprehensive assessment of the health effects of water fluoridation is contained in the York Review.

7.2 The York Review

The York Review¹⁵⁶, commissioned by the National Health Service in the United Kingdom (U.K.), published its conclusions in September 2000. This review claimed to be a full assessment of worldwide scientific literature into the effects of water fluoridation. Soon after publication in the British Medical Journal, Professor Trevor A. Sheldon,

Chairman of the York Review's Advisory Group, stated "the review was exceptional in this field in that it was conducted by an independent group to the highest international scientific standards and a summary has been published in the *British Medical Journal*".¹⁵⁷ However, the conclusions drawn from this review are as controversial as the whole issue of water fluoridation.

Professor Sheldon continued by expressing his growing concerns that pro-fluoridation groups had spun the conclusions of this independent report. They were now misleading the public. "It is particularly worrying then that statements which mislead the public about the review's findings have been made in press releases and briefings by the British Dental Association, the British Medical Association, the National Alliance for Equity in Dental Health and the British Fluoridation Society".¹⁵⁸ Professor Sheldon ended his letter to the press by concluding, "the review team was surprised that in spite of the large number of studies carried out over several decades there is a dearth of reliable evidence with which to inform policy. Until high quality studies are undertaken providing more definite evidence, there will continue to be legitimate scientific controversy over the likely effects and costs of water fluoridation".¹⁵⁹

In Ireland, despite this "dearth of reliable evidence", fluoridation continues. There are growing public concerns of the health effects of artificial water fluoridation. Therefore, it is important to consider all aspects, both pro- and anti-fluoridation, of this "legitimate scientific controversy".

7.3 The "Legitimate Scientific Controversy"

The Department of Health offers reassurance that, "major reviews of the evidence by leading medical scientists have shown time and time again that the use of fluoride in drinking water at one part per million is safe to human health".¹⁶⁰ Dr. Gerard Gavin (former Chief Dental Officer, Department of Health) lists, "...organisations that support water fluoridation, such as the World Health Organisation, the Centres for Disease Control and Prevention in Atlanta... and the Royal College of Physicians in Ireland, through their faculty of public health".¹⁶¹ The World Health Organisation (hereafter W.H.O.) regularly cited as endorsing water fluoridation declares that, "fluorine is probably an essential element for animals and humans. For humans, however, the essentiality has not been demonstrated unequivocally, and no data indicating minimum nutritional requirements are available".¹⁶² The York Review also confirmed a similar lack of conclusive efficacy; "no randomised controlled trials to the effects of water fluoridation were found".¹⁶³

In Ireland, as regards the general health of fluoridated communities, a clause in the Health (Fluoridation of Water Supplies) Act requires that the Minister of Health carry out health surveys.¹⁶⁴ Despite this legislation, the Department of Health and successive health ministers have never carried out a health study into the possible health effects of water fluoridation. Dr. Gavin, on behalf of the Department of Health, confirmed this fact to the Dáil Committee on Health and Children.¹⁶⁵ Though not an independent review of fluoridation in Ireland, the Royal College of Physicians, Faculty of Public Health, published a report ("Water Fluoridation and Public Health") in 1999. This

faculty report reaffirmed the status quo; "... the data available to date strongly support the continuation of the current water fluoridation policies".¹⁶⁶ They expressed concern about dental fluorosis, "... a defect of enamel caused by excess fluoride disrupting the developing enamel prior to tooth eruption".¹⁶⁷ Dr. Gavin agrees that, "dental fluorosis is a side effect of ingesting more than the ideal amount of fluoride"¹⁶⁸ and Professor Denis O'Mullane, University College Cork, stipulates that, "we find that approximately 50% of the population who reside in fluoridated communities have this very mild, very questionable change in the appearance of the enamel".¹⁶⁹ In conclusion, a significant percentage of the Irish population, who have dental fluorosis, are getting "more than the ideal amount of fluoride".¹⁷⁰ This level of fluoride overexposure gives rise for concern.

7.4 Dental Fluorosis

Both proponents and opponents agree on the fact that fluoride overdosing causes dental fluorosis. However, the nature, the prevalence of this condition and the implications for dental fluorosis sufferers are very much in dispute. There is also disagreement in the definition of this fluoride disorder. According to the Faculty of Public Health, Royal College of Physicians of Ireland, "... dental fluorosis is permanent hypo-mineralisation of enamel resulting from excess fluoride reaching the developing tooth during developmental stages".¹⁷¹ Dr. Geoffrey Smith, Dental Surgeon, argues, "dental fluorosis, no matter how slight is an irreversible pathological condition recognised by authorities around the world as the first readily detectable clinical symptom of previous chronic fluoride poisoning. To suggest we should ignore such a sign is as irrational as saying that the blue-black line which appears on the gums due to chronic lead poisoning is of no significance because it doesn't cause any pain or discomfort".¹⁷² On the other hand, proponents say that dental fluorosis is "... a cosmetic issue, not a health problem"¹⁷³ and the Department of Health classifies this condition under "Aesthetic Effects".¹⁷⁴ Meanwhile, opponents of fluoridation claim that dental fluorosis is classified as a cosmetic issue in an attempt to lessen its significance.¹⁷⁵ However, there is evidence that this condition is not merely cosmetic but, in fact, structural damage: that dental fluorosis results in a variety of pathological changes in the structure of teeth.^{176,177} Proponents of fluoride do admit that even teeth with very mild fluorosis are more porous.¹⁷⁸ In 1999, Dr. Susheela, et al., performed a study examining fluorosed teeth under a scanning electron microscope. They found, "the scanning electron micrographs of the enamel surface of fluorosed human teeth show pitted, uneven and rough surfaces. Cracks and fissures were also observed on the enamel surface of fluorosed teeth".¹⁷⁹ After 50 years of fluoridation, the exact mechanism for this fluoride tooth damage is still largely unknown.

7.5 Signs of Dental Fluorosis

The first signs of dental fluorosis² are seen as fine white lines running across the tooth, the tips of the teeth may appear opaque white. This known as the "snow cap phenomenon".¹⁸⁰

²See <http://www.fluoridealert.org/dental-fluorosis.htm>

In more affected teeth the white lines thicken and are more evident. As the severity increases most of the tooth has cloudy white areas with some slight brown discolouration. Next, there is some loss of enamel surface with pitting. This pitting can result in chipping off enamel. Eventually in the more severe cases, there is complete loss of enamel and major brown staining. Dr. Gerard Gavin summarises, “one gets white spots on the teeth, surface pitting and in severe cases, there is brown staining on the teeth”.¹⁸¹

7.6 Prevalence

Dental fluorosis was described as early as 1916.¹⁸² The condition was then known as “mottled enamel“. Dentists expressed concern about the condition commonly referred to as “Colorado Brown Stain”. This condition was linked to areas with significant fluoride levels in the water.¹⁸³

There is growing concern about the increasing number of people with this condition in fluoridated areas. “More recently, a prevalence of 80.9% was reported in children 12–14 years old in Augusta, Georgia, the highest prevalence yet reported in an optimally fluoridated community in the United States”.¹⁸⁴ In Ireland, the Royal College of Physicians concurs, “in recent years concerns have been raised about the increased prevalence of dental fluorosis in the United States. Mild levels of fluorosis in some children are associated with the ingestion of ‘optimally fluoridated’ water”.¹⁸⁵ They also admit that “the optimal level of fluoride intake has yet to be fully determined”.¹⁸⁶ In fact, “the most important and widely disregarded fact about dental fluorosis is this: no safe established daily intake exists...”.¹⁸⁷

7.7 Dental Fluorosis Levels in Ireland

The levels of dental fluorosis in Ireland are also disputed. Dr. Gerard Gavin estimates, “... that dosing at 0.8 to 1 part per million, the Irish standard, gives a 10% risk of mild to very mild dental fluorosis”.¹⁸⁸ This figure is estimated using Dean’s Index which is over 60 years old. In addition, Dr. Gavin’s 10% figure also excludes the category called “questionable fluorosis”. A study by Myers showed that this category is associated with fluoride levels in water.¹⁸⁹ In contrast, Professor O’Mullane quoted a figure of “50% of the population”¹⁹⁰ exhibit dental fluorosis or mottling of teeth in fluoridated communities. However, in a letter to Irish Medical Journal, Professor O’Mullane changed this 50% figure. He now states, referring to the 1997 study of dental fluorosis in 12 year olds (Eastern Health Board), “... 20% had questionable/very mild fluorosis” and “... the remaining 4% showed evidence of mild/moderate fluorosis”.¹⁹¹ Therefore, 24% of this study had dental fluorosis. Moreover, the study which Professor O’Mullane refers to in his letter, is also at the age limit for accurate assessment for dental fluorosis. “... Examination of age groups under 12 years of age (with few permanent teeth) in areas where fluoride content is relatively low introduces an error of considerable magnitude”.¹⁹² In essence, if not all teeth have erupted into the mouth an accurate assessment of dental fluorosis is impossible.

7.8 Dental Fluorosis Levels according to the York Review

The York Review, "...an important document which looks at the general side effects of water fluoridation"¹⁹³, agrees closely with Professor O'Mullane's earlier 50% estimate. They concluded that 48% of a fluoridated population would develop dental fluorosis. "Fluorosis was the most widely and frequently studied of all the possible adverse effects considered"¹⁹⁴ "The prevalence of fluorosis at a water fluoride level of 1.0ppm was estimated to be 48% for any fluorosis and 12.5% for fluorosis of aesthetic concern".¹⁹⁵ In effect, after assessing 88 studies, they concluded 48% of a fluoridated population will show some signs of fluoride tooth damage. One eighth of a fluoridated population will have tooth damage, which may require dental intervention. Proponents of fluoridation in Ireland find that this is an acceptable pay-off. Professor O'Mullane declares that, "at present it would seem that these do not pose an aesthetic problem and, in my view should be weighed ... against dental decay. In other words there is a risk benefit decision to be taken between dental caries and dental fluorosis".¹⁹⁶ Interestingly, Dr. Hardy Limeback, Head of Preventive Dentistry, University of Toronto and past president of Canadian Association of Dental Research, has an alternative viewpoint. He states that, "I treat patients with fluorosis all the time in my dental surgery and there is a growing number of patients who are terribly unhappy with their teeth affected with fluorosis. In fluoridated areas throughout the world the incidence of very mild fluorosis ... is as high as 80%".¹⁹⁷

7.9 Risks

There is a growing concern that nearly half of the population has some form of dental fluorosis. Though contending the York figures, Dr. Gavin agrees that, "... dental fluorosis levels need to be monitored and action taken to reduce them if necessary".¹⁹⁸ To reduce dental fluorosis in a population it is first necessary to identify the risks. As highlighted earlier, since the introduction of fluoridation in Ireland, there is an increase in total fluoride intake. Total fluoride intake has increased through a variety of sources. For example, any use of fluorides, whether systemic or topical, in caries prevention and treatment in children results in ingestion and absorption of fluoride into the blood circulation.¹⁹⁹ Dental fluorosis is a dose response condition.²⁰⁰ This means that the more fluoride absorbed by the body the greater the risk and severity of the condition. Therefore, "it is the total dietary intake of fluoride from all sources that is critical in the development of dental fluorosis".²⁰¹ Given this, it is crucial to consider the total fluoride intake.

