Public Health Investigation of Epidemiological data on Disease and Mortality in Ireland related to Water Fluoridation and Fluoride Exposure

Key findings and observations on Fluoride by the U.S National Research Council examined within the context of a comparison of population health and disease burdens between Fluoridated Republic of Ireland and Non-Fluoridated Northern Ireland and Europe.

Report for
The Government of Ireland
The European Commission and World Health Organisation

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Dedicated to Gladys Ryan
Died: February 23rd, 2013

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Article 174 of the TREATY OF EUROPE

mandates

that Community policy on the environment must contribute to the preservation,

protection and improvement of the

quality of the environment,

the protection of human health and

the prudent and rational utilisation of natural resources based on the

PRECAUTIONARY PRINCIPLE.

The precautionary principle is detailed in Article 191 of the Treaty on the Functioning of the European Union (EU). It aims at ensuring a higher level of environmental protection through preventative decision-taking in the case of risk. However, in practice, the scope of this principle is far wider and also covers consumer policy, European legislation concerning food and human, animal and plant health.

Contents

INTRODUCTION

The impetus for this report came from a recently released U.S. National Research Council (NRC) report which reviewed toxicologic, epidemiologic and clinical data on fluoride and exposure data on orally ingested fluoride from drinking water and other sources and which examined the adverse effects on various organs systems, and genotoxic and carcinogenic potential of fluoride on human health. A growing body of research is calling attention to this problem. As a follow-up to the 2006 NRC report and my previous report on Human Toxicity, Environmental Impact and Legal Implications of Water Fluoridation (2012); this study highlights the key findings of the NRC scientific committee under specific headings and examines the health disadvantages for the population of Ireland from increased dietary exposure to fluorides by comparison to disease incidence/burden in non-fluoridated Northern Ireland and Europe.

The results clearly document that higher mortality and inferior health is evident for the population in the Republic of Ireland compared to non-fluoridated Northern Ireland. The findings clearly support the published findings of the NRC scientific committee and conclusively demonstrate that fluoridation of drinking water has significantly increased the dietary fluoride exposure of the entire population in Ireland to unsafe levels that have contributed directly and indirectly to numerous adverse health effects on the population. Ultimately this has culminated in significantly higher disease burdens and mortality and inferior health compared to their counterparts in Northern Ireland or other non-fluoridated EU countries. Overall the Republic of Ireland fares worse in the prevalence of disease and morbidity for a wide range of disease categories compared with Northern Ireland the UK or the EU region. The report also highlights similar disease burdens in the few other countries that continue to practice fluoridation especially in North America, Australia and New Zealand. The NRC report (2006) highlighted the potential contribution that fluoride exposure may have for many if not all of these diseases.

This report identifies that water fluoridation chemicals have been classified as low dose Endocrine Disruptors (EDCs) in current peer reviewed scientific publications and examines how EDCs impact on overall human health in general. The gravity of the findings in this report raises urgent and fundamental questions about the safety of artificial fluoridation of drinking water. Given the strength of the findings and seriousness of the evidence presented in this report continuation of such a policy, in light of the information contained, would represent gross culpable negligence and a crime against humanity. With so much at stake and when the evidence of harm is so overwhelming, public health authorities simply have no choice but to act in the public interest and discontinue artificial fluoridation as a matter of urgency.

Summary of Main Findings of the NRC Report (2006)

The NRC concluded that there was evidence to demonstrate that fluoride exposure contributed to causing cancers and well as promoting cancers, fluoride exposure impairs glucose metabolism, causes impaired glucose tolerance and decreases insulin production.

Fluoride exposure increases the production of free radicals in the brain, impairs brain function, causes neurotoxic effects on the brain, affects the general nervous system and increases the risk of developing Alzheimer's. Cytogenetic effects of fluoride exposure may contribute to Down's syndrome.

Fluoride exposure contributes to musculoskeletal disease with associated symptoms such as chronic joint pain, arthritic symptoms, calcification of ligaments, and osteosclerosis of cancellous bones as well as weakens bone and increases the risk of fractures.

Fluoride exposure contributes to hyperparathyroidism, increased calcium deficiency, osteoporosis, and may be associated with hypertension, arteriosclerosis, degenerative neurological diseases, diabetes mellitus, some forms of muscular dystrophy and colorectal cancer.

Fluoride contributes to other adverse health effects including increased concentration of lead in critical organs and nutritional rickets. Fluoride is an endocrine disruptor contributing to hypothyroidism and hyperparathyroidism.

Fluoride exposure decreases melatonin production that may indirectly contribute to increased anxiety reactions, development of postmenopausal osteoporosis, anticarcinogenic effects and psychiatric diseases.

Fluoride directly affects the immune system while silicofluorides inhibit cholinesterases, including acetylcholinesterase which is a contributory factor in Alzheimer disease. Human leukemic cells lines are also susceptible to the effects of silicofluorides and symptoms such as oral ulcers, colitis, urticaria, skin rashes, nasal congestion and epigastric distress may be due to sensitivity of some sufferers to silicofluorides or fluoride.

Fluoride also forms complexes with other elements including aluminium, sodium, iron, calcium, magnesium, copper and hydrogen that may have implications for neurotoxic effects.

Executive Summary of Health Review Findings

This report demonstrates how overexposure of a population to fluorides through artificial fluoridation of public water supplies applied to almost the entire population of the Republic of Ireland (RoI) is perhaps the largest single overall contributor to the disease burdens present in Ireland today. Fluoridation of public water has significantly increased the total dietary exposure of the population to fluorides regardless of the individual's nutritional status or health in an uncontrolled manner impacting on every aspect of health.

Apart from the debate over causality, chemical intolerance to fluoride may also have significantly increased certain medical and psychiatric conditions among the population in the Republic of Ireland. Previous peer reviewed studies in the Netherlands, Finland and U.S have shown that a percentage of the population are intolerant to fluoride and that exposure to fluoride in water/food resulted in dermatologic, gastro-intestinal and neurological disorders.

Taken together, the evidence suggests that chemical intolerance and increased exposure to fluorides through fluoridation of public water supplies may be viewed as one of the largest single causes of preventable death and health inequality in the Republic of Ireland.

The complete lack of any public-health surveillance on the population of the RoI over the previous half century to interpret the risks posed by low-level exposure to fluorides and silicofluroides is astonishing. Not only have no detailed epidemiologic, toxicologic, or exposure assessment studies been undertaken by the Health authorities responsible for fluoridation but they have failed to adequately incorporate bio-monitoring data for interpretation of health risks at the individual, community, and population levels especially for the most sensitive subgroups with in the population.

The lack of toxicological testing of fluoridation chemicals to ensure the safety and protection of the population or environment is undeniable. The failure of the Irish Expert Body on Fluoride and Health to recognise the importance of the NRC report published in 2006 is shocking, as is their unwillingness to pursue any of the wide ranging recommendations noted in this report to address specific public health safety concerns regarding the health impacts of fluoride exposure.

The NRC scientific committee clearly identified children as a high priority risk group requiring special consideration because their health risks can differ from those of adults as a result of their immature physiology, metabolism, and differing levels of exposure due to factors such as greater food consumption per unit of body weight. The scientific committee highlighted the lack of toxicity data on silicofluorides and the lack of appropriate safety standards for children for fluoride exposure or its long term toxicity on humans.

The committee highlighted other potential significant sources of fluoride such as occupational, industrial, and therapeutic sources and outlined how certain environmental, metabolic, and disease conditions may cause more fluoride to be retained in the body. For example, fluoride retention might be affected by environments or conditions that chronically affect urinary pH, including diet, drugs and certain diseases (e.g., chronic obstructive pulmonary disease). It is also affected by renal function, because renal excretion is the primary route of fluoride elimination.

The committee also identified Individuals with renal disease as a subgroup of particular concern because their ability to excrete fluoride can be seriously inhibited, causing greater accumulation of fluoride in their bodies. Another category of individuals in need of special consideration includes those who are particularly susceptible or vulnerable to the effects of fluoride. For example, Downs syndrome children.

The NRC also identified the elderly as another sector of the population of concern, because of their long-term accumulation of fluoride into their bones. The NRC further noted that there are also Individuals with medical conditions that can make people more susceptible to the effects of fluoride. An example would be individuals with thyroid disorders or individuals with compromised immune systems.

The abject failure of the Irish Expert Body, the Department of Health and Food Safety Authority as well as other state agencies to protect the most vulnerable from fluoride intoxication is deeply disturbing. This is particularly the case for pregnant mothers, for fetal development and for new-born infants who continue to be exposed to alarmingly high levels of toxicity from fluorides, aluminofluorides and silicofluorides that may clearly contribute to the significantly increased incidence of SIDS, Downs syndrome, hypothyroidism, behaviour problems, neurological disorders, learning disorders, dental fluorosis, gastrointestinal disorders and other conditions and often fatal diseases such as osteosarcoma, leukaemia or other disease outlined in this report.

As with exposure to any chemical these agencies have a duty of care to ensure that information needed for health and environmental assessment of fluoridation chemicals was available prior to commencement of fluoridation as well as providing detailed information on the total dietary exposure of the Irish population.

Any such risk assessment should have included information on acute toxicity, irritation, hypersensitivity corrosivity, sensitisation, repeated dose toxicity, mutagenicity, genotoxicity, carcinogenicity and toxicity for reproduction. Investigations should have been undertaken on the toxicokinetics of the chemical substance used and its derivative compounds including silicofluorides and aluminofluorides

compounds as well as the bioavailability of fluoride compounds in varying water chemistry, in particular examining the impact of water hardness on fluoride toxicity of the population.

Human population studies must examine the high risk subgroups of the population including infants, people with nutrition deficiencies, and individuals with endocrine disorders, while also providing for risk characterisation for diabetics and workers or athletes who consume large volumes of water.

All of these important recommendations and more were provided by the NRC in their report in 2006, some were identified by the British Medical Research Council[1] in their report (2002) and ignored by the Irish authorities. In addition the legislation for fluoridation in Ireland requires for on-going human health data to be monitored yet no epidemiological studies have ever been undertaken by the public health authorities in Ireland examining the impact of fluoridation on public health since this policy was first implemented almost fifty years ago.

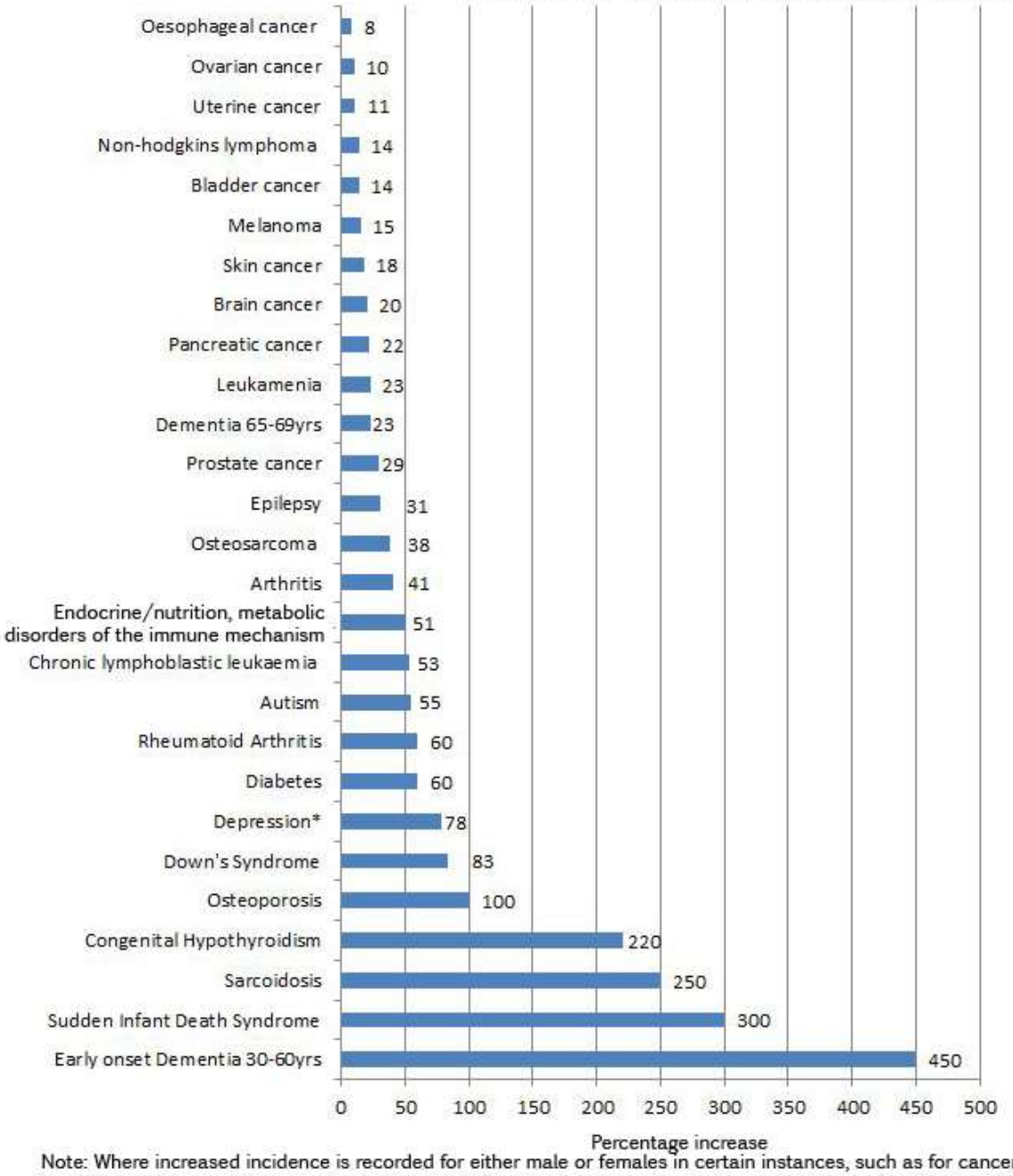
This report examines approximately 28 disease categories and the prevalence or incidence of disease burden for both fluoridated and non-fluoridated communities all living on the same island of Ireland from published and available data sources. The variation in disease burdens between the RoI and Northern Ireland (NI) was calculated for each of the categories with a persistent and significant increase documented for the population across all diseases for persons living in the RoI, compared to non-fluoridated NI or other EU member states.

This report shows how premature death and health inequalities are far greater for all ages in the ROI compared to NI or other European countries.

In each of the disease categories a highly significant increased burden of disease has been recorded for Southern Ireland with the most pronounced variation being early onset dementia (450%) followed by sudden infant death syndrome (300%), sarcoidosis (250%), congenital hypothyroidism (220%), osteoporosis (100%) Downs syndrome (83%), depression (78%), rheumatoid arthritis (60%) diabetes (60%) and cancer where significant increased risk for a wide range of cancers are to be found in ROI compared to non-fluoridated NI and Europe.

Overall cancers incidence was significantly higher in fluoridated RoI compared to non-fluoridated NI. The World Health Organisation has also reported that the overall incidence of cancer per 100,000 in the RoI is 85% above the European region average, 43% above the EU average and 38% above the UK incidence. It is important to highlight that over 6million citizens in the UK (<10%) also consume artificially fluoridated drinking water.

Figure 1. Variation in Disease Burden for Population of Republic of Ireland (Fluoridated) compared to Northern Ireland (Non-Fluoridated).



Note: Where increased incidence is recorded for either male or females in certain instances, such as for cancers, the highest percentage increase is presented for either sex .Where data is not available for NI, UK data is provided
* Data from AWARE ROI/NI and Health Promation Agency UK. Further information included in report.
Ireland has highest incidence in EU of Prostate cancer, Non Hoddgkins lymphoma and Ovarian cancer.
** Data from NICR/NCRI Cancer in Ireland 1994-2004

It is particularly worth noting the statement of Richard A. Kunin, M.D.[2] regarding fluoride exposure and disease burdens when he stated *"the background (fluoride exposure) from all sources is increasing to such an extent that everyone with chronic medical symptoms has to consider fluoride as a probable cause, even before nutrient imbalance."* The enormity of the disparity between disease burdens in the RoI compared to NI when examined in light of the documented effects of

fluorides on human health, as noted by the NRC and others, unquestionably demonstrate beyond any reasonably doubt, that increased exposure to fluoride has played a major role in the increase in disease burdens and mortality in the RoI.

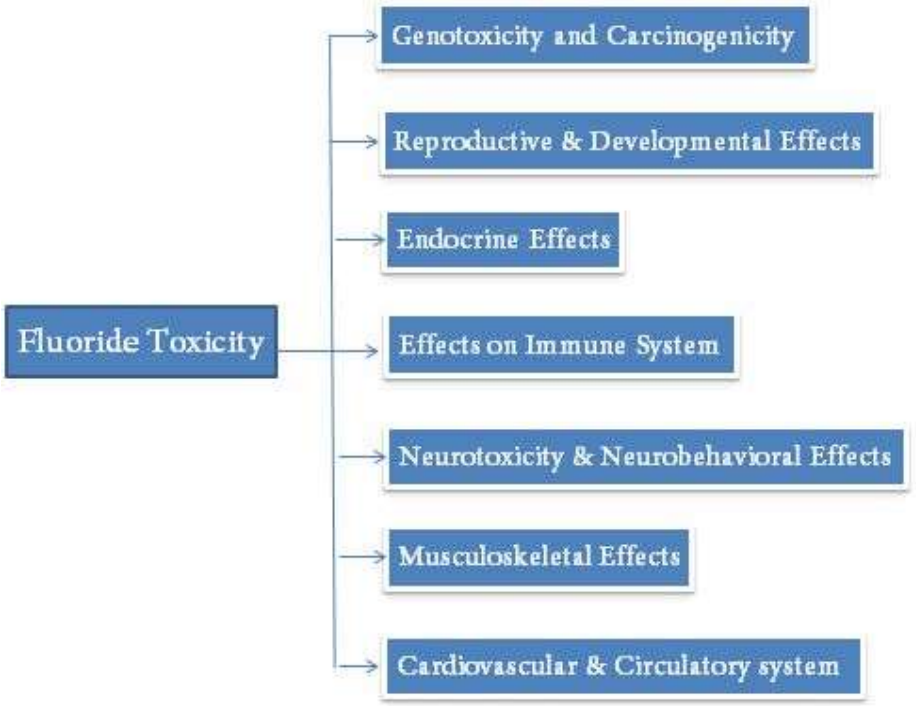
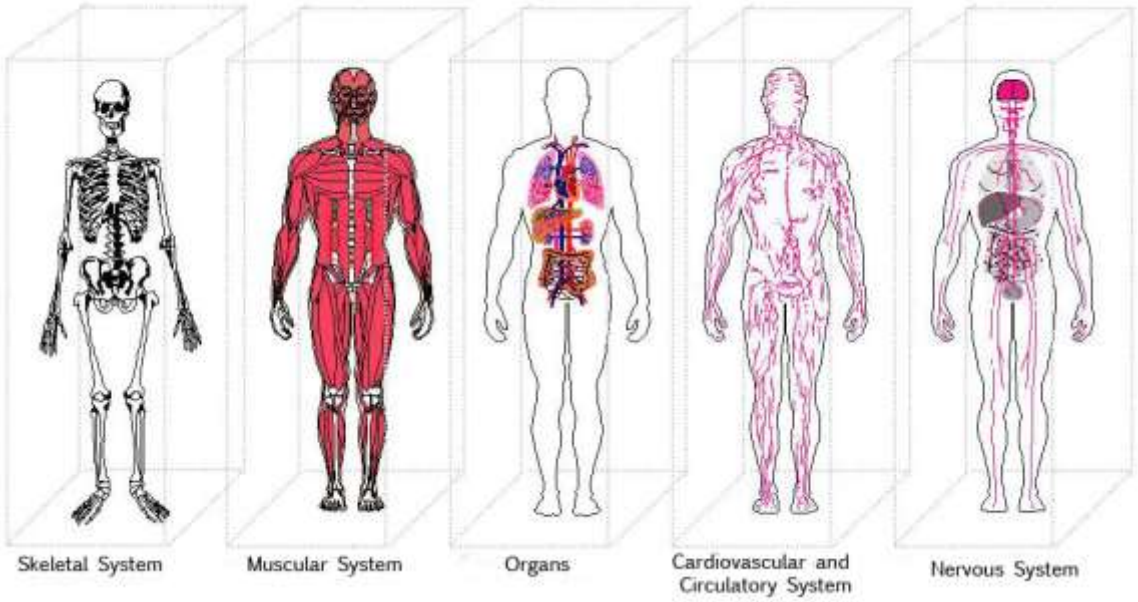


Figure 2: Biological Toxicity of Fluoride



The overall significance of the alarming increased incidence of disease in RoI compared to non-fluoridated NI clearly demonstrates the possibility of causality in the association between water quality and the impact of low level intoxication of the population with fluoridation chemicals and their role in the development of disease.[3] The findings when examined in light of the recommendations and observations of the NRC scientific committee clearly demonstrate, beyond any reasonable doubt, that fluoridation of drinking water is contributing to increased disease prevalence and mortality in the RoI.

It is apparent based on the disease prevalence among the population, that exposure to fluoridation chemicals in drinking water combined with fluorides and silicofluorides ability to increase the bioavailability of other harmful elements such as aluminium and lead, and fluorides competition and interaction with calcium, magnesium, iodine and other essential elements, that fluoride is a significant contributor to the disease burden in RoI. This impact is reflected most strikingly with the increased incidence of neurological diseases followed by increased disorders of the immune system, endocrine disorders, musculoskeletal disorders and cancer.

The potential and known contribution of fluoride to each of these diseases was previously examined by the NRC scientific committee who recommended wide ranging detailed toxicological and epidemiological investigations on fluoride and its impact on human health. To my knowledge public health authorities who promote fluoridation have never undertaken or investigated any of the critical important recommendations provided by the NRC.

All of the NRC recommendations were noted in my original report dated Feb 2012 and many of the serious and hugely significant concerns raised regarding fluoride/silicofluorides exposure and the current disease burdens present in Ireland were ignored and remain unanswered. Subsequent independent reports by this author submitted to the Minister for Health, Chief Medical Officer and the National Cancer Register Ireland addressing specific concerns regarding infant toxicity, cardiovascular health, cancer incidence, periodontal disease, neurological disease and other concerns have also remained unanswered.

The following sections of this report will address the principle findings and observations of the NRC Scientific committee under specific categories followed by specific information on the incidence of each disease in Ireland with comparisons to NI the UK and Europe. What is clearly evident however is that for each of the major categories, effects on the neurological, immune system, endocrine system and musculoskeletal system are profoundly compromised for people living in the RoI compared to NI.

The astonishing increased prevalence of disease in each of these categories unquestionably demonstrates beyond any reasonable doubt that increased exposure to fluoride both directly, from exposure to fluoridated water, and indirectly from contamination of the food chain amongst is contributing to the catastrophic disease burdens present in the population in the population of southern Ireland today.

The significance of increased fluoride exposure and its contribution to disease burdens and morbidity in the RoI should clearly have been identified and reported before now; the failure to do so raises serious questions regarding the Expert Body and other State agencies with responsibility for public safety, protection of the most vulnerable and the provision of safe drinking water.

This is particularly so given the obvious association between certain increased disease burdens present in the RoI and the known effect of fluoride toxicity on humans in particular the many preclinical stages of fluorosis such as arthritis, musculoskeletal pain as well as the mechanisms of the neurotoxicity of fluoride.

The lack of any attempt in the RoI to examine the disease and mortality burden in regard to exposure to fluorides and silicofluorides also raises many serious questions, not least that not a single epidemiological or risk assessment study has been undertaken in the five decades since commencement.

Furthermore the lack of examination or even consideration by public health bodies of the health implications of mass fluoride intoxication is deeply disturbing. Their inability and unwillingness to apply the precautionary approach to protect infants from overexposure to fluoridation chemicals or acknowledge, as other EU countries have done, that individual dietary exposure cannot be controlled when public drinking water is fluoridated, their dismissal of the potential of increased fluoride exposure contributing to a wide range of diseases is unscientific and presents a clear violation of the precautionary principle.

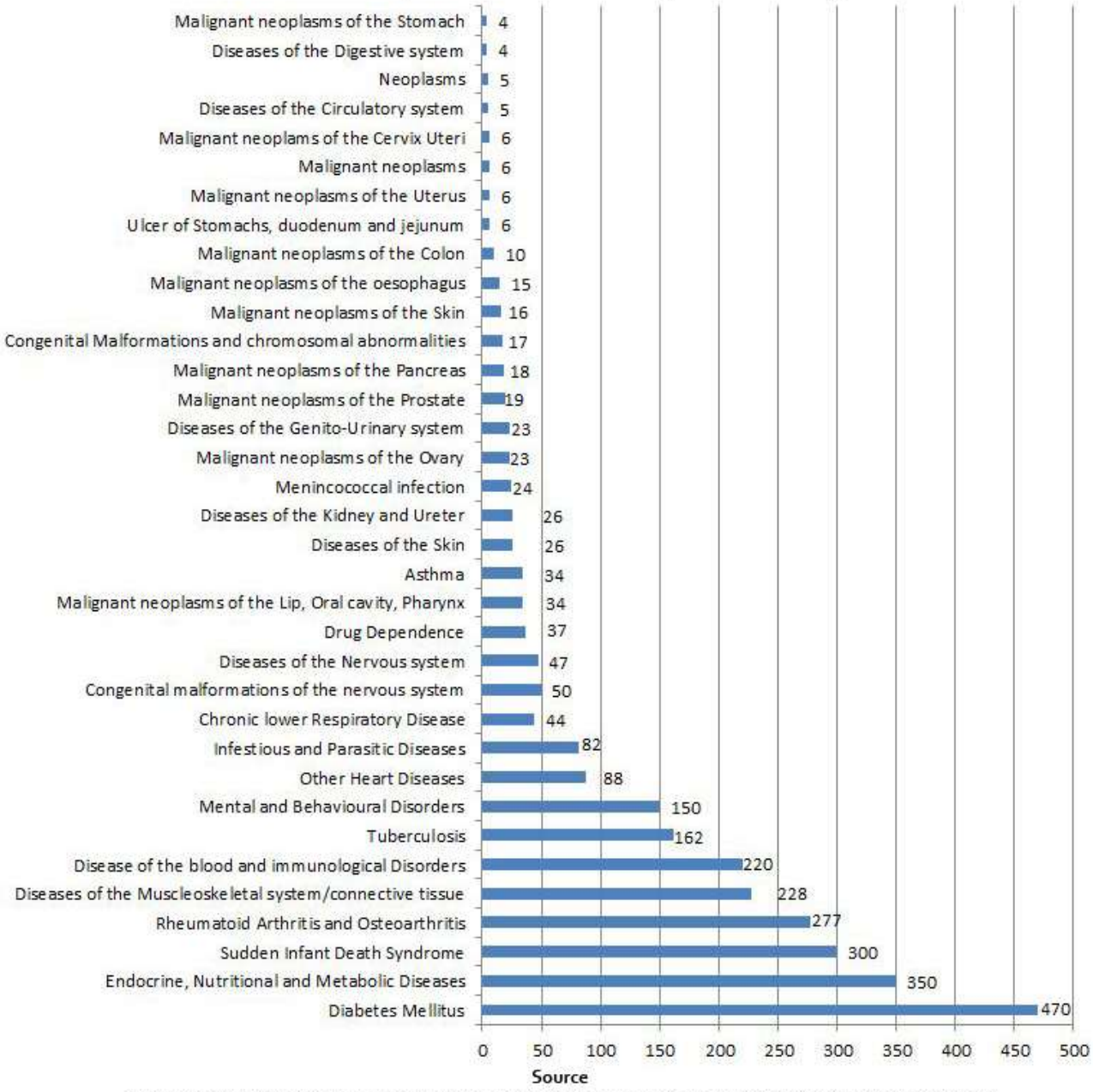
It is also alarming how the authors of two important All Ireland health studies examining cancer incidence[4], disease burdens and mortality[5] between the RoI and NI did not include or entirely overlooked fluoridation of drinking water and increased dietary fluoride exposure in the RoI as a key risk factor in the alarming and clearly identifiable increased burden of disease prevalent in ROI compared to NI. This is graphically illustrated in Figure 4 overleaf using data from the report published from the Institute of Public Health (2001).[6]

What is absolutely clear in the data is the alarmingly high mortality in the RoI for certain diseases that are directly related to fluoride exposure. The All Ireland Mortality study documents a significantly higher incidence of mortality for disease resulting from endocrine disorders, immune disorders, neurological disorders,

metabolic disorders, hormone related cancers, musculoskeletal diseases and bone diseases such as arthritis among the population of the RoI, compared to NI.

For example, mortality from diabetes was 470% higher, endocrine and metabolic disorders (350%) rheumatoid arthritis (277%) and diseases of the musculoskeletal system (228%) in the RoI compared to NI.

Figure 3. Increased Mortality for persons living in the Republic Of Ireland (Fluoridated) compared to Northern Ireland (Non-Fluoridated)



Source

(Inequalities in Mortality, A report on all Ireland Mortality data 1989-1998, Institute of Public Health 2001)

Based on the observations in the NRC report (2006) regarding fluoride and cancer[7] it is not surprising that the All Ireland Cancer Atlas (2011) clearly demonstrates significantly increased cancer prevalence in the RoI compared to NI.

The NRC (2006) scientific committee observed: *"fluoride has the potential to cause genetic effects as well as carcinogenic potential".*[8]

The authors of All Ireland Cancer Atlas report stated: *"The risk of developing many of the cancers presented was higher in RoI than in NI. The risk of non-melanoma skin cancer, melanoma, leukaemia, bladder, pancreas and brain/central nervous system cancers was significantly higher for both sexes in RoI. For men, the risk of prostate cancer was higher in RoI and, for women, cancer of the oesophagus and cervix."* Yet remarkably no mention was made of fluoride as a possible contributor to the increased cancer incidence.

Furthermore the authors concluded that: *"There was a marked geographical variation in the risk of some common cancers..— the most consistent geographical distribution of cancer risk was seen for three cancers (pancreas, brain/central nervous system and leukaemia) which showed an increasing gradient of risk from northeast to south-west."* The report documents that the risk for bladder cancer was up to 14% higher in the ROI, leukaemia up to 23%, Pancreatic cancer up to 22%, skin cancer up to 18%, prostate cancer 29%, oesophageal cancer up to 8%, brain cancer up to 20% and cancer of the cervix and uterus up to 11% higher compared to Northern Ireland. A previous report by the National Cancer Registry Ireland and Northern Ireland documented that the incidence of chronic lymphoblastic leukaemia was 53.5% higher for males and 53.1% higher for females in the RoI compared to Northern Ireland.[9]

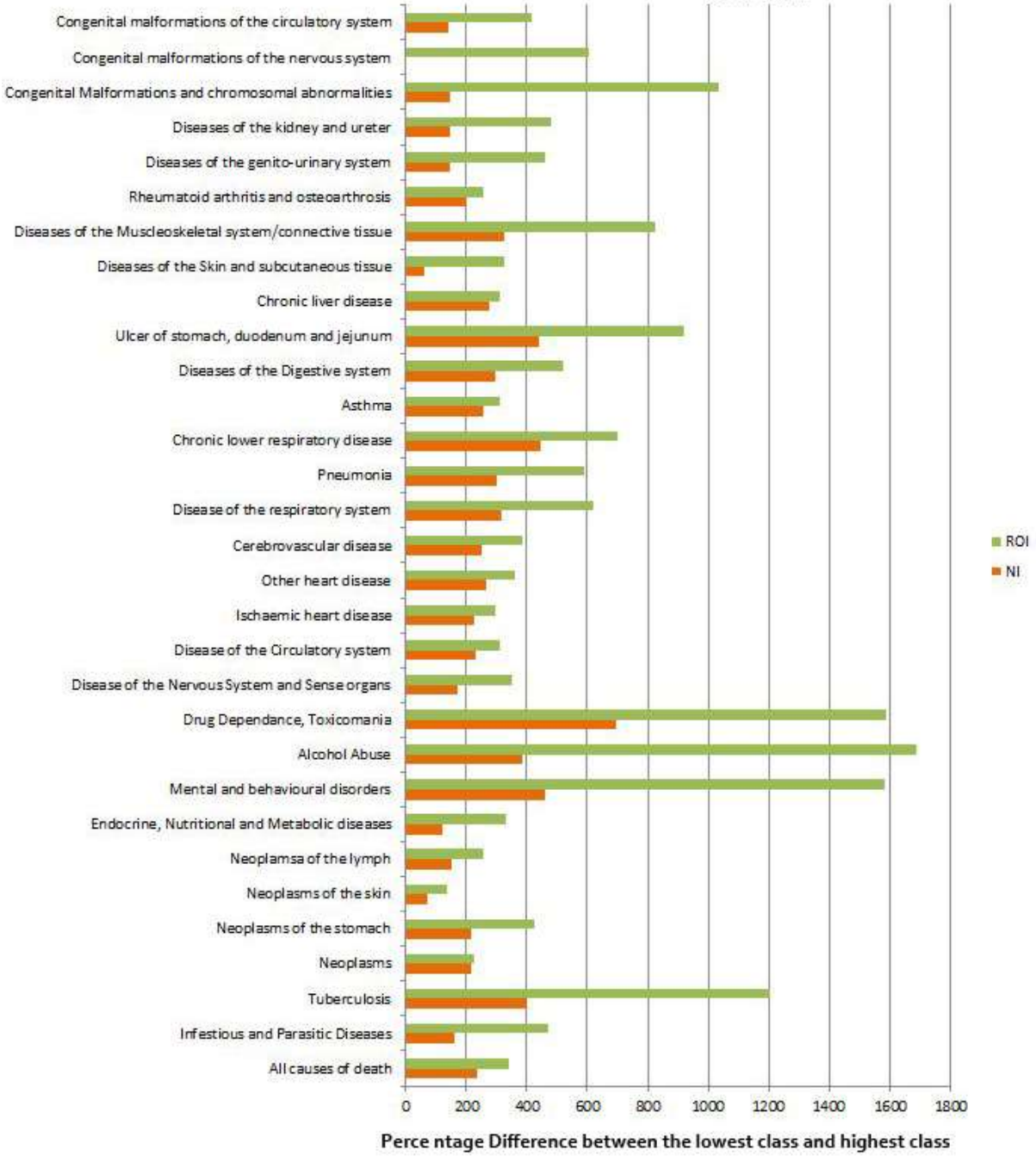
The lack of inclusion of fluoride as a risk factor is even more remarkable as systemic inflammation, immune dysfunction and immune cancers such as lymphoma and leukaemia in humans have been associated with EDC exposures.[10] It is also known that hormone related cancers such as prostate, pancreatic and uterus may be directly related to endocrine disruptor (EDCs) at low level doses.[11],[12]

The All-Ireland study by Balanda and Wilde[13] documented significantly increased mortality from these diseases in the RoI compared to NI. It is equally astonishing that although skeletal fluorosis has been studied intensely in other countries for more than 50 years, no research at all has been done in the ROI to determine how many people are afflicted with the earlier stages of the disease, particularly the preclinical stages such as arthritis and musculoskeletal pain.[14,15,16,17] Because some of the clinical symptoms mimic arthritis, the first two clinical phases of skeletal fluorosis could be easily misdiagnosed. [18,19,20] The late Dr. George Waldbott stated that the symptoms and severity of fluoride poisoning depend on an individual's age, nutritional status, environment, kidney function and susceptibility to allergies, and he also suggested most physicians know almost nothing about chronic fluoride poisoning and therefore they don't look for it.[21]

Social Inequalities, Disease Burdens and Mortality

Data from the Institute of Public Health All Ireland study[22] also provides a stark illustration on the variations in disease burdens based on socioeconomic status in both the RoI and NI. Figure 5 illustrates the percentage difference in mortality between the lowest income class and the highest income class for over 30 diseases in both regions.