7.10 Total Fluoride Intake

To date, in Ireland, there is no effective measure of either fluoride intake in the population or the individual. The Department of Health hold the empirical belief that one systemic source (water fluoridation) and one topical source of fluoride (fluoridated toothpaste) provide "adequate levels of fluoride". But figures from the United States question this hypothesis. By 1991, the average fluoride intake in fluoridated America was approximately 6.5mg.²⁰² This is many times the 1960s estimate for fluoride intake in

“optimally fluoridated” areas. In 1996, the Department of Health in the U.K. published safe fluoride intakes at various ages: in adults, this is 3mg per day. This is equivalent to drinking 3 litres of water in Ireland but does not consider other sources of fluoride. However, there are many additional sources of fluoride. These include dental products containing fluoride such as fluoride toothpaste, fluoride supplements and fluoride dental gels and mouth rinses, and are discussed in a subsequent section. There are also many dietary sources of fluoride.

1. Tea.

It is known that fluoride accumulates in the leaves of the tea plant. Ireland has the highest per capita consumption of tea in the world. In 1998, the Journal of the Irish Dental Association published a review of high levels of fluoride in tea and their dental significance in Ireland.²⁰³ Two studies from the U.K. reported on upper levels of fluoride intake from tea only. These ranged from 2.7mg²⁰⁴ to 9.9 mg.²⁰⁵ These high levels of fluoride intake have serious bone implications and are discussed in the skeletal fluorosis section. The Irish review concluded that, “. . . it is recommended that a research project be carried out to analyse the fluoride levels and the rates of the releases from teas available on the Irish market”.²⁰⁶ There have been no such studies. Kiritsy, et al., in an assessment of fluoride levels in tea called for manufacturers of tea to label the fluoride content of their products.²⁰⁷ Another study (Pang et al.) concluded that the fluoride content of tea, prepared with de-ionised water (unfluoridated) and drunk by children, “must be considered as a risk for causing aesthetically significant dental fluorosis”.²⁰⁸

2. Fruit Juice.

There have been several studies into the levels of fluoride in fruit juices.²⁰⁹ They concluded that intake of fluoride from juices or juice flavoured drinks is a factor in the development of dental fluorosis. In 1999, another study of fizzy drinks had similar results.²¹⁰ Grape juice in particular is high in fluoride.²¹¹

3. Fish.

Some fish contain high levels of fluoride. Canned sardines contain 61mg/kg²¹² and shrimp are very high in fluoride at 61.73mg/kg.²¹³ Other canned fish and shellfish are also noticeably high in fluoride.²¹⁴

4. Processed Foods.

Any foods manufactured in a fluoridated area using fluoridated water will contain elevated levels of fluoride. Cereals for infants for example contained 3–4 times more fluoride when manufactured in a fluoridated area.²¹⁵ Soft drinks and beer produced in Ireland are more likely to have a raised fluoride level. Guinness use treated reservoir water in production. This water is fluoridated.

5. Other sources.

Other sources include pesticides (e.g. cryolite), pollution²¹⁶ (e.g. unleaded petrol, coal burning, brick making), cigarette smoke, pharmaceuticals and anaesthetics (e.g. prozac and rohypnol), and aerosol (e.g. chlorofluorocarbons).

7.11 Risk from Systemic Fluorides.

In addition to the sources listed above, public water fluoridation is an important systemic source of fluoride in Ireland. “Currently, over 70% of the Irish population have fluoridated water supplies”.²¹⁷ There are members of these communities, which are more sensitive to fluoride ingestion. The Royal College of Surgeons of Ireland says, “. . . window of maximum sensitivity occurs during the first year of life. . .”.²¹⁸ During the first year of life, exposure to fluoride occurs mainly during bottlefeeding.²¹⁹ In Ireland, there is concern that in fluoridated areas when formula feed is made up using tap water, infants are receiving an overdose of fluoride.²²⁰ Due to an infant’s size it has been estimated that a newborn will receive, three times the safe fluoride limit set by the British Medical Association. A three-month old, due to greater intake, will receive nearly six times this limit.²²¹ An Australian study confirms this. “Prolonged consumption (beyond 12 months of age) of infant formula reconstituted with optimally fluoridated water could result in excessive amounts of fluoride being ingested during the enamel development of the anterior permanent teeth and therefore may be a risk factor for fluorosis of these teeth”.²²² Dr. Limeback also concurs, “we carried out a study, published last year, where we determined that children who are breast-fed until age one, are at less risk of developing dental fluorosis because when you use city (fluoridated) tap water to make up the formula you increase the fluorosis incidence”.²²³ W.H.O. recommends that, “. . . steps should be taken to reduce fluoride ingestion during the ages of tooth development”.²²⁴ Yet, there is still no advice from the Department of Health regarding fluoride intake and bottle-feeding infants. Dr. Limeback suggests an effective method of reducing dental fluorosis in Ireland. He postulates, “if the fluoridation equipment was shut down tomorrow in Ireland, at most one would see one extra filling for every fourth person. If one continues to fluoridate, every sixth person will suffer from fluorosis of the kind mild/moderate. . . with about ten surfaces affected”.²²⁵ Even proponents of fluorides are now questioning the efficacy of fluoridation due to the increase in dental fluorosis as the benefit from fluoride is topical, not systemic. Fejerskov, et al., agree,

“since the predominant cariostatic effect of fluoride is not due to its uptake by the enamel during tooth development, it is possible to obtain extensive caries reductions without a concomitant risk of dental fluorosis”.²²⁶

7.12 Risk from Fluoride Supplements

In non-fluoridated areas, children are encouraged to take fluoride supplements. However, in recent years, recommendations have been reduced. The reason is the implication of supplemental fluoride in the development of dental fluorosis. “Fluoride supplements are a risk factor for dental fluorosis, though their contribution to the increase in fluorosis prevalence is less than that of water fluoridation and fluoridated dentrifices because of

their more limited and shorter use”.²²⁷ There is increasing pressure to stop this supplementation. “It is important for dental practitioners to determine the fluoride intake of every patient before recommending or dispensing any fluoride supplementation”.²²⁸ A study looking at the effectiveness of sodium fluoride drops found that, “considerable dental fluorosis was found in both regular and irregular user groups of the fluoride supplement between 38–63% of children seen”.²²⁹ In 1994, Dr. Brian Burt, presented at the Dietary Fluoride Supplement Conference of the American Dental Association. He argued that, “the risks of using fluoride supplements in young children outweigh the benefits”.²³⁰ Similarly, due to the near epidemic levels of dental fluorosis in Canada, the Canadian Dental Association (from March 2000) now advises no fluoride supplements for children under seven years old.²³¹ Dental fluorosis is also on the increase in non-fluoridated communities, with commercially prepared soft drinks, juices and processed foods manufactured in fluoridated areas.²³² In addition, the advent of fluoridated toothpaste in the 1970s provides another fluoride source, and risk factor in the development of dental fluorosis.²³³

7.13 Risk from Topical Fluorides

Dr. Gavin claims that, “most fluorosis in this country is caused by young children swallowing too much toothpaste”.²³⁴ He continues, “it is a recommendation of the Department of Health that mothers and parents of young children must supervise the brushing of teeth of children under six years of age for a variety of reasons”.²³⁵ Current recommendations, from the Department of Health, state that, children should use no more than a pea-sized amount of fluoride toothpaste. (However, there are many television advertisements in Ireland showing large amounts of toothpaste on toothbrushes).²³⁶ The United States has gone further and placed a poison warning on every tube of fluoride toothpaste, which states, “Keep out of reach of children under six years of age. If you swallow more than used for brushing then seek professional advice or contact a poison control centre immediately”.²³⁷ U.S. Food and Drug Administration require this poison warning by law since 1997. Dr. Gavin recently expressed his opinion on this practice, “well I think putting a poison warning on it is carrying it a bit far, but I do think that manufacturers and suppliers of toothpaste should give much clearer advice in relation to the amount of fluoride toothpaste that should be used by young children”.²³⁸ It is clear that authorities and studies alike also mirror this advice of prudent use of fluoride toothpaste for young children.^{239 240}

7.14 Implications of Dental Fluorosis

Proponents of fluoridation refer to dental fluorosis as a “cosmetic effect”²⁴¹, barely visible to the sufferer and therefore ‘of little concern’. Professor O’Mullane agrees, “most children who have these white lines are not aware they have them”.²⁴² However, a study into the perceptions of dental fluorosis found that “. . . the appearance would increasingly embarrass the child as the TF score (level of fluorosis) increased. Observers, except the dentists, tended to feel that higher TF scores indicated neglect on the part

of the child”.²⁴³ Returning to the York Review, dental fluorosis of aesthetic concern, will likely affect 12.5% of a fluoridated population.²⁴⁴ This term aesthetic concern refers purely to the perception of this tooth damage and projects that these patients will, in all probability, request treatment to cover this irreversible tooth damage. There are several treatment options available to remove or cover this tooth damage. Dr. Limeback, in his presentation to the Dáil committee, highlights some of these options, “many dentists use fillings such as cosmetic bonding or porcelain veneers. A conservative approach, one which I use, is a simple micro-abrasion procedure to remove the surface defective enamel”.²⁴⁵ Dr. Don Mac Auley of IDOF agrees that, “these teeth are usually brittle and more susceptible to wear. Expensive cosmetic dental treatment is usually the only treatment and is not available under the PRSI or medical card schemes”.²⁴⁶ Interestingly, the American Dental Association reported that dentists’ profits in fluoridated areas are 17% greater than those working in unfluoridated areas.²⁴⁷ The Department of Health accepts that dental fluorosis “. . . was always known and was accepted as a trade-off against the dental benefits”.²⁴⁸ However, concerns have been expressed both in Ireland and in other countries about possible adverse health effects from water fluoridation.²⁴⁹ There is increasing concern that dental fluorosis is a sign of more serious health damage. Dr. Limeback concludes, “where there is smoke, there is fire. Fluorosis is the first sign of harm. Soon, we will see people with obvious, measurable systemic illness”.²⁵⁰ Already a Polish study in 1993 found that children with dental fluorosis had identifiable bone change.²⁵¹ “Their findings indicate greater trabecular [bone] height and area in children with dental fluorosis than in controls”.