Fig 4. The occupational class (lowest:highest) rate ratios for Northern Ireland and the Republic of Ireland
DIRECTLY STANDARDISED MORTALITY RATE RATIOS (1989-1998)

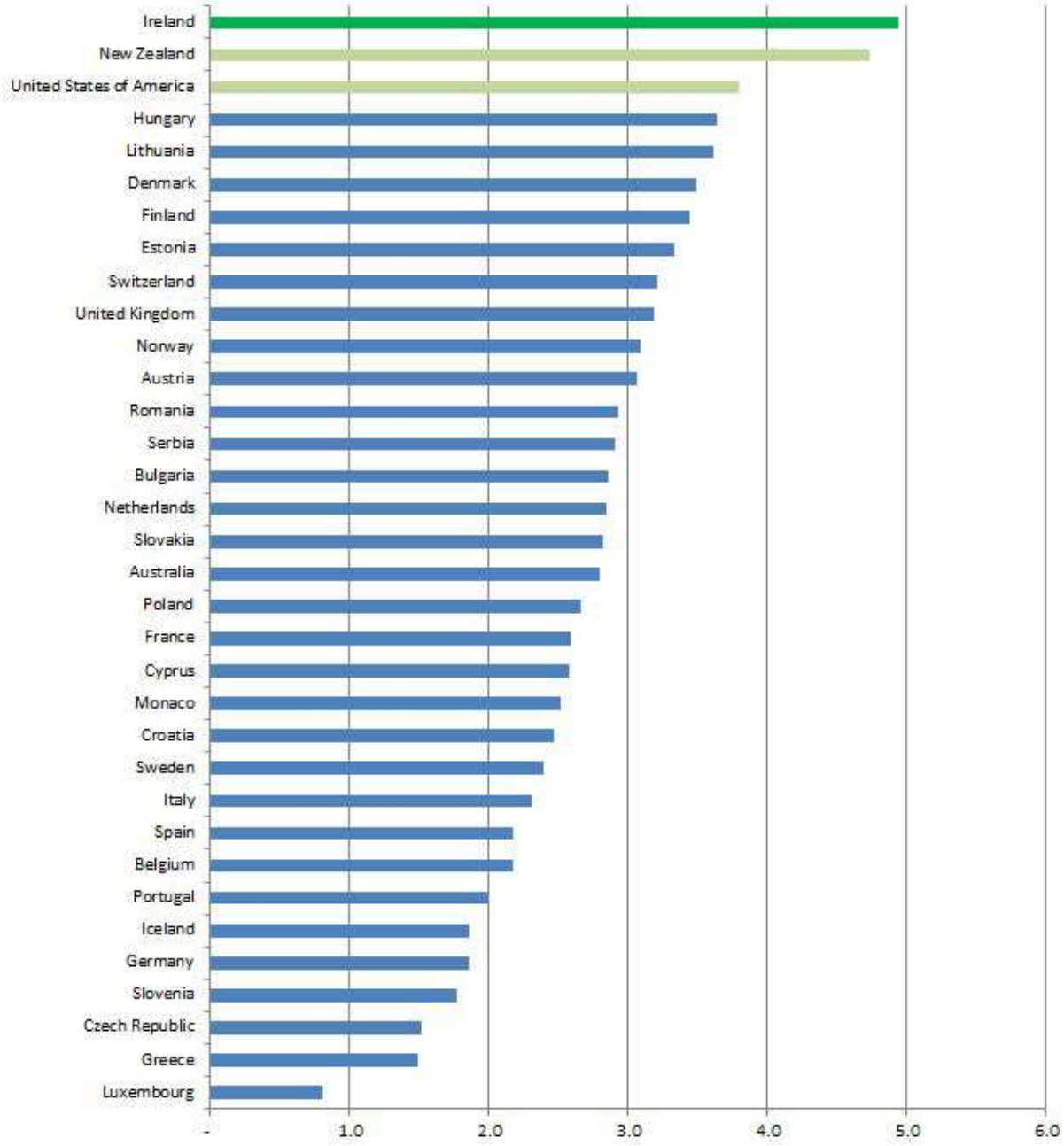


Source
(Inequalities in Mortality, A report on all Ireland Mortality data 1989-1998, Institute of Public Health 2001)

Deaths from drug dependence, alcohol abuse and mental disorders are over 1500% higher in the lower income groups in the RoI, the mortality rates are significantly higher than for a similar sub-group of the population in NI.

Deaths from tuberculosis, congenital malformations and chromosomal abnormalities are over 1000% higher in lower income groups in the RoI, followed by death from ulcers of stomach and disease of the musculoskeletal system at over 800% increased mortality. The RoI has the highest incidence of mortality from deaths from congenital disorders in the EU Region.

Figure 5. **Estimated Deaths per 100,000 of Population from Congenital anomalies WHO Department of Health and Information 2011**



The most common serious congenital disorders are heart defects, neural tube defects and Down's syndrome.[23] According to the WHO It is estimated that about 94% of serious birth defects occur in middle- and low-income countries, where mothers are more susceptible to macronutrient and micronutrient malnutrition and may have increased exposure to any agent or factor that induces or increases the incidence of abnormal prenatal development.

To my knowledge no study has ever been undertaken to examine if fluoride exposure combined with nutritional status may be a contributory factor to the alarming levels of congenital defects in fluoridated compared to non-fluoridated countries. As is evident from Figure 6 both New Zealand and Australia also have higher mortality from congenital defects compared to the EU region.

While variations in the classification of occupational classes may exist between NI and the RoI, it is accepted that the descriptions of the two highest and the two lowest occupational classes are similar.[24] Even allowing for differences in data gathering the increased mortality among the lower income groups in RoI compared to NI is very significant

In almost every disease category the difference in mortality rate in RoI between low income and high income is significantly higher in some instances over 1000% compared to NI. For all causes of death the mortality ratio for lower income groups to higher income groups is over 100% higher in the RoI compared to NI.

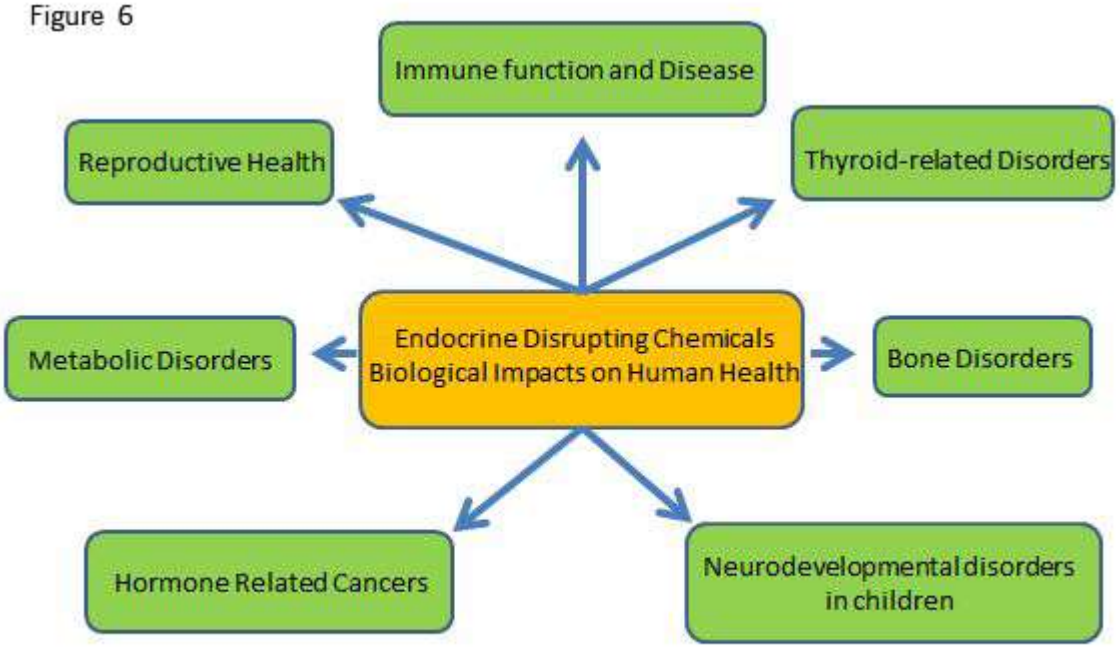
These are important facts to observe as distinguished medical physicians and scientists have found that lower income groups with poorer nutritional status are much more susceptible to fluoride toxicity and will have a higher burden of disease and mortality as a consequence of fluoridation of drinking water. [25,26]

Understanding the Variation in disease and Mortality

A recent scientific review by Vandenberg et al.[27] (2012) examining low dose exposures to endocrine-disrupting chemicals (EDCs) lists water fluoridation additives added to prevent dental caries as EDCs with reported low dose effects in animals or humans. The report documents that they inhibit insulin secretion, inhibit parathyroid hormone secretion and reduce thyroid hormone output. The review states that it is well established in the endocrine literature that natural hormones act at extremely low serum concentrations. The report highlights that the endocrine system is particularly tuned to respond to very low concentrations of hormone and that recent epidemiological studies reveal links between environmentally relevant low concentrations and disease prevalence. The review reports that there is also evidence that EDCs work additively or even synergistically with other chemicals and natural hormones in the body.

The report identifies the main areas of human health impacted by endocrine disrupting chemicals as outlined below.

Figure 6



Source: State of the Science of Endocrine Disrupting Chemicals – 2012
Inter-Organization Programme for the Sound Management of Chemicals

It is clearly evident on examination of the disease burden and variation in incidence and mortality between RoI and NI that each the disease burden in the RoI for the areas identified above is significantly higher compared to non-fluoridated NI.

The Vandenberg et al review states that the effects of hormones and EDCs are dependent on dose, and importantly, low (physiological) doses can be more effective at altering some endpoints compared with high (toxicological) doses. The study notes that low doses of EDCs are capable of altering organ morphology, physiology, and reproductive development. The review notes that that exposure to EDCs can influence the prostate, which may help explain the fact that Ireland has the highest incidence of prostate cancer in the world. It is acknowledged that direct acting EDCs interfere with some step in the mechanism of action of the normal hormone, for example by binding to the steroid hormone receptor or by altering subsequent downstream events in signal transduction. Indirect acting EDCs alter the rates of synthesis, secretion, transport, uptake, metabolism or clearance of the steroid hormone.[28]

A current publication on endocrine disrupting chemicals by international experts for the WHO and United Nations Environment Programme lists water fluoridation chemicals as low dose EDCs.[29]

The report highlights that a wide variety of developmental problems and common adult diseases and disorders are well-known to be caused by abnormal endocrine function. For example, diabetes is the result of a defect or defects in insulin action. Thyroid hormones control metabolic processes and coordinate these with the many hormones involved in appetite and body weight regulation and metabolism. The adrenal hormones control the various physiological responses to stress. Endocrine disruptors interfere in some way with hormone action, and in doing so can produce adverse effects on human health. Some of the findings of this report are extremely relevant to understanding the variations in both disease and mortality between the RoI and NI and include:

- Increased understanding of endocrine pathways governing female reproductive processes suggests that a role for EDCs in the multicausality of female reproductive dysfunction is biologically plausible.
- There is limited and conflicting experimental and epidemiological evidence to support a role for EDCs in advancing puberty and breast development and in causing fibroids
- There is more evidence from laboratory studies now than in 2002 that chemical exposures can interfere with endocrine signalling of pubertal timing, fecundity and fertility and with menopause.
- The strength of evidence supports a role for EDCs in disrupting thyroid function.
- There are some strong data sets showing that environmentally relevant developmental exposures to EDCs and potential EDCs have caused cognitive and behavioural deficits in humans.
- Increased evidence supports the involvement of thyroid hormone mechanisms in neurodevelopmental disorders in humans.
- Reduced thyroid hormones during pregnancy is also associated with reduced intelligence quotient, ADHD and even autism in children.
- Developing organs are particularly sensitive to alterations in hormone levels, and exposure to chemicals during critical windows of development may cause irreversible effects on the adrenal glands that may not be expressed until adulthood.
- Obesity, diabetes and metabolic syndrome are due to disruption of the energy storage–energy balance endocrine system and thus are potentially sensitive to EDCs.
- Because EDCs are disrupting many components of the endocrine system involved in controlling weight gain (adipose tissue, brain, skeletal muscle, liver, pancreas and gastrointestinal tract), these chemicals constitute a new class of endocrine disruptors called “obesogens”.

- Obesity is also correlated with type 2 diabetes, and chemicals that have been shown to cause obesity in animal models also result in altered glucose tolerance and reduced insulin resistance.
- Limited epidemiological data exist to support the notion that EDC exposure during pregnancy can affect weight gain in infants and children. Limited epidemiological data show that adult exposures to some EDCs are associated with type 2 diabetes.
- It is clear that EDCs can play a role in the development of immune-related disorders and are at least partially responsible for their rise in recent years.
- Systemic inflammation, immune dysfunction and immune cancers such as lymphoma and leukaemia in humans have been associated with EDC exposures.
- A wide variety of developmental problems and common adult diseases and disorders are well-known to be caused by abnormal endocrine function. For example, diabetes is the result of a defect or defects in insulin action.
- Endocrine disruptors interfere in some way with hormone action, and in doing so can produce adverse effects on human health.
- Fat development and weight gain is a good example of complex physiological systems that are influenced by endocrine disruptors. There are a number of endocrine disruptors that have been shown to affect weight gain, insulin sensitivity and glucose tolerance indicating a potentially important role for endocrine disruptors in the development of obesity type 2 diabetes and metabolic syndrome.
- The elements of the endocrine system that control weight gain and metabolism/energy expenditure include the adipose tissue, pancreas, GI tract, liver, skeletal muscle, bone and brain, and endocrine disruptors could specifically and directly affect each of these tissues by interfering with their various hormone systems.
- There is now data suggesting that exposure to some endocrine disrupting chemicals during pregnancy can lead to altered cholesterol metabolism, weight gain and type 2 diabetes in the offspring later in life.
- There is evidence that the obesity risk may begin early in life, during pregnancy, and in early childhood and that rapid weight gain, in the first few months of life, is associated with obesity later in life.
- Because obesity is an endocrine-related disease/dysfunction, it is potentially sensitive to endocrine disrupting chemicals.
- In humans, there is growing epidemiological evidence that adult exposures to EDCs may contribute to the development of type 2 diabetes
- The effects of exposure to endocrine disruptors during development will remain throughout life, due to their effects on programming of cell differentiation and tissue development, resulting in a tissue that has a different predisposition for disease in adulthood to that of a non-exposed tissue.
- Sensitivity to endocrine disruption is highest during tissue development; developmental effects will occur at lower doses than are required for effects in adults.

- Many immune disorders are deeply rooted in the endocrine system and, therefore, inappropriate activation or inactivation of select endocrine pathways may aberrantly disturb the balance of the immune response.
- EDCs have been linked with disorders of metabolism, energy balance, thyroid function and reproduction, as well as an increased risk of endocrine cancers.
- The immune system plays an important role in osteoporosis, which often arises from estrogen deficiency and secondary hyperparathyroidism. It is possible that exposure to EDCs may influence the development of osteopenia and osteoporosis.
- The developing and neonatal immune response is easily affected by EDCs, and disruption during critical windows of development may have detrimental long-term consequences.
- Developmental immunotoxicity (DIT) caused by EDC exposure may be one early-life immune insult that could cause lifelong effects on immunity and the overall health of exposed individuals.

It is now also considered that commercial silicofluorides chemicals such as those used for water fluoridation are likely to be contaminated with fluo siloxanes.[30] Fluo siloxanes are classified by Health Canada and Environment Canada as toxic, persistent, and having the potential to bio-accumulate in aquatic organisms.[31,32] The European Union has classified siloxanes compounds as endocrine disruptors based on evidence that it interferes with human hormone function and a possible reproductive toxicant that may impair human fertility. [33,34] In laboratory experiments, exposure to siloxane has been shown to cause uterine tumours and harm to the reproductive and immune systems. Importantly they are also known to influence neurotransmitters in the nervous system.[35]

It is also important to reference a more recent scientific peer reviewed report (2009) which found that fluoride exposure impairs glucose tolerance via decreased insulin expression and oxidative stress.[36] It should also be noted that glucose intolerance is often a gateway to developing type 2 diabetes according to the International Diabetes Federation and that thyroid disorders remain the most frequent autoimmune disorders associated with type 1 diabetes.

What this report has identified is that the impact of low dose EDCs such as water fluoridation chemicals are particularly insidious and are often overshadowed by coexisting health problems, or the symptoms are incorrectly attributed to aging or some other cause. Causal inference is not done directly from the epidemiological study results; instead, it is done via combining information from the epidemiological observations with findings from the detailed studies of pathways and animals.

This study clearly demonstrates that there is sufficient evidence to conclude from a wide range of human health endpoints that fluoridation of public water supplies clearly has resulted in increased fluoride exposure of the population in the RoI with wide ranging adverse effects on health. This evidence will be examined in greater detail in the following sections.

Fluoride intake

According to the EFSA while the intake of fluoride from water can be estimated with some certainty, an estimation of fluoride intake from other sources will vary significantly based on individual habits and health status. For example, exposure to fluoride from pharmaceutical drugs, consumption of tea or other fluoridated beverages such as fruit drinks, beer or stout produced using fluoridated water, smoking and consumption of processed foods or fish. The EFSA found that there is no reason to suppose that fluoride available from food, including fluoridated salt and beverages, and other sources has a different effect on maturing enamel than fluoride from water and that there is no real threshold value for a fluoride intake which is not associated with the occurrence of dental fluorosis in the population.[37]

The 2006 Report of the National Research Council of the National Academy of Sciences designated kidney patients, diabetics, athletes, seniors and babies as 'susceptible sub-populations' that are especially vulnerable to harm from ingested fluorides.

Furthermore the United States Public health Service has warned that: *"segments of the population are unusually susceptible to the toxic effects of fluoride. They include "postmenopausal women and elderly men, pregnant woman and their foetuses, people with deficiencies of calcium, magnesium and/or vitamin C, and people with cardiovascular and kidney problems."*[38]

The EFSA also noted[39] that within Europe *"The total daily intake of fluoride from all sources can range from the low intake of 0.5 mg/day from solid foods, milk, beverages and low-fluoride water reported for Germany when no fluoridated salt is used, no fluoride containing dentifrice is used and no supplements are taken, to the moderate amount of 1.2 mg/day reported for the United Kingdom If fluoridated salt would be used 0.5-0.75 mg fluoride would be added, if fluoridated water was drunk (1 mg/L) and used for the preparation of food and tea (1-2 L of water/day; 500 mL of tea with a fluoride concentration of 5 mg/L) 3.5 to 4.0 mg fluoride would be added. The sum could be 6.0 mg fluoride per day, without fluoride from toothpaste taken into account."* The EFSA noted that *"even more extreme scenarios are possible"* as is clearly evident in Ireland with the Irish Population being the highest consumers of tea within the EU. The ESFA further observed that fluoride exposure will result from pharmaceutical medications many of which contain fluoride

and recommended that *"More reliable data on total daily fluoride intake and the identification of the main sources of fluoride, particularly in young children, are needed."*

No database is available providing fluoride content of beverages, foodstuffs or medications in Ireland.

According to a recent study by N Gouri Pratusha et al, at birth infant serum fluoride levels are approximately 75% of maternal levels. [40] Fluoride ions are incorporated into bone (of the developing infant) substituting hydroxyl groups in the carbonate-apatite structure to produce flurohydroxyapatite, thus altering the mineral structure of the bone. Fluoride is a chemically active ionized element, it may affect oxygen metabolism and induce oxygen free radicals which appears to play a role in diminishing cognitive ability processes such as learning and memory. Exposure to fluoride can manifest several changes in two key organs involved in metabolism and excretion which are liver and kidney respectively. Liver is one of the target organs attacked by high amounts of fluoride given by drinking water. As a very active site for metabolism, the liver is especially susceptible to fluoride intoxication. Studies have shown that fluoride can induce excessive production of oxygen free radicals leading to the decrease in biological activities of some substances, such as catalase (CAT), superoxide dismutase (SOD) xanthine oxidase (XOD), and glutathione peroxidase (GSH-Px) which play important roles in anti-oxidation and eliminating free radicals. Secondly fluoride, can also disturb the metabolism of proteins. It is indicated that fluoride can impair the activities of a series of enzymes such as alkaline phosphatases, cholinesterase and adenylate cyclise. Fluoride can interfere with the metabolism of carbohydrate, lipid and nucleic acids, injure immune system and damage various parts of the body. The authors of this study further highlight that several functional and structural dose and time related changes might be associated with ingestion of fluoride. The fluxes of water, sodium, potassium, protons and other ions increase sharply, mucus secretion increases, followed by patchy or widespread loss of the mucus layer. Surface mucus cells are shed; parietal and chief cells which lie deeper in the gastric pits are injured or shed.[41]

This supports the findings of a recent study[42] which demonstrated that fluoride exposure damaged histological structure in gastric mucosa, due to the formation of hydrofluoric acid (HF) in the stomach. Following fluoride ingestion the highest concentration of HF in the body is found in the stomach. A similar study by Easmann RP et al. found that fluoride exposure produced a much greater degree of damage and cell loss than that from naturally occurring hydrochloric acid, a strong acid that helps to break down food in the stomach.[43]

To put this in context, by adding fluoridation chemicals to public water supplies the state is indirectly responsible for exposing the population to hydrofluoric acid.

In the EU, hydrofluoric acid is classified in acute toxicity category 1 (which stands

for the highest hazard).[44] It is classified as very toxic according to directive 97/548/EEC or 1999/45/EC and classified as a dangerous chemical according to EC regulation 1272/2008 (CLP). The HF hazard is due to the double presence of H+ and F- in an acidic medium. The chemical materials data safety sheet for HF states that while toxicological data is sparse *"absorbed fluoride can cause metabolic imbalances with irregular heartbeat, central nervous system depression, seizures, and deaths. Long-term exposure may cause osteofluorosis (weakened bone structure), skin disorders, and respiratory, liver and kidney effects. To the best of our knowledge, the chronic toxicity of this substance has not been fully investigated."* It is also noted that repeated or prolonged exposure to the substance can produce target organs damage and that repeated exposure to a highly toxic material even at low doses may produce general deterioration of health.[45]

According to world-renowned D.r A K Susheela Professor of Anatomy (Histocytochemistry) and Chief of the Fluoride and Fluorosis Research Laboratories, at the All India Institute of Medical Sciences, New Delhi and executive director of the Fluorosis Research and Rural Development Foundation in India, *"when we consume fluoridated water hydrofluoric acid is created in the stomach which is highly corrosive and damaging, it destroys the lining of the stomach and intestine. Fluoride inhibits the enzymes that produce the mucus in the globet cells. When you microvilli in the lining is gone, you will not absorb nutrients no matter what food you consume."*[46]

The major function of intestinal goblet cells and their main secretory product, mucin, is the formation of mucus layers which serve as the front line innate host defense mechanism. The mucus layer overlying the epithelium secreted by the goblet cells promotes the elimination of gut contents and provides the first line of defense against physical and chemical injury caused by ingested food, microbes and the microbial products.[47]

Professor (Dr) A.K. Susheela who has researched fluoride for more than 20 years, has listed a range of health issues linked to fluoride ingestion, she has more than 80 scientific publications in leading Western and Indian Journals in which it has been demonstrated that fluoride destroys muscle structure and muscle function, depletes muscle energy; destroys the bone and teeth, red blood cells, blood vessels and the lining of the stomach and intestine. The published findings also observed that gastro-intestinal complaints are the earliest manifestations of fluoride toxicity and fluorosis including pain in the stomach, gas formation in the stomach (bloated feeling); constipation and intermittent fermentation diarrhea, nausea and loss of appetite. Many if not all of these conditions are extremely prevalent in infants, especially bottle fed infants.

A study by Scariati PD et al. in fluoridated United States of America compared exclusively breastfed infants, with infants who were exclusively formula-fed and

found that bottle fed infants had an 80% increase in their risk of developing diarrhea.[48]

A study by W Oddy et al. in fluoridated Western Australia found that predominant breast feeding for at least six months and partial breast feeding for up to one year may reduce the prevalence and subsequent morbidity of respiratory illness and infection in infancy.[49]

A study by Dewey KC et al. in the U.S observed that the increase in morbidity associated with bottle feeding in infants is of sufficient magnitude to be of public health significance.[50]

A study by Cushing AH et al. in the U.S. confirmed that bottle feeding significantly increased the incidence and duration of respiratory illness during the first 6 months of life.[51]

Scariati PD et al. in another U.S study demonstrated that infants who were exclusively formula-fed had a 70% increase in their risk of developing an ear infection when compared with exclusively breastfed infants.[52]

Levine OS et al. in a U.S study found that bottle feeding was associated with a increased likelihood of invasive pneumococcal disease. Invasive pneumococcal disease includes bacterial infection of the blood, meningitis and pneumonia.[53]

Davis, M.K. examined the incidence of childhood cancers in bottle fed infants compared to breast fed babies in fluoridated Denver Colorado and concluded in a study published in the Lancet that bottled fed infants are at an increased risk of developing cancer before age 15. The risk of artificially fed children was 1-8 times that of long-term breastfed children. The study concluded that this increased risk was largely due to an increased incidence of lymphoma.[54]

It has also been reported that bottle fed infants compared to exclusively breastfed during their first three months of life had a 34% higher risk of developing diabetes than those who were not breastfed. Children given cow's milk-based formula in their first three months were 52% more likely to develop insulin-dependent diabetes mellitus than those not given cow's milk formula.[55]

A recent U.S. study concluded that bottle fed infants had an increased incidence of infectious morbidity, including gastroenteritis, and pneumonia, as well as elevated risks of childhood obesity, type 1 and type 2 diabetes, leukemia, and sudden infant death syndrome (SIDS).[56]

A similar study in the peer reviewed U.S journal of Obstetrics and Gynecology concluded that formula feeding is associated with adverse health outcomes for infants, ranging from infectious morbidity to chronic disease.[57]

It is astonishing however that none of the studies noted above ever considered to include exposure to fluoride as a confounding factor in their investigations.

A current major ongoing research project in University College Cork is investigating children from before birth (3000 plus infants) and subsequent development examining prenatal and postnatal development, the incidence and prevalence of food allergy, eczema and disease in early childhood and the incidence and effect of maternal and infant vitamin D status on health and growth.[58] My own infant child is participating in this study and despite peer reviewed published scientific studies demonstrating intolerance among the population to fluoride including eczema (a fact accepted by the NRC scientific committee), exposure to fluoride is not even examined in the long list of questions that parents are required to complete as part of this study. I have sought for two simply questions to be included in this study (do you use tap water for bottle feeding and are you on a private well, community water scheme or public water supply-the latter being fluoridated) in order to control for such confounding factors but my request was denied.

While the increased risk of chronic disease and mortality for bottle fed infants is now accepted internationally, to my knowledge no study has ever been undertaking in any country that practices artificial fluoridation to examine the chronic fluoride overexposure of bottle fed infants and its potential contribution to childhood illness and morbidity.

One can in such instances only compare the incidence of SIDs in fluoridated and non-fluoridated countries, as has been undertaken in this report to determine if there exists a greater incidence of SIDS in fluoridated countries.

As noted earlier in Figure 1 the incidence of SIDs in non-fluoridated Northern Ireland was found to be 300% less than fluoridated RoI.

Fluoride Intolerance

The NRC scientific Committee (2006) found that *"The possibility that a small percentage of the population reacts systemically to fluoride, perhaps through changes in the immune system, cannot be ruled out"* and noted that *"Perhaps it is safe to say that less than 1% of the population complains of GI symptoms after fluoridation is initiated".* The NRC also highlighted the fact that the numerous fluoridation studies in the past have failed to rigorously test for fluoride sensitivity amongst the population.

A European study conducted by a team of clinical medical physicians in the

Netherlands using double blind clinical methodologies documented that that certain individuals are intolerant to fluoride and reproducibly developed gastrointestinal symptoms with pains in the epigastric area and in the bowels; nausea; vomiting; diarrhea alternating with constipation; and symptoms attributable to the neuromuscular system, namely headaches, paresthesias, muscular fibrillation, pains in arms and legs, and arthritis in the spinal column as well as skin disorders such as (urticaria), inflammation oral cavity (stomatitis), visual disturbances and excessive thirst (polydipsia).[59] The findings of this public health study ultimately resulted in cessation of water fluoridation in the Netherlands in 1973.

A study conducted in Finland[60] similarly reported that the significant decrease in certain medical ailments post cessation of fluoridation would favor the view that a *"segment of the population may have some kind of intolerance to fluoride."*

Feltmann and Kosel[61] undertook a 14 year study of prenatal and post natal ingestion of fluorides which was published in the Journal of Dental medicine in 1961. This extensive study found that a percentages of patients reacted adversely to fluoride exposure. These reactions, particularly affected gravid women (late pregnancy) and in children of all ages affecting their dermatologic, gastro-intestinal and neurological systems. Eczema, atopic dermatitis, urticaria, epigastric distress, emesis and headaches all occurred with the use of fluoride and disappeared upon the use of placebo tablets, only to reoccur when fluoride was unknowingly given to the patient.

The clinical syndrome has been presented in several other publications which has been attributed to total fluoride intake from water[62,63,64] and food.[65,66]

The NRC scientific committee considered that it may be possible that certain individuals may be hypersensitive to fluoride and noted the lack of detailed public health epidemiological studies undertaken to investigate this phenomenon or how fluoride in drinking water can affect immune responses.

The link between chemical intolerance disease prevalence and comorbidity was recently heighted in a major study by Katerndahl et al.[67] where they found that between 13% and 33% of people in various populations report considering themselves to be “unusually” sensitive to certain common environmental chemicals. Symptoms were typically multisystem, that is, affecting cognitive, affective, musculoskeletal, gastrointestinal, genitourinary, and cardiovascular systems.

Apart from the debate over causality, chemical intolerance to fluoride holds particular relevance to health burdens and morbidity present in Ireland today. Patients who are chemically intolerant use health care services at increased rates (making an average of 23.3 visits to a medical professional per year).[68] In addition, chemical intolerance is associated with poor quality of life and functional impairments leading to loss of employment and socioeconomic hardships.[69, 70, 71] It is also associated with more medication prescriptions,[72] greater use of physicians and hospitals after exposures,[73] and more visits to environmental specialists.[74]

Previous studies show that persons meeting various criteria for MCS or the less severe, more common chemical intolerance also have increased rates of certain medical and psychiatric conditions. Comorbid diagnoses include heart problems,[75] bronchitis,[76] asthma,[77] pneumonia,[78] rhinitis,[79, 80] sinusitis,[81] hypothyroidism and other autoimmune diseases,[82, 83] irritable bowel syndrome,[84] migraine,[85] fibromyalgia,[86, 87, 88, 89] and chronic fatigue syndrome.[90, 91, 92, 93]

Other studies report associations with panic disorder,[94, 95] major depression,[96, 97, 98] and childhood hyperactivity.[99, 100] A substantial subset of affected individuals also report multiple food intolerances,[101,102,103] and several studies have demonstrated food triggers in a subset of children with attention-deficit/hyperactivity disorder (ADHD), migraine, and epilepsy,[104, 105, 106, 107, 108, 109] as well as adults with schizophrenia.[110,111]

Apart from etiology, elevated levels of subjective mental distress (e.g., somatization, anxiety, depression) are a major factor in increasing health care use across diagnoses in the general population.[112, 113] Persons with chemical intolerance score higher on scales measuring somatization, anxiety, and depression.[114,115]

Katerndahl et al[116]. evaluated comorbid medical and psychiatric disorders, functional status, and rates of health care use and found that 20.3% of the their sample patients met criteria for chemical intolerance. The chemically intolerant group reported significantly higher rates of comorbid allergies and more often met screening criteria for possible major depressive disorder, panic disorder, generalized anxiety disorder, and alcohol abuse disorder, as well as somatization disorder.

The total number of possible mental disorders was correlated with chemical intolerance scores ($P < .001$). Controlling for demographics, patients with chemical intolerance were significantly more likely to have poorer functional status, with trends toward increased medical service use when compared with non–chemically intolerant patients. After controlling for comorbid psychiatric conditions, the groups differed significantly only regarding limitations of social activities.

The researchers concluded, that the evidence suggests that chemical intolerance may be an important yet unrecognized contributor to the clinical presentation and use patterns of patients in primary care.[117]

Overall these findings, taken in the context of the alarmingly increased disease prevalence (Figure 1) and morbidity (Figure 3) in the ROI compared to non-fluoridated Northern Ireland, are very significant.