7.15 Fluoride and Bone

The fluoride ion has an attraction for calcifying tissues. In fact as Dr. Gavin states, “fluorosis levels are a bio-marker for the level of fluoride in the body”.²⁵² And further, “dental fluorosis is past evidence of damaging levels of fluoride in the body.” The W.H.O. agrees, “it is widely recognised that we retain about 50% of the fluoride that we ingest, with it being incorporated into our teeth and bones”.²⁵³ “Fluoride is also a toxic substance”²⁵⁴ Despite the widespread use of this “toxic substance”, the York Review expressed surprise at the poor quality research surrounding the issue of public water fluoridation. They concluded that, “given the level of interest surrounding the issue of public water fluoridation, it is surprising to find that little quality research has been undertaken”.²⁵⁵ Not surprisingly, the storing of a toxic substance in parts of the body, over a lifetime, along with the lack of its demonstrated safety, gives raise for concern. Dr. Limeback explains, “the York Review stated that no-one has designed a careful study to measure the safety of fluoride. We do not know what the long-term effects might be. We conducted a study comparing Montreal residents (unfluoridated) and Toronto residents (fluoridated). The hip bones of Toronto residents have twice the amount of fluoride in them and, at such levels, some are at risk of breaking their bones. The water in Toronto has been fluoridated for approximately 30 years”.²⁵⁶ Professor O’Mullane counters this evidence, “[fluoridation] does not pose a hazard to health or any specific aspect of health”.²⁵⁷ According to the W.H.O., “many epidemiological studies of pos-

sible adverse effects of the long term ingestion of fluoride via drinking water have been carried out. These studies clearly establish that fluoride primarily produces effects on skeletal tissues (bone and teeth). Low concentrations provide protection against dental caries, especially in children”.²⁵⁸ This concern for calcified and skeletal tissues, in particular bone, resulted in many investigations into the relationship between fluoridation and fractures of bones. The majority of these scientific studies focus specifically on hip fracture. The York Review recently concluded that, “. . . there is no clear association of hip fracture with water fluoridation. The evidence on other fractures is similar”.²⁵⁹ However, in such a review “. . . limitations are inevitable”.²⁶⁰ For example the York Review did not include animal or laboratory studies. In addition, they also excluded fluoride intake from other sources (see “Total Fluoride Intake”). These other sources are essential, to fully assess the impact of fluoride on health, as “. . . total fluoride exposure has increased over recent years, partly in industrialised nations”.²⁶¹ The York Review acknowledged this, “. . . it would seem sensible that any future studies should attempt to measure total fluoride intake in areas being researched.”²⁶²

George Glasser, an investigative journalist and medical writer, summarised this error, in his presentation to the Dáil Committee on Health and Children, “it is fundamentally flawed. One cannot look at something without looking at the whole picture.”²⁶³ He also pointed out that the York Review completely ignored skin absorption of fluoride from bathing in fluoridated water. Mr. Glasser explained, “in actuality, one absorbs more contaminants through one’s skin and bathing than in drinking water. The fluoridation people cannot produce one study on dermal [skin] absorption. That means they are saying the dose they put in the water is based on ingestion only. The York Review based their studies on ingestion only”. Nevertheless, the Irish Department of Health continues to reassure: “concerns about adverse health effects other than dental fluorosis have not been substantiated”.²⁶⁴ But, there has never been a health study carried out in Ireland in forty years of fluoridation so the local health effects of water fluoridation, specifically in Ireland, remains unknown. The former Minister of Health, Micheal Martin, recently declared that such health surveys, relating to hip fractures, were impractical. The reason; Ireland’s population is too small.²⁶⁵ Opponents of fluoridation find this attitude unacceptable and see the lack of policy as a breach of the law placed to protect public health.²⁶⁶ Others have voiced their concerns, “successive health ministers have failed to monitor public health”.²⁶⁷ Dr. Maire O Connor, Faculty of Public Health explains, “with a population of 3 million and only just over 2 million are on public piped water supplies, it would be a long time before we’d would expect to show up anything in this size. I think we have to continue monitoring the US, Canada, Australia, New Zealand, the 10 percent in the UK who are on it to try and pick up anything there because just the size of the population alone, we would not expect necessarily to find something”.²⁶⁸

7.16 Hip fracture

There have been many studies investigating the relationship between water fluoridation and hip fracture and other bone fractures. In 1993, the Agency for Toxic Substances

and Disease Registry (ATSDR) in the United States highlighted their concerns of the published studies on hip fractures. They commented, “the weight of evidence from these experiments suggests that fluoride added to water can increase the risk of hip fractures in both elderly women and men... If this effect is confirmed, it would mean that hip fracture in the elderly replaces dental fluorosis in children as the most sensitive endpoint of fluoride exposure”.²⁶⁹ In the last ten years there have been around 18 studies looking at the effect of water fluoridation on hip fracture alone. Of these 18, 10 show an association between fluoride exposure and increased hip fracture, however 8 do not.²⁷⁰ Although, the York Review found, “overall the findings of studies of bone fracture effects showed small variations around the ‘no effect’ mark”, there are still studies in the literature showing a link between fluoridation and hip fracture.

Professor O’Mullane, in his reply to questions at the Dáil Committee, stated that there was no link between hip fracture and fluoridation. He asserted there was conclusive evidence.²⁷¹ Professor O’Mullane cited two studies one from the UK by Drs. Hilliers and Cooper and another study from Australia. The UK study concluded that, “... there is a low risk of hip fracture for people ingesting fluoride drinking water at concentrations of about 1ppm. This low risk should not be a reason for withholding fluoridation of water supplies”.²⁷² The other study from Australia, not included in the York Review, concludes “water fluoridation appears... to have little effect on fracture risk, either protective or deleterious, at a population level.”²⁷³ In addition, it suggests that further investigation is required on an individual level.

Dr. Limeback agrees, “that these studies miss the individual response to fluoride. There are people who have kidney failure, who are accumulating so much fluoride in their system that their skeletal system is riddled with fluoride. There is no way that one can tease out those numbers from these studies. A clear, well controlled study obviously must be done”.²⁷⁴

Another study, included in the York Review, offers conflicting evidence to Professor O’Mullane’s submissions. “We found a small but significant increase in the risk of hip fracture in both men and women exposed to artificial fluoridation at 1 ppm, suggesting that low levels of fluoride may increase the risk of hip fracture in the elderly”.²⁷⁵ Another study, one of the largest studies ever carried out on hip fracture, Jacobsen and co-workers examined the possible association of hip fracture with water fluoridation in the US for white women and men over 65. After exclusions, they examined 218,951 patients. They concluded, “There was a small statistically significant positive association between fracture rates and fluoridation”.²⁷⁶ (As discussed earlier the York Review did not include animal studies but there is evidence in the literature that when rats are treated with fluoride their bones become more brittle).^{277 278} The Faculty of Public Health in Ireland declares that other studies²⁷⁹, showing a link with hip fracture, used individual measurements of bone mass. “Although exposure to fluoride in drinking water was associated with reduced radial bone mass, this did not occur until the levels were 3.5–4.0 mg/litre, far in excess of that recommended for optimal fluoridation”.²⁸⁰

7.17 Skeletal fluorosis

Skeletal fluorosis affects millions of people worldwide especially in India, Pakistan, China and parts of Africa. High levels of naturally occurring fluoride in the soil and subsequently in well water cause this condition. In relation to skeletal fluorosis, the W.H.O. declared, “there is no evidence to suggest the guideline value of 1.5mg/litre set in 1984 needs to be revised. Concentrations above this value carry an increasing risk of dental fluorosis, and much higher concentrations lead to skeletal fluorosis”.²⁸¹ Again, it is important when considering skeletal fluorosis that the overall fluoride intake is estimated. Not just fluoride from water but from other sources, as described earlier in “Total Fluoride Intake”. The clinical symptoms of this chronic fluoride poisoning has the following stages²⁸²: --**Pre-clinical phase**: asymptomatic; slight radiographically-detectable increase in bone mass. --**Phase I**: Musculoskeletal: sporadic pain; stiffness in joints; osteosclerosis of pelvis and spine. --**Phase II**: Degenerative and destructive: chronic joint pain; arthritic symptoms, slight calcification of ligaments; increase osteosclerosis/cancellous bones; with or without osteoporosis of long bones. --**Phase III**: Crippling fluorosis: limitation of joint movement; calcification of ligaments/neck, spinal column; crippling deformities/spine and major joints; muscle wasting; neurological defects/compression of spinal cord.