Chronic Disease Prevention in Babies

The term Tolerable Upper Intake Level is defined as the maximum level of total chronic daily intake judged to be likely to pose no risk of adverse health effects to the most sensitive members of the healthy population.

Like all chemical agents, fluoride can produce adverse health effects if intakes from any combination of food, water, nutrient supplements, and pharmacologic agents are excessive.

No tolerable upper limit for fluoride has been established for infants up to 6 months. Nevertheless the very low fluoride intake of breast-fed infants which is about 0.01 mg/day is defined as the adequate intake for age 0-6 months by the FNB.[118]

According to the European Food Safety Authority[119] if formula milk were prepared with fluoridated drinking water the fluoride intake of babies would be in the region of 0.18mg/kg. This is one hundred and eighty percent above the recommended adequate intake level as recommended by the FDA for infants, eighty percent above the tolerable upper intake level for children up to eight years of age (0.1mg/kg/body weight/day) and fifty percent above the Tolerable Upper Intake Level for fluoride for an adult (0.12mg/kg/day).

The World Health Authority drinking water guidelines specify that the Tolerable Daily Intake (TDI) from all sources including drinking water should not be exceeded.[120]

The WHO identify that a specific subpopulation, in particular bottle fed infants, that are at greater risk from a substance than the rest of the population due to high exposure. They also identify that some genetic subpopulations may show greater sensitivity to particular toxicity. This would include children with Downs syndrome.

The WHO note that "if the potential exposure from drinking water in an incident is greater than the Tolerable Daily Intake or exposure is likely to be extended beyond a few days, then this would require consideration in conjunction with health authorities, In such circumstances, it may be possible to target action to avoid exposure at the specific group concerned, such as supplying bottled water for bottle fed infants." Alternatively, the WHO recommend that "such steps can be used on a household basis to reduce exposure and allow the continued use of the supply without interruption."

In light of these recommendations it is alarming that in the RoI all bottle fed infants consuming formula milk made from fluoridated tap water exceed the upper TDI established as the chronic daily intake of fluoride for a healthy adult, and do so for the first twelve months of life.

A recent peer reviewed paper in the *International Research Journal of Pharmacy* concluded[121] that; *"The presence of fluoride in drinking water could have deleterious consequences on the physiological system. Skeletal and dental toxicity was most common because of fluorides, however soft tissues could also be affected with damage by fluoride. Care and precaution should be advocated in growing children consuming fluoride containing drinking water in order to minimize fluoride related disabilities"*

In this context is clearly evident that the Department of health and the Irish Expert Body on Fluoride and Health have been negligent in not protecting the most vulnerable in our society from chronic overexposure to fluoride at their most sensitive period of development. It is equally disturbing that they have not warned parents of the dangers of overexposure from using fluoridated tap water in making formula feed.

The World Health Organization (WHO) has advised[122] that there is increasing evidence that chronic disease risks begin in fetal life and continue into old age. Adult chronic disease, therefore, reflects cumulative differential lifetime exposures, none more so than chronic overexposure for fluorides from fetal development through childhood. The WHO acknowledge that the weight of current evidence indicates adverse effects of formula milk on cardiovascular disease risk factors; this is consistent with the observations of increased mortality among older adults who were fed formula as infants. This risk is clearly compounded by the addition of silicofluorides to drinking water as previously addressed in my report *Human Toxicity, Environmental Impact and Legal Implications of Water Fluoridation.*

Similarly, the WHO have acknowledge that the risk for several chronic diseases of childhood and adolescence (e.g. type 1 diabetes, coeliac disease, some childhood cancers, inflammatory bowel disease) have also been associated with infant feeding on breast-milk substitutes and short-term breastfeeding. These risks are also clearly compounded by the addition of silicofluorides to drinking water as previously addressed in my report *Human Toxicity, Environmental Impact and Legal Implications of Water Fluoridation.* This will be addressed later in this report under the heading endocrine disruptors.

The WHO reported[123] that a recent review by the International Agency for Research on Cancer (IARC) in Lyon, France, concluded that there was clear evidence of a relationship between onset of obesity (both early and later) and cancer risk[25]. Other risk factors are continually being recognized or proposed. These include the role of high levels of homocysteine as noted by the WHO. These risks are clearly compounded by the addition of silicofluorides to drinking water as scientific studies have found fluoride to be an inhibitor of homocysteine metabolism, resulting in increased levels of homocysteine in the body. These concerns were addressed in detail in my previous report *Human Toxicity, Environmental Impact and Legal Implications of Water Fluoridation* but no comment on any of the specific health concerns raised was recorded by the Irish Expert Body or Minister for Health.

Fluoride intake of Babies

The NRC noted that a baby drinking fluoridated formula *receives the highest dosage of fluoride among all age groups in the population* (0.1-0.2+ mg/kg/day), whereas a breast-fed infant receives the lowest.

Ireland has the highest incidence of bottle fed babies in Europe. At three months of age less than 23% of babies are breast fed in Ireland compared to the European average of over 70%. At six months of age less than 10% are breast fed compared to the European average of over 40%.[124]

The NRC reported that the total fluoride intake for formula fed babies using fluoridated water (up to 6 months in age) is substantially higher than for breast fed babies (up to186 times greater). For children aged 7 months to 4 years the scientific committee reported that the total fluoride intake from food, water and household products (excluding medication) may be up to 3.5 times higher for children in fluoridated areas compared to non-fluoridated areas.

The NRC also found that when body weight is taken into account, non-nursing infants receiving formula made with water fluoridated who are less than one year old are exposed to a fluoride intake on average of about three times that of adults.[125] The adequate intake of fluoride for infants aged from 0-6 months, as defined by the Food and Nutrition Board (FNB) Institute of Medicine of the National Academies, is 0.01mg/l.[126]

It is an absolute certainty that all bottle-fed infants in Ireland less than 6 months of age bottle-fed with formula reconstituted from fluoridated water would exceed by multiples this recommended level. It is also evident, as noted by the U.S. Agency for Toxic Substances and Disease Registry (ATSDR), that damage may not be evident until a later stage of development. The agency reported in their toxicological profile of fluorides that children also have a longer remaining lifetime in which to express damage from over-exposure to such chemicals; this potential is particularly relevant to cancer.[127]

Neither the Irish nor European Food Safety Authority (EFSA) has established a safe dietary Upper Limit for fluoride for infants, who represent the most sensitive sub-group to fluoride exposure. The EFSA however, clearly observed that infants who consume powered formula milk will exceed the maximum limit set for infant formula established by the EU Scientific Committee on Food, if water containing more than 0.7 mg/L is used for its preparation. The upper fluoride limit for fluoridated drinking water in Ireland is 0.8mg/L and boiled fluoridated tap water will have a higher concentration than water delivered from the tap.

The *Journal of Public Health Dentistry* reported that more than 50 per cent of infants in North America are formula fed by one month of age and these infants are likely to be exposed to high levels of fluoride for nine of ten months. [128]

The prevalence for bottle feeding is higher in Ireland with up to 97% of infants fed powered formula at 6 months of age. This is to be expected as Ireland has the lowest prevalence of breast feeding in the world.

In Europe parent and infant carers are been advised that a major effort should be used to avoid the use of fluoridated water for dilution of formula powers. In addition when economical feasible young infants fed formulas prepared from concentrated liquids should have these formulas made up with non-fluoridated water.[129] Similar warning have been provided in North America

While the optimum intake level of fluoride for infants has yet to be determined scientifically the EU Scientific Committee on Food has recommended a maximum fluoride level of 0.6-0.7 mg/L in infant formula and follow on formula, equivalent to an intake of about 0.1 mg/kg body weight per day in infants during the first six months of life (body weight 5 kg). At current fluoride levels in drinking water in Ireland all bottle fed babies will exceed the maximum upper recommended fluoride level when fluoridated tap water is used to constitute formula milk. It is also a scientific fact that boiling water increases the concentration of fluoride, contributing to further exceedances of the safety standard.

Importantly the European Food Safety Authority (EFSA) noted that with regard to the fluoride content of drinking water, that if Formula milk were prepared with water containing 0.3 mg fluoride/L and a 5-kg infant drinks 800 mL, fluoride intakes of 60 ug fluoride/kg body weight/day would result.[130] Alarmingly the EFSA highlight that the use of fluoridated drinking water would considerably increase the fluoride intake threefold.[131] This means that the fluoride intake would be approximately 180ug fluoride/kg body weight/day. The maximum upper limit for adults is 120ug fluoride/kg body weight/day. The EFSA reported that in infants up to 90% of consumed fluoride is retained in the body of infants within the bone, calcified ligaments and organs such as the pineal gland while healthy adults retain 50% of dietary fluoride intake.

The UL for adults is based on this medical fact. For infants therefore the actual exposure to fluoride and its toxic actions on biological systems would be in the region of twice the maximum UL established as safe for a healthy adult. In addition to the direct exposure from fluoridated water the EFSA also noted that fluoride containing drugs can amount up to 70% of the estimated reasonable maximum dietary exposure value in both infants and young children. Furthermore the EFSA further determined that use of fluoridated water to cook food may increase the fluoride content of all food by at least 0.5 mg/kg, this includes baby infant foods.[132] As a consequence of water fluoridation the vast majorities of babies in Ireland have been and continue to be directly exposed to prolonged and uncontrolled intake of fluoride above the maximum tolerable level established as safe for healthy adults.

Fluoride as a Developmental Endocrine Disruptor

A recent scientific review by Vandenberg et al.[133] (2012) examining low dose exposures to endocrine-disrupting chemicals (EDCs) lists water fluoridation additives added to prevent dental caries as EDCs with reported low dose effects in animals or humans. The report documents that they inhibit insulin secretion, inhibit parathyroid hormone secretion and reduce thyroid hormone output.

A current publication on endocrine disrupting chemicals by international experts for the WHO and United Nations Environment Programme also lists water fluoridation chemicals as low dose EDCs.[134]

The report highlights that exposures to EDCs and potential EDCs can cause cognitive and behavioural deficits in humans, the report further highlights that studies have demonstrated that exposure to EDCs during early development have been shown to result in weight gain, revealing the possibility of an origin for obesity early in development. According to the authors of the report because EDCs are disrupting many components of the endocrine system involved in controlling weight gain (adipose tissue, brain, skeletal muscle, liver, pancreas and gastrointestinal tract), these chemicals constitute a new class of endocrine disruptors called "obesogens". Obesity is also correlated with type 2 diabetes, and chemicals that have been shown to cause obesity in animal models also result in altered glucose tolerance and reduced insulin resistance, both of which were documented as associated with fluoride exposure by the NRC in their review of fluoride.

The international panel of experts who contributed to the WHO and UNEP report stated that there was limited epidemiological data exist to support the notion that EDC exposure during pregnancy can affect weight gain in infants and children. There is evidence that the obesity risk may begin early in life, during pregnancy, and in early childhood and that rapid weight gain, in the first few months of life, is associated with obesity later in life.[135,136] Indeed data from animal studies indicate that chemical exposures during vulnerable windows of development may affect adult weight.[137,138] There are animal data suggesting that developmental exposure to chemicals can lead to altered cholesterol metabolism and weight gain later in life.[139,140,141; 142;143;144;145;146;147]

Worryingly, given the exposure of infants in Ireland to water fluoridation chemicals, the authors of the WHO and UNEP report on endocrine disruptors highlight that the effects of exposure to endocrine disruptors (which includes water fluoridation chemicals) during development will remain throughout life, due to their effects on

programming of cell differentiation and tissue development, resulting in a tissue that has a different predisposition for disease in adulthood to that of a non-exposed tissue. The authors warn that sensitivity to endocrine disruption is highest during tissue development; developmental effects will occur at lower doses than are required for effects in adults. One of the many reported findings in the study notes that EDCs can play a role in the development of immune-related disorders and are at least partially responsible for their rise in recent years. The report observes that Developmental immunotoxicity (DIT) caused by EDC exposure may be one early-life immune insult that could cause lifelong effects on immunity and the overall health of exposed individuals.

A recent study[148] on future health risks from immunotoxicology warns that the maturing immune system represents a vulnerable target for toxicants as it progresses through a series of novel prenatal and perinatal events that are critical for later-life host defence against a wide array of diseases. According to the author these critical maturational windows display a particular sensitivity to chemical disruption with the outcome usually taking the form of persistent immune dysfunction and/or misregulation. For this reason the author notes, health risks are significantly increased following early life vs adult immunotoxic exposure.

The WHO and UNEP report[149] notes that systemic inflammation, immune dysfunction and immune cancers such as lymphoma and leukaemia in humans have been associated with EDC exposures. Interestingly the All-Ireland study by Balanda and Wilde[150] documented significantly increased mortality from these diseases in the ROI compared to NI.

It is clear that serious risk and public health concerns exist regarding the impact of artificial fluoridation on human health. The lack of any detailed epidemiological studies and abject failure of the health authorities who promote and legislate for this policy to properly examine the long term risks may have serious implications for the State.

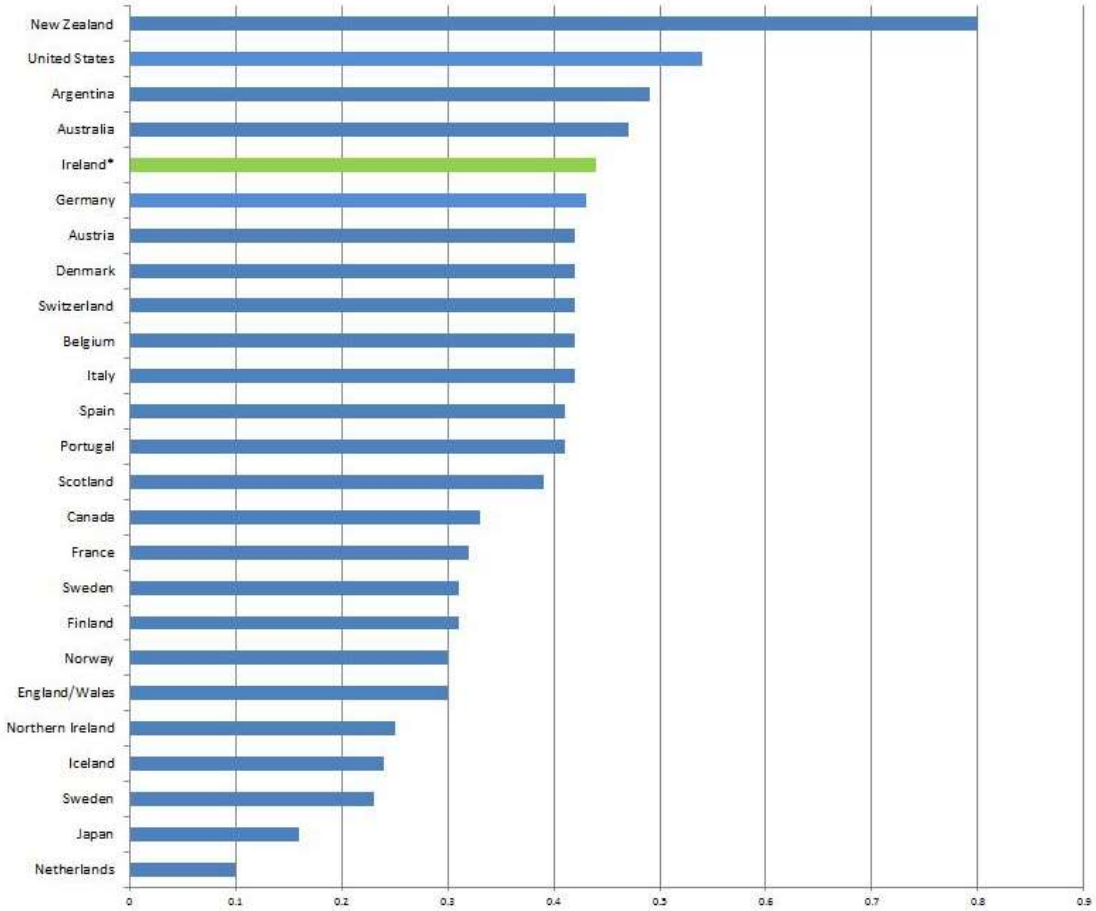
Clearly to allow such an unsafe practice to continue should not be tolerated in any circumstances especially when infant baby's kidneys and organs are not yet fully developed and when most of the fluoride is retained in their developing bodies and organs. [151]

This clearly presents very serious immediate and long-term safety concerns for public health. It is deeply worrying to note therefore that the mortality rate for infants from sudden death syndrome was 300% higher in fluoridated ROI compared to non-fluoridated NI and clearly indicates a possible association between infant fluoride exposure and SIDS.[152]

Sudden Infant Death Syndrome

Death rates from SIDS are variable among developed countries and comparisons between countries should be carefully interpreted. Nevertheless the highest SIDS rates in 1990 (≥2.0 in 1000 live births) were in Ireland and New Zealand.[153] In a recent international comparison of SIDs mortality rates (2005) the highest incidences were to be found in New Zealand followed North America, Argentina and Australia and Ireland.

Figure 7 **International Comparisons of SIDS Rates per 1,000 Live Births 2005**



Sources:
Hauck RF, Tanabe KO. 2008. International trends in sudden infant death syndrome: stabilization of rates requires further action. Pediatrics 122(3): 660-666.
*National Paediatric Mortality Register Ireland

Artificial fluoridation of drinking water is implemented in each of these countries by public health authorities.

More males than females are affected by SIDs (1.5:1).[154] Interestingly it is also known that Osteosarcoma also affects more males than females for which fluoride has been found to be a contributory factor.[155],[156],[157] It is also known that autism affects more males than females[158] and coincidentally the highest incidences of autism are also to be found in countries artificially where the population are exposed to artificially fluoridated drinking water.

While it is accepted that there are a combination of environmental and sleeping factors associated with SIDs, it is remarkable nevertheless that no study has ever examined the potential linkages between infant exposure to fluoride, hypersensitivity or fluoride intolerance and premature infant morbidity. Naturally to undertake such a such a study now would be regarded as immoral and ethical unlawful given that where fluoride intoxication were found to be the cause of death public health authorities may be charged with criminally negligent manslaughter. Nevertheless, in in the absence of any scientific evidence to demonstrate the safety of silicofluoride chemicals and in the absence of internationally recognised safe limits for fluoride exposure, in countries where fluoridation is practiced newborn infants continue to be exposed to unsafe levels of fluoride at concentration far above those found to be safe for a health adult; this clearly violates the precautionary principle. It is now established that there is no benefit for newborn infants to be exposed to fluoride, it is also established a small percentage of the population may be intolerant or hypersensitive to fluoride. There is now an urgent need to identify factors that contribute to these deaths in Irish society and internationally so that appropriate intervention measures may be applied. As the highest incidence of SIDs internationally are to be found in fluoridated countries a simply and cost free intervention measure is simply not to expose newborn infants to fluoridated water.

In the ROI the fact that infant mortality from SIDs has been documented as up to 300% lower in non–fluoridated NI compared to ROI[159] clearly suggests an association between infant exposure to fluoride and increased risk of SIDs.

It is interesting to note that in the Brisbane City Council's review of fluoridation[160] the report noted that the communities with the longest history of fluoridation had the highest SIDs rates, while the rates were lowest in non-fluoridated communities. In contrast, countries with a high prevalence of breast feeding and where fluoridation has either been discontinued or never commenced all have significantly lower mortality rates from SIDs compared to fluoridated countries.

It has also been documented that the SIDS rate remains significantly higher among certain racial and ethnic groups, including Mäori, non-Hispanic Blacks and American Indian/Alaska Natives. In New Zealand the Mäori SIDs rate is now around five times higher than that of non-Mäori.[161] While in U.S.A the infant mortality rate for non-Hispanic black women was 2.4 times the rate for non-Hispanic white women, the infant mortality rate for American Indian or Alaska Native women was 64 percent higher than the rate for non-Hispanic white women; and the infant mortality rate for Puerto Rican women was 37 percent higher than the rate for non-Hispanic white women.[162]

The NRC Report (2006) documented how dental fluorosis was also more prevalent in certain ethnic groups. It is also know that they are more susceptible to diabetes, hypertension and autoimmune diseases. [163, 164, 165, 166, 167, 168] The NRC found that

fluoride contributes to each of these disease therefore from a toxicological standpoint it is likely those ethnic groups will be a high risk population to the effect of exposure to fluorides.

Fluoride as a Developmental Neurotoxin

The U.S. EPA's National Health and Environmental Effects Research Laboratory recently classified fluoride as a *"chemical having substantial evidence of developmental neurotoxicity".* [169]

The fact that fluoride is a developmental neurotoxin should be of great concern to parents and public health providers as the conclusion of a recent published study suggested that low levels of fluoride exposure in drinking water had negative effects on children's intelligence and dental health and confirmed the dose–response relationships between urine fluoride and IQ scores as well as dental fluorosis.[170] The authors noted in particular that either a small decline in IQ scores or the sickness of dental fluorosis can lead a profound influence for individuals on their developments, and that these findings may have policy implications for a country to put more effort on removing fluoride to alleviate toxicity of long-term effects of fluoride exposure to local residents and their offspring.

Furthermore in July 2012, the Department of Environmental Health, Harvard School of Public Health at Harvard University published the findings of a systematic review and meta-analysis of published studies on increased fluoride exposure in drinking water and neurodevelopmental or cogitative impairment in children.[171] The results suggest that fluoride may be a developmental neurotoxin that affects brain development at exposures much below those that can cause toxicity in adults. The authors noted that even a slight reduction in IQ in a population will have substantial impacts, especially among those in the high and low ranges of the IQ distribution and concluded that their results support the possibility of adverse effects of fluoride exposures on children's neurodevelopment.

It is obvious that the most sensitive subgroup to the neurotoxicity of fluoride would be children with Downs's syndrome especially in countries where public water supplies are fluoridated. Children with Down's syndrome are already intellectually challenged and consume formula milk for extended periods of their early development compared to healthy children.

Fluoride ingestion and teeth in Infants

The Journal of the American Dental Association[172], reported that fluoride is a toxic substance that can destroy teeth in developing young children and babies. Furthermore the authors found that "fluoride incorporated developmentally— that is, systemically into the normal tooth mineral— is insufficient to have a measurable

effect on acid solubility. Fluoride incorporated during tooth development is insufficient to play a significant role in caries protection."

Importantly, this means that ingested fluoride is not beneficial to the teeth of children.

According to the European Food safety Authority is a fact that there is no real threshold value for a fluoride intake which is not associated with the occurrence of dental fluorosis in the population[173]. Furthermore the EFSA state that enamel fluorosis is caused by fluoride ingestion during the pre-eruptive formation and maturation of enamel of teeth. Therefore, the sensitive period is before the age of eight years. The EFSA also note that there is a clear dose-response relationship with a prevalence of 48% of very mild and mild forms of dental fluorosis at fluoride intakes from water of 0.043 mg/kg/day.[174],[175]

The EFSA advise that consumption of water with an "optimal" fluoride content as the only source of dietary fluoride amounts to an intake of 0.4 to 1.7 mg fluoride/day in children between one and twelve years of age. According to the EFSA on a body weight basis this is about 0.05 mg/kg/day which is above the threshold noted in the EFSA report. This threshold is exceeded from one source of fluoride alone, in drinking water.

Dental Fluorosis

The only indisputably proven harm of water fluoridation is dental fluorosis, for which there is no discernible threshold. However, the risk of dental fluorosis increases as fluoride concentration of water exceeds 0.3 parts per million.[176]

This view is supported by findings of the European Commission who established that systemic fluoride (fluoridated drinking water) may impair normal development of enamel in the pre-eruptive tooth and cause fluorosis, that the incidence of fluorosis increases with consumption of fluoride, and will therefore be higher in member states or geographical areas where water fluoridation is instituted.[177]

The NHS University of York Fluoridation Review found water fluoridation to be significantly associated with high levels of dental fluorosis which was not characterized as "just a cosmetic issue" and estimated that up to 48% of children who live in fluoridated areas have some form of dental fluorosis.[178],[179]

These findings are supported by O Mullane et al.[180] (2003) Browne et al.[181] (2005) and Verkerk et al.[182](2010) who observed that the prevalence of dental fluorosis, representing chronic overexposure of the population to fluoride, has reached endemic proportions in Ireland and that water fluoridation is the principle cause of the increased incidence.

Remarkably the study by O' Mullane et al. identified that the prevalence of dental fluorosis in communities with no fluoridated water was as low as 1.5% compared to 37% in fluoridated communities. It was also documented that no children were observed with moderate or severe dental fluorosis in non-fluoridated communities it was found that both moderate and severe dental fluorosis was evident in children living in fluoridated communities. Similarly international studies have shown from epidemiological data that the prevalence of fluorosis in permanent incisors of 8-9 years-old-children, living in communities supplied with fluoridated and non-fluoridated water was 54% and 23%, respectively.[183]

Considering that dental fluorosis represents overexposure to fluoride resulting in irreversible harm to the developing teeth of children, concerns regarding how fluoride may biologically affect parts of the developing body is an are less studies and one of great importance. The recent published findings, for example, that fluoride is a developmental neurotoxin in children, raises serious concerns regarding its long term neurological impact on a population, while the impact of aluminum fluoride complexes and their contribution to Alzheimer's is a matter of great concern as is the toxicity of silicofluorides.

Fluoride intake of Adults

The European Food Safety Authority have determined that while the intake of fluoride from water can be estimated with some certainty an estimation of fluoride intake from other sources is prone to the influence of a wide variety in individual habits. The EFSA note that fluoride content of the skeleton increases with increasing intake of fluoride via water. In areas with water fluoride contents of <0.3, 1.0 and 4 mg/L fluoride in bone ash was 140-790, 400- 2300 and 6900 mg/kg, respectively.[184]

As noted by the NRC the dietary intake of fluoride by adults in the UK including NI is expected to be high compared to North America due largely to the consumption of popular beverages such as tea which can result in individual dietary exposure of up to 9mg of fluoride a day for an adult. The NRC committee noted that the fluoride content of commercial instant teas can be substantial and that the combination of exposures from tea and fluoridated drinking water can lead to higher than expected fluoride intake with associated musculoskeletal problems.

Ireland has the second highest consumption of tea in the world surpassing the UK in the consumption of tea by consuming on average 20% more tea than the average UK tea drinker. Consequentially the potential fluoride dietary intake for a significant subgroup of the adult population in Ireland is greater for many

individuals compared to the risk for consumers in the UK. A further and significant risk factor for the population of Ireland is that less than 10% of the UK population compared to (75-80%) of the Irish population are provided with artificially fluoridated water the majority of the population in Ireland. Boiling fluoridated tap water increases the concentrations of fluoride in water and food. The concentration of fluoride in tea beverages is significantly increased by using boiled fluoridated water to make tea. This results in significant additional concentrations fluoride being added to a tea beverage that is already high in fluoride content, thereby contributing further to the daily exposure of an individual to fluoride.

The European Food Safety Authority noted that if fluoridated water were drunk and used for the preparation of food and tea (1-2 L of water/day; 500 mL of tea (2 cups) with a fluoride concentration of 5 mg/L) 3.5 to 4.0 mg fluoride would be added to the daily dietary intake of an individual.[185]

The EFSA noted that even more extreme scenarios are possible and not completely unrealistic; for example in the ROI many individual consume 6-8 cups of tea daily made with boiled fluoridated water. This would increase the daily dietary intake for many individuals to 8mg from beverages and to >10mg for all sources.

The total dietary exposure of an individual is the sum of exposure from all food and other sources consumed in a day. Because of the wide variability of exposures to fluoride it is impossible to control the total dietary intake of fluoride for any individual. Nevertheless the risk factors for increased exposures to fluoride increase significantly when public water supplies are fluoridated and dietary exposures cannot be controlled to protect the health and welfare of citizens when such a policy is enacted. When fluoridated water is used for the preparation of hot beverages such as tea the measured increase in fluoride content for the beverage may increase by up to 1.5mg/L. This is very significant when examining total dietary fluoride intake. It is also significant that tea beverages are acidic and depending on the length of time left to brew will fall in the range 5.5 - 6.3 pH.

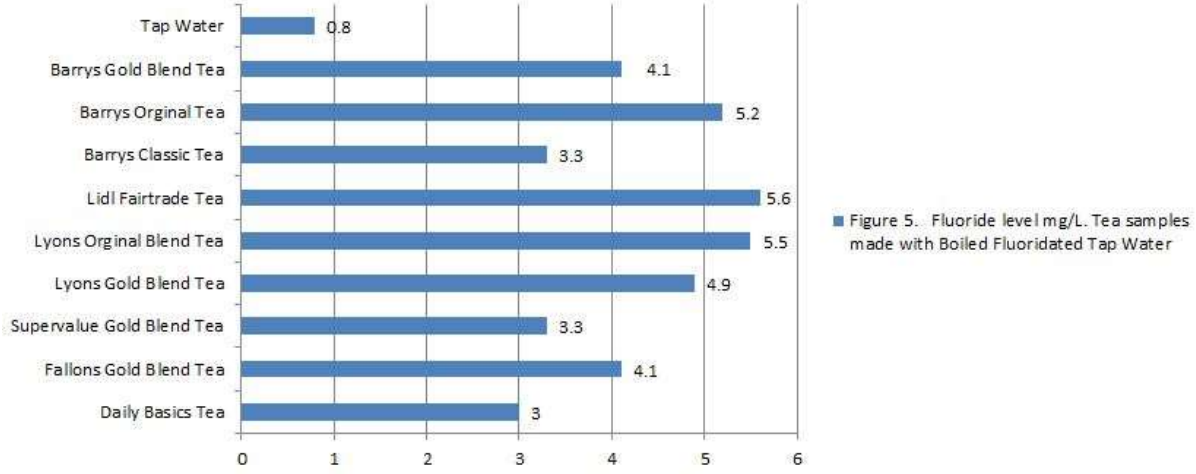
It is important to note that there are no published studies documenting in detail the total fluoride dietary intakes for either adults or children in Ireland and no public database exists providing the fluoride content of foods, beverages or medicines. What is clearly evident however is that the total fluoride bone content of people living in Ireland is expected to be very high due to their total dietary fluoride sources combining fluoridated water with other sources such as tea. As such it is to be expected that the fluoride bone concentration in Irish adults is expected to be multiples of the level to be found in bone of Europeans living in non-fluoridated countries.

The EFSA note that with increasing fluoride incorporation into bone clinical stage I and II with pain and stiffness of joints, osteosclerosis of both cortical and

cancelleous bone, osteophytes and calcification of ligaments develop. Crippling skeletal fluorosis (clinical stage III) may be associated with movement restriction of joints, skeletal deformities, severe calcification of ligaments, muscle wasting and neurological symptoms. All stages are accompanied by disturbed or deficient mineralisation of the bone, and osteomalacia may be present, particularly when calcium intake is insufficient. The EFSA also highlight that patients with renal insufficiency have an increased risk of developing skeletal fluorosis.

Figure 5 provides the total fluoride content in popular tea products sold in Ireland. As is evident from this graph the contribution of fluoridated water to certain food products such as tea results in dietary fluoride levels that would significantly exceed the recommended fluoride intake of 3mg per day for an adult (0.05mg/Kg/day for a 60kg person) which has previously been deemed to be acceptable[186],[187] where an individual were to consume three cups of tea or more a day.

Figure 5. Fluoride level mg/L. Tea samples made with Boiled Fluoridated Tap Water



The WHO have documented that total intakes of fluoride above about 6 mg fluoride per day may cause skeletal fluorosis and an increased risk of bone fractures.[188, 189] The total dietary intake for an individual from consuming four cups of tea a day, constituted with fluoridated water, would exceed 5mg fluoride from this single food source alone. Dietary fluoride exposure will also be increased by the consumption of any other beverage of foodstuffs prepared with fluoridated tap water. Typical examples include beer, stout, fruit drinks, soft drinks, soup and foods such as processed chicken which all combine to add further substantial contributions to an individual's total fluoride intake (NRC 2006). The EFSA determined that use of fluoridated water to cook food may increase the fluoride content of all food by at least 0.5 mg/kg, providing additional dietary sources of fluoride.[190] Additional contributions of fluoride are also provided by fluoridated dental products including toothpastes, dental mouthwashes and other dental treatments as well as from food additives, vitamin supplements, pharmaceutical drugs and from residues of fluoride based pesticides and fumigants (NRC 2006). Another major source of fluoride are

cigarettes which are known to contain very high levels of fluoride.

There are many atmospheric sources of fluoride that also exist including emissions from coal powered stations, combustion of coal in the home, aluminum production plants, chemical production facilities, steel mills and brick manufacturing (NRC 2006). The EFSA has documented that with increasing fluoride incorporation into bone clinical stage I and II with pain and stiffness of joints, osteosclerosis of both cortical and cancelleous bone, osteophytes and calcification of ligaments develop. Crippling skeletal fluorosis (clinical stage III) may be associated with movement restriction of joints, skeletal deformities, severe calcification of ligaments, muscle wasting and neurological symptoms. The EFSA also highlighted that patients with renal insufficiency are at increased risk of fluoride toxicity. [191]

The NRC scientific committee observed that people living in fluoridated communities will have accumulated fluoride in their skeletal systems and potential have very high fluoride concentration in their bones, this would certainly apply to many persons living in Ireland who have extremely high dietary fluoride exposure. The NRC noted that the bone system is where immune cells develop and fluoride could affect humoral immunity and the production of antibodies to foreign chemicals.[192]

The WHO has consistently and correctly stated that *"in the assessment of the safety of a water supply with respect to the fluoride concentration, the total daily fluoride intake by the individual must be considered."* It is astonishing and deeply worrying that considering this common sense recommendation from the WHO that no proper dietary fluoride risk assessment has been undertaken in the ROI and that no database is readably available for the public to examine or calculate their fluoride exposure form foodstuffs and beverages. As with tea any beverage produced in Ireland that uses public water supplies will have elevated fluoridated levels. This includes soft drinks, alcoholic beverages and fruit drinks.

The WHO Guidelines for Drinking Water similarly recommend that *"when setting national standards for fluoride that it is particularly important to consider volume of water intake and intake of fluoride from other sources."* [193]

Unfortunately, it is clearly evident that these recommendations were never applied by the Health Authorities in Ireland, and were subsequently overlooked by the *Forum for Fluoridation* (2002) in addition to the current Irish Expert Body on Fluorides. This is a matter that I have communicated repeatedly with the Government of Ireland and its agencies over the past twelve months and to which I have never received any reply.

It is a certain fact that dietary exposure to fluoride for persons living in the ROI is significantly greater than for individuals residing in NI mainly from consuming fluoridated drinking water and other foodstuffs prepared with fluoridated water. Other dietary sources will add significantly to the dietary intake especially through

the consumption of tea. The consumption of tea in both regions of the island is expected to be similar.

However human exposures aluminofluorides are far greater for persons living in the ROI compared to NI due to the combination of aluminum and fluoride sources in drinking water.

Aluminum in drinking water comes from the alum used as a flocculent or coagulant in water treatment.[194] Artificial fluoridation also results in increasing the concentration of free fluoride ions that will bind to substances such as aluminum which is already present in high concentrations in tea.

Exposure to aluminum fluoride and silicofluorides compounds has many serious health implications for consumers.

Water fluoridation and Dental Health of Adults

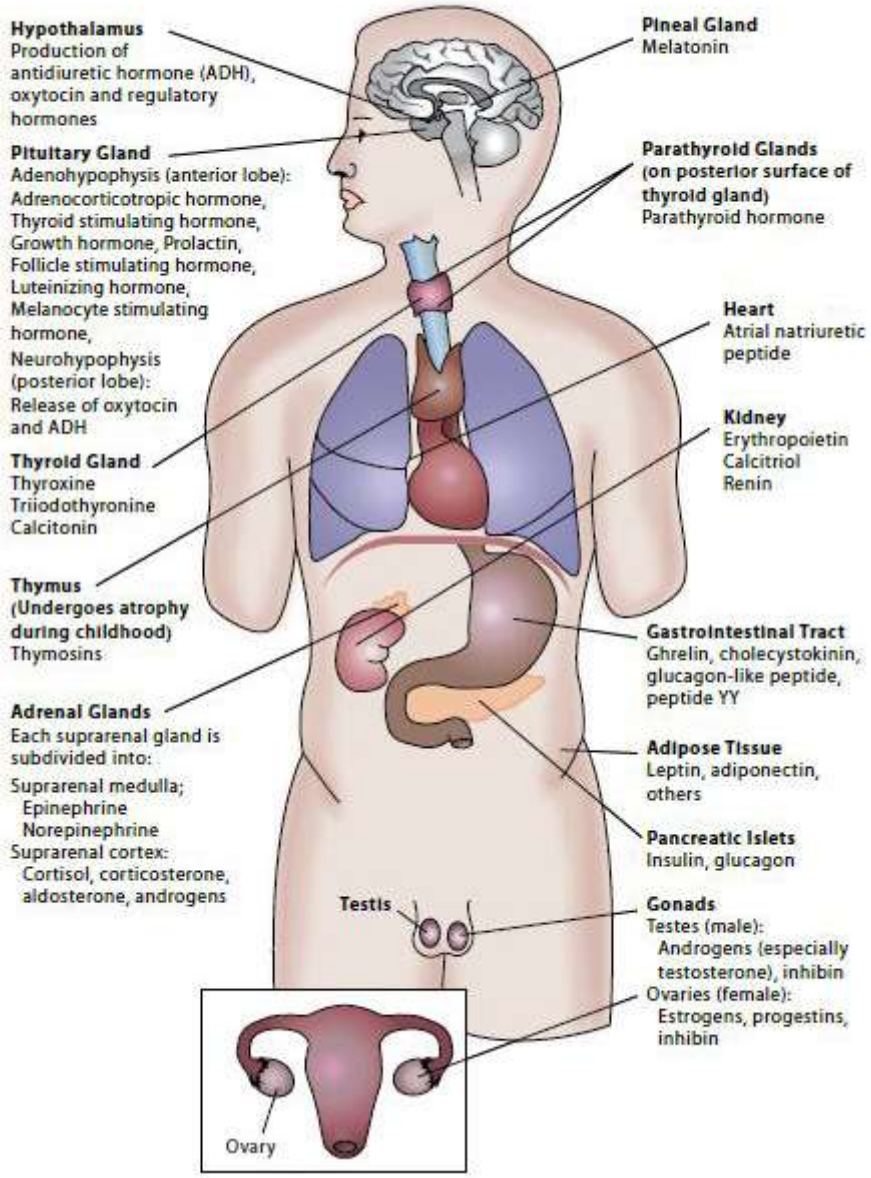
The NHS York review on fluoridation (2000) found water fluoridation to be significantly associated with high levels of dental fluorosis which was not characterized as "just a cosmetic issue". The prevalence of fluorosis at a water fluoride level of 1.0 ppm was estimated to be 48% and for fluorosis of aesthetic concern it was predicted to be 12.5%

The European Commission Scientific Committee on Health and Environmental Risks (SCHER) review of water fluoridation (2010) found that the benefits of fluoridation to adult and elderly populations in terms of reductions in coronal and root decay are limited, that the caries preventive effect of systemic fluoride treatment from fluoridation of community drinking water is rather poor and that the improved dental health in countries that do not fluoridate suggests that water fluoridation plays a relatively minor role in the improved dental health.

Endocrine System

The endocrine system is complex with many organs contributing to a multifaceted regulatory system that governs the normal growth, development and reproduction of the human body. All aspects of the endocrine system and potentially, all chemical signalling pathways in the organism are susceptible to the effects of endocrine disruption. Hormones are specific chemical products of organs or tissues of the endocrine system that are transported by the blood or other body fluids, and elicit a specific regulatory effect on target tissues or organs. Specific actions of hormones may include a whole body response; a regulatory action; a morphogenic action, or a permissive or complementary action.

Figure 9. Endocrine System



Pineal Gland *Key Findings of the Scientific Committee*

The pineal gland is responsible for melatonin production.

According to the 2006 report issued by the National Research Council:

- *"Fluoride is likely to cause decreased melatonin production and to have other effects on normal pineal function, which in turn could contribute to a variety of effects in humans. Melatonin seems to be involved in anxiety reactions and other physiological effects including regulation of sleep, effects on calcium and phorphorus metabolism, parathyroid activity, bone growth, development of postmenopausal osteoporosis and anticarcinogenic effects, antioxidant actions, effects on the central nervous system, psychiatric disease and sudden infant death syndrome. The pineal gland is a calcifying tissue, Melatonin secretion is well correlated with the amount of uncalcified pineal tissue. An increase in the calcification of the pineal gland represents a decrease in the individual's ability to produce melatonin. As with other calcifying tissue, the pineal gland can accumulate fluoride with fluoride concentrations being positively related to the calcium concentration in the pineal gland."*
- The NRC reported that *"animal studies have demonstrated that circadian rhythm of melatonin production was altered by fluoride exposure, prepubescent animals had significantly lower melatonin production and it was shown that the sexual maturation in females occurred earlier when exposed to fluoride."*
- The NRC reported that *"no studies are available that specifically address the effect of fluoride exposure or cumulative fluoride intakes on pineal function or melatonin production in humans."* The NRC reported on two human studies undertaken in fluoridated and non-fluoridated communities in the USA[195] and Hungary[196] examining the age of onset of sexual maturity in girls and found early onset of sexual maturity in fluoridated compared to non-fluoridated areas.

Parathyroid Gland *Key Findings of the NRC Scientific Committee*

According to the 2006 report issued by the National Research Council:

- *"The indirect action of fluoride on the parathyroid function occurs by fluoride inducing a net increase in bone formation and decreasing calcium absorption from the gastrointestinal tract; both of these effects lead to an increase in the body's calcium requirement. If dietary calcium is inadequate to support the increased requirement, the response is an increase in secondary*

hyperparathyroidism. Fluoride exposure in the presence of calcium deficiency further increases the dietary requirement for calcium."

- *"Fluoride clearly has the effect of decreasing serum calcium and increasing the calcium requirement in some or many exposed persons. Secondary hyperparathyroidism in response to calcium deficiency may contribute to a number of diseases, including osteoporosis, hypertension, arteriosclerosis, degenerative neurological diseases, diabetes mellitus, some forms of muscular dystrophy and colorectal cancer. Calcium deficiency induced or exacerbated by fluoride exposure may contribute to other adverse health effects including increased concentration of lead in critical organs and nutritional rickets. Recent increases in nutritional rickets in the United States appear to reflect calcium-deficient diets rather than Vitamin D Deficiencies."*
- *"The possibility also exists that a direct effect (of fluoride) on either the parathyroid or the thyroid parafollicular cells leads to a compensatory response from the other, but this has not been examined."*

Thyroid Function *Key Findings of the NRC Scientific Committee*

- *"Fluoride affects normal endocrine function and 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."*
- *Note: Hyperparathyroidism can also be induced by hypothyroidism*
- *"One factor that might be of relevance to fluoride is impairment of thyroid gland function. For example, hypothyroidism produces tiredness, depression, difficulties in concentration, memory impairments, and impaired hearing. In addition, there is some evidence that impaired thyroid function in pregnant women can lead to children with lower IQ scores"*
- *"Aluminium fluoride complexes are also involved in regulating the pineal melatonin system as well as the thyroid-stimulating hormone-growth hormone connection."*

Other Endocrine Organs *Key Findings of the NRC Scientific Committee*

According to the National Research Council "the effects of fluoride exposure have been examined for several other endocrine organs, including the adrenals, the pancreas, and the pituitary. Effects observed in animals include changes in organ weight, morphological changes in tissues, increased mitotic activity, decreased concentrations of pituitary hormones, depressed glucose utilization, elevated serum glucose, and elevated insulin like growth factor-1 (IGF-1). Effects reported in humans include "endocrine disturbances," impaired glucose tolerance, and elevated concentrations of pituitary hormones."

Fluoride Intake and Thyroid Function

According to the 2006 report by the National Research Council of the National Academies fluoride is *"an endocrine disruptor in the broad sense of altering normal endocrine function."* This altered function can involve your thyroid, parathyroid, and pineal glands, as well as your adrenals, pancreas, and pituitary gland. Altered thyroid function is associated with fluoride intakes as low as 0.05-0.1 mg fluoride per kilogram body weight per day (mg/kg/day), or 0.03 mg/kg/day with iodine deficiency. Increased prevalence of goiter (>20 per cent) is associated with fluoride intakes of 0.07-0.13 mg/kg/day, or 0.01 mg/kg/day with iodine deficiency.[197]

For a 70 kg adult, this means that 3.5 mg fluoride per day (or 0.7 mg fluoride per day with iodine deficiency) could result in thyroid dysfunction.

The NRC estimated that the dietary intake of fluoride for an adult in the UK can be in excess of 9 mg fluoride on a daily basis from consumption of tea. Drinking six cups of normal instant tea a day made with fluoridated water will routinely result in excesses of 6mg day. The Irish consume more tea (made with fluoridated water) than the average UK consumer. For a 14 kg child, it has been estimated that fluoride intakes greater than 0.7 mg per day (or 0.14 mg per day with iodine deficiency) puts the child at risk for endocrine dysfunction. The U.S. EPA estimates children within this weight range (1-3 year-olds) consume over 1.5 mg fluoride each day, or more than twice the amount necessary to induce altered thyroid function, even with an adequate iodine intake.[198] These chronic exposures could have profound and life-long effects on the intellectual, social, sexual and overall physical development of children. Decreased thyroid function is a major contributor factor in increased cholesterol, growth retardation, a healthy neuromuscular system, influencing body weight, energy expenditure and cold intolerance.[199]

Thyroid hormones affect glucose metabolism via several mechanisms[200]. Hyperthyroidism has long been recognised to promote hyperglycaemia[201.] During hyperthyroidism, the half-life of insulin is reduced most likely secondary to an increased rate of degradation and an enhanced release of biologically inactive insulin precursors.[202,203]

It has been reported that within the last two decades thyroid cancer has become the fastest rising neoplasm among women in North America (Holt, 2010).[204] In Ireland since the early 1970's there has been a documented 2.5 fold increase in thyroid cancers[205]. This period happens to also coincide with water fluoridation in Ireland. It is interesting to observe that thyroid cancer rates in Sweden reduced by 18 per cent in the period after cessation of water fluoridation.[206]

Iodine deficiencies in the Irish Population

Iodine is an essential micronutrient present in the human body in minute amounts almost exclusively in the thyroid gland. It is an essential component of the thyroid hormones which regulate metabolic processes in most cells, as well as playing a determining role in the process of early growth and development of most organs, especially that of the brain. In humans, most of the growth and development of the brain occurs during the fetal period and the first two to three years of postnatal life. Consequently, iodine deficiency, if severe enough to affect thyroid hormone synthesis during this critical period, will result in hypothyroidism and brain damage. The clinical consequence will be irreversible mental retardation. According to the WHO the population of the Republic of Ireland are deficient in iodine intake.[207] The WHO report also noted that a high degree of apathy has been noted in populations living in severely iodine deficient areas.[208]

Irish research published in 2006 confirmed that dietary intake of iodine by Irish women is significantly less than the level recommended by the World Health Organisation. According to Prof Smyth and his colleagues at University College Dublin, School of Medicine iodine deficiency was present in 55 per cent of pregnant women tested in summer and 23 per cent in winter,[209]

A recent study partly carried out by Professor Peter Smyth -- of UCD School of Medicine and School of Physics, NUIG researchers on behalf of the British Thyroid Association looked at 700 teenage girls in Belfast and other parts of the UK and found that more than two-thirds of them were low in iodine. The study's conclusion was that an entire generation of schoolgirls is growing up deficient in the vital mineral.

According to the WHO 56.9 % of school age children (aged 6-12years) in Western Europe and 56.9% of general population have insufficient iodine intake.

Iodine deficient leads to oxidative stress in the thyroid gland and diminished thyroid hormone production resulting in cell proliferation resulting in enlargement of the gland but also cellular hyperfunction.[210]

Another consequence of long-standing iodine deficiency in adults, but also in the child, is the development of hyperthyroidism in multinodular goitres with autonomous nodules in which thyrocyte proliferation occurs with scattered cell clones harbouring activation mutations of the TSH receptors.[211] Researchers in Sweden have identified that exposure of females to iodine deficiency during puberty was found to be associated with a 1.9-2.5 fold increased risk of follicular carcinoma and papillary carcinoma respectively.[212]

Fluoride and Iodine

Fluoride is in the same chemical family as iodine and can replace iodine in the body if the iodine is deficient. It is also known that fluoride can act to depress both cellular oxygen consumption and iodide uptake.[213]

Animal studies have demonstrated that after 100 days of treatment, in iodine deficiency conditions fluoride had a stimulatory effect on the thyroid, however, after 150 days the effects of fluorine on the thyroid reversed causing as inhibitory effect on the thyroid function. It was also noted that iodide intake could also increase the toxic effects of Fluoride. [214]

Where a significant percentage of the population of Ireland are known to be iodine deficient, there are serious questions as to the safety of a public health policy that mandates the addition of fluoride chemicals to drinking water that is itself deficient in iodine, to be consumed by a population that already have insufficient iodine intake. In such circumstances it is to be expected that certain health impacts may arise in the population.

Incidence of Thyroid Disorders

No accurate data is available on prevalence of thyroid disorders in Ireland however it is estimated that there are in the region of over 300,000 people in the Republic of Ireland with a thyroid disorder representing approximately 7% of the population. Subclinical hypothyroidism (SCH), affects about one in six people over the age of 65 in Ireland and has been linked to various health problems, such as heart attacks and strokes, in later life. Subclinical hypothyroidism is considered a strong risk factor for later development of overt hypothyroidismassociate and subclinical thyroid dysfunction with changes in cardiac function and corresponding increased risks of heart disease.[215],[216],[217]

Subclinical hypothyroidism is associated with increased cholesterol concentrations increased incidence of depression, diminished response to standard psychiatric treatment, cognitive dysfunction, and, in pregnant women, decreased IQ of their offspring.[218],[219]

Ireland has the highest incidence of congenital hypothyroidism (CHT) in the EU.[220,221]

It was recently reported that the incidence of congenital hypothyroidism has nearly doubled over the past two decades. in several countries in which it has been studied including the USA (Harris and Pass 2007[222];Western Australia (Kurinczuk et al., 2002)[223], the northern UK (Pearce et al., 2010b)[224] Water fluoridation is practised in each of these geographic regions or countries.

Thyroid hormone deficiency at birth is most commonly caused by a problem with thyroid gland development (dysgenesis) or a disorder of thyroid hormone biosynthesis (dyshormonogenesis). These disorders result in primary hypothyroidism. Thyroid dysgenesis accounts for 85% of permanent primary CHT, while transient CHT most commonly occurs in preterm infants born in areas of endemic iodine deficiency.

The incidence of CHT was 1 case per 2296 live births in the Republic of Ireland (ROI) in the past decade with increasing numbers over recent years.[225] As with fluoridated Ireland the incidence of CHT has increased significantly in the United States to approximately 1 in 2,300.[226] The overall incidence of congenital hypothyroidism in non-fluoridated Northern Ireland has been estimated at 1 in 5074 live births[227] while the Global mean incidence for Congenital Hypothyroidism (CHT) is 1/3800 with a reported incidence of 1:3500 in Caucasian populations.

Despite the apparent prevalence of thyroid disorders among the population there is a complete lack of detailed accurate epidemiological data of thyroid disorders available for Ireland. One Irish study[228] undertaken in the North West found the accumulated prevalence of overt spontaneous primary hypothyroidism was 8.6% in 544 females aged 50 years or more but only 0.9% in the 1,000 females between 18 and 50 years of age. This prevalence was approximately twice that of an Irish National general practice population sample of 4,314 females aged 50 years or more (8.6% vs. 4.6%).

The study concluded that an 8.6% accumulated prevalence of hypothyroidism in females greater than 50 years of age when a population is aggressively investigated demonstrates the relative importance of its contribution to total morbidity and suggested that the disorder may be under diagnosed in Ireland.

Worryingly international studies report a prevalence rate higher for children with Down's syndrome than that in the general population. An evaluation of reported studies would suggest a lifetime prevalence of approximately 25-30%. Ireland has the highest incidence of Down's syndrome in the EU.

Many babies with Down's syndrome are unable to breast feed and are therefore exposed to fluoride from birth through consuming formula milk constituted from fluoridated tap water. In addition, babies with Down's syndrome tend to bottle feed for much longer than normal infants further exposing them to the harmful effects of fluoride, which in itself may clearly explain the much higher incidence of thyroid disorders in children with Down's syndrome as well as other ailments.

In ending, it is important to reference up to date information from the WHO. In 2010 the standardised disease ratio (SDR) for endocrine, nutrition, metabolic disease disorders involving immune mechanism, was 13.32 for all ages/100,000 for Ireland and 8.71 per 100,000 for the UK.

Once again this demonstrates a significant increased incidence for these diseases in the Republic of Ireland compared to the UK. This represents a 51% increased prevalence of these diseases in Ireland compared to the UK.

Other conditions associated with thyroid problems

Premature puberty has been reported in both girls and boys. In girls it can present with breast development, pubic hair, vaginal secretion and menstruation, acceleration of growth and in boys with pubic hair, testis enlargement and height spurt. Barnes et al[229] studied the association of early puberty with juvenile hypothyroidism and concluded that long standing thyroid failure induces increased TSH secretion, both indirectly (through the action of thyrotropin releasing hormone) and directly (at the level of the pituitary) and this action on pituitary may induce subsequent premature sexual development. Hypothyroidism is also documented to be associated with weight gain, diabetes, musculoskeletal pain, cardiac disease, dementia, gastrointestinal anomalies, cancer of the testis, hair loss and depression.

In Ireland significant geographic variations are to be expected due to differences in drinking water chemistry, the presence of iodine in drinking and in particular due to water hardness or the calcium concentration in drinking water, which is one of the single most important factors in fluoride toxicity. In high calcium waters most of the fluoride is excreted while in low calcium waters the majority of fluoride is absorbed; resulting in elevated blood plasma fluoride levels, and retention of fluoride in various organs of the body. [230]

The research undertaken by Dr. Rapp Professor of Biochemistry and Physiology, School of Dentistry of Loyola University, Chicago College of Dental Surgery in the 1950's established that multiple smaller doses of fluoride (such as by drinking fluoridated water) will result in greater retention of fluoride than exposure to a single large dose. Consequently dietary retention of fluoride will vary considerably by individual depending on the source and chemistry of drinking water that is fluoridated, the individuals metabolism and nutritional health.

Similarly, it should be noted that the NRC observed that one of the indirect actions of fluoride is to decrease calcium absorption from the gastrointestinal tract thereby increasing in the body's calcium requirement, if dietary calcium is inadequate to support the increased requirement, the NRC noted that this would result in an increase in secondary hyperparathyroidism. It is also now accepted that altered calcium homeostasis is recognised as a key pathophysiological mechanism in heart failure, leading to altered contractile function and transcriptional activity.[231]

It is not surprising to observe therefore that the highest prevalence of both thyroid disorders and cardiovascular disease are to be found in geographic areas with artificially fluoridated low calcium drinking water.

Thyroid hormone and other organ systems

It is important to recognize that thyroid hormone concentrations are correlated with adverse effects in organ systems other than the nervous system in the adult, including the cardiovascular system and control of serum lipids (Asvold et al., 2007a[232]; Biondi et al., 2005[233]; Osman et al., 2002[234]), pulmonary system (Krude et al., 2002[235]; Lei et al., 2003[236]; Mendelson & Boggaram, 1991[237]) and kidney. Total cholesterol, low density lipoproteins (LDL), nonhigh density lipoproteins (non-HDL), and triglycerides increase linearly with increasing TSH, and HDL decreases consistently with increasing TSH across normal reference ranges without evidence of any threshold effect (Asvold et al., 2007b)[238]

Within the reference ranges for TSH, there is a linear positive association between TSH and both systolic and diastolic blood pressure (Asvold et al., 2007b)[239]. Intimal medial thickness (IMT), a measure of atherosclerosis and predictive of coronary vascular disease and stroke, is inversely related to free T4 after controlling for lipids, clinical factors, and thyroid autoantibodies (Dullart et al., 2007).[240]

Not surprisingly, deficits in thyroid homeostasis are associated with cardiovascular risk in multiple epidemiologic studies. A meta analysis of 14 epidemiologic studies (Rodondi et al., 2006)[241] found an overall increase in risk of coronary heart disease (CHD) of over 65% in those with subclinical hypothyroidism (elevation in TSH with normal T4).

Therefore, epidemiologic as well as mechanistic and therapeutic evidence substantiates the concern that thyroid disrupting chemicals may adversely affect cardiovascular risk in humans by reducing serum T4.

Immune System *Key Findings of the NRC Scientific Committee*

- *"People who live in artificially fluoridated communities will accumulate 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."*

- *"Fluoride has a number of effects on immune cells, including polymorphonuclear leukocytes, lymphocytes, and neutrophils. Fluoride also augments the inflammatory response to irritants."*
- *"There is no question that fluoride can affect the cells involved in providing immune responses."*
- *Despite this the NRC stated that "not a single epidemiologic study has investigated whether fluoride in the drinking water is associated with changes in immune function". Nor according to the NRC "has any study examined whether a person with a immunodeficiency disease can tolerate fluoride ingestion from drinking water"*
- *"Several subpopulations are likely to be susceptible to the effects of fluoride exposure. From an immunologic standpoint, individuals who are immune-compromised (e.g., AIDS, transplant, and bone marrow-replacement patients) could be at greater risk of immunologic effects of fluoride."*
- *"Not a single epidemiologic study has investigated whether fluoride (<4mg/l) in the drinking water 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."*
- *"Studies of the effects of fluoride on the kidney, liver, and immune system indicate that exposure to concentrations much higher than 4 mg/L can affect renal tissues and function and cause hepatic and immunologic alterations"*

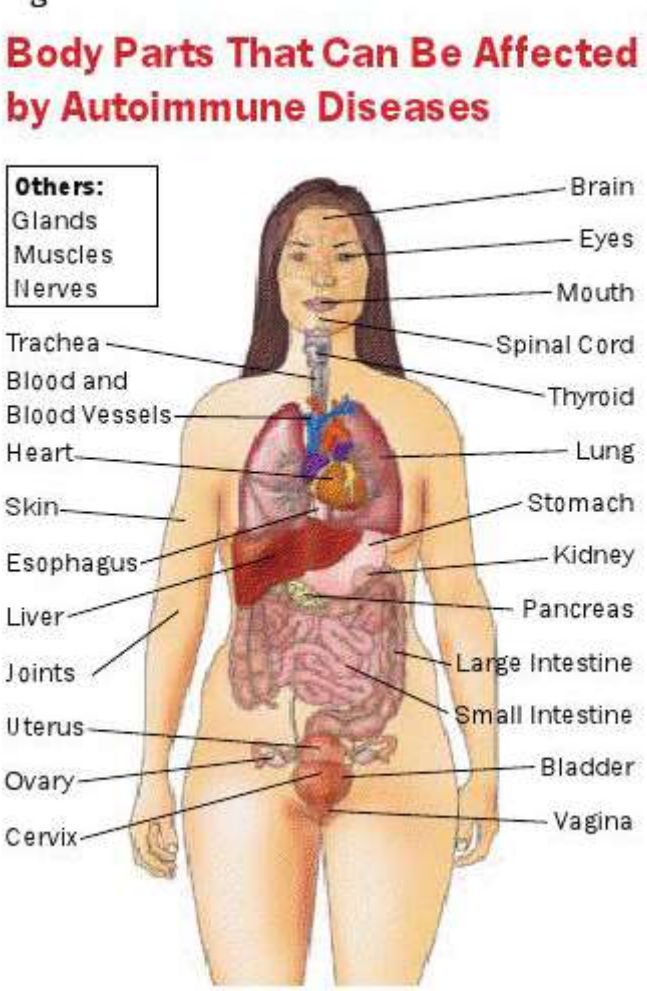
Note: This latter statement is important in the context of total fluoride intake from beverages including drinking water, soft drinks and tea as tea can have a fluoride concentration of 4mg/l or more of fluoride when constituted with fluoridated water. For a significant proportion of the population the consumption of tea continues to be the single major intake of fluids.

Common Immune Disorders in Ireland

The immune system is a complex network of special cells and organs that defends the body from "foreign" invaders. These invaders can include germs, viruses and antigens. At the core of the immune system is the ability to distinguish between self and non-self: what's you and what's foreign. A flaw can make the body unable to tell the difference between self and an no self. When this happens, the body makes autoantibodies that attack normal cells by mistake. At the same time, special cells called regulatory T cells fail to do their job of keeping the immune system in line.

The result is a misguided attack on your own body. This causes the dame we know as an autoimmune disease.

Figure 10



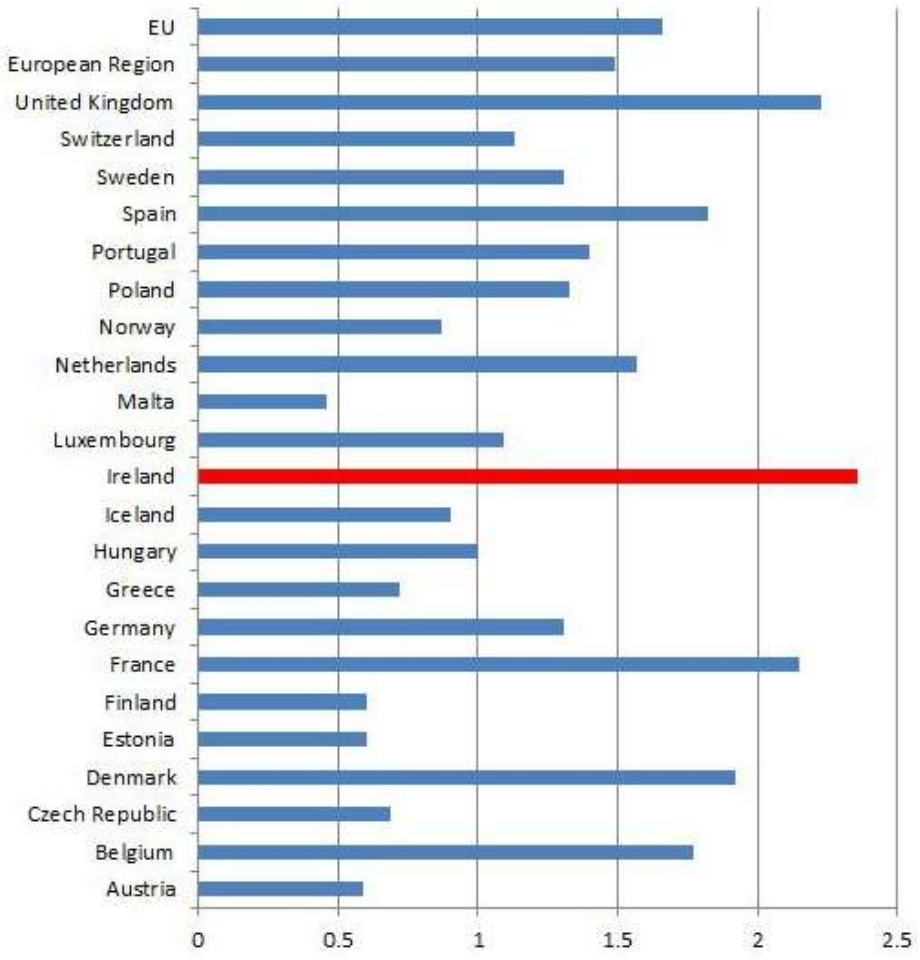
Alterations in the immune system such as immune modulation, hypersensitivity, and autoimmunity can lead to a decreased quality of life. Human allergic diseases constitute the most common causes of chronic illness in developed countries. Human autoimmune diseases are also rising. To date, more than 80 systemic and organ-specific autoimmune diseases have been defined, and their cumulative burden is substantial, both medically and financially. In developed countries around the world, 5 to 7% of the population is affected and rates are rising. Many immune disorders are deeply rooted in the endocrine system and, therefore, inappropriate activation or inactivation of select endocrine pathways may aberrantly disturb the balance of the immune response. This is due to the fact that the immune and the endocrine systems are intricately connected, ensuring that the body can simultaneously handle infections, stress, the immune response, and hormonal signalling.[242] EDCs have been linked with disorders of metabolism, energy balance,

thyroid function and reproduction, as well as an increased risk of endocrine cancers (Walker & Gore, 2011).[243] Importantly research has also demonstrated that fluoride has the ability to affect the cells of the human immune system.[244] These studies revealed that fluoride damages the human lymphocyte system. The authors of this study concluded that the ability of fluoride to negatively impact the mitogenic and antigenic response of human blood lymphocytes could be one of the primary means by which the fluoride ion influences the immune system.

Blood disorders and Immune mechanisms

The WHO have documented that the ROI has the highest incidence of mortality for disorders involving immune mechanisms including severe immuno deficiency, diseases of the blood and blood forming organs, as well as nutritional anaemia's, haemolytic anaemia, aplastic anaemia's, coagulation defects and haemorrhagic conditions.[245]

Figure 11. Mortality rates per 100,000 for diseases of the blood including severe immuno deficiency,



Source: WHO European Health Database 2012

Sarcoidosis an inflammatory autoimmune disease

Ireland has one of the highest incidences of sarcoidosis disease in the worldwith a prevalence of this disease over twice that of Northern Ireland or Europe. [246,247] It is thought that an environmental contaminant plays a role in the development of the disease.

For 1996-2005, the prevalence of sarcoidosis was 28.13 per 100,000 for ROI compared with 11.16 per 100,000 for NI.[248] Two significant spatial clusters of disease were detected in the Northwest (Prevalence = 44.9 per 100,000) and also the Midlands region (32.1 per 100,000). Two lower-prevalence spatial clusters were also detected in the South and Southeast of ROI. Perhaps the highest incidence of this disease recorded in the world was observed in a Galway/Mayo cluster where a prevalence of 96.55 per 100,000 was recorded.[249] In 2004 there were nine reported deaths from this disease in Ireland.[250]

The regional clusters appear to match the regions of the country where the drinking water is particularly soft as well as fluoridated. Considering the direct affect of fluoride on the immune system and its ability to cause inflammatory responses, it is biologically plausible that fluoride exposure, as a contaminant in water, may be contributing to the prevalence of this disease burden in Ireland.

Rheumatoid arthritis

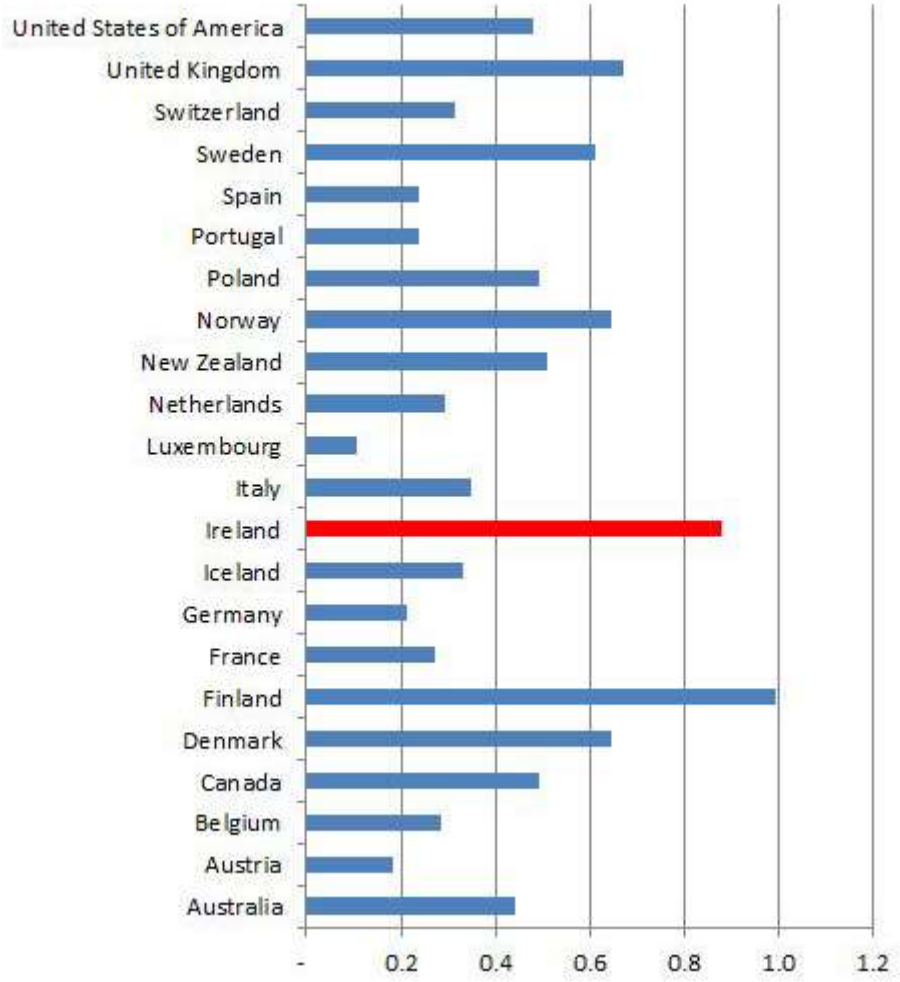
Rheumatoid arthritis is an auto immune disease, a chronic, systemic inflammatory disorder resulting from an abnormal immune system. It is not surprising therefore to find that the highest prevalence of Rheumatoid arthritis (RA) is to be found in countries where the population are exposed to fluorides in drinking water, given that the National Academy of Sciences found *"there can be no question that fluoride can affect the cells involved in providing immune responses"* and that *"fluoride also augments the inflammatory response to irritants."* [251]

Rheumatoid arthritis affects around 400,000 people or 1 in 156 of the population in the UK[252](ten per cent of population provided with fluoridated water), compared to 40,000 or 1 in 112 of the population in Ireland[253] (70-80 per cent provided with fluoridated water) and 1 in 178 in Northern Ireland (non-fluoridated).[254]

The fact that the incidence of RA in Northern Ireland is approximately 60% less than in the Republic of Ireland is very significant and again demonstrates beyond reasonable doubt that exposure to fluoride (fluoride exposure is the only known variable between the two populations) is a major contributor to the incidence of RA among the population of Ireland.