Fluoride levels of 10-20mg per day for 10-20 years will cause Phase III-Crippling Fluorosis.²⁸³ If we extrapolate this figure to include a normal lifetime then you are at risk from skeletal fluorosis if you ingest 2.5–5.0 mg for 40–80 years. By 1991, the average fluoride intake in fluoridated America was approximately 6.5mg.²⁸⁴ It is possible that fluoride intake in Ireland is also within this range. In 1996, the Department of Health in the U.K. published safe fluoride intakes at various ages: in adults, this is 3mg per day. This is equivalent to drinking 3 litres of water in a fluoridated area not including fluoride from any other source.²⁸⁵

Ireland does not have any figures for safe fluoride intake nor research, to date, of levels of fluoride intake of the Irish public. The focus in Ireland is more on dental concerns, for example, “in developing countries where fluoride levels are naturally high, research on bone is the main topic of interest. In countries with established fluoridation programmes like Ireland dental epidemiology is the main focus of research”.²⁸⁶

Department of Health and Children acknowledge that “...in countries with unusually high levels of fluoride at ten parts per million or higher in drinking water, skeletal fluorosis is a significant public health problem”.²⁸⁷ But, in an article published in The Guardian, called “Nutrition is the key to healthy bones and teeth“ on 16/7/1998, reference is made to a village near Delhi, India with water fluoride levels between only 0.6 and 1.6ppm and 17% of the population suffers with skeletal fluorosis. The W.H.O. agrees, “crippling skeletal fluorosis develops where drinking water contains over 10 mg of fluoride per litre”.²⁸⁸ However, as shown in the box above, there are three phases of skeletal fluorosis before the onset of crippling skeletal fluorosis. The question arises could our total fluoride intake be reaching dangerous levels. Therefore, some individuals may already be experiencing early stages of skeletal fluorosis because “...early cases [of skeletal fluorosis] may be misdiagnosed as rheumatoid or osteo arthritis”.²⁸⁹ Signif-

icantly, the W.H.O. verifies that, “skeletal fluorosis (with adverse changes in bone) is observed when drinking water contains 3- 6mg/litre of fluoride per litre”.²⁹⁰ Dr. Hardy Limeback responds affirmatively, “there is clear association of fluoride accumulation in the various stages of skeletal fluorosis and hip and bone fractures, including forearm fractures, vertebral fractures etc. That has been well documented in the endemic fluorosis areas of China, India and Africa. We are at a stage in North America where we are starting to accumulate so much fluoride in our systems that we are close to stage one of skeletal fluorosis. If we allow fluorosis to continue over a lifetime, we will see an increase in fractures”.²⁹¹

7.18 Cancer

The Royal College of Physicians of Ireland explain that, “claims have been made that fluoride results in an increased occurrence of malignancies. The Knox report in England in 1985 failed to find such a link. In a review by Kaminsky et al in 1990 of the benefits and risks of fluoride exposure, the conclusion was that “there is no evidence that chronic exposure to concentrations of fluoride reported to be greater than 2 mg/l in drinking water increase human cancer mortality or incidence”.²⁹² In addition, the York Review concludes, “there is no clear picture of association between water fluoridation and overall cancer incidence and mortality”.²⁹³

This is not conclusive as the York Review excluded all animal studies. The value in animal laboratory studies is that they establish precise controls, but care is needed in extrapolating these results to humans. Therefore, a combination of laboratory and epidemiological studies (man in his actual environment) is optimal in establishing a causal link. These two factors coincided in a famous court case, of Paul Whitehead v Borough of West View (No Gd-4585-78 on the docket of the Allegheny County Court of Common Pleas in Pittsburgh, U.S. Judge John Flaherty heard the case). This American case revolved around whether fluoridation posed a threat to health. There were many presentations including both laboratory and epidemiological studies.

One of the more important laboratory studies followed the work of Dr. Alfred Taylor, a biochemist at University of Texas, who found that cancer prone mice drinking water containing fluoride at 1ppm and 10ppm, introduced as NaF (sodium fluoride), had shorter life spans by 9-10%.²⁹⁴ This relationship was statistically significant compared to the control mice, drinking distilled water. Drs. Taylor and Taylor followed this with another study, which showed that fluoride in water induced growth in implanted tumours.²⁹⁵

Dr. Dean Burk, Chief Emeritus of the U.S. National Cancer Institute, and Dr. Yi-amouyiannis, also presented a keynote study - comparison between the ten largest fluoridated cities and the ten largest non-fluoridated cities. Their extensive research showed that, while cancer rates had been identical initially, after 20 years the fluoridated cities had 10 percent more cancer deaths than the non-fluoridated ones.²⁹⁶

Based on these and other investigations both for and against public water fluoridation Judge Flaherty gave his findings on November 16, 1978. He understood, “...the sole question before the court is whether fluoride may be a carcinogen”. He then found,

“... point by point, every criticism made of the Burk-Yiamouyiannis study was met and explained by the plaintiffs. Often the point was turned around against the defendants. In short, this court was compellingly convinced of the evidence in favour of the plaintiffs”. In effect, fluoride is a carcinogen. Jurisdiction to enter this decree was sustained on appeal, but on a technicality of administrative law, it was found there was no jurisdiction in the court in the first instance. The findings of Judge Flaherty remain undisturbed.

Following this case, a special committee of the Environment Ministry in Quebec, Canada returned a report on the findings of this court. This report, published in 1979, recommended executive suspension of fluoridation in Quebec.²⁹⁷ This was accepted and still exists today.

In contrast to Judge Flaherty’s findings, the International Agency for Research on Cancer concluded, in relation to carcinogenicity, that the limited data provided inadequate evidence of carcinogenicity in experimental animals. This in itself is quite surprising considering the results from the National Toxicology Program animal study. In 1977 U.S. Congress ordered the United States Public Health Service, to carry out an animal study to review the relationship between fluoride and cancer. The initiative for this important animal study followed the furor caused by the cancer rates study by Burk and Yiamouyiannis listed above. The NTP study published in 1990, they found a dose-related increase in osteosarcoma (bone cancer) in male rats.²⁹⁸

They also found other cancers but these were eliminated by a peer review process which so angered Dr. William Marcus, who was then head of toxicology of the water division of the US Environmental Protection Agency, that he exchanged several memos with his superiors. Finally, the report concluded that fluoride is an equivocal (probable) carcinogen. However, the authors continued to stress that the levels of fluoride were very high but Dr. Marcus has pointed out the fluoride levels in the rats’ bones was within the range you expect in the human population. The U.S. Department of Health and Human Services (1991) point out that a study commissioned by Procter and Gamble, the makers of Crest toothpaste, failed to reproduce the same result in their rat studies.²⁹⁹ Finally, the W.H.O. admit that there “was equivocal evidence of carcinogenicity in one study in male rats, extensive epidemiological studies have shown no evidence of it humans”.³⁰⁰

7.19 Bone Cancer

There was much scepticism about how this relationship, between fluoride and bone cancer in rats, affected the human population. After all, these were animal studies alone.

Under the SEER (Surveillance, Epidemiology and End Results Program Cancer Registry) 16 years of cancer incidence data was examined for the years between 1973 and 1987, covering approximately 10% of the United States population. This examination turned up higher rates of osteosarcoma (bone cancer) in young males in fluoridated areas compared with non-fluoridated areas. However, the US Department of Health and Human Services (1991) explained this result as follows; “the amount of increase observed in young males was greater in fluoridated than in non-fluoridated areas. Although the reason for the increase in young males remains to be clarified, an extensive analysis

reveals that it is unrelated to the introduction and duration of fluoridation”.³⁰¹

Osteosarcoma is a rare cancer of bone, but is one of the most prevalent cancers in young males aged 9-20. It appears to strike young men in the period of rapid bone growth during puberty. Historically there is a link between this disorder and the initial fluoridation trials in Kingston and Newburgh, in the United States³⁰² A National Academy of Sciences report in 1977 commented on this fact, “there was an observation in the Kingston-Newburgh study³⁰³ that was considered spurious and has never been followed up. There was a 13.5% incidence of cortical defects in bone in the fluoridated community but only 7.5% in the non-fluoridated community. . . Caffey (1955) noted that the age, sex, and anatomical distribution of these bone defects are ‘strikingly’ similar to that of osteogenic sarcoma. While progression of cortical defects to malignancies has not been observed clinically, it would be important to have direct evidence that osteogenic sarcoma rates in males under 30 have not increased with fluoridation”.

The Royal College of Physicians of Ireland highlights an investigation offering conflicting evidence.³⁰⁴ “A study was carried out in New York by Mahoney et al in 1991 to investigate the potential relationship between water fluoridation and bone cancer. The resulting data did not support an association between fluoride in drinking water and the occurrence of cancer of the bone”.³⁰⁵ The following year another study, published by the New Jersey Department of Health offered conflicting evidence. Dr. Perry Cohn issued a report entitled: “An Epidemiologic Report on Drinking Water and Fluoridation”. This report indicated that in three counties of New Jersey there was approximately 7 times the osteosarcoma rate in young males in the fluoridated communities compared to the non-fluoridated communities. For the years (1979-87) in the fluoridated communities (in Mercer, Middlesex and Monmouth Counties) there were 22 cases per million and in the non- fluoridated communities there were 3.2 cases per million.³⁰⁶ It must be added, that a further investigation in 1995 failed to show a similar correlation.³⁰⁷

7.20 Uterine Cancer

The Japanese Okinawa Islands were under United States administration from 1945–1972. During this period, fluoridation schemes were installed in most regions. Dr. E. Tohyama, Department of Preventive Medicine, University of Ryukyus, Okinawa, studied the relationship between fluoride levels in drinking water and uterine cancer death rates.³⁰⁸ He concluded that there was a significant positive correlation between fluoride levels on drinking water and uterine cancer deaths. In addition, he found this relationship remained significant after considering possible confounding factors. Finally, he discovered that the time trends in these cancer deaths were related to changes in water fluoridation practices. The Royal College of Physicians of Ireland disputes the methodology used in this study and reassures that “this association has not been found elsewhere”.³⁰⁹

7.21 Fluoride and the Brain

In 1982, studies in China provided the initial evidence that fluoride could affect the brain.³¹⁰ ³¹¹ Up until then, it was accepted that fluoride was unable to cross the

blood/brain barrier. Dr. Phyllis Mullenix and colleagues published a landmark study in 1995.³¹² Dr. Mullenix specialises in neurotoxicity (i.e. the study of toxic effects on the nervous system). From 1982-1986, Dr. Mullenix worked at the Forsyth Dental Infirmary for Children in Boston developing a very accurate animal model, which could measure behaviour. The completed computer program was noted for this achievement in the Wall Street Journal. Mullenix and her colleagues set about investigating the effects of different fluoride concentrations on the rat's behaviour, using the computer model. She also measured the levels of fluoride in their blood and brains. She surprisingly concluded that fluoride accumulated in brain tissue. In addition, there were behavioural changes, which depended on both the level of fluoride exposure and the age of exposure. Mullenix found that males were most sensitive to prenatal exposure and females to weanling and adult exposures. This altered behaviour, "flagged potential for motor dysfunction, IQ deficits and/or learning difficulties".