The prevalence of RA in Ireland at 0.89% of the population demonstrates a significantly higher incidence of RA among the population compared to the UK at 0.63% (10% of population fluoridated) and Northern Ireland (non-fluoridated) 0.55% which is similar to the prevalence of RA in non-fluoridated Sweden at 0.51%[255] and non-fluoridated the Netherlands at 0.64%.

Figure 12. Mortality from Rheumatoid Arthritis Deaths per 100,000
Source: WHO Department of Health and Measurement Information 2011



One of the highest prevalence of RA in the world is in Australia[1] at 1.7% where fluoridated drinking water is provided to approximately 80% of the population and where due to climatic conditions the consumption of water would be greater than in temperate northern European countries.

Similarly the prevalence of RA is high in fluoridated New Zealand where some reports estimate the disease affects 1-2% of the population.[1]

The incidence of RA is also high in fluoridated Canada where it is estimated that 1% of the population suffer from this disease.[1] Peer-reviewed studies by Gabriel, Crowson, et al.[256] and Linos, Worthington, et al.[257] with years of data collection

ranging from 1950-1985, found that 1.02% to 1.07% of Americans who visited heath care providers had RA.

The prevalence of RA in Singapore where drinking water is also fluoridated is likewise estimated at 1% of population.[1] As with Australia water consumption would be high in Singapore due to climatic conditions however the concentration of fluoride in drinking water in Singapore is half that of Australia, this may explain the difference between the two countries.

The WHO have documented that Ireland after Finland has one of the highest incidence of deaths per 100,000 of the population from this disease globally.[258] Finland discontinued water fluoridation in 1991. While rheumatoid arthritis is very prevalent in Scandinavian countries it is also known that some drinking water supplies in these countries contain elevated levels of fluoride naturally.

The epidemiological data would clearly indicate that the significantly higher prevalence of this disease among the population of ROI compared to non-fluoridated NI or the UK (10% fluoridated) combined with the increased prevalence in other fluoridated countries such as Australia, New Zealand, Canada and USA clearly demonstrates an association of this disease with exposure to fluorides its ability to cause an inflammatory response as well as impair the body's immune system.

Obesity and Diabetes *Key Findings of the NRC Scientific Committee*

The NRC noted that "*animal studies[259] on diabetic rats considered to be an animal model for human Type II (noninsulin-dependent) diabetes mellitus and found that even though the study was terminated before an age that might be more comparable to ages associated with late-onset diabetes and diabetic complications in humans, significantly increased fluoride concentrations was found in the bone that were in the range associated with fluorosis in humans and exceeded concentrations of bone fluoride associated with decreased bone strength. In a second study[260] fluoride exposure to fluoridated water was seen to significantly alter blood glucose levels in diabetic animals and plasma fluoride levels were higher. In similar animal studies considered representative of Type I (insulin-dependent) diabetes mellitus in humans the NRC reported that the general severity of the diabetes (blood glucose concentrations, kidney function, weight loss) was worse in animals given fluoride in their drinking water and plasma, soft tissue, and bone fluoride concentrations were elevated. Thus, the NRC reported that any health effects related to plasma or bone fluoride concentrations, for example, would be expected to occur in animals or humans with uncontrolled (or inadequately controlled) diabetes at lower fluoride concentrations in drinking water than for non-diabetics, because of the elevated water intakes.*"

In addition, according to the NRC the results reported suggested that, *"for some situations (e.g., diabetes in which kidney function is compromised), the severity of the diabetes could be increased with increasing fluoride exposure".* [261],[262],[263]

The NRC reported *"that human studies*[264] *found impaired glucose tolerance in 40% of young adults with endemic fluorosis, with fasting serum glucose concentrations related to serum fluoride concentrations; the impaired glucose tolerance was reversed after 6 months when fluoride concentrations were reduced in drinking water."*

It is not clear, according to the NRC, *"whether individuals with elevated serum fluoride and impaired glucose tolerance had the highest fluoride intakes of the group with endemic fluorosis or a greater susceptibility than the others to the effects of fluoride. In all fluorosis patients a significant positive correlation between serum fluoride and fasting serum immunoreactive insulin (IRI) was observed, along with a significant negative correlation between serum fluoride and fasting glucose/ insulin ratio. The authors of the study suggested that the observed increases in both IRI and serum glucose indicate elevated pro-insulin or insulin resistance."*

The NRC reported that *"inhibition of one of the prohormone convertases (the enzymes that convert proinsulin to insulin) would result in both elevated proinsulin secretion and increased blood glucose concentrations and would be consistent with the decreased insulin secretion reported in other studies."*

The conclusion of the NRC 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 and noted that given the increasing prevalence of diabetes mellitus "any role of fluoride exposure in the development of impaired glucose metabolism or diabetes is potentially significant.""*

Importantly the NRC also observed that "*It is possible that the decline in glucose utilization is an early sign of the onset of dementia."*

Dementia is a disease which is growing alarmingly in prevalence in Ireland.

Incidence of Obesity in Ireland

The findings of the WHO and UNEP report on endocrine disruptors is of great significance to understanding the health burdens in ROI and other countries that use water fluoridation chemicals for the treatment of drinking water not only for identifying water treatment chemicals as low dose EDCs but the manner in which explain how EDCs contribute to disease burdens such as obesity and diabetes.

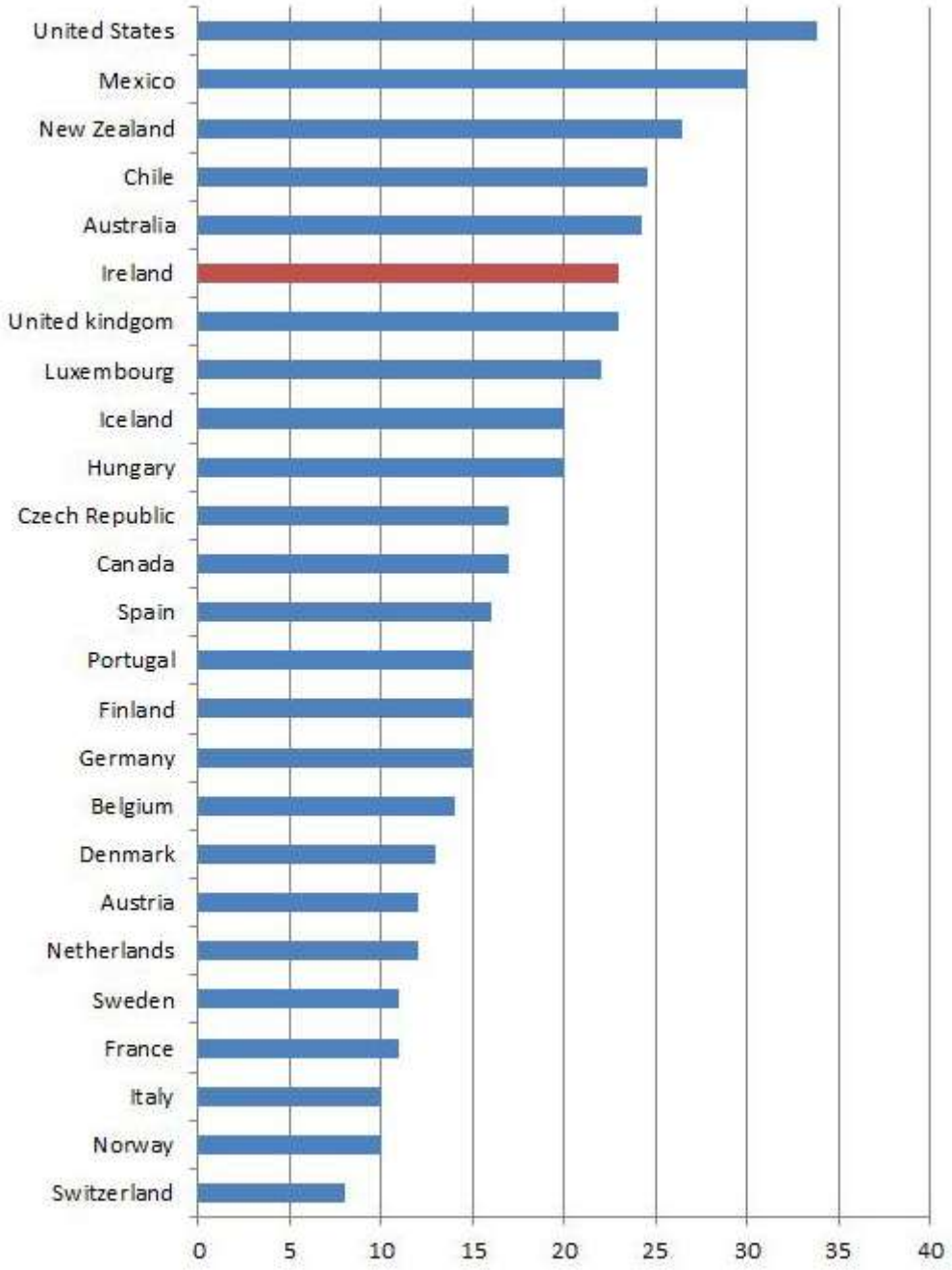
It is self-evident when one examines the geographic distribution of obesity that countries which practice artificial fluoridation have the highest incidences of obesity worldwide. The fact that water fluoridation chemicals are now recognised as EDCs should clearly result in the cessation of water fluoridation and protection of public health based on the precautionary principle. The WHO and UNEP report clearly states that extremely low levels of EDCs can have a profound impact on the endocrine system. According to the report exposures to such chemicals especially during early development (i.e bottle fed infants consuming formula milk made up with fluoridated water) can disrupt the endocrine system involved in controlling weight gain (adipose tissue, brain, skeletal muscle, liver, pancreas and gastrointestinal tract), as noted in the report these chemicals constitute a new class of endocrine disruptors called "obesogens". Exposures to such such chemicals have also been shown to result in in altered glucose tolerance and reduced insulin resistance. The NRC scientific committee (2006) similarly reported on the ability of fluoride to cause glucose intolerance and reduce insulin resistance. It is also well recognised that the inhibition of glucose metabolism is a risk factor in weight gain and obesity.

According to a recent OECD report the countries with the highest incidence of obesity are the United States, New Zealand, Chile, Australia, Ireland and UK. Water fluoridation is practiced in each of these countries to varying degrees. Mexico a country that was also identified with significantly higher obesity levels has both a high level of naturally occurring calcium fluoride in drinking water and has mandatory legislation for salt fluoridation.

The prevalence of obesity in the U.S is 35% for males and 36% for females, in Canada 37% for males and 23% for females, Australia 35.6% for males and 21% for females, New Zealand 25% for males and 26% for females.[1]

[1] International Obesity Taskforce, Obesity Worldwide 2008-2010.

Figure 13. Obesity Rates Amongst Adults



Source: OECD Health Indicators 2011

In Ireland, based on the findings from the 2008-10 National Adult Nutrition Survey (NANS), estimated prevalence of overweight in adults is 37%, with a further 24% meeting current body mass index (BMI) criteria for obesity with 26% for males and 21% for females documented as obese. The prevalence of obesity in 18-64 year old adults has increased significantly between 1990 and 2011, from 8% to 26% in men, and from 13% to 21% in women, with the greatest increase observed in men aged 51-64 years.[265] Notwithstanding other lifestyle and dietary factors this is also the latter sub group represents individuals with the highest lifetime exposure to

fluoride in the Republic of Ireland since commencement of artificial fluoridation in mid-1960s. It is also worth noting that figures for obesity in Ireland are considerable above the EU average.

Mexico has one highest incidences of dental fluorosis in the world, yet mass fluoridation of salt is mandatory. Government policy provides for 250 mg of fluoride to be added to each kilogram of salt destined for human consumption (table salt, cooking salt, breads and bakery products, processed foods, etc.). The current consumption of fluoridated salt per person – child or adult – is estimated at 7.14g per day[266] bringing the fluoride dietary intake from salt alone to 1.85mg similar to the dietary intake from consuming artificially fluoridated water. This may help explain the incidence of obesity in Mexico which stands at over 30% of the population, a level comparable to the USA.

Other Latin American countries with extremely high prevalence of obesity include Argentina. In Argentina extremely high fluoride levels have been recorded in groundwater with large sectors of the population exposed to very high levels of fluoride. A survey undertaken in 2003 found that less than 3% of groundwater samples had fluoride levels less than 1.5mg/l with fluoride concentrations ranging from 0.9–18.2 mg l–1, with a mean value of 3.8 mg l.[267] In addition to naturally elevated fluoride levels artificial fluoridation is practiced in parts of the country where approximately 20% of the population consume artificially fluoridated drinking water. It is not surprising therefore to find that Argentina has the highest incidence of obesity and overweight children in Latin America.[268]

A recent scientific review by Vandenberg et al.[269] (2012) examining low dose exposures to endocrine-disrupting chemicals (EDCs) lists water fluoridation additives added to prevent dental caries as EDCs with reported low dose effects in animals or humans. The report documents that they inhibit insulin secretion, inhibit parathyroid hormone secretion and reduce thyroid hormone output. A current publication on endocrine disrupting chemicals by international experts for the WHO and United Nations Environment Programme also lists water fluoridation chemicals as low dose EDCs.[270]The report highlights how obesity, diabetes and metabolic disorders are due to disruption of the energy storage–energy balance endocrine system and thus are potentially sensitive to EDCs. .According to the report fat development and weight gain is a good example of complex physiological systems that are influenced by endocrine disruptors. There are a number of endocrine disruptors that have been shown to affect weight gain, insulin sensitivity and glucose tolerance indicating a potentially important role for endocrine disruptors in the development of obesity type 2 diabetes and metabolic syndrome. The elements

of the endocrine system that control weight gain and metabolism/energy expenditure include the adipose tissue, pancreas, GI tract, liver, skeletal muscle, bone and brain, and endocrine disruptors could specifically and directly affect each of these tissues by interfering with their various hormone systems.[271]

The NRC review (2006)identified how fluoride and fluoride compounds may interfere with each of these tissues.

There are now animal data suggesting that exposure to some endocrine disrupting chemicals during pregnancy can lead to altered cholesterol metabolism, weight gain and type 2 diabetes in the offspring later in life[272]. There is evidence that the obesity risk may begin early in life, during pregnancy, and in early childhood and that rapid weight gain, in the first few months of life, is associated with obesity later in life (Ong et al., 2000[273]; McAllister et al., 2009[274]) Because obesity is an endocrine-related disease/dysfunction, it is potentially sensitive to endocrine disrupting chemicals (Ropero et al., 2008[275]; Sargis et al., 2010[276]).

In addition to the well-established modern societal influences of over-nutrition and lack of exercise, it has been hypothesized that exposures to chemicals are also contributing to the rapid rise in cases of obesity (Newbold et al., 2008[277]; Newbold, 2010[278]; Keith et al., 2006[279]). Indeed, there are now data in animal studies indicating that chemical exposures during vulnerable windows of development may affect adult weight (Newbold, Padilla- Banks & Jefferson, 2006[280]; Baillie-Hamilton, 2002[281]). For instance, there are animal data suggesting that developmental exposure to chemicals can lead to altered cholesterol metabolism and weight gain later in life (Newbold, Jefferson & Padilla Banks, 2007[282]; Newbold et al., 2008[283]; Grun et al.,2006[284]; La Merrill & Birnbaum, 2011[285]; Heindel & vom Saal, 2008286; Li, Ycaza & Blumberg, 2011[287]; Slotkin, 2011[288]; Dirinck et al., 2011[289]; Janesick & Blumberg, 2011[290];

Chemicals with endocrine disrupting properties may potentially act either on specific or multiple sites to:

- Alter endocrine pathways responsible for control of adipose tissue development
- Increase the number of fat cells
- Alter food intake and metabolism via effects on sexually dimorphic and appetite and reward centers in the brain
- Alter insulin sensitivity and lipid metabolism via effects on endocrine (and endocrine-related) tissues such as the pancreas, adipose tissue, liver, GI tract, brain and muscle

The net result of these changes is an alteration or deregulation of the "endocrine set point" or changes in homeostatic sensitivity that predisposes individuals to obesity later in life.[291]

It is no surprise (where fluoride is a risk factor in both diabetes and obesity) to see such a high incidence of both diseases in countries where water fluoridation may not be practiced but where the resident populations are exposed to dietary fluoride levels through fluoridated salt consumption and high natural fluoride water levels similar if not higher than in fluoridated North America, Canada, Australia, New Zealand or Ireland.

Incidence of Diabetes in Ireland

In Ireland, it is estimated that there are 200,000 people with diabetes and a further 200,000 who have diabetes but are unaware that they have the condition.[292] The majority of the latter group will only be diagnosed through an acute medical event of the complications of long term untreated hyperglycaemia.

A further 250,000 people have impaired glucose tolerance or "pre-diabetes" of which 50% will develop diabetes in the next 5 years if lifestyle changes are not made.[2]

Type I (insulin dependent) diabetes is increasing in children, particularly in under-fives while Type 2 (non-insulin dependent) diabetes is increasing across all age groups. In Ireland, the incidence of type 1 diabetes is 16.8 per 100,000, which is above the European average.[3]

The prevalence of diabetes in Ireland is estimated at 6.1 per cent of the population, however it is accepted that this figure is an underestimation as it does not include those that have diabetes but are unaware they have the condition. According to the WHO the standardised disease ratio for diabetes (2010) in Ireland for all ages is 9.5 per 100,000 compared to 5.97 for the UK.

The prevalence of diabetes in non-fluoridated NI is 3.8 per cent of the population, while the UK average is 4.45%.[4] A 60% increase in the incidence of diabetes in Southern Ireland compared to NI is highly significant for such a small island. The significantly increased disease burden of diabetes in Ireland clearly supports the

[2] Diabetes Federation of Ireland
[3] Diabetes: The Policy Puzzle, Is Europe Making Progress, The International Diabetes Federation (2012).
[4] Diabetes UK

findings and observations of the NRC review and highlights that the contribution of silicofluorides and fluoride in drinking water may be a significant risk factor in the current disease burden present in southern Ireland today.

A highly alarming trend in recent years shows from HSE hospital data that rates of stroke and kidney failure among people with diabetes have now reached record levels in Ireland. The figures suggest that rates of inpatient treatment for stroke and kidney failure were significantly higher in 2010 than in 2006. A 36% rise in strokes among people with diabetes since 2006 has been recorded, with 1,134 people with diabetes treated for stroke in 2010. For kidney failure, the 2010 rate is 62% higher than 2006 with over 4,300 people with diabetes being treated in hospital for kidney failure in 2010.[293]

It is important to acknowledge that the NRC identified diabetics and individuals with impaired kidney function as two of the most sensitive subgroups to fluoride toxicity.

The recent sharp increase in mortality from strokes and kidney failure in Ireland may therefore represent a growing trend in future years as the numbers of incidence of both diseases continues to rise.

Musculoskeletal Disease *Key Findings of the Scientific Committee*

According to the National Research Council, *"excessive intake of fluoride will manifest itself in a musculoskeletal disease with associated symptoms such as chronic joint pain, arthritic symptoms, calcification of ligaments and osteosclerosis of cancellous bones. In patients with reduced renal function the potential for fluoride accumulation in the skeleton is increased. People with renal insufficiency will have elevated plasma fluoride concentrations compared to normal healthy persons."*

The scientific committee found that *" lifelong exposure to fluoride at 2mg/L fall within or excess the range associated with Stage II and Stage III skeletal fluorosis."*

All members of the committee agreed that there is scientific evidence that under certain conditions fluoride can weaken bone and increase risk of fractures.

The figure of 2mg/L must be examined in the context of total fluoride intakes from consumption of liquid beverages, not just water. In Ireland the main beverage consumed by adults is tea, which may have fluoride content in the range of 3-6mg/L when prepared with fluoridated tap water.

Musculoskeletal Pain

Musculoskeletal pain is one of the most easily recognisable symptoms of overexposure to fluoride brought on from excessive quantities of fluoride deposited in the skeleton and soft tissues. The recently published Irish Longitudinal Study of Ageing, by Trinity College Dublin, found that musculoskeletal pain involving bones, muscles, ligaments, tendons, and nerves was the most widely reported condition amongst the wider Irish population. The study reported that there are approximately 585,000 people in Ireland who suffer from chronic pain representing 36% of all households in Ireland.[294]

This figure is likely however to be a significant underestimate as 1 in 5 people (915,000 individuals) suffer from arthritis in Ireland. It has also been reported according to a survey conducted by Chronic Pain and Pfizer that an estimated 400,000 adults suffer from chronic back pain alone in Ireland.[295] If you were to include chronic in cancer sufferers, where Ireland has the highest incidence of cancer in the EU region, this figure would increase significantly.

Chronic pain is also a condition that many diabetes sufferers have where it has been reported[296] that almost half of adults with type 2 diabetes report acute and chronic pain, in excess of 200,000 people in Ireland have type 2 diabetes.[297].

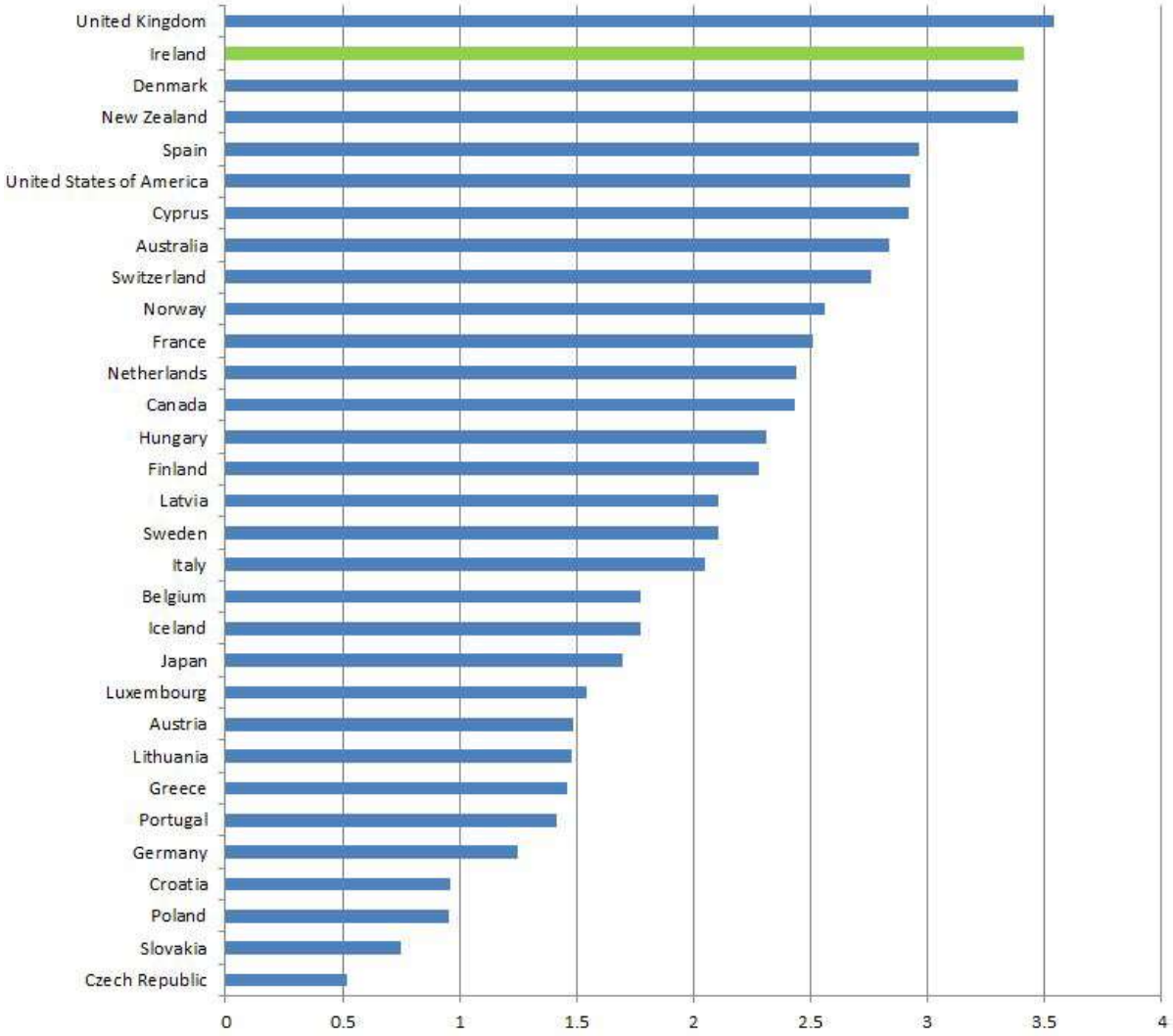
In addition over 300,000 people in Ireland over the age of 50 are estimated to have osteoporosis; osteoporosis is a condition that also causes severe pain in suffers.[298]

Furthermore, 1 in 112 of the population in Ireland suffers from Rheumatoid arthritis[299] which is also a condition which results in chronic pain for sufferers that may affect approximately 40,000 people in Ireland. The total costs of chronic pain have been estimated at €5.34bn per year, which is 2.86% of the Irish GDP in 2008.[300]

The Alberta Heritage Foundation for Medical Research published a Health Technology Assessment report[301] in 2002 on the prevalence of chronic pain. They concluded that overall, chronic pain prevalence ranges vary from 10.1% to 55.2%. When it comes to severe chronic pain, prevalence rates are increasing with age: 8% in children, 11% in adults and 15% in the elderly. The identified prevalence in Ireland was 13% of the adult population. A recent European study estimated a similar prevalence for the UK.[302]

According to the World Health organisation the RoI has the second highest mortality from musculoskeletal diseases in the EU next to the UK. Both countries are high tea drinkers and both countries practice water fluoridation affecting some 6 million UK citizens and approximately. 3.6million residents of the RoI. High mortality rates are also recorded for fluoridated New Zealand, the United States and Australia. Of the top eight ranking countries six are fluoridated.

Fig 14 **Age-standardized death rates per 100,000 Musculoskeletal Diseases WHO 2008**



According to the European Food Safety Authority with increasing fluoride incorporation into bone clinical stage I and II with pain and stiffness of joints, osteosclerosis of both cortical and cancelleous bone, osteophytes and calcification of ligaments develop. Crippling skeletal fluorosis (clinical stage III) may be associated with movement restriction of joints, skeletal deformities, severe calcification of ligaments, muscle wasting and neurological symptoms. All stages are accompanied by disturbed or deficient mineralisation of the bone, and osteomalacia may be present, particularly when calcium intake is insufficient.. Patients with renal insufficiency have an increased risk of developing skeletal fluorosis.

Arthritis

It has been estimated that the cost of arthritis in lost working days in Ireland is approximately 1.6 billion euro per annum.[303] Over 1 in 5 people have some form of arthritis in Ireland. This means around 915,000 (2011 census) Irish people have arthritis. Some 34% of women and 23% of men are affected by arthritis.[304] It is estimated that 18% (165,000 persons in Ireland) of arthritis patients are less than

55 years old, while 1,000 Irish children are living with juvenile arthritis (JA). By the year 2030, 25% of adults aged 18 years and older will have doctor-diagnosed arthritis.[305]

In comparison to Ireland, 23% of females in the UK will consult their GP with musculoskeletal problems and 17% of males. Overall one in five (20%) of the adult population in the UK has arthritis[306] compared to 29.1% of the adult population in Ireland.

Arthritis accounts for the largest category of GP visits in Ireland, with 30% of GP visits relating to musculoskeletal disorders, in comparison to 20% of GP visits in the UK.

Approximately 60% of people with arthritis will be treated within the primary healthcare system while the remainder will require specialist services to deal with arthritis in Ireland.

There is a significant burden of ill-health due to disability that is directly attributable to arthritis. For example according to Arthritis Ireland;

- 27% of people with arthritis also suffer from depression.
- 31% of people with arthritis also suffer from high cholesterol.
- 35% of people with arthritis also suffer from high blood pressure.
- 36% of people with arthritis also suffer from diabetes.
- 47% of people with arthritis also suffer from heart disease.
- 48% of people with arthritis also suffer from osteoporosis.

Osteoporosis

The immune system plays an important role in osteoporosis, which often arises from estrogen deficiency and secondary hyperparathyroidism (excessive production of parathyroid hormone (PTH) by the parathyroid glands situated at the back of the thyroid gland).[307]

Current research suggests that the remodelling of bone is a very tightly controlled process that is easily perturbed by small fluctuations in pro-inflammatory and inhibitory cytokines, NF-κB, together with hormones and their corresponding receptors (Clowes, Riggs & Khosla, 2005[308]).

An imbalance in this interplay, due to infection or inflammation, could tip the bone creation/bone destruction scale in favour of bone loss, which subsequently increases the risk of fracture. Furthermore, age-related fluctuations in the immune and endocrine systems add to the risk for decreased bone density. It is possible

that exposure to EDCs may influence the development of osteopenia and osteoporosis.[309]

Water fluoridation chemicals have been identified as low dose EDCs[310], therefore it is entirely plausible that fluoridation is contributing to the high level of Osteoporosis present in the ROI today.

It is estimated that 6.5% of the population in Ireland have osteoporosis[311,] compared to 3.2% for the UK. [312] This represents a 100% increased prevalence in the ROI.

The increased prevalence would support the findings of a recent study published in the British Journal of Radiology, which found that individuals living in predominantly fluoridated communities in the U.S.A., at fluoride levels comparable to Ireland, had a substantially increased prevalence of osteoporosis for both sexes (55% in women, 68% in men) compared to British subjects living in UK where only approximately 10% of the population have fluoridated water. [313]

Currently in the region of 300,000 people in Ireland over the age of 50 are estimated to have osteoporosis. One in 5 men and 1 in 2 women over 50 will develop a fracture due to Osteoporosis in their lifetime.[314]

Reproductive & Developmental Effects *Key Findings of the Scientific Committee*

According to the 2006 report issued by the National Research Council:

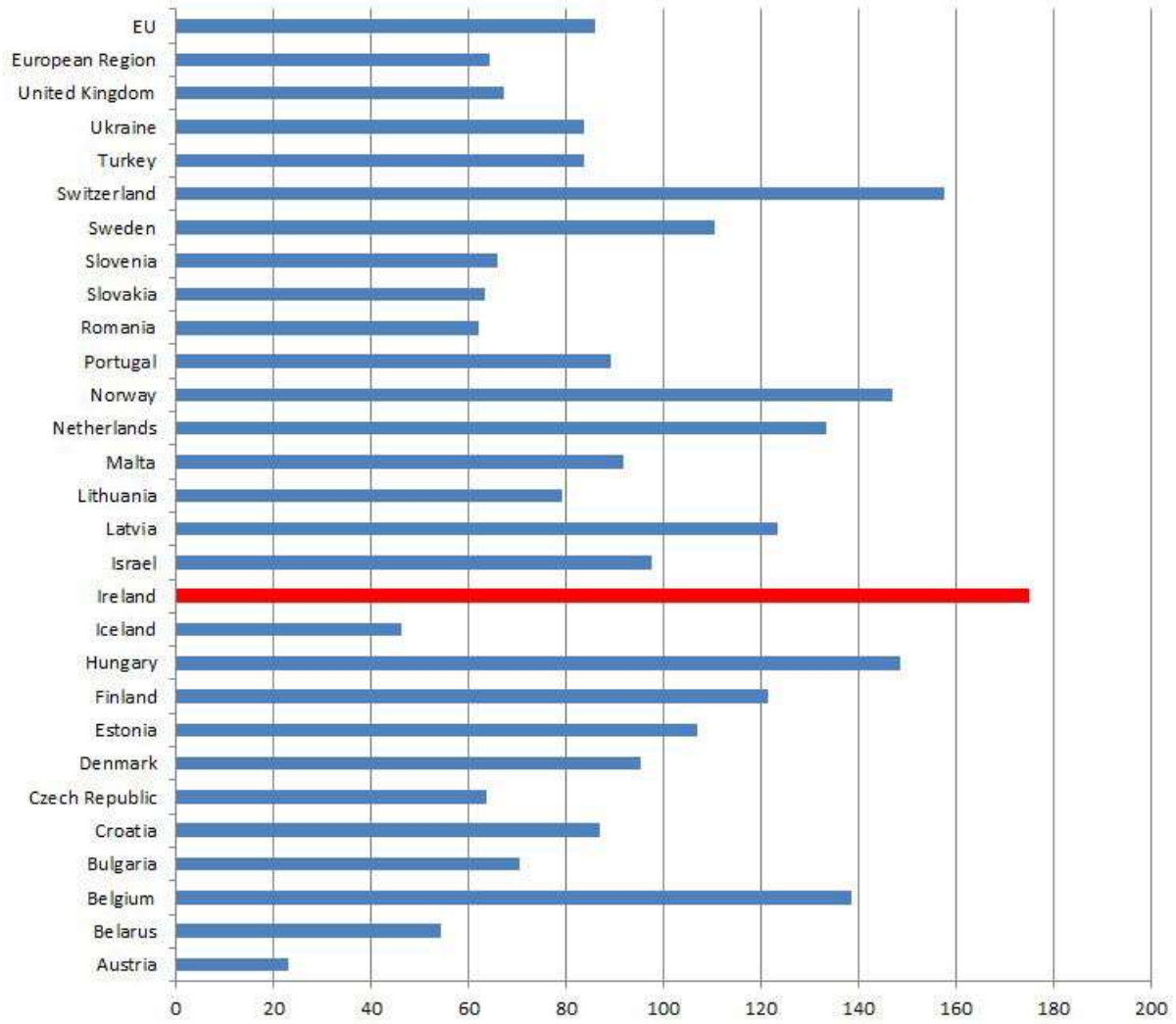
- *"The possible association of cytogenetic effects of fluoride exposure suggests that Down's syndrome is a biologically plausible outcome of exposure"*
- *"A few studies of human populations have suggested that fluoride might be associated with alterations in reproductive hormones, fertility and Down's syndrome"*

Incidence of Down's syndrome in Ireland

It is estimated that there are approximately 7,000 people in Ireland with Down syndrome, with one baby in every 546 births born with the congenital chromosomal anomaly.[315]

Many of the associated health conditions with Down's syndrome are also linked to potential fluoride toxicity including thyroid, neurological problems and gastro-intestinal problems as well as childhood cancers. In comparison 1 in every 1000 babies in the UK are born with Down's syndrome.[316]

Figure 15. **Births with Downs Syndrome per 100,000 live births**



Source: WHO Health Database European Region

A confounding factor may be the availability of abortion in the UK yet despite this antenatal screening and subsequent terminations of pregnancy in the UK has resulted in only a 1% fall in the number of babies born with Down's syndrome.[317]

Even taking into consideration the increasing age of mothers (which is also prevalent in other countries) and the subsequent increased risk of congenital abnormalities, the significantly increased prevalence of Down's syndrome in Ireland clearly suggests as indicated by the NRC that fluoride exposure could be contributing to increases prevalence of Down's syndrome.

Neurological Disease *Key Findings of the Scientific Committee*

According to the 2006 report issued by the National Research Council:

- *"It is apparent that fluorides have the ability to interfere with the functions of the brain and the body by direct and indirect means"*
- *"Fluorine also forms complexes with other elements including sodium, iron, calcium, magnesium, copper and hydrogen that may have implications for neurotoxic effects after fluoride or silicofluoride exposure."*
- *"Fluoride has been shown to decrease the activities of superoxide dismutase and glutathione peroxidase the consequences being increased free radicals"*
- *"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."*
- *"Fluorides also inhibit the activity of cholinesterases, including acetylcholinesterase.[5] Recently, the number of receptors for acetylcholine has been found to be reduced in the regions of the brain thought to be most important for mental stability and for adequate retrieval of memories. The progressive accumulation of acetylcholinesterase at synaptic locations produced by the diminished esterase activity leads to a number of complex effects that can be summarized as an initial increase in stimulation of the target cells but ultimately leads to diminished stimulation—even a blockade of all activity in addition to a depletion of acetylcholinesterase, fluoride produces alterations in phospholipids metabolism and/or reductions in the biological energy available for normal brain functions. In addition, the possibility exists that chronic exposure to AlFx can produce aluminum inclusions with blood vessels as well as in their intima and adventitia. The aluminum deposits inside the vessels and those attached to the intima could cause turbulence in the blood flow and reduced transfer of glucose and O2 to the intercellular fluids."*
- *"It appears that many of fluorides effects, and those of the aluminofluoride complexes are mediated by activation of Gp, a protein of the G family. G proteins mediate the release of many of the best known transmitters of the central nervous system. Not only do fluorides affect transmitter*

[5] Note: Alzheimer disease (AD) is strongly associated with reduced acetylcholinesterase. Ref:. Geula C, Mesulam MM. Department of Medicine, Harvard Medical School, Cholinesterases and the pathology of Alzheimer disease. Alzheimer Dis Assoc Disord. 1995;9 Suppl 2:23-8.

concentrations and functions but also are involved in the regulation of glucagons, prostaglandins, and a number of central nervous system peptides, including vasopressin, endogenous opioids, and other hypothalamic peptides. The aluminium fluoride binds to GDP and ADP altering their ability to form the triphosphate molecule essential for providing energies to cells in the brain. Thus, aluminium fluoride complexes not only provides false messages throughout the nervous system but, at the same time, diminishes the energy essential to brain function."

- *"G protein-coupled receptors mediate the release of many neural transmitters including the catecholamines, serotonin, ACh, and the excitatory amino acids. They also are involved in regulating glucagons, vasopressin, neuropeptides, endogenous opioids, prostaglandins, and other important systemic influences on brain and behavior. AlFx is also involved in regulating the pineal melatonin system as well as the thyroid-stimulating hormone growth hormone connection. It has been said in this regard "every molecule of AlFx is the messenger of false information"*
- *"the disruption of aerobic metabolism in the brain, a reduction of effectiveness of acetylcholine as a transmitter, and an increase in free radicals are thought to be causative factors for this disease (Alzheimer's). More research is needed to clarify fluoride's biochemical effects on the brain"*
- *"The G protein effects produced by AlFx are not limited to enzymes that bind phosphates or nucleoside-polyphosphate. AlFx also impairs the polymerization-depolarization cycle of tubulin."*[6] *See note below.*
- *"There are numerous reports of mental and physiological changes after exposure to fluoride from various routes (air, food, and water) and for various time periods. A number of the reports are, in fact, experimental studies of one or more individuals who underwent withdrawal from their source of fluoride exposure and subsequent re-exposures under "blind" conditions. In most cases, the symptoms disappeared with the elimination of exposure to fluoride and returned when exposure was reinstated. In some instances, when the fluoride was given in water, this procedure was repeated several times under conditions in which neither the patient nor the provider of the fluoride knew whether the water contained fluoride. Also reported are instances when fluoride-produced symptoms occurred when people moved into a community with fluoridated water but disappeared when the individuals moved to a non-fluoridated community"*
- *"An especially important neurochemical transmitter that reaches almost all areas of the brain is ACh. Some studies have shown that NaF and SiF inhibit cholinesterases, including acetylcholinesterase. The progressive accumulation of ACh at synaptic locations produced by the diminished esterase activity leads to a number of complex effects that can be summarized as an initial increase in stimulation of the target cells but ultimately leads to diminished*

[6] The cycle of tubulin influences the production of tumours and cancer.

stimulation—even a blockade of all activity."

- *"One system particularly sensitive to carbohydrate utilization is the collection of areas involved with the synthesis of ACh. The release of this transmitter is also negatively affected by the interruption of aerobic metabolism and the effect can be noticed in the projection* fields of the cholinergic systems."
- *"Fluoride produces additional effects on the ACh systems of the brain by its interference with acetylcholinesterase"* (Note: Alzheimer disease (AD) is strongly associated with reduced acetylcholinesterase)[318]
- *"Fluorides also distort the structure of cytochrome-c peroxidase"*[7]
- *"There is evidence that fluoride enhances the uptake of aluminium"*
- *"Exposure to fluorosilicates could occur under some conditions. There are reports that such chemicals enhance the uptake of lead*[8] *into the body and brain, whereas NaF does not."*

Anatomical Changes in the Brain

"Studies of rats exposed to NaF or AlF3 have reported distortion in cells in the outer and inner layers of the neocortex. Neuronal deformations were also found in the hippocampus and to a smaller extent in the amygdala and the cerebellum. Aluminum was detected in neurons and glia, as well as in the lining and in the lumen of blood vessels in the brain and kidney. The substantial enhancement of reactive microglia, the presence of stained intracellular neurofilaments, and the presence of IgM observed in rodents are related to signs of dementia in humans. The magnitude of the changes was large and consistent among the studies. Given this, the committee concludes further research is warranted in this area"

AluminoFluorides *Key Findings of the Scientific Committee*

- *"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 anatacids or medications, deodorants, cosmetics, and glassware. Aluminium in drinking water comes from both the alum used as a flocculent or coagulant in water treatment and from leaching of aluminium into natural water by acid rain."*
- *"Aluminofluorides might influence the activity of a variety of phosphatases, phosphorylases, and kinases, as well as the G proteins involved in biological signalling systems."*

[7] Cytochrome c peroxidase main function is to destroy radicals which are normally produced within the cells and which are toxic to biological systems.
http://www.uniprot.org/uniprot/P00431

[8] Note: Lead is a neurotoxin and carcinogen

Silicofluorides *Key Findings of the Scientific Committee*

"The toxicity database on silicofluorides is sparse and questions have been raised about the assumption that they completely dissociate in water as well as comparing their toxicity to fluoride salts. No studies have compared the toxicity of silicofluorides to fluoride salts used for fluoridation of water."

- *"It is reasonable to expect that some silicofluorides would be present in acidic beverages or products made from fluoridated tap water especially fruit juice from concentrate, tea and soft* drinks. *Consumption rates of these beverages are high for many people, and therefore the possibility of biological effects of silicofluorides should be examined."*
- The NRC observed that *"symptoms such as oral ulcers, colitis, urticaria, skin rashes, nasal congestion and epigastric distress may be due to sensitivity of sufferers to silicofluorides present in drinking water ."*
- The NRC observed *"human leukemic cells lines may also be susceptible to the effects of hexafluorosilicicate the compound used for fluoridation."*
- The NRC noted that "*silicofluorides were found to inhibit cholinesterases, including acetylcholinesterase".* (Note: Alzheimer disease (AD) is strongly associated with reduced acetylcholinesterase)[319]

Acetylcholinesterase and Neurological Disorders

A study by Finney, et al[320] (2006) investigating the dissociation of silicofluorides in drinking water presented evidence that silicofluoride results in the creation of either "colloidal silica" or an "oligomerosilicate": the first is a sheet of silicate, the second a string of silica atoms, like beads. Either of these structures can influence brain chemistry by acting as acetylcholinesaterase inhibitors.

The primary toxic effect of Acetylcholinesterase inhibitors is to block the normal breakdown of the neurotransmitter, **acetylcholine** which is critical for concentration and learning functions of the brain. Research into Attention Deficit Hyperactivity Disorder (ADHD) in children undertaken by the Experimental Neuropsychiatric Research Group of Örebro University Sweden, found that children with ADHD had dramatically reduced levels of acetylcholine which could lead to problems with concentration and learning.[321],[322]

Therefore the possibility that silicofluoride (SiF) compounds from water fluoridation chemicals may act to increase the risk of children developing ADHD, or may contribute to the existing disability in children or adults cannot be overlooked. The prevalence of the disability has increased significantly in Ireland in the recent past

in parallel with the epidemic of alcohol and substance abuse since the mid 1970's a period from which over 50% of the population of Ireland were consuming artificially fluoridated drinking water.

It is currently estimated to affect around 60,000 children under 18 years of age. According to consultant child and adolescent psychiatrist, Dr. Keith Holmes, more than half of young people diagnosed with the condition will be prescribed medication. The cost for ADHD drugs for children paid for by the state in 2009 was in excess of €3.2 million. A further 120,000 adults in Ireland are now also believed to be living with this disability.

Several studies have shown a strong connection between ADHD, drug abuse, and alcoholism.[323],[324],[325],[326],[327],[328],[329],[330],[331],[332],[333] ADHD is five to 10 times more common among adult alcoholics than it is in people without the condition. It is also more common for children with ADHD to start abusing alcohol during their teenage years.

Substance Abuse and Behavioural Toxicity

It is important to reference the increase in substances abuse amongst the population of Ireland based on the findings of Professor Roger Masters and Dr. Coplan who have highlighted through his published research investigating the linkages between exposure to silicofluorides and increased substance abuse, violent behavior and learning disabilities. [334],[335],[336],[337],[338],[339],[340],[341],[342],[343],[344]

An assessment of the nature and extent of drug abuse shows that since 1979 there has been an alarming increase in drug abuse among young people in Ireland. Surveys of schoolchildren and young people indicate a sixfold increase in drug experimentation. The number of heroin addicts and other opiate addicts seeking treatment increased 5-6 times during the period from 1979 to 1983. Statistics show the existence of a significant drug abuse problem involving illegal drugs, as well as legal drugs and medicines.[345] In 2011 Ireland the European Monitoring Centre for Drugs and Drug Addiction reported that Ireland had the highest users of opiates in the EU, second highest users of ecstasy, fourth highest for cocaine as well as crack cocaine.[346]

Professor Masters forwarded to my offices hardcopies of some of his published research which I subsequently forwarded by registered post in mid-2012 to the Government of Ireland and its various departments and agencies including the Environmental Protection Agency, Department of Health, Department of Environment and Local Government and the Department of Justice among others. I have yet to receive any reply or acknowledge to this communication.

Professor Master's main concern regards the ability of silicofluorides used for water fluoridation to increase environmental exposures to other toxins. His research shows, where water is treated with hydrofluorosilicic acid, children's blood levels are significantly higher (roughly twice the level compared to children in non-fluoridated communities. Masters has identified individuals who are lactose intolerant or who have a calcium intake as high risk subgroups within populations. Low calcium intake permits divalent lead to bond to sites in proteins normally filled by divalent calcium. Research undertaken by Masters has identified that silicofluorides have been found to leach lead from copper pipes and soldered connections (especially if used in combination with either chlorine or chloramine and that the combination of silicofluorides and other heavy metals such as lead may contribute significantly to disease burdens and behavioral toxicity in certain individuals.

As I previously highlighted in correspondence dated the 15th June 2012 forwarded to the Minister for Health and the EPA, this is a matter of particular concern to many in Ireland given that lead drinking water pipes remain in use in some local authorities. In addition lead fittings would be found in many houses build pre-1970's in Ireland.

Masters research also demonstrates that increased substance abuse and violent behavior is to be found in communities exposed to silicofluoride water fluoridation chemicals. No study has ever been undertaken in Ireland to examine the link between fluoridation chemicals increased bioavailability of environmental toxins and behavioral toxicology. Masters has identified that the lower income sectors of society are a high risk group to the neurological toxicity of silicofluorides and metal fluoride compounds due to poorer nutrition and generally poorer standard of building infrastructure. This may have some significance to certain urban geographic areas in Ireland where both violent crime and substance abuse is rampant.

Substance abuse is however now prevalent throughout Ireland. According to the National Advisory Committee on Drugs[347], it is clear that indicators are pointing to an upward trend in drugs and alcohol abuse. The extent to which cocaine use has increased is exampled by the apparent three and four-fold increase in those seeking treatment for cocaine use as a primary and secondary problem drug respectively. Cocaine is one of the multiple substances commonly used; the others are alcohol, cannabis and ecstasy. Since the early 1990s the number of new cases seeking treatment for cocaine problems has increased most years and now represents a larger share of the total treatment seeking population than ever before. A higher proportion (4.7%) of young respondents (15–34 years) had used cocaine in their lifetime (more than three times greater than the rate for the 35–64 age groups). Cocaine ranked fourth after cannabis (18%), magic mushrooms (4%) and ecstasy (4%), as the most commonly used illegal drugs.

In the context of Professor Master's research it is important to note that the Institute of Public health noted in their report of 2001 that the incidence of mortality from drug dependence in the ROI is 31% higher in the ROI compared to NI.[348] Ireland also has the highest users of opiates in EU, second highest users of ecstasy, fourth highest for cocaine as well as crack cocaine.[349]

A recent report commissioned by the Health Service Executive finds that alcohol consumption (per head of population) in Ireland shows an increase of 48% over the twenty-year period 1986-2006, ranking third in per adult alcohol consumption when compared with other EU countries. [350]

The Department of Health and Children have reported that *"there is clear evidence that "young Irish men (18-29 age group) reported the highest consumption of alcohol and had more binge drinkers than any other group in the population"* [351]

It has also been reported that compared with their European counterparts, young Irish adults are generally characterized by high levels of alcohol intoxication that causes a disturbing increase in medical and social issues surrounding excessive or problem alcohol consumption across Ireland.[352]

Aluminium Fluorides and Neurobiology

A study by Chen Y et al[353]. found that aluminium fluorides activated a G Protein resulting in a "tonic" inhibition of the Ca(2+) current of isolated serotonergic neurons in animals. It is now known that the serotonergic system plays a key role in the regulation of brain states in particular the acquisition of information and memory formation.[354]

The serotonin system is involved in the regulation of behaviour, cognition and mood, and plays an important role in brain development. Changes in serotonin receptor expression and function have been linked to neuropsychiatric disorders and anxiety related behavior. Disturbance to the serotonerginc system contributes to neurological and neuropsychiatric diseases associated with disturbances in neurotrophin regulation exemplified by depression and depression-like conditions and the sleep disorder narcolepsy. Serotonin is mainly located in the intestines and blood.[355]

Alzheimer's disease (AD) is one of the major neurodegenerative diseases that deteriorates cognitive functions and primarily affects associated brain regions involved in learning and memory, such as the neocortex and the hippocampus. Following the discovery and establishment of its role as a neurotransmitter, serotonin (5-HT), was found to be involved in a multitude of neurophysiological processes including mnesic function, through its dedicated pathways and interaction with cholinergic, glutamatergic, GABAergic and dopaminergic transmission systems.

Abnormal 5-HT neurotransmission contributes to the deterioration of cognitive processes in ageing, AD and other neuropathologies, including schizophrenia, stress, mood disorders and depression.[356]

According to Vijendra K. Singh, Ph.D., an expert in neurobiology and immunology research, the nervous system also plays a central role in the immune system. Some neuropeptides and neurotransmitters have a clear influence on the immune response. Some central nervous system diseases such as multiple sclerosis (MS) have been heavily investigated as an immune disorder and autoimmunity may play a key role in autism and obsessive compulsive disorders.[357]

The immune system also plays a role in cardiac disease and pathogenesis of atherosclerosis, and there is evidence that supports the role of an inflammatory response in heart disease.[358] Inflammation is nothing but an abnormal immune response and fluoride has been found to cause inflammation response.

A study published by Ma et al.359 (2012) investigated the effect of exposure to fluoride alone on inflammatory response in rabbit aorta. It was found that fluoride increased the expression of VCAM-1, P-sel, MCP-1, IL-8, and IL-6 at the RNA and protein levels. All of these are now known to play a critical role in development of heart disease.[360,361,362,363,364,365,366,367]

In animal studies Aluminium fluoride (AlF) has also been found to cause differential activation of femoral arteries. AlF was seen to strongly desensitized arteries to phenylephrine, causing a 73% reduction in the ability of phenylephrine to achieve maximum steady-state stress. AlF also produced large increases in stress (force/muscle cross-sectional area) within arteries, producing additional muscle activation.[368] The link between fluoride and phenylephrine is important as it is now known that changes in phenylephrine levels affect cardiac output.[369]

AlF has also been shown to stimulate significant increase in phasic contractions.[370] It is also know that the heart can fail in either the contraction (systole) or rest (diastole) phase of the cardiac cycle. This is called phasic heart failure.

While it is evident that in the ROI the increased risk of neurological, immune and cardiac responses to increased fluoride exposure has not been investigated in any meaningful manner, nevertheless the increased prevalence of diseases for each of these categories must be a serious cause for concern, particularly the biological impact of AIF on neurological health as well as its potential contribution to both adult and infant sudden death syndrome from cardiac failure.

Neurological Illness in Ireland

It is estimated by the HSE that over 725,000 people in the Republic of Ireland suffer from neurological conditions.[371] It is noteworthy that while neurological disorders constitute 6.3% of the global burden of disease[372] the figure is 17.9% in Ireland representing over twice the global average neurological disease burden.[373]

In a study on depressive disorders in Europe Ireland had the highest prevalence of depressive disorders significantly about those for Finland, Norway, Spain and UK.[374]

Alarmingly, the HSE reported that there are over 43,000 newly diagnosed cases each year and it is estimated that the number of people in Ireland developing neurological conditions is set to increase dramatically to over 869,143 by 2021 as our population ages. Neurological disease has other consequences, as currently 62,000 people care for persons with neurological conditions at home, placing a significant burden on society as a whole.

There appears however to be a significant underestimation of the prevalence of mental health problems among the Irish population. Ireland has a serious self-harm and suicide problem, with around 11,000 episodes of deliberate self-harm presenting at hospital A&E departments each year (National Suicide Research Foundation) and up to 500 suicide deaths reported.[375]

In the last few decades, large increases in rates of suicide have been reported across most regions of the world, particularly in New Zealand, the United States and Ireland.[376] It is interesting to observe that each of these three countries fluoridate their public water supplies.

On a provincial basis on the entire island of Ireland it has recently been reported based on the latest census data from the Central Statistics Office that Munster has the highest suicide rate at 13.8 deaths per 100,000 followed by Connacht (11.9), Leinster (10.2) and Ulster (9.5). [377] Similarly the Department of Health Social Services and Public Safety in NI have reported that the overall suicide rate in Northern Ireland is 9.7 per 100,000 persons.[378]The higher suicide rates in the ROI is alarming as it has been found that children who grew up in Northern Ireland during the Troubles are more prone to suicide, according to a new study carried out by Queens University Belfast than children elsewhere in the UK. Researchers found that young people who grew up in the worst years of the violence in the 1970s have

the highest and most rapidly increasing suicide rates.[379] It has been estimated that around a quarter more people suffer from mental health disorders in Northern Ireland than in England and Scotland.[380]

Many people in disadvantaged or broken families, trapped in worklessness and impacted by the 'Troubles' suffer from mental health problems. There is an especially high prevalence of mental ill-health among men; much of this is attributable to the turbulent history. The extent of this is revealed in the alarming numbers of people who use prescription medication – close to 90,000 people are using anti-depressants on a monthly basis, and this is one in ten 35 – 64 year olds. [381]

In comparison in 2005 according to official government figures a total of 176,123 medical-card holders in the ROI were prescribed anti-depressants for medication. This figure does not include private patients not including in the medical card scheme. Dr Michael Corry, a consultant psychiatrist at the Institute of Psychosocial Medicine in Dun Laoghaire says that *"The use of anti-depressants is rising at a rate of 10 per cent per year."* The HSE argues that it is not possible to state the exact numbers of people who take anti-depressant medication. A spokesperson for the service, Paul O'Hare, said, *"The figure of 250,000 is consistent with the estimated number of people in Ireland who are suffering from depressive illness at any given time whether diagnosed or not."* Clearly, people whose depressive illness is undiagnosed will not have been prescribed anti-depressant medication. Also, some people present with symptoms of physical illness such as stomach complaints or fatigue which may result from or be made worse by underlying, undiagnosed depressive illness. This second group of patients may not be prescribed anti-depressants either. [382]

Given the significance of the 'Troubles' in NI on the mental and general health of the population as well as its contribution to social conflict, anxiety, post-traumatic stress, family breakdown, alcoholism and drug abuse, it is remarkable to find a greater incidence of mental health problems and burdens of disease in the ROI.

According the Department of Health the Samaritans and Aware are the best known organizations which help people with mental health problems In Ireland.[383] Aware is a voluntary organisation formed in 1985 by a group of interested patients, relatives and mental health professionals. It aims to assist people whose lives are directly affected by depression.

Young Onset Dementia

Dementia normally begins to present in a healthy population after the age of 65 therefore the fact that significantly more individuals under 60 (who have been longer exposed to fluoride in drinking water) have dementia in the ROI compared to NI or that there are more adults under the age of 59 with dementia compared to the age group between 60-64 or 65 to 70 years of age raises urgent and serious

concerns regarding the contribution of exposure to aluminofluorides and fluoride in drinking water to high levels of dementia in the ROI.

The risk of developing dementia increases exponentially with age, it is known that the prevalence of dementia doubles every five years from the age of 65 years onwards.[384] The significance of this frightening variation in early offset dementia in the ROI is clearly represented in the stark differences in prevalence of young dementia present in the Republic of Ireland compared to non-fluoridated Northern Ireland.

There are 396 cases of young offset dementia for people under 65 years of age in non-fluoridated Northern Ireland[385] compared to 4505 in the fluoridated Republic of Ireland.[386] The population of NI is 1,789,000 and the ROI is 4,487,000. The population adjusted number of young offset dementia cases for NI when compared to ROI would be equivalent to 990. The fact that the rate of young offset dementia in the Fluoridated region of the Republic of Ireland is 4.5 times that of non-fluoridated NI is deeply worrying and demonstrates beyond any reasonable doubt a clear association between increased exposure to fluoride and AIF are significant risk factors in the development of this disease in the ROI.

Alzheimers Disease

Alzheimer's or dementia affects almost 44,000 people in Ireland[387] costing an estimated €1.7 billion in care every year.[388] It is estimated that approximately 4,000 new cases of dementia arise in the general Irish population every year. The Irish dementia prevalence rates may be slightly underestimated as they exclude data on people with intellectual disability (ID) including those with Down syndrome and dementia. [389]

A recent review of dementia strategy concluded that a major increase in the number of people with dementia in Southern Ireland is likely to occur after the year 2021, with the numbers growing to between 67,500 and 70,000 in 2021 and to between 140,500 to 147,000 in 2041.[390]

Overall the population prevalence of dementia for the age group 65-69 is 1.6% in the Republic of Ireland compared to 1.3% in Northern Ireland. This represents, for all age groups, a 23% increase in the incidence of Alzheimer's between the ROI compared to NI.

Taking into account that average life expectancy for men is lower in the Republic of Ireland (76 years) compared to Northern Ireland (77) it would be expected that the prevalence of Alzheimer's would be higher in Northern Ireland for age specific factors, however as with other disease burdens social and economic risk factors are also known to play a critical role in cognitive decline and dementia, this again would clearly suggest that dementia should be higher in Northern compared to Southern Ireland. For example, lower levels of education are tied to lower levels of cognitive function throughout adulthood and a higher risk for dementia.[391]

The percentage of people with a third-level qualification in Southern Ireland has doubled from 14 per cent to 31 per cent in the past 20 years. The percentage of young people in Ireland with third level education is higher than the EU average.

In 2007, 41.3% of the population aged 25-34 in the Republic of Ireland had third level education, compared with 29.1% across the EU 27 as a whole. Compared to Northern Ireland access to education in Southern Ireland has been significantly higher for all age groups.[392]

Again these facts would support a greater incidence of dementia among the population in Northern compared to Southern Ireland. Taking these confounding factors into account the 19% increased incidence of dementia in Southern compared to Northern Ireland in the 65-69 age group is very significant.

Dementia and its impact on families and communities

There are 26,104 people with dementia currently living at home in the community; most of these do not have a formal diagnosis, many are not aware that they have the disease and few are likely to be in contact with the health and social care system.

There are an estimated 50,000 family carers in Ireland looking after someone with at least one of six specified symptoms of dementia: for example there are an estimated 25,000 carers looking after someone with marked forgetfulness on a regular or occasional basis, while 15,000 people are looking after someone with confusion to the point of interfering with everyday life.

An estimated 14,266 people with dementia live in various public and private long-stay facilities across the country; the number of people with dementia in long-stay facilities suggests that 63% of all long-stay residents have dementia.[393]

Autism

Autism is a lifelong disability which affects the social and communication centre of the brain. The prevalence of autism in Ireland is estimated to be 1.1% which is similar to the recently reported figure of 1/100 (0.9% by the Centre for Disease Control in the US.[394] These are among the highest rates of autism in any population in the world and they continue to rise.

A survey by the Office of National Statistics of the mental health of children and young people in Great Britain found a prevalence rate of 0.9% while a recent briefing the National Autistic Society in the UK found the prevalence of autism to be 0.58 % of children in the UK. This gives a potential increased prevalence in

autism between 89% and 22% (mean of 55%) between the Republic of Ireland and UK. It is widely acknowledged that the prevalence of autism has increased 10 fold per decade since earlier epidemiology studies in the 1970's. This represents the period post commencement of fluoridation in the ROI. By late 1970 over 52% of the population of Ireland were provided with fluoridated water. Although it was widely maintained that the increase in incidence was until recently, in part largely attributed to better diagnostic procedures, Hertz-Picciotto and Delwiche concluded in a recent major examination of autism that "younger ages at diagnosis, differential migration, changes in diagnostic criteria, and inclusion of milder cases do not fully explain the observed increases." [395] After publication of the article, the author noted that some environmental toxin/contaminant must be responsible for the remarkable increase in the rate of autism.

Epilepsy

Epilepsy is the most common serious brain disorder world-wide. It is the second most commonly seen neurological condition in primary care, and the most commonly seen among neurologists.

The prevalence of adult epilepsy in the Republic of Ireland is around 10 per 1000 individuals.[396] The UK has an adult prevalence of 6.1 per 1000, Northern Ireland 7.6 per 1000, Wales 7.3 per 1000 and Scotland 7.3 per 1000.[397]

The prevalence of epilepsy increases with disability groups including autism, Down syndrome, cerebral palsy, mental retardation[398] and race or etiology. It is known that the prevalence of Autism is significantly higher for non-whites compared to whites in a population[399] as is the prevalence of SIDs, diabetes and other diseases.

A recorded 31% increased prevalence of epilepsy in the population of the Republic of Ireland compared to Northern Ireland is very significant and supports the observation of the NRC that fluorides can directly and indirectly affect the functions of the brain.

Depression

Within Europe, it is estimated that 20% people will experience depression during their lifetime (WHO, 2003).[400] According to the Irish College of General Practitioners and the Health Service Executive, 25% of Irish people become depressed at some point.[401]

According to the Health Service Executive there appears to be a significant underestimation of the prevalence of mental health problems among the Irish population.[402] In 2007 the estimated number of people in the ROI affected by depression at any one time was 400,000.403 This figure has risen to 450,000 (10% per cent) based on the latest census data.404

In comparison both Aware and the Northern Ireland Health Promotion Agency have estimated that 100,000 individuals (5 per cent) in NI suffer from depression.[405, 406 ,407]

While these figures are only estimates of the rates of depression taken together with prescriptions for anti-depressives they offer the best available information available on the prevalence of depression in both the ROI and NI.

According to the Department of Health in 1999, 13.6% of the total General Medical Card Scheme (GMCS) population were prescribed a benzodiazepine derivative at least once over the six months period, compared to 9.9% in 2000. The study found that benzodiazepines were commonly prescribed in the GMS population, being taken by approximately 1 in 10 persons overall and up to 1 in 5 in the older age groups.

In 2003 the number of prescription items issued under the GMCS was 32.2 million, this represents an approximate 200 per cent increase over the period 1993-2003. Expenditure on medicines in Ireland increased over 4 fold during the 10 year period 1993 – 2003, largely due to increased volume of prescribing. Between 2000-2002 the increase in antidepressants sales a year in ROI was 1.5 times as fast as the global growth over the same period. 1 in 10 adults were taking antidepressants in Ireland in 2002 (estimate 300000), 300000 people were claimed depressed in Ireland in 2002.408

Under the GMCS it is estimated that more than five million prescriptions for drugs to treat depression, psychosis, anxiety or lack of sleep are being written every year costing in excess of €110 million.[409] In 2009 nine anti-depressants, most of which are selective serotonin re-uptake inhibitors (SSRIs), were prescribed more than 2.2 million times under the GMCS.

GMCS accounts for less than 40% of the population, for the remaining 60% of the population no accurate figures are available.

The National Advisory Committee on Drugs (NACD) has reported that one in five Irish people admitted taking sedatives, tranquillisers or anti-depressants during their lifetime. It also found that, of that one in five, nearly half said they had used sedatives, tranquillisers or anti-depressants in the last month and 84 per cent of those were taking them on a daily basis.[410]

Figures compiled by the Irish Examiner from the HSE's 2009 Primary Care Reimbursement Service show 14,000 prescriptions for anti-depressants, benzodiazepines (addictive tranquillising pills), anti- psychotics and sleeping tablets were being written every day, at a cost of €113m.[411] A report by the Department of Health and Children (2002) found that 11.6% of the adult medical card population were using benzodiazepines.412 Benzodiazepines are used for patients with an anxiety disorder co-occurs with depression. The Mental Health Commission, during the inspections of 2010, found the use of benzodiazepine in both acute and long-stay units was widespread. In total, 57% of in-patients were prescribed benzodiazepines.

Illness-benefit payments for mental health problems have jumped by more than 80 per cent over the past decade, up from 9,884 in 2001 to 18,173 in 2011. Over the past five years, prescriptions for antidepressants, benzodiazepines and sleeping pills on the medical-card scheme increased by more than 25 per cent. The three-million-plus prescriptions for mental health drugs on the medical-card system and the Drugs Payment Scheme in 2010 cost the State in excess of €100 million. In addition, mental health problems are estimated to cost the Irish economy around €2.5 billion a year through lost employment, absenteeism, lost productivity and early retirement, according to recent research by the Mental Health Commission, the State's independent watchdog for psychiatric care. According to medical card figures for 2010, the medications most prescribed for mental health problems were Valium (500,550 prescriptions) and Xanax (432,000), both of which are benzodiazepines or sedative-type drugs that can be highly addictive, and the antidepressant Effexor (323,000).[413]

A mental Health study conducted in the ROI in 2008 by the Health Research Board found that there is little information available on the level of psychological distress in the Irish population.[414] The Health Research Board National Psychological Wellbeing and Distress Survey (HRB NPWDS) found a total of 12% of survey respondents had high GHQ12 scores indicative of psychological distress and 14% of the sample reported experiencing mental health problems in the previous year. The survey provided projected figure of 320,381 people for the population aged 18 years and over who will attend a general practitioner for mental health problems. The survey 389,258 people in the Republic of Ireland are experiencing minor or major psychiatric problems at any given point in time; this equates to a rate of 12 in every 100 people aged 18 years and over who are experiencing mild to severe mental health problems.