In a non peer-reviewed critique by Gary Whitford, circulated by the Centres for Disease Control, Division of Oral Health, the levels of fluoride used were criticised (i.e. they were very high). However, Dr. Mullenix reassures that the fluoride levels used were less than one tenth the amount found in children's plasma one hour after receiving topical fluoride applications of dental fluoride gels, or equivalent to humans drinking 5-10 ppm fluoridated water. Dr. Mullenix stated, "thus humans are being exposed to levels of fluoride we know alters behaviour in rats". Following this landmark study, a letter to "*Neurotoxicology and Teratology*" questioned its validity. The authors declared, "we do not believe the study by Mullenix et al. can be interpreted in any way as indicating the potential for NaF (sodium fluoride) to be a neurotoxicant".³¹³

7.22 Alzheimer's Disease

The Mullenix study was not included in the recent York Review. However, they did include a study which "found a statistically significant negative effect (increased risk) of water fluoride on Alzheimer's disease".³¹⁴ In conclusion, on this and other studies, the York Review pointed to the lack of control for other compounding factors. They finally projected, "overall, the studies examining other possible negative effects provide insufficient evidence on any particular outcome to reach conclusion".³¹⁵

There are animal studies, excluded from York, which demonstrate that when rats are fed aluminium fluoride they develop loss of smell, short term memory loss and other similar characteristics of Alzheimers.³¹⁶ Dr J. A. Varner *et al*, concluded, "the presence of low levels of fluoride in the drinking water, equal to the amount found in fluoridated water, caused damage to the tissues of the brain similar to Alzheimer's and other forms of dementia, as well as kidney damage"³¹⁷. Following this landmark study, a report from the American Dental Association questioned the experimental design involved.³¹⁸ Another study found there were fewer cases of degenerative dementia in fluoridated areas³¹⁹ but "no measure of statistical significance of this effect was provided".³²⁰

There are recent studies from China, which indicate a lowering of IQ of children, as a function of their exposure to fluoride.³²¹ ³²² However, the York Review reviewed of these studies and concluded, "skeletal fluorosis and IQ were both negative (increased risk) in

association with water fluoride, but again no measure of the statistical significance of this association was presented".³²³

7.23 Silico-fluorides and Lead levels in Children's blood

In individual studies, hyperactivity in children and criminal behaviour is linked to increased blood lead levels. Lead is notable for its effects on the brain. A most recent study from Dartmouth College in the United States investigated the blood lead levels of 151,225 children aged 0-6 inclusive, living in 105 communities of populations from 15,000 to 75,000.³²⁴ They compared these lead levels with the type of fluoridation scheme employed. They concluded, "for every age/race group, there was a consistently significant association of Silico-fluoride treated community water and elevated blood lead". In essence, their investigations concluded that children living in fluoridated areas, using silico-fluorides as the fluoridating agent, had higher levels of lead in their blood. Silico-fluoride is the fluoridating agent used in Ireland. Miles and Coplan also comment, "chronic, low-level dosage of silicofluoride (SiF) has never been adequately tested for health effects in humans". In Ireland, the Irish Medicines Board, verified that this silico-fluoride "... is not registered as a medicine, is unlicensed and has never been proven safe or effective".³²⁵

Following the publication of Miles and Coplan's study, a rebuttal paper, addressing the silico-fluorides study, was published in the Indian International Journal of Environmental Studies. This stated that, "... we conclude that no credible evidence exists to show that water fluoridation has any quantifiable effects on the solubility, bio-availability, bio-accumulation, or reactivity of lead(0) or lead(2) compounds".³²⁶

7.24 The Pineal Gland

The pineal gland lies in the centre of the brain but is outside the blood/brain barrier. It has a high blood supply and is a calcifying tissue similar to teeth and bone. The pineal gland is implicated in melatonin production. Dr. Jennifer Luke, investigated the levels of fluoride in the crystals in the pineal gland.³²⁷ She found these levels on average 9000ppm fluoride in the crystals and estimated 300ppm in the tissue itself. This level is far in excess of the 1ppm known to inhibit many enzymes.

Dr. Luke next examined the effect of dosing Mongolian gerbils (the animal of choice for studying the pineal gland) with fluoride. She found that the melatonin production was reduced in the gerbils with raised fluoride exposure. Luke postulates that fluoride is inhibiting the enzyme catalysts crucial for production of serotonin or melatonin. Melatonin is very important in the regulation and timing of puberty. Of particular interest, is the fact that in the United States there is an earlier onset of puberty, especially in girls, and no one knows what is causing this.³²⁸ Of historical interest is the Newburgh-Kingston study in 1955 (ten years after fluoridation was begun). When children were examined it was found that the girls in fluoridated Newburgh reached menstruation five months earlier, on average, than the girls in non-fluoridated Kingston.³²⁹

7.25 Other Related Health Implications

7.25.1 Down's syndrome

The York Review looked at six studies which investigated the association between Down's Syndrome and fluoridation. Three of the studies show an increased risk of Down's Syndrome,^{330 331 332} one found a reduced association³³³ and one found no association.³³⁴ The remaining study produced a mixed response.³³⁵ "None of the three studies that found a negative association (increased risk) presented any measure of statistical significance". The York Review found the evidence inconclusive.

7.25.2 Renal Disease

The Royal College of Physicians quotes Kaminsky et al³³⁶ in reassuring that exposure to fluoride in drinking water does not increase the risk of renal disease.³³⁷ However, they also acknowledge the conclusion of this study calls for "...studies in the effects of fluoride in individuals with renal insufficiency are needed".³³⁸

As discussed earlier, fluoride is a toxic substance. The W.H.O. state that, "it is incorporated into teeth and bones; there is virtually no storage in soft tissues. Incorporation into teeth and skeletal tissues is reversible: after cessation of exposure, mobilisation from these tissues takes place. Fluoride is excreted mainly via urine, feces and sweat".³³⁹ "Approximately 50 percent of the daily intake of fluoride is cleared by the kidneys".³⁴⁰ People unable to clear this "toxic substance" from their bodies will more likely suffer fluoride damage. Therefore, it follows that, "subsets of the population may be unusually susceptible to the toxic effects of fluoride and its compounds. These populations include the elderly, people with deficiencies of calcium, magnesium and/or vitamin C, and people with cardiovascular and kidney problems".³⁴¹ There is genuine concern that people who have kidney problems cannot clear fluoride from their systems. Therefore, the fluoride builds up and increases the risk of fluoride poisoning. "Because fluoride is excreted through the kidneys, people with renal insufficiency would have impaired renal clearance for fluoride".³⁴² This is also particularly worrying for elderly people. Elderly people have reduced renal fluoride clearance after the age of 50. "This decreased clearance of fluoride may indicate that elderly people are more susceptible to fluoride toxicity".³⁴³

7.25.3 Allergic responses

The American Academy of Allergy reviewed clinical reports of possible allergic responses to fluoride and concluded, "there is no evidence of allergy or intolerance to fluorides as used in the fluoridation of community water supplies".³⁴⁴ However, there are those who complain of suffering a range of symptoms when exposed to fluoride or fluoridated water, and whose symptoms disappear when they remove the source of fluoride. Dr. Waldbott documented this illness after many years of investigation.³⁴⁵

Dr. Waldbott, an allergy specialist, described six cases of urticaria (rash) due to fluoridated water.³⁴⁶ In one case of a forty year old woman, the relation of the urticaria to fluoride in water was substantiated by a double-blind test.³⁴⁷ The patient was required

to take a tablespoonful of water daily from three bottles labelled 1, 2 and 3, using each for a week at a time. One bottle contained 1 mg of fluoride per tablespoonful but neither the patient nor her attending physician knew which one it was. The urticaria reappeared on the third day of using the fluoride solution. Waldbott, also reported the case of a 62 year old woman who developed the allergic symptoms of rhinitis (runny nose), allergic sinus disease and urticaria (rash) within hours of using fluoridated water with an intake of 1 to 2 mg a day.³⁴⁸

In addition, eight physicians in Holland conducted double blind studies which confirmed a similar phenomenon.³⁴⁹ By double-blind testing (see above), with 60 patients, he showed that certain individuals were intolerant to fluoride and that exposure to this could reproduce gastrointestinal symptoms, stomatitis (sore mouth), joint pains, polydipsia (uncontrollable thirst), headaches and visual disturbances. Ulcers of the mouth have been described in persons using fluoride toothpaste and in children who have had topical fluoride applications applied to their teeth.³⁵⁰ Douglas has described 133 cases of stomatitis from fluoride-containing toothpaste.³⁵¹

Despite this evidence, the U.S. National Academy of Sciences reached a conflicting conclusion. They state, “the reservation in accepting (claims of allergic reaction) at face value is the lack of similar reports in much larger numbers of people who have been exposed to considerably more fluoride than was involved in the original observations”.³⁵²

7.25.4 Infant Mortality

From the York Review, “three studies examined the association infant mortality and water fluoride level. All three studies^{353 354 355} found a negative direction (increased risk i.e. higher infant mortality in fluoridated areas) of association, but again no measure of the statistical significance of this association was presented and so it is difficult to draw conclusions from these results”.³⁵⁶

In Chile in the 1960s, Dr. Albert Schatz (best known for his discovery of the antibiotic Streptomycin) investigated the relationship between artificial fluoridation and increased death rates in Chile.³⁵⁷ He found that areas which received artificially fluoridated water had increased infant mortality. Fluoridation ceased in Chile in the 1970s. However, WHO figures verify that since 1985, fluoridation has started again. Now, 10% of Chile is fluoridated (approximately 1.5 million people). In 1993, in an affidavit, Schatz gave evidence to the high levels of infant mortality after drinking water was fluoridated. He stated, “in Chile, with widespread malnutrition and high infant mortality, it was not necessary to observe a generation of people throughout their entire lifespan in order to determine whether the effect of artificial fluoridation is or is not harmful. One could see the lethal effect of fluoridation within the first year of life in terms of increased infant mortality”.

7.25.5 The Thyroid Gland

Further disputes and scientific controversy surround the effect of fluoride on the thyroid gland. Proponents of fluoridation, the American Dental Association, declare that, “there

are no available data to indicate that, in humans drinking optimally fluoridated water, the fluoride affects enzyme activities with toxic consequences".³⁵⁸ However, there is a body of evidence contradicting this statement.

In the past fluoride was used as an anti-thyroid medication to treat hyperthyroidism (overactive thyroid). Fluoride can suppress the action of the thyroid gland. There is also a remarkable similarity between the symptoms listed for hypothyroidism (under-active thyroid gland) and those reported for fluoride poisoning. There is evidence that excess fluoride in water levels is a risk factor of more rapid development of thyroid pathology.³⁵⁹ Therefore, it appears that fluoride decreases the production of thyroid hormones. Hillman et al., found that cattle afflicted with fluorosis developed hypothyroidism, anaemia, and eosinophilia of leukocytes³⁶⁰. Fluoride might be of some benefit for people suffering from hyperthyroidism. But for a normal person, or perhaps someone who is sensitive to fluoride, exposure to too much fluoride it could result in reducing thyroid hormone production below normal and necessary levels (i.e. hypothyroidism).