A similar report published in the UK (2002) provides information on mental of the

population in NI. Within the UK generally a significantly large proportion of respondents reported deteriorating mental health over the last 12 months, around one third higher in Northern Ireland (21.1 per cent) than in both England (14.3 per cent) and Scotland (15.5 per cent). There were however more people with better mental health in 2001 compared to 1997. The report found that just over one in five respondents (21.1 per cent) in Northern Ireland showed signs of a possible mental health problem. The proportion of respondents in Northern Ireland over the GHQ12 threshold was one third higher than in both England and Scotland.

The high prevalence of mental health problems in NI reflects the impact of the troubles on mental health in NI which are also reflected in the findings of a recent United Nations report which stated that Northern Ireland (UK) reports the highest annual prevalence of prescription opioids anywhere in the world at 8.4 per cent. The annual prevalence of sedatives and tranquilizers is reported at 9.2 per cent and anti-depressants at 9.1 per cent in the general population.415

While NI has the highest prevalence of prescription opioids in the world, a current study published by the European Monitoring Centre for Drugs and Drug Addiction found that the ROI had the highest users of opiates in EU and were the second highest users of ecstasy, fourth highest for cocaine as well as crack cocaine.416

The earlier findings of 2002 do not reflect the current findings is a recent study undertaken by the BBC which found that in the United Kingdom for the period 2011, Wales had the highest rate of antidepressant prescriptions of any UK nation at 1.24 per head, compared to 1.18 in Northern Ireland, 0.89 in Scotland and 0.88 in England. There were 3.8 million prescriptions issued for anti-depressants in Wales in 2011.417 No accurate figures are available for number of anti-depressants prescribed in Ireland for the same period; however in 2000 the number of prescriptions for antidepressants in the GMCS in Ireland was 1.8 per adult.418

A study conducted in 2002 by RTE Prime Time found than 300,000 people were prescribed anti- depressant drugs in 2002. Of this figure nearly 200,000 claimed the drug on medical cards. The study found that almost 1.4million prescriptions for drugs such as Prozac were handed out in the first four months of 2002. On an annual basis this would equate to 4.2 million prescriptions for anti- depressant drugs in 2002.

In 2010 according to the Lundbeck Mental Health Barameter comprising a national health survey of 1000 adults aged 16 years and older, found that almost one in five people know someone close to them who suffers with depression. In addition,

the research also found that 12% know someone with anxiety. In 2009 there was a significant uplift from 2 in 5 to 1 in 2 people saying that there would have been familial or wider knowledge of a depressive episode. This figure has been sustained into 2010, suggesting a continued trend and reflecting the impact of the current social and economic climate. [419] Alarmingly the study also found that seven out of 10 Irish people would find it difficult to discuss depression with their doctor reflecting perhaps a significant underreporting of the disease in ROI.

Overall what the available information clearly suggests is that there a huge prevalence of anti-depressant use amongst the population in the ROI combined with an epidemic of drug dependence and alcohol abuse at levels comparable to or significantly higher than NI.

This is an alarming especially given that it is generally accepted that low socio-economic status, conflict and trauma are all associated with a higher prevalence of mental illness.[420,421] The period of 'the Troubles' in NI combined with greater social inequality and poverty should provide a significantly higher incidence of disease burden, particularly depression, compared to southern Ireland. A study by O' Reilly and Stevenson (2003) found that in Northern Ireland up to 21% of the population may have been affected physiologically by the social unrest and violence that occurred during 'the Troubles', many suffering from mental depression as a result; the authors concluded that "it is probable that mental health of the population of Northern Ireland has been significantly affected by the Troubles."

In comparison for the period associated with this data the South of Ireland had a considerable higher socioeconomic status than Northern Ireland and no conflict.

Taking these findings into consideration the incidence of mental depression, mental illness and suicide in ROI may support the observations of the NRC and a recent study by Valdez-Jimenez et al.[422] published in the *Journal Neurologia* which reported that *"the prolonged ingestion of fluoride may cause significant damage to health and particularly to the nervous system".*

The study examined how fluoride induces changes in the brain's physical structure and biochemistry which affects the neurological and mental development of individuals. The authors of the study observed that chronic exposure to, and ingestion of, the synthetic fluoride chemicals added to water supplies can cause serious brain and neurological damage. This in itself should be a major cause for concern for the Irish public, the Government of Ireland and its Health Service Executive, especially as it is estimated that over 725,000 people in the Republic of Ireland suffer from neurological conditions.[423]

Cardiovascular Disease *Key Findings of the Scientific Committee*

The NRC found that fluoride may indirectly contribute to a number of diseases, including hypertension and arteriosclerosis.

The World Health Organization rates hypertension as one of the most important causes of premature death worldwide. Hypertension is a risk factor for coronary heart disease and the single most important risk factor for stroke. It causes about 50% of ischaemic strokes and increases the risk of hemorrhagic stroke. Hypertension stresses your body's blood vessels, causing them to clog or weaken. Hypertension can lead to atherosclerosis and narrowing of the blood vessels making them more likely to block from blood clots or bits of fatty material breaking off from the lining of the blood vessel wall. Damage to the arteries can also create weak places that rupture easily or thin spots that balloon out the artery wall resulting in an aneurism.[424]

Most strokes (about 80%) are ischaemic, and most of those are caused by atherosclerosis. It is now established that insulin affects coronary artery calcification.[425] It is also now known according to the NRC report (2006) that fluoride affects insulin sensitivity and glucose tolerance.

In the examination of cardiovascular disease and mortality it is important to recognize that thyroid hormone concentrations can cause adverse effects in organ systems other than the nervous system in the adult, including the cardiovascular system and control of serum lipids (Asvold et al., 2007[426]; Biondi et al., 2005[427]; Osman et al., 2002[428]), pulmonary system (Krude et al., 2002[429]; Lei et al., 2003[430]; Mendelson & Boggaram, 1991[431]) and kidney. Total cholesterol, low density lipoproteins (LDL), nonhigh density lipoproteins (non-HDL), and triglycerides increase linearly with increasing Thyroid Stimulating Hormones (TSH), and HDL decreases consistently with increasing TSH across normal reference ranges without evidence of any threshold effect (Asvold et al., 2007b)[432]

Within the reference ranges for TSH, there is a linear positive association between TSH and both systolic and diastolic blood pressure (Asvold et al., 2007)[433]. Intimal medial thickness (IMT), a measure of atherosclerosis and predictive of coronary vascular disease and stroke, is inversely related to free T4 after controlling for lipids, clinical factors, and thyroid autoantibodies (Dullart et al., 2007).[434]

Not surprisingly, deficits in thyroid homeostasis are associated with cardiovascular risk in multiple epidemiologic studies. A meta-analysis of 14 epidemiologic studies (Rodondi et al., 2006)[435] found an overall increase in risk of coronary heart disease (CHD) of over 65% in those with subclinical hypothyroidism (elevation in TSH with normal T4).

Therefore, epidemiologic as well as mechanistic and therapeutic evidence substantiates the concern that EDCs being thyroid disrupting chemicals may adversely affect cardiovascular risk in humans by reducing serum T4.[436] Since water fluoridation chemicals have been identified as low dose EDCs their contribution to the high incidence of heart disease and mortality in the ROI cannot be discounted.

Cardiovascular Disease in Ireland

Cardiovascular disease is the single largest cause of death in Ireland: in 2008, diseases of the circulatory system accounted for 9,883 (35%) of all deaths. Of these, 5,188 were due to coronary (ischaemic) heart disease, 2,116 due to stroke and 2,579 due to other diseases of the circulatory system. In terms of premature deaths (i.e. death in those less than 65 years, 20% of all deaths were as a result of diseases of the circulatory system.[437]

Ireland had, on average, 118 (age-standardized) deaths from ischaemic heart disease per 100,000 population annually. This was higher than the EU15 rate of 80 deaths per 100,000 and higher than the EU27 rate of 101 deaths per 100,000.

Regarding premature deaths, ischaemic heart disease death rates annually in Ireland averaged 25 per 100,000, compared to 18 deaths in the EU15 and 24 in the EU27.

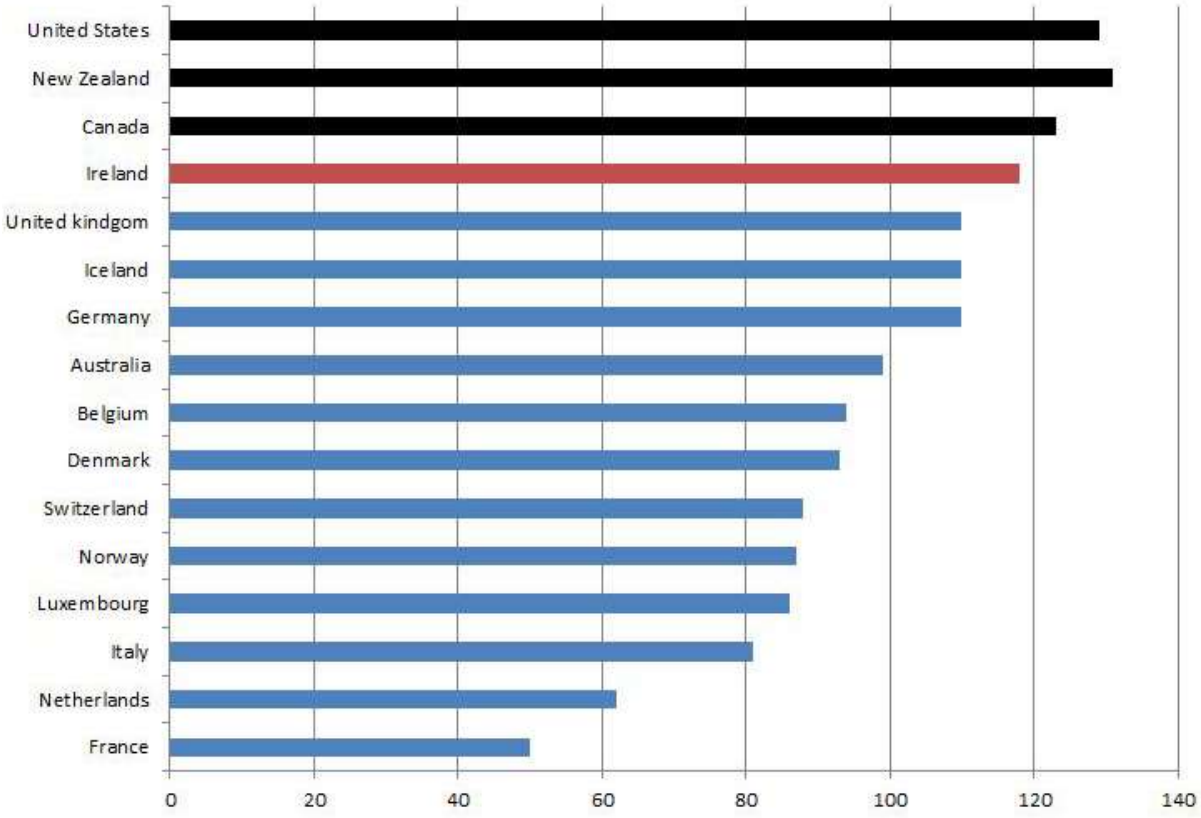
Ireland currently has the highest rate of premature deaths from ischaemic heart disease (<65yrs) in the European Union. [438] It is estimated that there are 240,000 living in ROI with coronary heart disease.[439] This represents a prevalence of 6% in the population. In comparison there are 75,000 individuals in NI with CHD representing 4% of the population.[440] The Irish Heart Foundation predicted that by 2010, 300,000 people in Ireland will be affected by heart failure (Irish Heart Foundation, 2002) representing approximately 7% of the population of ROI. In comparison approximately 61,000 people in Northern Ireland have had a heart attack representing 3.4% of the population of NI.[441]

In 2010, it was estimated that more than 79,000 (2.4%) adults aged 18+ years in ROI have been told by a doctor in the previous 12 months that they have CHD (clinically diagnosed CHD). This excludes undiagnosed CHD and is likely to be an underestimate of the number of people with the condition.442 In 2007 nearly 131,000 adults had ever had a Coronary Heart Disease (CHD, angina and heart attack). By 2020 this is expected to rise to over 195,000 people - an additional 65,000 people (a 50% increase in less than 15 years).

In 2007 almost 59,000 adults have ever had a stroke. By 2020 this is expected to rise to almost 87,000 people – an additional 28,000 adults (an increase of 48% in less than 15 years).[443] These figures do not include individuals who have undiagnosed cardiovascular disease. International research has shown that 50% of

men and 64% of women who have had a fatal heart attack or stroke never knew they had the disease.[444] From 2000 to 2004 Ireland had on average 144 deaths from CHD per 100,000 of the population, which was higher than EU 15 of 92 deaths per 100,000 and higher than the EU 27 of 113 deaths per 100,000.[445]

Figure 16. Ischaemic Heart Disease, Mortality rates Males per 100,000



Source: OECD Health Indicators (2011)

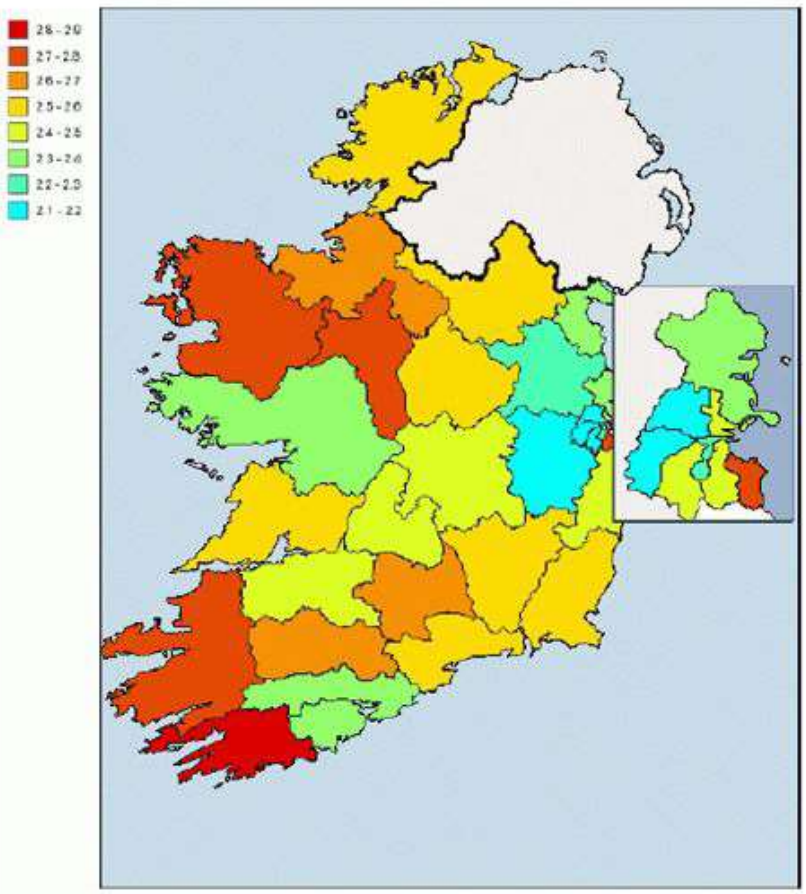
The Department of Health, National Cardiovascular Health Policy Report[446] published in 2010 compares cardiovascular health data for Ireland with other EU Member States from the years 2003 to 2007 across all ages. During this time Ireland had a reduction on the years 2000-2004 to on average 118 (age-standardized) deaths from ischaemic heart disease per 100,000 of population annually.

Mortality was however higher than the EU15[9] rate of 80 deaths per 100,000 and higher than the EU27[10] rate of 101 deaths per 100,000. The Department of Health reported that in regard to premature deaths, ischaemic heart disease death rates annually in Ireland averaged 25 per 100,000, compared to 18 deaths in the EU 15 and 24 in the EU 27. The Department of Health further observed that this could not have been achieved without the increasing workload in health services in the hospital, primary care including a four-fold increase in the use of prescribed

[9] EU15 data refers to 9 countries in 2007 and 12 in 2006 who had reported mortality data.
[10] EU27 data refers to 19 countries in 2007 and 23 in 2006 who had reported mortality data.

cardiovascular medication. The geographic spread for CHD largely mirrors that for other major diseases in Ireland such as diabetes, cancer and neurological illness. The areas with the highest prevalence of disease burdens are largely those where drinking water is both soft (low in calcium) and fluoridated.[447]

Figure 17. Percentage of Adults with Clinically Diagnosed Coronary Heart Disease in the previous 12 months (Local Health Offices, Republic of Ireland 2010)



Source: html://www.thehealthwell.info
Institute of Public Health in Ireland

It is interesting to note that the most Southerly part of Ireland has the highest incidence of CHD. Drinking water in large parts of South and South East Ireland including West Cork located in the southern tip of (the area identify as red on the map above) Ireland, are extremely soft with less than 20mg/L Calcium. Similarly soft drinking water is found in large parts of geographic areas such as Mayo, Donegal, Kerry, Wexford, Waterford and Roscommon. All of these counties have elevated CHD significantly above the National and European average.

Comparison with Northern Ireland and Europe

According to figures from the cardiac rehabilitation unit, Wexford General Hospital, the number of deaths from Coronary Artery Disease in Ireland is 60,7 per 100,000, almost twice the EU average of 32.6. In comparison the age standardized death rate from CHD in Northern Ireland is 60.44 for men and women 21.01. The higher mortality rates in southern Ireland are unexpected given the importance that education, poverty, stress and social conflict play in heart disease.

The influence of the these factors and period of the 'Troubles' is clearly evident in the mortality rates for within NI. Significantly higher CHD prevalence is noted in the geographic areas with the highest social inequality, poverty and unemployment. These same areas not only represent those that are the most socially deprived but also where conflict and trauma were most prevalent during the 'Troubles' in Northern Ireland. For example significantly higher CHD rates for males are to be found in Derry (80.09), Belfast.(89.05) and Ballymena (115.45) compared to more rural areas such as Castlereagh (30.08) Antrim (24.9) and Moyle (33.48).448

In comparing CHD in Ireland with Europe the Age-standardized Disability-adjusted life years (DALYs) per 100,000 for CHD, stroke and other CVD, provides further insights to the impact of CHD and the gap between Ireland and other European Member States. The DALYS for CHD for Ireland is calculated at 671 compared to the UK (657), Iceland (470), Norway (503), for Sweden (506), Denmark (478), Germany (574), France (259), Spain (367) and the Netherlands (460). A similar pattern is provided for CVS.449

Hypertension

In 2001, 23 per cent of respondents in NI said that they were diagnosed with high blood pressure by a health professional. [450] It is estimated that hypertension affects 30 per cent of the adult population in the RoI affecting about half of people over 65, and about 1 in 4 middle aged adults. ONE IN 10 Irish school children have high blood pressure. [451] The Institute of Public Health in Ireland (IPH) suggest that by 2020 the number of adults aged 45+ years in the Republic of Ireland with hypertension (high blood pressure) is expected to rise to more than 1,220,000 people (63.1% of the population aged 45+ years).

Diseases of the Respiratory System

Ireland has the highest death rate from respiratory disease in Western Europe – death rates are almost twice the EU average. Diseases of the respiratory system are the cause of one in five deaths in Ireland today.[452] In Eurasia, only Kyrgyzstan has a death rate from respiratory disease higher than Ireland.

In 2004, respiratory disease caused over 6,000 deaths; approximately 3,100 deaths in men and 2,900 in women. In Ireland, deaths from respiratory disease exceed those from coronary heart disease (which accounted for 5,485 deaths in 2004), and are almost the same as deaths from non-respiratory cancer (6,225). There is a particularly marked excess of respiratory deaths in women, with respiratory disease the second highest cause of death (21%) after non-respiratory cancer (22%). This is compared to coronary heart disease (CHD) which accounts for 17% of all mortality in women.

One third (33%) of deaths from respiratory disease are from pneumonia, which is the leading respiratory killer. In all, 1,968 people died from pneumonia in Ireland in 2004. Cancers of the respiratory system are the second largest cause of respiratory death, accounting for over one quarter (28%) of total respiratory mortality. These include cancers of the nasal cavities (11 deaths), larynx (48), pleura (24), and lung (1,609)

Chronic obstructive pulmonary disease (COPD) is the third biggest cause of respiratory death, accounting for over one fifth (22%) of total respiratory mortality.

COPD is a chronic inflammatory disease as is asthma. Mortality rates at 44 percent and 34 per cent respectively for both these diseases are significantly higher in the ROI compared to NI.

The remaining one sixth of respiratory deaths (1,038 in 2004) are caused by a wide range of respiratory diseases, including tuberculosis, acute respiratory infections, congenital anomalies, pneumoconiosis and foreign bodies in the respiratory system.[453]

Comparison with UK and Europe.

For 2004 the Age-standardized death rates per 100,000 population from diseases of the respiratory system for EU, Europe, UK and Ireland were 52, 57, 86 and 101 respectively.[454] Ireland had a 17% increased mortality compared to UK and approximately 100% higher mortality compared to the European region.

World Health Organization
REGIONAL OFFICE FOR Europe

Standarised Death Rates, diseases of the respiratory system, all ages per 100000

Countries	2000	2008	2010
004 Austria	32.89	28.54	27.69
007 Belgium	...	...	...
011 Cyprus	...	36.57	34.49
013 Denmark	65.85	...	...
015 Finland	57.04	22.34	21.34
016 France	36.03	27.66	...
018 Germany	39.11	37.71	37
019 Greece	51.84	53.45	49.07
021 Iceland	51.96	43.77	...
024 Italy	36.94	28.59	...
029 Luxembourg	48.57	39.75	36.37
033 Netherlands	67.3	53.35	48.09
034 Norway	58.16	49.93	45.29
035 Poland	46.42	40.06	38.09
036 Portugal	68.28	62.01	57.87
046 Switzerland	39.08	26.22	25.35
045 Sweden	39.32	31.39	27.3
030 Malta	68.36	53.57	47.14
044 Spain	62.91	52.81	45.09
052 United Kingdom	105.94	74.69	67.59
022 Ireland	117.33	69.79	61.47
054 European Region	61.3	47.11	43.99
055 EU	54.51	44.27	41.81
056 EU members before May 200	55.82	44.75	42.04
057 EU members since 2004 or 2	49.79	42.44	40.89
060 Eur-A	54.95	44.17	41.43
061 Eur-B+C	68.05	50.49	46.95

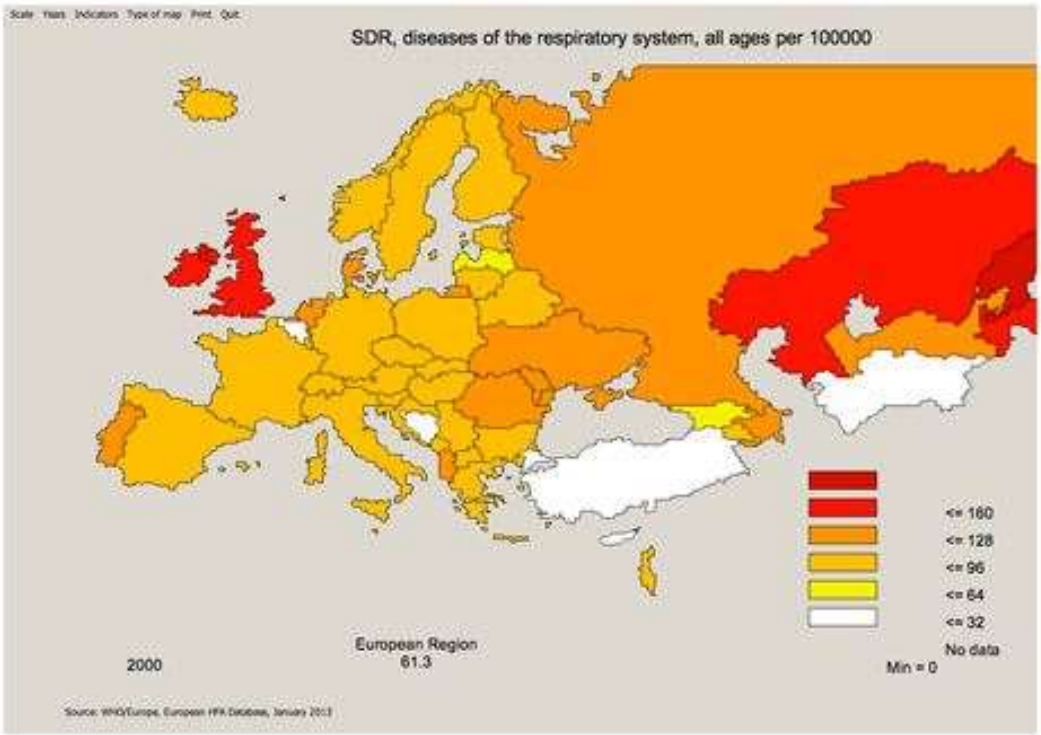
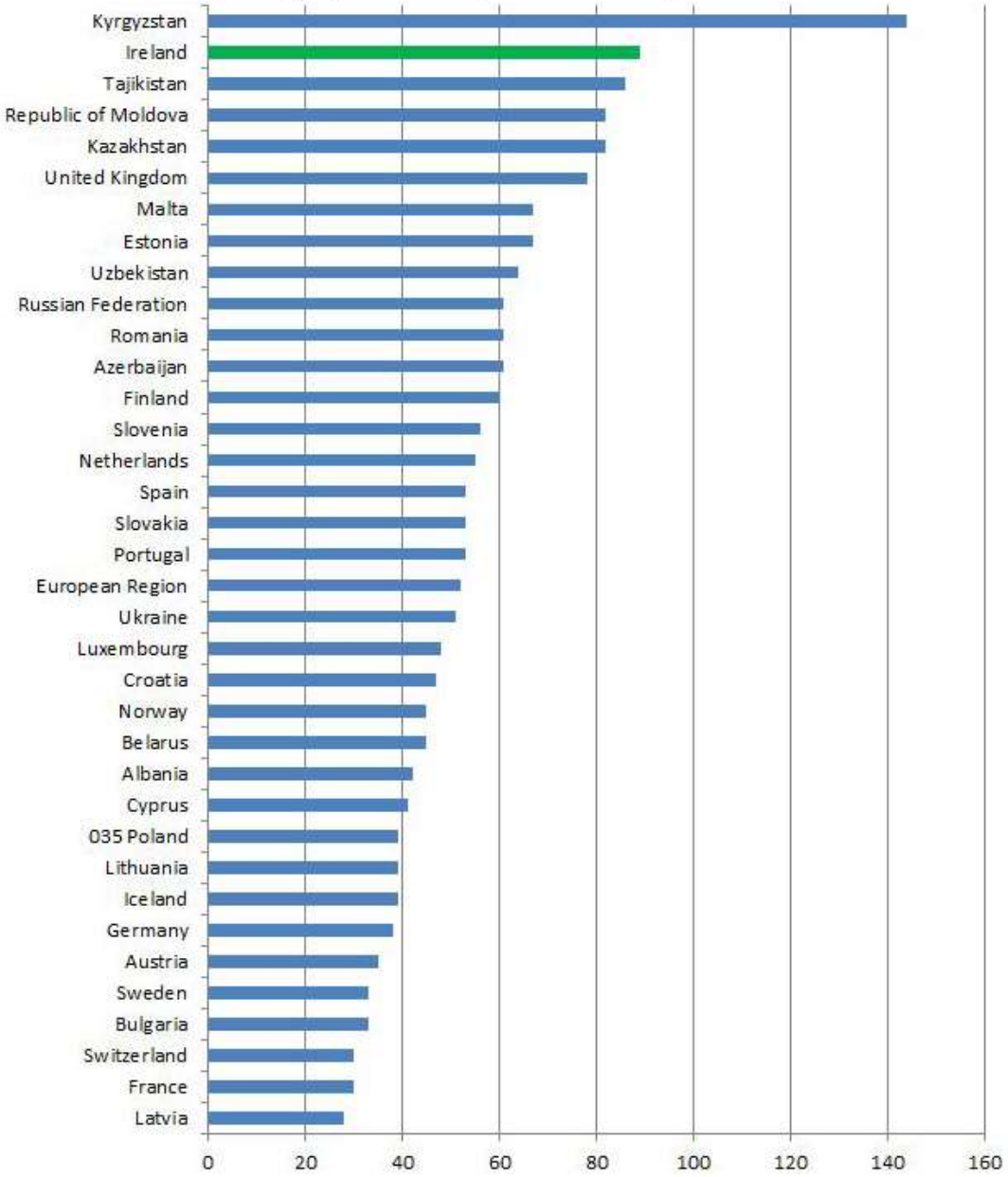


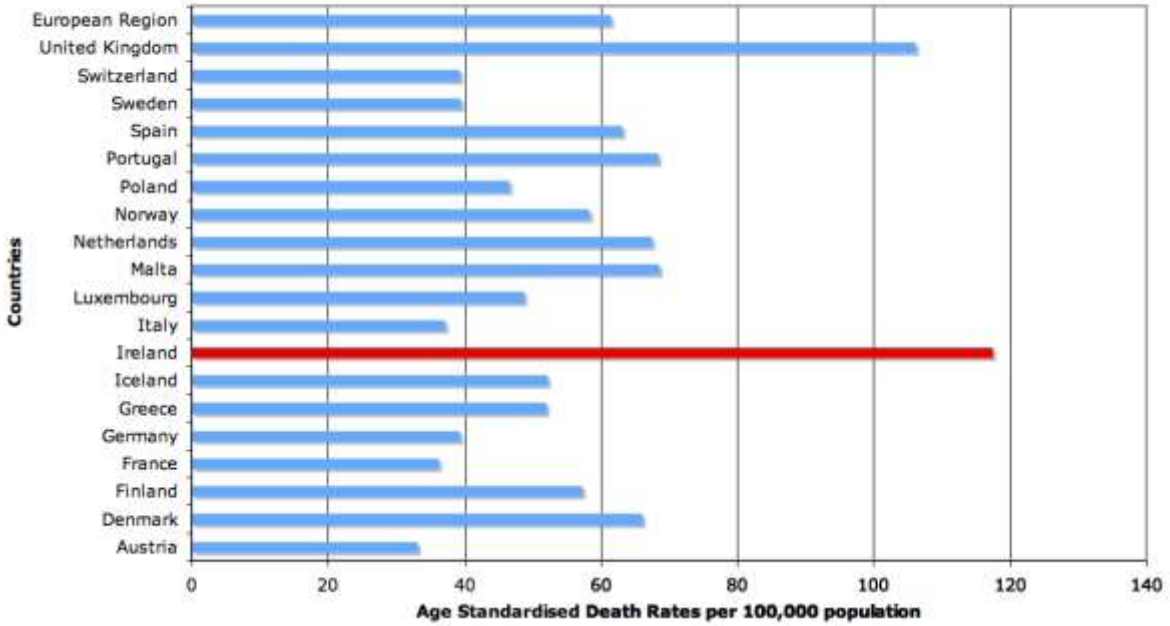
Figure 18. Age Standardised Death Rates per 100,000 population from diseases of the Respiratory System 2004, Selected European Countries



Source: Ireland Needs Healthier Airways and Lungs, INHALE Report, Irish Thoracic Society, 2nd Edition Page 26, 2008,
Date from World Health Organisation (2004) European Health for All Database (3).

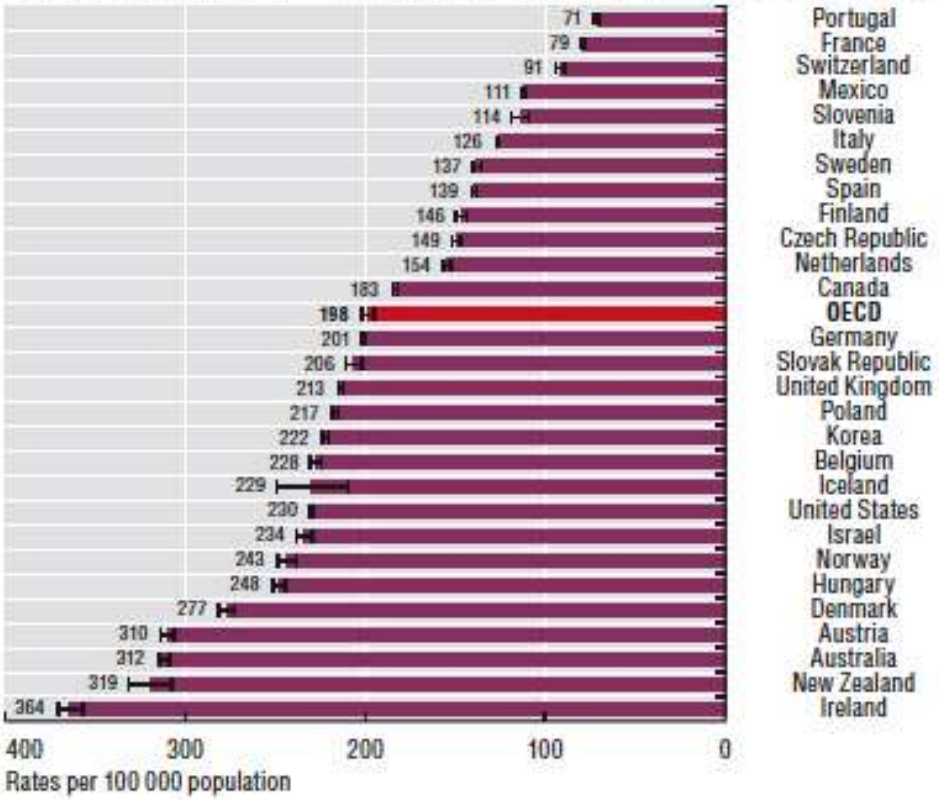
In 2000, the ROI had the highest death rates for COPD in EU (see figure overleaf), followed by the UK. The death rates in ROI were approximately twice the EU Region average.

Figure 19. Age Standardised Death Rates, Diseases of the Respiratory System, All ages per 100,000 EU Countries
Source: WHO 2000



In 2011 the ROI had the highest hospital admission rates for COPD in the OECD countries and internationally followed by Australia and New Zealand, both fluoridated countries.