It is not clear just how fluoride reduces thyroid hormone production. There is a study demonstrating that changes in the pituitary-thyroid axis, in workers exposed to fluorides, were caused by disorders of the regulatory chain and fluorine impact on thyroid hormones' metabolism at the level of target cells.³⁶¹ In essence, this indicates a disruption of enzyme activity. Additionally, there is evidence that fluoride competes with iodine uptake into the thyroid. There is an extensive study on mice receiving several fluoride-iodine combinations in addition to basal diet. They found that iodine and fluorine do have mutually interacting effects on both goitre and fluorosis in the experimental mice.³⁶² There is evidence that where fluoride intake is high and iodine levels are low there is an increase in the symptoms of iodine deficiency i.e. sub-clinical cretinism with mental retardation.³⁶³

In contradiction to the above, it also appears that fluoride can also cause over-stimulation of thyroid tissue when the conditions are suitable. For example if there is an iodine shortage then a condition called goitre may occur. In this condition the gland grows and grows producing a swelling in the neck. Because there are no thyroid hormones produced, there is nothing to switch off the stimulating signal (thyrotropin or thyroid stimulating hormone) which is produced by the pituitary gland as a response to low thyroid hormone levels. Jooste et al have shown that high fluoride water levels, where iodine is sufficient, have been linked to goitre.³⁶⁴

7.25.6 Fertility

The York Review included a list of studies, which met criteria but were not included in the main analysis. One study related to the association between fluoridation and birth rates.³⁶⁵ York concluded, in this study, that "...the way fluoride exposure is classified is unclear and misleading" However, Freni's study concluded that "most regions showed an association of decreasing Total Fertility Rate (TFR) with increasing fluoride levels in water".³⁶⁶ He also suggested that more studies be carried out in relation to this effect in individual women. In other studies, there is further evidence of the adverse effects of fluoride on human sperm³⁶⁷ and reduced testosterone in skeletal fluorosis patients.³⁶⁸

“Fluoride Fluoride toxicity may cause adverse effects in the reproductive system of males living in fluorosis endemic areas”. Animal studies have also reinforced this relationship.
369 370

7.25.7 Mutagenicity

A mutagen is a substance that can induce genetic mutations. These are changes that can affect structure, development and physical characteristics of resultant offspring. Many substances that are mutagens are also carcinogens i.e. cancer causing. The W.H.O. admits that “in mammalian cells, in vitro, fluoride causes genetic damage (including chromosomal aberrations) at cytotoxic concentrations only (=10mg/litre), the mechanism is not known”. Scientists in many countries have demonstrated this is the case with fluoride.^{371 372 373} Fluoride is a well-known inhibitor of enzyme systems and this may well be a viable explanation of its ability to cause genetic mutations.^{374 375} However, further reassurance from the W.H.O. reassures, “this genetic effect is probably of limited relevance for practical human exposure”.

7.26 US National Academy of Sciences

After three years work by eleven of the leading experts in their respective fields, the National Academy of Sciences 500 page report '*Fluoride in drinking water a scientific review of EPA's standards* (NRC³ 2006) was published on 22nd March 2006. Below are some of the key recommendations and conclusions:

1. Need for baseline data on fluoride exposure.

“Fluoride should be included in nationwide bio-monitoring surveys and nutritional studies; in particular, analysis of fluoride in blood and urine samples taken in these surveys would be valuable.” [1, p 9]

“To assist in estimating individual fluoride exposure from ingestion, manufacturers and producers should provide information on the fluoride content of commercial foods and beverages.” [1, p 71]

“The concentrations of fluoride in human bone as a function of exposure concentration, exposure duration, age, sex and health status should be studied.” [1, p 9]

“Information is particularly needed on fluoride plasma and bone concentrations in people with small-to-moderate changes in renal function as well as in those with serious renal deficiency.” [1, p 9]

“More research is needed on the relation between fluoride exposure and dentin fluorosis and delayed tooth eruption patterns.” [1, p 9]

“To permit better characterisation of current exposures from airborne fluorides, ambient concentrations of airborne hydrogen fluoride and particulates should be reported on national regional scales, especially for

³National Research Council (NRC) functions under the auspices of the National Academy of Sciences (NAS)

areas of known air pollution or known sources of airborne fluorides. Additional information on fluoride concentrations in soils in residential and recreational areas near industrial fluoride sources also should be obtained.” [1, p71-72]

2. Bone effects.

“A systematic study of clinical stage II and stage III skeletal fluorosis should be conducted to clarify the relationship between fluoride ingestion, fluoride concentration in bone, and clinical symptoms.” [1, p 10]

“More studies of communities with drinking water containing fluoride at 2 mg/L or more are needed to assess potential bone fracture risk at these higher concentrations.” [1, p 10]

[NB this applies to all who consume high amounts of drinking water with 1mg/l of fluoride, since fluoride dosage depends on total water intake].

3. Immuno-compromised subjects and cancer.

“Nevertheless, patients who live in either an artificially fluoridated community or a community where the drinking water naturally contains fluoride at 4 mg/L have all accumulated fluoride in their skeletal systems and potentially have very high fluoride concentrations in their bones. The bone marrow is where immune cells develop and that could affect humoral immunity and the production of antibodies to foreign chemicals.” p249

“There is no question that fluoride can affect the cells involved in providing immune responses. The question is what proportion, if any, of the population consuming drinking water containing fluoride at 4.0 mg/L on a regular basis will have their immune systems compromised? Not a single epidemiologic study has investigated whether fluoride in the drinking water at 4 mg/L is associated with changes in immune function. Nor has any study examined whether a person with an immunodeficiency disease can tolerate fluoride ingestion from drinking water.” [1, p 250]

“bone concentrates fluoride and the blood-borne progenitors could be exposed to exceptionally high fluoride concentrations. Thus, more research needs to be carried out before one can state that drinking water containing fluoride at 4 mg/L has no effect on the immune system.” [1, p 250]

“it is important to consider sub-populations that accumulate large concentrations of fluoride in their bones (e.g., renal patients). When bone turnover occurs, the potential exists for immune system cells and stem cells to be exposed to concentrations of fluoride in the interstitial fluids of bone that are higher than would be found in serum. From an immunologic standpoint, individuals who are immunocompromised (e.g.,

AIDS, transplant, and bone-marrow-replacement patients) could be at greater risk of the immunologic effects of fluoride.” [1, p 258]

“In addition, studies could be conducted to determine what percentage of immunocompromised subjects have adverse reactions when exposed to fluoride in the range of 1-4 mg/L in drinking water.” [1, p 259]

“It is paramount that careful biochemical studies be conducted to determine what fluoride concentrations occur in the bone and surrounding interstitial fluids from exposure to fluoride in drinking water at up to 4 mg/L, because bone marrow is the source of the progenitors that produce the immune system cells.” [1, p 259]

“Fluoride appears to have the potential to initiate or promote cancers, particularly of the bone, but the evidence to date is tentative and mixed (Tables 10-4 and 10-5). As noted above, osteosarcoma is of particular concern as a potential effect of fluoride because of (1) fluoride deposition in bone, (2) the mitogenic effect of fluoride on bone cells, (3) animal results described above, and (4) pre-1993 publication of some positive, as well as negative, epidemiologic reports on associations of fluoride exposure with osteosarcoma risk.” [1, p 286]

“Because fluoride stimulates osteoblast proliferation, there is a theoretical risk that it might induce a malignant change in the expanding cell population. This has raised concerns that fluoride exposure might be an independent risk factor for new osteosarcomas.” [1, p 109]

“Osteosarcoma presents the greatest a priori plausibility as a potential cancer target site because of fluoride’s deposition in bone, the NTP animal study findings of borderline increased osteosarcomas in male rats, and the known mitogenic effect of fluoride on bone cells in culture (see Chapter 5). Principles of cell biology indicate that stimuli for rapid cell division increase the risks for some of the dividing cells to become malignant, either by inducing random transforming events or by unmasking malignant cells that previously were in non-dividing states.” [1, p 275]

“Further research on a possible effect of fluoride on bladder cancer risk should be conducted.” [1, p 288]

“in vivo human genotoxicity studies in U.S. populations or other populations with nutritional and sociodemographic variables similar to those in the United States should be conducted.” [1, p 288]

4. Endocrine effects.

“Further effort is necessary to characterise the direct and indirect mechanisms of fluoride’s action on the endocrine system and the factors that determine the response, if any, in a given individual. Such studies would address the following. . .

- identification of those factors, endogenous (e.g., age, sex, genetic factors, or pre-existing disease) or exogenous (e.g., dietary calcium

or iodine concentrations, malnutrition), associated with increased likelihood of effects of fluoride exposures in individuals;

- consideration of the impact of multiple contaminants (e.g., fluoride and perchlorate) that affect the same endocrine system or mechanism.” [1, p 223]

“The effects of fluoride on various aspects of endocrine function should be examined particularly with respect to a possible role in the development of several diseases or mental states in the United States. Major areas for investigation include the following:

- thyroid disease (especially in light of decreasing iodine intake by the U.S. population);
- nutritional (calcium-deficiency) rickets;
- calcium metabolism (including measurements of both calcitonin and PTH);
- pineal function (including, but not limited to, melatonin production);
- development of glucose intolerance and diabetes.” [1, p 224]

5. Thyroid effects

“The chief endocrine effects of fluoride exposures in experimental animals and in humans include decreased thyroid function, increased calcitonin activity, increased parathyroid hormone activity, secondary hyperparathyroidism, impaired glucose tolerance, and possible effects on timing of sexual maturity. Some of these effects are associated with fluoride intake that is achievable at fluoride concentrations in drinking water of 4 mg/L or less, especially for young children or for individuals with high water intake. Many of the effects could be considered sub-clinical effects, meaning that they are not adverse health effects. However, recent work on borderline hormonal imbalances and endocrine-disrupting chemicals indicated that adverse health effects, or increased risks for developing adverse effects, might be associated with seemingly mild imbalances or perturbations in hormone (Summary, page 7) concentrations. Further research is needed to explore these possibilities.” [1, p 7]

The NRC states, “Biondi *et al.* (2002) associate sub-clinical thyroid dysfunction with changes in cardiac function and corresponding increased risks of heart disease”.

Other reports listed by the NRC show thyroid malfunction is associated with:

“bone demineralization, increased cholesterol, depression, cognitive dysfunction and reduced IQ levels in offspring”.

“Thus, several lines of information indicate an effect of fluoride exposure on thyroid function.” [1, p 197]

The NRC adds that because of the complexity of thyroid function and other factors including nutrition,

“it is difficult to predict exactly what effects on thyroid function are likely at what concentration of fluoride exposure and under what circumstances”. [1, p 197]

“Fluoride exposure in humans is associated with elevated TSH concentrations, increased goitre prevalence, and altered T4 and T3 concentrations; similar effects on T4 and T3 are reported in experimental animals.” [1, p 218]

“In humans, effects on thyroid function were associated with fluoride exposures of 0.05-0.13 mg/kg/day when iodine intake was adequate and 0.01-0.03 mg/kg/day when iodine intake was inadequate.” [1, p 218]

“The recent decline in iodine intake in the United States (CDC 2002d; Larsen et al. 2002) could contribute to increased toxicity of fluoride for some individuals.” [1, p 218]

“Intake of nutrients such as calcium and iodine often is not reported in studies of fluoride effects. The effects of fluoride on thyroid function, for instance, might depend on whether iodine intake is low, adequate, or high, or whether dietary selenium is adequate.” [1, p 222]

Fluoride levels associated with goitre prevalence in some areas studied were less than “0.1 to 0.36 mg/L.” According to the American Association of Clinical Endocrinologists, approximately 27,000,000 Americans now have thyroid disorders.

6. Pineal gland effects

“The single animal study of pineal function indicates that fluoride exposure results in altered melatonin production and altered timing of sexual maturity (Table 8). Whether fluoride affects pineal function in humans remains to be demonstrated. The two studies of menarcheal age in humans show the possibility of earlier menarche in some individuals exposed to fluoride, but no definitive statement can be made. Recent information on the role of the pineal organ in humans suggests that any agent that affects pineal function could affect human health in a variety of ways, including effects on sexual maturation, calcium metabolism, parathyroid function, postmenopausal osteoporosis, cancer, and psychiatric disease.” [1, p221-222]

“In summary, evidence of several types indicates that fluoride affects normal endocrine function or response; the effects of the fluoride-induced changes vary in degree and kind in different individuals. Fluoride is therefore an endocrine disruptor in the broad sense of altering normal endocrine function or response, although probably not in the sense of mimicking a normal hormone. The mechanisms of action remain to be worked out and appear to include both direct and indirect mechanisms, for example, direct stimulation or inhibition of hormone secretion by in-

interference with second messenger function, indirect stimulation or inhibition of hormone secretion by effects on things such as calcium balance, and inhibition of peripheral enzymes that are necessary for activation of the normal hormone.” [1, p 223]

“Further effort is necessary to characterise the direct and indirect mechanisms of fluoride’s action on the endocrine system and the factors that determine the response, if any, in a given individual.” [1, p 223]

“The effects of fluoride on various aspects of endocrine function should be examined further, particularly with respect to a possible role in the development of several diseases or mental states in the United States.” [1, p 224]

7. Effects on insulin secretion/diabetes

“The conclusion from the available studies is that sufficient fluoride exposure appears to bring about increases in blood glucose or impaired glucose tolerance in some individuals and to increase the severity of some types of diabetes. In general, impaired glucose metabolism appears to be associated with serum or plasma fluoride concentrations of about 0.1 mg/L or greater in both animals and humans. In addition, diabetic individuals will often have higher than normal water intake, and consequently, will have higher than normal fluoride intake for a given concentration of fluoride in drinking water. An estimated 16-20 million people in the U.S. have diabetes mellitus; therefore, any role of fluoride exposure in the development of impaired glucose metabolism or diabetes is potentially significant.” [1, p 217]

8. Neurological effects

“Carefully conducted studies of exposure to fluoride and emerging health parameters of interest (e.g., endocrine effects and brain function) should be performed in populations in the United States exposed to various concentrations of fluoride.” [1, p 10]

“More research is needed to clarify fluoride’s biochemical effects on the brain.” [1, p 186]

“The possibility has been raised by the studies conducted in China that fluoride can affect intellectual abilities. Thus, studies of populations exposed to different concentrations of fluoride in drinking water should include measurements of reasoning ability, problem solving, IQ, and short- and long-term memory.”

“On the basis of information largely derived from histological, chemical, and molecular studies, it is apparent that fluorides have the ability to interfere with the functions of the brain and the body by direct and indirect means.” [1, p 187]

“A few epidemiologic studies of Chinese populations have reported IQ deficits in children exposed to fluoride at 2.5 to 4 mg/L in drinking water.

Although the studies lacked sufficient detail for the committee to fully assess their quality and relevance to U.S. populations, the consistency of the results appears significant enough to warrant additional research on the effects of fluoride on intelligence.” [1, p 6]

“Studies of populations exposed to different concentrations of fluoride should be undertaken to evaluate neurochemical changes that may be associated with dementia. Consideration should be given to assessing effects from chronic exposure, effects that might be delayed or occur late-in-life, and individual susceptibility.” [1, p 187]

9. Effects related to renal function

“Human kidneys. . . concentrate fluoride as much as 50-fold from plasma to urine. Portions of the renal system may therefore be at higher risk of fluoride toxicity than most soft tissues.” [1, p 236]

“Early water fluoridation studies did not carefully assess changes in renal function.” [1, p 236]

“future studies should be directed toward determining whether kidney stone formation is the most sensitive end point on which to base the MCLG (maximum-contaminant level goal).” [1, p 247]

“On the basis of studies carried out on people living in regions where there is endemic fluorosis, ingestion of fluoride at 12 mg per day would increase the risk for some people to develop adverse renal effects.” [1, p 247]

“Thus, more studies are needed on fluoride concentrations in soft tissues (e.g., brain, thyroid, kidney) following chronic exposure.” [1, p 83]

“Research is needed on fluoride plasma and bone concentrations in people with small to moderate changes in renal function as well as patients with serious renal deficiency. Other potentially sensitive populations should be evaluated, including the elderly, postmenopausal women, and people with altered acid-base balance.” [1, p 83]

“More research is needed on bone concentrations of fluoride in people with altered renal function, as well as other potentially sensitive populations (e.g., the elderly, post-menopausal women, people with altered acid-balance), to better understand the risks of musculoskeletal effects in these populations.” [1, p 147]

“Additional studies should be carried out to determine the incidence, prevalence, and severity of renal osteodystrophy in patients with renal impairments in areas where there is fluoride at up to 4 mg/L in the drinking water.” [1, p 258]

“The effect of low doses of fluoride on kidney and liver enzyme functions in humans needs to be carefully documented in communities exposed to different concentrations of fluoride in drinking water.” [1, p 258]

10. Better characterisation of biological effects of fluoride and other substances⁴

“Intake of nutrients such as calcium and iodine often is not reported in studies of fluoride effects. The effects of fluoride on thyroid function, for instance, might depend on whether iodine intake is low, adequate, or high, or whether dietary selenium is adequate.” [1, p 222]

“Better characterisation of exposure to fluoride is needed in epidemiology studies investigating potential effects. Important exposure aspects of such studies would include the following: collecting data on general dietary status and dietary factors that could influence exposure or effects, such as calcium, iodine, and aluminium intakes.” [1, p 72]

“The possibility of biological effects of SiF_6 , as opposed to free fluoride ion, should be examined.” [1, p 72]

“The biological effects of aluminofluoride complexes should be researched further, including the conditions (exposure conditions and physiological conditions) under which the complexes can be expected to occur and to have biological effects.” [1, p 72]

“histopathological changes similar to those traditionally associated with Alzheimer’s disease in people have been seen in rats chronically exposed to AlF_3 .” [1, p 178]

“Fluorides also increase the production of free radicals in the brain through several different biological pathways. These changes have a bearing on the possibility that fluorides act to increase the risk of developing Alzheimer’s disease.” [1, p 186]

“Available information now indicates a role for aluminium in the interaction of fluoride on the second messenger system; thus, differences in aluminium exposure might explain some of the differences in response to fluoride exposures among individuals and populations.” [1, p 222]

“With the increasing prevalence of acid rain, metal ions such as aluminium become more soluble and enter our day-to-day environment; the opportunity for bio-active forms of AlF_3 to exist has increased in the past 100 years. Human exposure to aluminofluorides can occur when a person ingests both a fluoride source (e.g., fluoride in drinking water) and an aluminium source; sources of human exposure to aluminium include drinking water, tea, food residues, infant formula, aluminium-containing antacids or medications, deodorants, cosmetics, and glassware.” [1, p 42]

“Further research should include characterisation of both the exposure conditions and the physiological conditions (for fluoride and for aluminium or beryllium) under which aluminofluoride and beryllorfluoride complexes can be expected to occur in humans as well as the biological effects that could result.” [1, p 42]

⁴e.g. aluminium

“Another possible explanation for increased blood lead concentrations which has not been examined is the effect of fluoride intake on calcium metabolism; a review by Goyer (1995) indicates that higher blood and tissue concentrations of lead occur when the diet is low in calcium. Increased fluoride exposure appears to increase the dietary requirement for calcium (see Chapter 8); in addition, the substitution of tap-water based beverages (e.g., soft drinks or reconstituted juices) for dairy products would result in both increased fluoride intake and decreased calcium intake.” [1, p 43]

“Given the expected presence of fluoride ion (from any fluoridation source) and silica (native to the water) in any fluoridated tap water, it would be useful to examine what happens when that tap water is used to make acidic beverages or products (commercially or in homes), especially fruit juice from concentrate, tea, and soft drinks. Although neither Urbansky (2002) nor Morris (2004) discusses such beverages, both indicate that at $\text{pH} < 5$, SiF_6^{2-} would be present, so it seems reasonable to expect that some SiF_6^{2-} would be present in acidic beverages but not in the tap water used to prepare the beverages. Consumption rates of these beverages are high for many people, and therefore the possibility of biological effects of SiF_6^{2-} , as opposed to free fluoride ion, should be examined.” [1, p 44]

“More work is needed on the potential for release of fluoride by the metabolism of organofluorines.” p83

11. Birth defects

“The possible association of cytogenetic effects with fluoride exposure suggests that Down’s syndrome is a biologically plausible outcome of exposure.” [1, p 170]

“A reanalysis of data on Down’s syndrome and fluoride by Takahashi (1998) suggested a possible association in children born to young mothers. A case-control study of the incidence of Down’s syndrome in young women and fluoride exposure would be useful for addressing that issue. However, it may be particularly difficult to study the incidence of Down’s syndrome today given increased foetal genetic testing and concerns with confidentiality.” [1, p 172]

“The relationship between fertility and fluoride requires additional study.” [1, p 161]

“Two small studies have raised the possibility of an increased incidence of spina bifida occulta in fluorosis-prone areas in India; larger, well-controlled studies are needed to evaluate that possibility further.” [1, p 164]

12. Effects on gastrointestinal system

“The numerous fluoridation studies in the past failed to rigorously test for changes in GI symptoms and there are no studies on drinking water containing fluoride at 4 mg/L in which GI symptoms were carefully documented.” [1, p 230]

“GI effects appear to have been rarely evaluated in the fluoride supplement studies that followed the early ones in the 1950s and 1960s.” [1, p 231]

“The table suggests that fluoride at 4 mg/L in the drinking water results in approximately 1% of the population experiencing GI symptoms.” [1, p 231]

“Whether fluoride activates G proteins in the gut epithelium at very low doses (e.g., from fluoridated water at 4.0 mg/L) and has significant effects on the gut cell chemistry must be examined in biochemical studies.” [1, p 236]

“There are a few case reports of GI upset in subjects exposed to drinking water fluoridated at 1 mg/L. Those effects were observed in only a small number of cases, which suggest hypersensitivity. However, the available data are not robust enough to determine whether that is the case.” [1, p 250]

“Studies are needed to evaluate gastric responses to fluoride from natural sources at concentrations up to 4 mg/L and from artificial sources.” [1, p 258]

8 Irish Dentists Opposing Fluoridation

8.1 I.D.O.F. Policy on Water Fluoridation

⁵ Most dentists would refuse to prescribe for a patient he or she has never met, whose medical history he or she does not know, a substance which is intended to create bodily change; with the advice, take as much as you like but you will take it for the rest of your life, because some children have tooth decay. This is the water fluoridation ethos. Irish Dentists Opposing Fluoridation is a support group for fellow dental professionals who wish to express their opposition to the practice of mass medicating our drinking water with fluoride. Our primary aim is to highlight the undemocratic, unethical and unsafe nature of fluoridation in Ireland. As dentists, we have to lead the way in reducing the public's exposure to this toxic chemical. A chemical which, the Irish Medicines Board declares is not registered as a medicine, is unlicensed and has never been proved safe or effective for use on humans. We are opposed to water fluoridation for the following reasons:

⁵Original Policy statement link <http://homepage.eircom.net/~aud/home.htm>

8.1.1 Infringement of our human rights

Fluoridation is compulsory. There is no freedom to choose with this form of medication. The Irish government has never requested the free informed consent of the population to give them fluoride in their water supply. This is contrary to the Council of Europe's 'Convention on Human Rights and Bio-medicine' (1997).

8.1.2 Dental Fluorosis

Dental fluorosis is tooth damage caused by swallowing fluoride. Current estimates, of dental fluorosis, state that between 24-50% of all Irish children and teenagers have some form of this condition.

8.1.3 Health damage

There are numerous international scientific studies linking fluoride/fluoridation with serious health conditions such as hip fractures, cancer, osteoporosis, thyroid dysfunction, neurological impairment and irritable bowel syndrome.

8.1.4 Summary

The York Review of water fluoridation, "... conducted by an independent group to the highest international scientific standards...", published its findings in September 2000. One of the main conclusions of this review surprised many; "given the level of interest surrounding the issue of public water fluoridation, it is surprising to find that little high quality research has been undertaken". In Ireland, there has never been a health study in forty-two years of artificial water fluoridation. This is in breach of the Health (Fluoridation of Water Supplies) Act 1960, section 6, and there is public concern that the local health effects in Ireland are unknown. The Department of Health continue to reassure the public, "major reviews of the evidence by leading medical scientists have shown time and time again that the use of fluoride in drinking water at 1 part per million is safe to human health". Fluoridation became mandatory in the early sixties and an investigation in this era concluded that fluoride was safe and had no adverse health effects. However, over forty years on, the scientific climate has changed considerably. Since then, there have been innumerable studies, investigations and developments in artificial water fluoridation. The conclusions in many cases are contradictory but it is important to consider all aspects of these developments, both pro- and anti-fluoridation.

One adverse effect that both sides agree on is dental fluorosis. Descriptions of dental fluorosis range from "... a cosmetic issue..." to "... the first readily detectable symptom of previous chronic fluoride poisoning". Water fluoridation causes dental fluorosis in a significant proportion of the population. Moreover, the most important and widely disregarded fact about dental fluorosis is this: "no safe established daily intake of fluoride exists". As a marker for past fluoride overexposure, it is important to recognise the levels of this condition in the population. This dental condition is seen as, "... white spots on

the teeth, surface pitting and in severe cases there is brown staining”, according to Dr. Gerard Gavin, Chief Dental Officer, Department of Health.

There is much confusion about the estimated levels of dental fluorosis in Ireland. These figures range from 10–50%. The York Review concluded that 48% of a fluoridated population will develop dental fluorosis. Moreover, 12.5% of a fluoridated population will have such notable fluorosis that will probably require dental treatment. Dental fluorosis is increasing in Ireland. Since the introduction of water fluoridation in the 1960s, there has been an increase in the number of fluoride sources (total fluoride intake) and these are all added risk factors for dental fluorosis. Fluoride toothpaste introduced in the 1970s and additionally, fluoride supplements, dental products, tea, fruit juices and many other sources contribute to our total fluoride burden.

With nearly half of the population likely to have this fluoride disorder there is concern that we should be reducing our fluoride intake not extending water fluoridation. But the Department of Health declares this level of dental fluorosis is an acceptable cost/benefit result (i.e. increased dental fluorosis against reduction in tooth decay). However, as demonstrated in the previous chapter, the decay reduction from water fluoridation is less significant than previously estimated. Thus, the ethical question is: is a limited tooth decay reduction balanced by exposing nearly half the population to a new oral disease (dental fluorosis)?

The bone effects of water fluoridation are much more controversial. Fluoride exerts effects on mainly skeletal tissues e.g. bones and teeth. There are many studies investigating the relationship between fluoridation and hip fracture. Of 18 studies since 1990, 10 show a positive association between fluoride exposure and hip fracture, however 8 do not. The York Review concluded on this issue, “. . . there is no clear association of hip fracture with water fluoridation”. The Department of Health point to another bone disorder, linked to water fluoride levels, called skeletal fluorosis. Skeletal fluorosis is a degenerative bone disorder, which in its early stages can be misdiagnosed as rheumatoid or osteo-arthritis. The World Health Organisation, clarifies that, “skeletal fluorosis (with adverse changes in bone) is observed when drinking water contains 3–6mg/litre”. Ireland’s drinking water contains 0.8–1mg/litre. Considering total fluoride exposure has increased over recent years, from other sources — fluoride toothpaste, tea and fruit drinks, there is growing concern that there is not an adequate margin of safety with water fluoridation.

The Royal College of Physicians of Ireland affirms “. . . that there is no evidence that chronic exposure to concentrations of fluoride reported to be greater than 2mg/litre in drinking water increase human cancer mortality or incidence”. The York Review also found no clear association. There is concern that the York Review has limitations as they excluded animal studies. Yet, there are many animal studies linking fluoride and cancer.

A landmark court case in the United States, reviewing the pros and cons of water fluoridation, included both animal and epidemiological studies with particular attention to links between fluoridation and cancer. On the weight of the evidence, Judge Flaherty issued an injunction against water fluoridation. However, the case was overturned on jurisdictional grounds but the findings remain undisturbed. One related outcome of this

case was that following a review by the Ministry of the Environment in Quebec, Canada, fluoridation there was suspended. Quebec remains unfluoridated today.

In addition, there is conflicting evidence as regards the link between fluoridation and osteosarcoma. Osteosarcoma is a rare cancer of bone but is one of the most prevalent cancers in young males. Other cancers studied (e.g. uterine cancer), showing a positive relationship have been criticised on methodology.

The blood brain barrier, until recently, was believed to be impervious to fluoride. This is now in question. Some neurological implications for water fluoridation have been cited. These animal studies demonstrate behavioural change but are contended for using high levels of fluoride. Several studies have proposed a link between fluoride and Alzheimers disease. A recent study relating to blood lead levels in children found a positive correlation between these elevated levels and the fluoridating agent used. Interestingly, Ireland uses the same silico-fluoride chemical for water fluoridation. There has been a rebuttal paper questioning this study.

Other linked adverse health effects include the action of fluoride on the pineal gland, enzyme activity, the thyroid gland and fertility and mutagenicity. Other related but contended disorders include Down's syndrome, Renal Disease, allergic sensitivity and infant mortality.

There is much controversy over the health implications of water fluoridation, excluding dental fluorosis. The Department of Health in Ireland disputes all other adverse health effects despite no health studies in Ireland. The York Review concluded that there was no association between fluoridation/bone fracture and fluoridation/cancer based on the available evidence. Other adverse effects studied did not provide sufficient evidence. But, as discussed, there were limitations within the York Review.

A number of European regulatory authorities and non-governmental organisations have introduced the concept of the Precautionary Principle. The Irish government recently cited this principle in regards to vaccination safety. The Precautionary Principle states that if there is any doubt about the potential harm that exposure to a chemical substance may cause, then governments should not wait for complete and definitive proof, but instead ask several fundamental questions:

1. Does the weight of evidence from all scientific studies (biochemical, animal, tissue culture, human) suggest we have a problem?
2. How serious would that problem be if we continue to expose a whole population and cause harm?
3. How important is the goal that this exposure means to accomplish?
4. Are there available alternatives to the exposure that achieves the same goal?

Water fluoridation fails on all four of these grounds. Finally, Professor Sheldon, (Chairman of the Advisory Group of the York Review) sums up, "the review team was surprised that in spite of the large number of studies carried out over several decades there is a dearth of reliable evidence with which to inform policy. Until high quality studies are

undertaken providing more definite evidence, there will continue to be legitimate scientific controversy over the likely effects and costs of water fluoridation". There are no plans from the Department of Health, for general health studies in Ireland despite the current legislation requiring them.

9 Glossary

Glossary

prophylactic Preventive medicine or preventive care consists of measures taken to prevent diseases, (or injuries) rather than curing them or treating their symptoms..
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