Figure 20. COPD Admission rates population aged 15 and over
Source: Data from OECD (2012B) Health Indicators 2011



Cancer *Key Findings of the Scientific Committee*

The NRC noted several studies which found associations between fluoride exposure and bladder cancer, osteosarcoma, thyroid cancer, oral-Pharyngeal cancer, uterine cancer, soft tissue sarcoma, non-Hodgkin's lymphoma, colorectal cancer, and lip cancer and concluded:

- *"Alternations in DNA suggest that Fluoride has the potential to cause genetic effects as well as carcinogenic potential.., Fluoride appears to have the potential to initiate or promote cancers."*
- *"Aluminium Fluoride complexes impair the polymerization-depolarization cycle of tubulin."*455
- *"The plausibility of the bladder as a target for fluoride is supported by the tendency of hydrogen fluoride to form under physiological acid conditions, such as in urine. Hydrogen fluoride is caustic and might increase potential for cellular damage, including genotoxicity.*
- *"Alternations in DNA suggest that the chemical (Fluoride) has the potential to cause genetic effects as well as carcinogenic potential."*
- *"Fluoride has a role in p53 mutations that could influence the development of osteosarcoma"*
- *"Human leukemic cells lines may also be susceptible to the effects of hexafluorosilicicate the compound used for fluoridation."*
- *"Perhaps the single clearest effect of fluoride on the skeleton is its stimulation of osteoblast proliferation. Because fluoride stimulates osteoblasts proliferation, there is a theoretical risk that it might induce a malignant change in the expanding cell population."*
- *"Fluorides increases the production of free radicals in the brain"*

According to the peer reviewed Journal of Free Radical Biology and Medicine (Volume 2 Issue 2, 1988) "Free radicals participate in the development of carcinogenesis, particularly tumour promotion.

This is position is supported by the National Cancer Institute at the U.S. National Institutes of Health. The European Journal of Cancer (Jan 1996 32A(30-8)) similarly concluded that "*(a large body of evidence suggests important roles of oxygen free radical in the expansion of tumour clones and the acquisition of malignant properties. In view of these facts, oxygen free radicals may be considered as an important class of carcinogens."*

The U.S Public Health Service published the findings of a study (1991) that examined Fluoridation of Drinking Water and subsequent Cancer Incidence and Mortality, in which they found increases in soft tissue sarcoma, non-Hodgkin's lymphoma, colorectal cancer and lip cancer in people living in Fluoridated communities. (Ref: U.S. National Research Council, Fluoride in Drinking Water, A Scientific Review, 2006). An association of uterine cancer (combination of cervical and corpus uteri) with fluoridation was reported by Tohyama[456] (1996), who observed mortality rates in Okinawa before and after fluoridation was terminated, controlling for socio-demographics.

Ireland has been found to have the highest incidence rate of Prostate and Ovarian cancer in Europe, as well as higher incidence rates of colorectal, lung, non-Hodgkin's Lymphoma, and pancreatic cancers compared to the European average.

Cancer Incidence in Ireland

The National Research Council report highlighted published reports which found that fluoride may contribute to bladder cancer, brain cancer, leukemic and lymphoma cell lines, uterine cancer skin cancers as well as other cancers such as non-Hodgkin's lymphoma. The scientific committee highlighted the carcinogenic potential of fluoride and unanimously concluded that fluoride appears to have the potential to initiate and promote cancers.

An annual average of 29,745 cancer cases was registered during the three year period 2007-2009 This represents an increase of 12% from the annual average over the previous three year period (2004-2006) and is approximately 50% more cancers per year than in the mid 1990's when data on cancer in Ireland was first collected on a national basis. This equates to 681 cases per 100,000 persons per year.

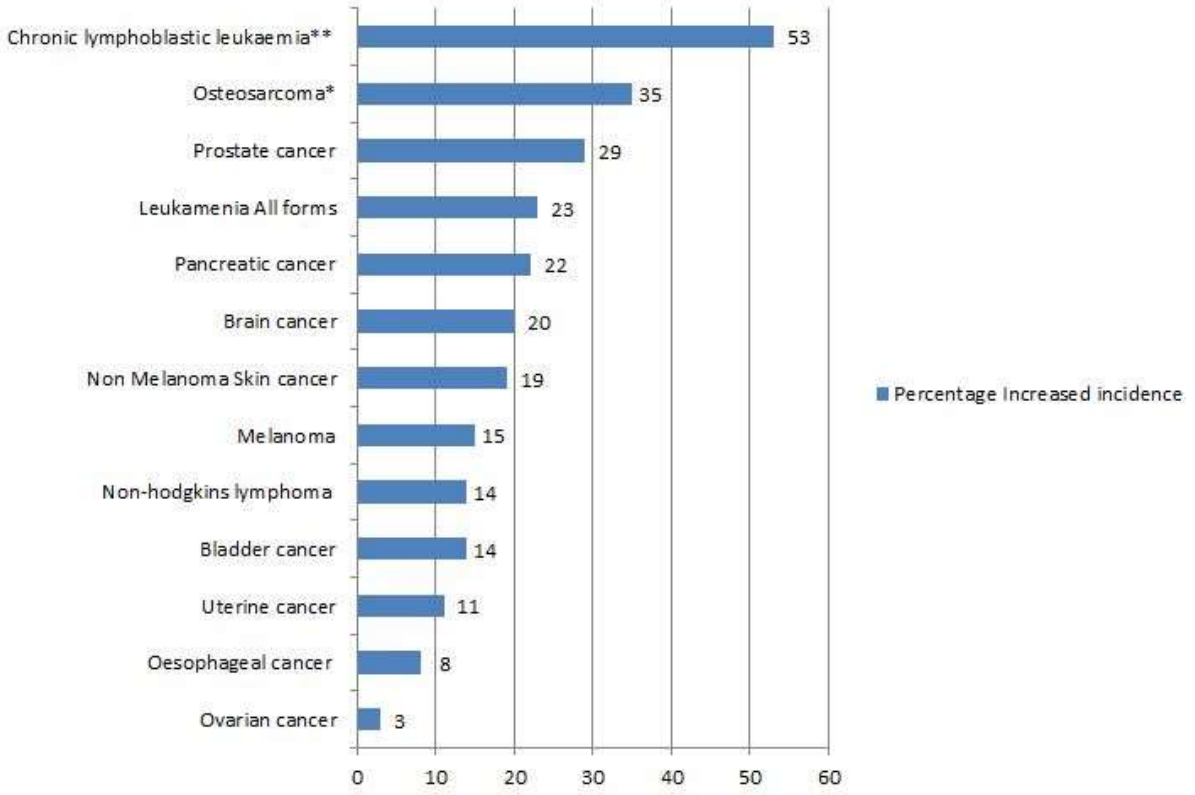
The All Ireland Cancer Atlas (1995-2007)[457] provides an examination of eighteen cancers sites in both ROI and NI. Of these seven demonstrated significant increased risk in the ROI compared to NI. In addition increased risk was also observed in the ROI compared to NI for colorectal cancer, stomach, kidney, ovarian and cancer of the corpus uteri. Separately the WHO have recorded that overall cancer incidence per 100,000 in the ROI is 38% higher than for the UK as a whole. [458]

Overall cancers incidence was significantly higher in fluoridated ROI compared to non-fluoridated NI.[459] The risk for bladder cancer was up to 14% higher in the ROI, leukaemia up to 23%, Pancreatic cancer up to 22%, skin cancer up to 18%,

prostate cancer 29%, oesophageal cancer up to 8%, brain cancer up to 20% and cancer of the cervix and uterus up to 11% higher compared to Northern Ireland.

The most significant difference was however in the incidence of Chronic lymphoblastic leukaemia, a blood and bone marrow disease called CCL. Research has demonstrated that fluoride has the ability to affect the cells of the human immune system.[460] These studies revealed that fluoride damages the human lymphocyte system. The authors of this study concluded that the ability of fluoride to negatively impact the mitogenic and antigenic response of human blood lymphocytes could be one of the primary means by which the fluoride ion influences the immune system. Abnormal lymphocytes may also be called leukemia cells.[461]

Figure 21. Increased incidence of certain Cancers in Fluoriodated RoI compared to Non-Fluoridated Northern Ireland



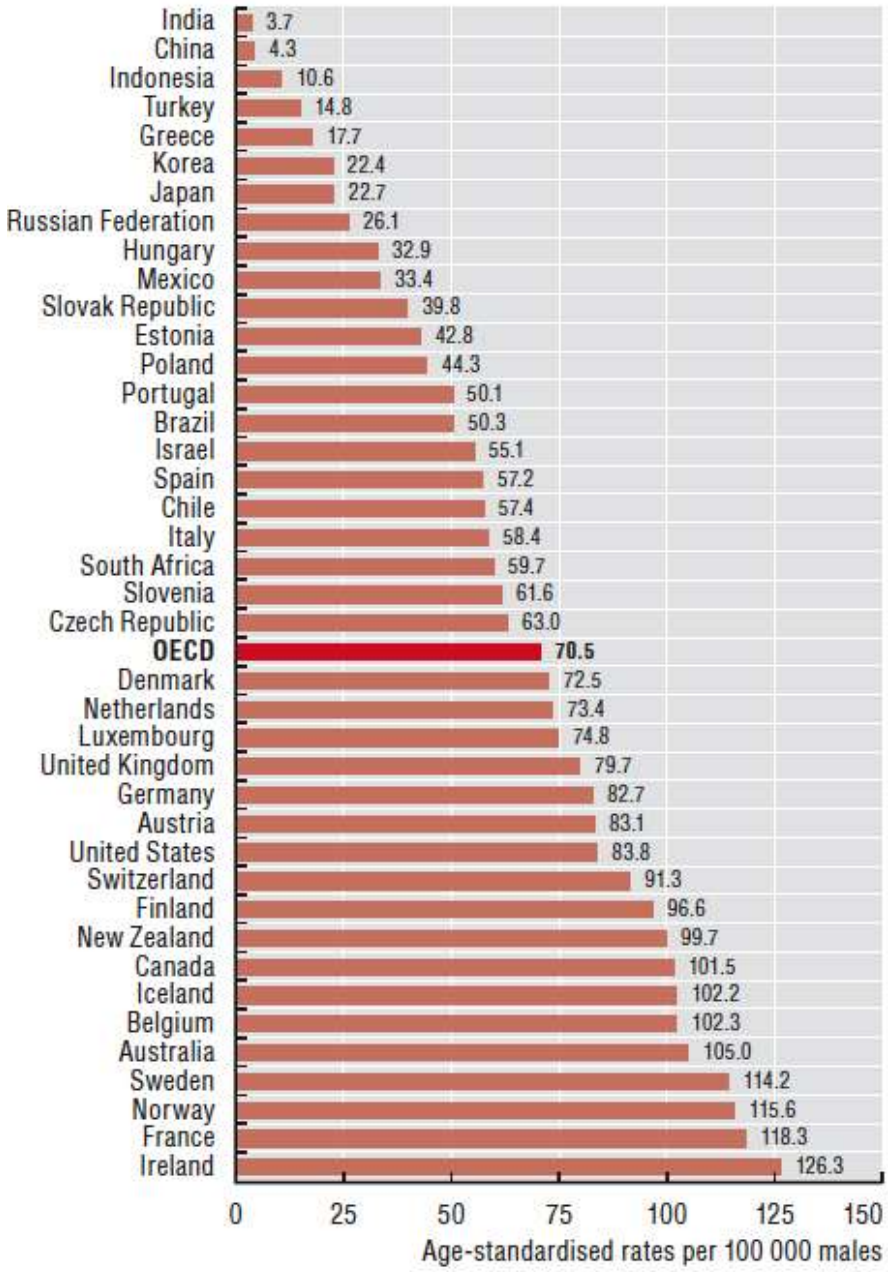
Prostate Cancer

Prostate cancer incidence was 29% higher in the ROI compared to NI. The incidence of prostate cancer in the ROI is the highest of all 30 European countries and was over 60% higher than the EU average.[462] In fact the incidence for Ireland is 180 per 100,000 ranking it number one in the world for this cancer followed by fluoridated Australia/New Zealand at 104 per 100,000 compared to the Western European average of 93 per 100,000. Cancer screening and PSA testing is common

in all these countries, as well as Ireland.[463] According to the European Environment Agency there is evidence linking foetal exposure to EDCs with prostate cancer.[464] Water fluoridation chemicals are now recognised as EDCs at low dose levels.

Similar incidence rates of prostate cancer are to be found in Australia, Canada, New Zealand and the United States.[465] Each of these countries practice artificial fluoridation.

Fig 22. **Male prostate cancer incidence rates, 2008**



Source: Data from OECD (2012B) Health Indicators 2011

The National Cancer Registry Ireland have suggested that the higher incidence of prostate cancer in Ireland is due to PSA screening, Yet the world's largest prostate cancer screening study – the European Randomized Study of Screening for Prostate Cancer (ERSPC) which commenced in 1992 and involved eight European countries including Belgium, Finland, France, Italy, Netherlands, Spain, Sweden and Switzerland did not include the RoI. According to one of the world leading prostate cancer specialists Dr. Catalona Ramon Guiteras, PSA screening is widely used in countries such Sweden, Austria, France and Spain. Dr Guiteras further observed that prostate cancer death rates continue to increase in countries where PSA screening has not been widely adopted such as: Denmark, Ireland, Greece, Bulgaria, and Belgium.[466]

Leukaemia

Leukaemia, the most common invasive cancer diagnosed in children. There were four main types of leukaemia the most common type of leukaemia was chronic lymphoblastic leukaemia. The incidence rates for chronic lymphoblastic leukaemia were 53.5% higher for males and 53.1% higher for females in the RoI compared to Northern Ireland. Males incidence rates increased in Republic of Ireland by 2.8% per year during 1994-2004, however in Northern Ireland rates were static.

Overall leukaemia incidence rates for the period 2007-2009, was 23% higher in ROI compared to NI. For the period 2000-2004 while iincidence rates were 29.6% higher in Republic of Ireland than Northern Ireland for males and 24.7% higher for females.

World age-standardised incidence rates (WASIR) of leukaemia in Northern Ireland were similar to those in the European Union for males and were some of the lowest among developed countries for females. Republic of Ireland however had high rates of the disease compared to other developed countries with WASIRs significantly higher than those in European Union and UK, but similar to those in USA for both males and females.[467]

The U.S like the RoI is fluoridated with over 60% of the population consuming fluoridated water. The incidence rate in RoI is above the EU-15 average and the EU-27 average. Worldwide for males four of the five highest ranking countries for Leukaemia are all fluoridated countries with Australia the highest followed by Canada, USA, Denmark and Ireland.[468]

Non-melanoma skin cancer

Non-melanoma skin cancer (NMSC) was the most common cancer in Ireland, accounting for 27% of all malignant neoplasms.. During 1995-2007, the number of new cases increased by approximately 3% per annum; since 2002 it has been

increasing by around 6% in RoI. The risk of developing NMSC before the age of 75 was 1 in 12 for women and 1 in 8 for men and was higher in RoI than in NI for both men and women. The National Cancer Registry in their ALL Ireland Cancer Atlas report noted that Individuals who are immune suppressed have a greatly increased risk of developing Non-melanoma skin cancer, however no mention was made of fluorides ability to interfere with the immune system or that fluoride was a known endocrine disruptor (EDC). It is well established that EDCs can play a role in the development of immune-related disorders.[469],[470]

The National Cancer Registry also state that residues of arsenic in drinking water may contribute to NMSC. Their report warns that arsenic is carcinogenic (International Agency for Research on Cancer, 1987; International Agency for Research on Cancer, 2004a) and ingestion of arsenic and inorganic arsenic compounds causes NMSC. No mention is given to the fact that arsenic is a known and measured contaminant in water fluoridation chemicals.[471]

The All Ireland Cancer Atlas found that the risk of NMSC was 13% higher in the ROI compared to NI. This difference increased to 19% when population density and area-based socioeconomic factors were taken into account. For men once age, population density and socio-economic factors were adjusted for the relative risk of NMSC was 23% higher in ROI compared to NI.

The incidence rates for malignant melanoma is 19% higher in the RoI compared to NI. The incidence is 14.5 per 100,000 for males and 18.9 for females in RoI compared to 12.2 and 16.1 for males and females respectively in NI. The combined incidence for RoI is 16.7 per 100,000 compared to 14 per 100,000 for NI and 16.2 for UK.[472]

Osteosarcoma

Osteosarcoma is a rare malignant bone tumour, commonly occurring in the age group of 10-24 years. Bone is the principal site of fluoride accumulation. In Ireland malignant bone tumours account for 4% of childhood cancers overall and 8% of all cancers diagnosed in 10-14year olds. The incidence rate in Ireland is higher than for the entire UK and similar to that found in fluoridated United States. For the period 1994-2000 the incidence rate were 33% higher in fluoridated Republic of Ireland (0.27/100,000) compared to non-fluoridated northern Ireland (0.21/100,000).[473]

A more recent short non-peer reviewed study[474] published by the National Cancer Registry (2009) shows a rate of osteosarcoma in the ROI of 0.25 /100,000 for the

period 1994 to 2007 compared to 0.21 /100,000 for Northern Ireland. This represents a16% increased incidence for this disease in the ROI. However on closer examination of the data provided in the study the incidence figures found 185 new cases between 1994 and 2006 of which 147 cases were in the ROI and 38 in NI; the incidence rate, when correlated to population under 18 years of age for both regions, shows a 37% increased incidence of osteosarcoma in the ROI compared to NI.

In either case a 16-37% increased incidence of this disease in fluoridated ROI compared to non-fluoridated NI would clearly support the observations of the NRC scientific committee when they noted that fluoride could have an influence on the development of this cancer.

New Published Research on Fluoride and Osteosarcoma

Recent reports have indicated however that there is a direct link between fluoride exposure and osteosarcoma.[475, 476, 477] In vitro studies have shown that exposure to fluoride cause osteoblast proliferation and malignant transformation. [478] Also a link between p53 mutations and fluoride bone content has been reported in tissue samples form osteosarcoma patients.[479] Most recently Kharb et al. [480] (2012) examined fluoride levels in serum and drinking water of osteosarcoma patients and found serum fluoride levels were significantly elevated in patients with osteosarcoma compared to controls. There was also a positive correlation ($r=0.85$, $P < 0.01$) between drinking water fluoride and serum fluoride levels in the osteosarcoma group patients. Samples of drinking water from the homes of these patients also showed a higher fluoride content (1.302 ±0.760) compared to the control group (0.475±0.243). Mean serum fluoride concentrations in the osteosarcoma group were 0.183 ± 0.105mg/L compared to the control group 0.042±0.035mg/L. This represents a very significant four-fold increase in plasma fluoride levels, at fluoride exposure levels within the range as found in fluoridated water in Ireland.

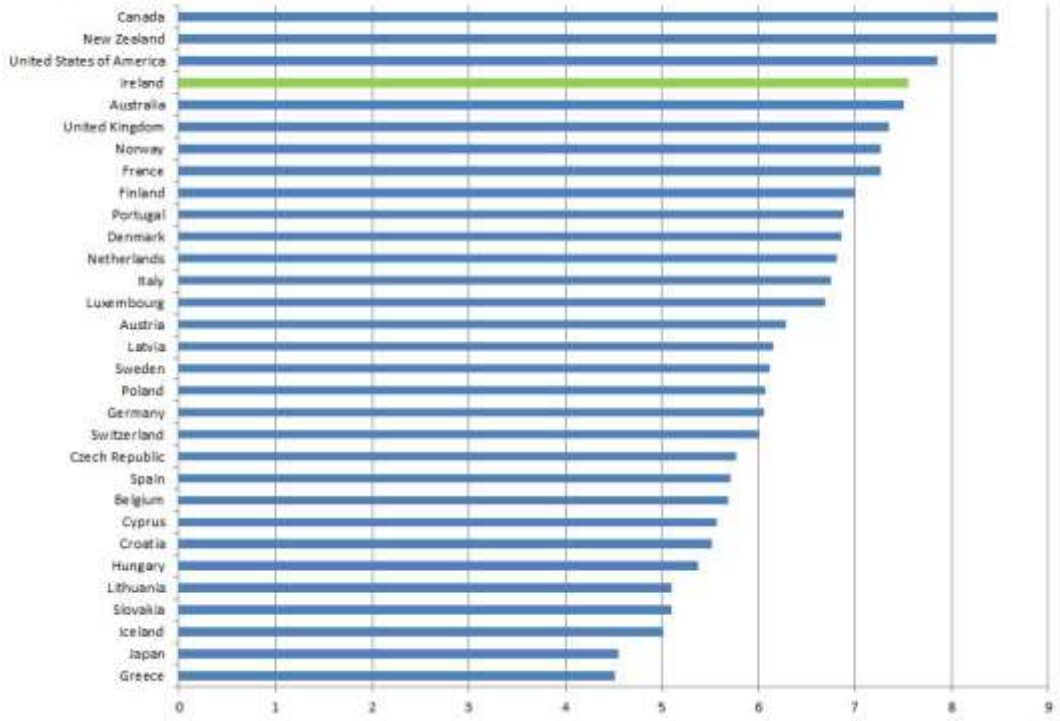
The study concluded that finding a high serum fluoride levels in osteosarcoma patients along with high drinking water fluoride level (range 0.54ppm - 2.06ppm) suggest a link between fluoride and osteosarcoma, again supporting the findings of the NRC review.

Non-Hodgkin's lymphoma

Data from Cancer Research UK (2008) and their examination of European Age-Standardised Incidence Rates, for all EU-27 Countries, Ireland has the highest incidence of non-Hodgkin's lymphoma (for females) in all 27 EU Member States.[481] The rate of new cases of non-Hodgkin's lymphoma has been slowly but steadily rising for the last 50 years. The HSE have noted that if the occurrence of non-Hodgkin's lymphoma continues to rise at the current rate, it is estimated that it will be as common as breast or lung cancer by 2025.[482]

Globally the highest incidence of this disease is to be found in the United States of America, followed by Australia/New Zealand. Fluoridation of drinking water is practised in each of these countries. According to the HSE, the high incidence in Ireland is for reasons that are not understood, including the possibility of some unknown environmental factor (i.e. chemical toxin, for which fluoride is one).

Figure 23. **Age-standardized death rates per 100,000 Lymphomas, multiple myeloma, WHO 2008**



Colorectal cancer

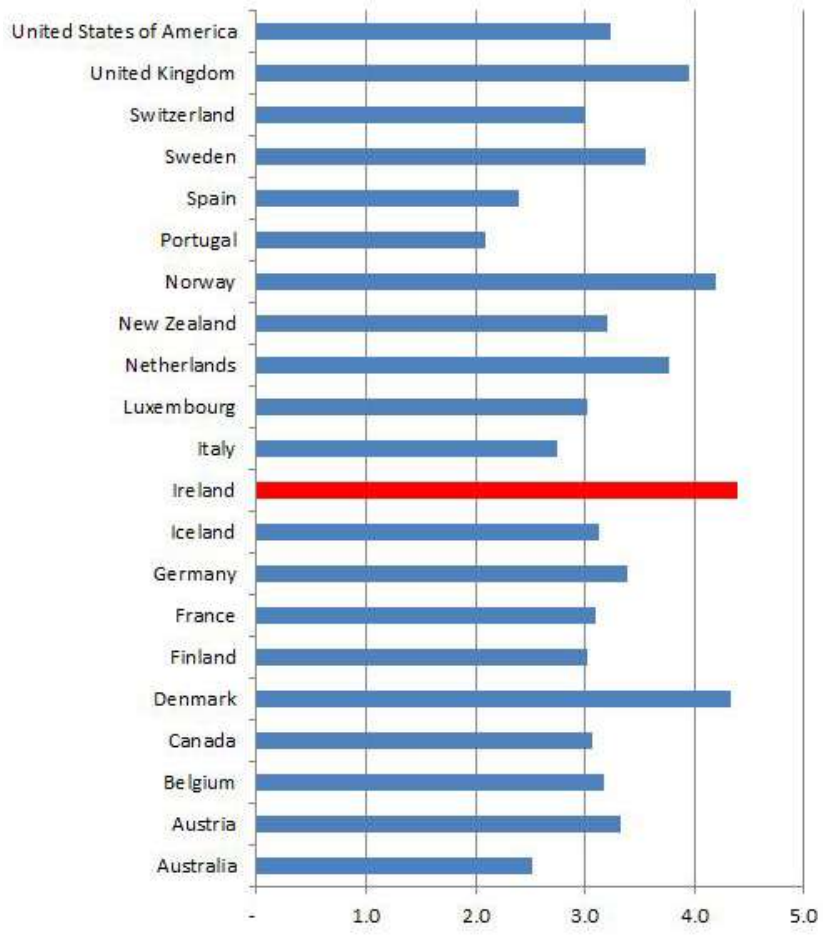
Irish female colorectal cancer incidence was 3% higher than NI. Irish female colorectal cancer incidence was 15% higher than the EU average and males 11% higher. [483] Ranking of the most commonly diagnosed invasive cancers (excluding NMSC) in the period 2007-2009. Similar incidence rates of colorectal cancer are to be found in Australia, Canada and New Zealand.[484]

A significantly higher incidence rate is to be found in the south of the country compared to Dublin-mid Leinster, Dublin North East and West of Ireland.

Ovarian Cancer

Ireland has been found to have the highest incidence rate of ovarian cancer in Western Europe, as well as higher incidence rates of colorectal, lung, non-Hodgkin's Lymphoma, and pancreatic cancers compared to the European average.[485] Mortality rates for ovarian cancer in Ireland are the highest in Europe.

Figure 24. Ovarian Cancer Estimated Deaths per 100,000



Source: WHO Department of Health and Measurement Information 2011

Other Cancers

Brain cancer incidence is 20% higher in ROI; bladder cancer was 14% higher, skin cancer 18%, uterine cancer 11%, while other cancers such as oesophageal cancer were 8%, higher in the RoI compared to NI.[486]

The NRC scientific committee (2006) highlighted that an association of uterine cancer with fluoridation was found in a Japanese study[487] undertaken in Okinawa before and after fluoridation was terminated. This analysis was a follow-up of the positive results from a previous exploratory

analysis that comprised a large number of comparisons conducted by this researcher with the same data set.[488]

Overall the most commonly diagnosed cancers are female breast cancer, prostate cancer, colorectal cancer, lung cancer, lymphoma, melanoma, bladder, stomach, kidney, oesophagus, leukaemia, pancreas, head and neck, brain and other central nervous system cancers and testis. Mortality from Breast cancer in the RoI is the second highest in EU.

Exceptions to cancer incidence in Northern Ireland.

A small number of cancers were found to be or higher risk in NI compared to ROI, however similar incidences were also recorded in geographic areas in the South. The risk of lung cancer was significantly higher in NI compared to ROI for both men (by 11%) and women (by 7%). The highest risk was to be found in urban areas of Belfast (NI), Dublin (ROI), Derry (NI) and Cork (ROI), and also in Louth, Kildare, Carlow and Wicklow (all-ROI). As with other cancers the increased risk was associated with increased population density, unemployment and low levels of education. The fact is however, that similar incidence of lung cancers were found in major cities and urban areas in ROI compared to NI.

One clearly cannot discount the significant impact of 'the 'Troubles' on consumption of tobacco as it is well documented that smoking rates are significantly higher among persons exposed to a traumatic event relative to those without such exposure.[489]

It is evident that the reduced incidence or risk of lung cancer in the population of ROI is therefore largely due to the impact of the 'Troubles' in NI with associated increased stress including post-traumatic stress, higher incidence of smoking. It is also evident that a larger rural population resident in ROI (mostly with non-fluoridated water, similar to NI) as well as lower levels of unemployment and better levels of education compared to NI would also be significant factors in reducing the overall mean incidence for the ROI. Compared to ROI, the risk of head and neck cancer and non-Hodgkin's lymphoma was greater for women but not men in NI, this however would be expected due to the increase risk of lung cancer as cigarette smoking has also been found to increase the risk of developing follicular lymphoma.[490]

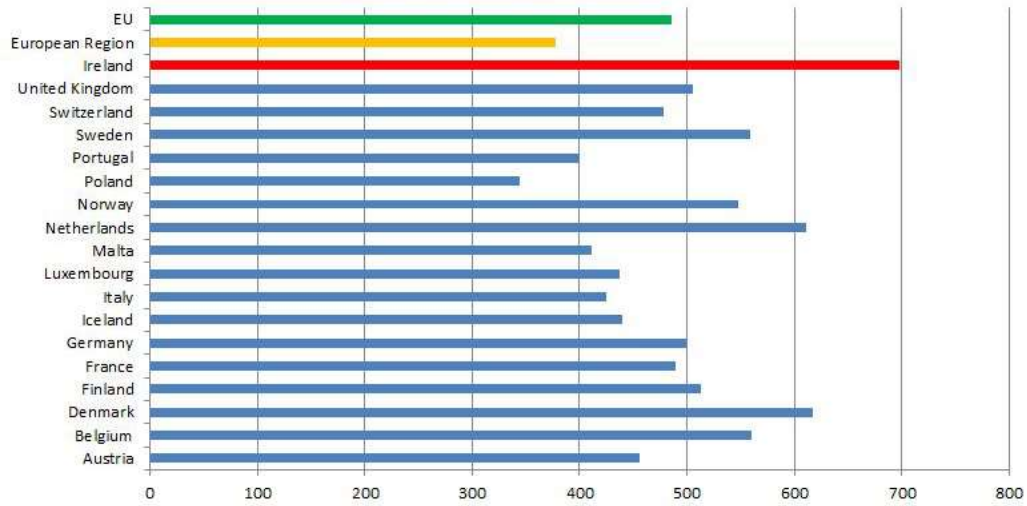
International Comparisons with other EU countries

According to WHO data[491] in the year 2000 the cancer incident in the population of Ireland was 583.03 per 100,000, the highest in Western Europe. This was 68% above the mean for the European region and 30% above the EU average. In 2008 the cancer incidence had risen 20% to 698.1 per 100,000, 85% above the corresponding incidence rate for European region and 43% above the EU incidence rate.

World Health Organization
REGIONAL OFFICE FOR Europe

	Cancer incidence per 100,000				
Countries	Year 2000	Year 2005	Year 2008	Year 2010	Year2011
011 Cyprus	252.96	324.59	356.74	...	...
036 Portugal	360.22	365.13	...	...	...
024 Italy	...	430.3	424.84	421.57	...
030 Malta	408.23	469.88	411.16	452.41	479.97
029 Luxembourg	412.02	434.04	437.11	...	...
021 Iceland	420.77	457.3	440.26	...	...
015 Finland	431.42	505.67	513.32	544.38	...
004 Austria	458.68	460.48	460.55	437.94	...
007 Belgium	460.51	573.95	560.19	578.6	...
052 United Kingdom	461.09	481.39	505.56	522.45	...
046 Switzerland	463.4	485.74	486.85	...	...
016 France	472.45	523.61	...	...	578.41
033 Netherlands	483.16	553.19	614.03	647.04	...
018 Germany	493.29	528.75	572.07	...	...
034 Norway	501.17	524.04	547.82	578.23	...
013 Denmark	509.79	570.77	617.56	645.47	...
045 Sweden	512.63	564.74	558.89	590.12	...
022 Ireland	583.03	632.75	697.59	763.89	733.81
057 EU members since 2004 or 2007	357.62	422.14	457.08	459.81	474.11
056 EU members before May 2004	479.25	500.05	518.11	524.85	...
055 EU	449.74	481.69	503.78	509.66	...
054 European Region	348.25	372.26	391.57	397.88	...

Figure 25. Cancer Incidence per 100,000 of population
Republic of Ireland (Artificially Fluoridated Water) compared to Europe (Non-Fluoridated)
WHO Health Database European Region 2012



Cancer Incidence per 100,000
Cancer incidence rate for Ireland is 85% above the European region and 43% above the EU region

Chemical contaminants in Water and Cancer incidence

It is interesting to note also the findings of a published study examining chemical contamination of water and cancer which found that most common cancer sites statistically associated with various measures of population exposure to chemicals in water were bladder, stomach, colon and rectum although other sites showing statistically significant relationships were oesophagus, liver, gallbladder, pancreas, kidney, prostate, lung and breast. [492] Five case-control studies were reviewed in the study (Alavanja et al[493]., 1979, Struba[494], 1979, Brenniman et al. [495] 1980, Young et al.[496,] 1981, Gottlieb et al[497]., 1982) representing New York County, North Carolina, Illinois, Wisconsin and Southern Louisiana. Significant associations with water quality were found for: bladder cancer in two studies, colon cancer in three and rectal cancer in four. While the study intended to examine the link between water chlorination and cancer, it did not report the fact that the water supplies in each of these regions were fluoridated.[498]

NRD Findings on Fluoride and Cancer

The NCR concluded that fluoride appears to have the potential to initiate or promote cancers, particularly of the bone, but the evidence to date is tentative and mixed. Several in vivo human studies of genotoxicity, although limited, suggest fluoride's potential to damage chromosomes. The human epidemiology study literature as a whole is still mixed and equivocal. In animal studies, the overall incidence of osteosarcoma in male rats showed a positive trend. The 1993 NRC review concluded that the increase in osteoma in male and female mice was related to fluoride treatment. The NCR (2006) noted that the evidence of osteoma remains important in the overall weight-of-evidence consideration and that several studies indicating at least some positive associations of fluoride with one or more types of cancer have been published since the 1993 NRC report.

In considering the possibility of fluoride contribution to cancer one must take into consideration the findings of the Agency for Toxic Substances and Disease Registry (ATSDR 2003) when they concluded that the ecologic studies performed to date for fluoride and cancer did not have sensitivities to detect less than 10% to 20% increases in cancer risk.[499]

Weight of Evidence

The overall findings of this study, providing multiple comparisons of cancer incidences rates for a wide range of cancers, clearly demonstrates a positive associated between fluoridation and significant increased incidence of cancer in the RoI compared to non-fluoridated NI.

Confounding Factors in Exposure disease relationship between Republic of Ireland and Northern Ireland

In comparing disease incidence between two communities of RoI and NI over time, a number of important factors must be considered including:

Employment

Overall, 40% of the NI 16-74 year old population was economically inactive compared to 34% in RoI. 30% of the NI population lived in the areas of highest unemployment, compared to 16% of the RoI population.[500]

Education

Among 16-74 year olds in RoI, 87% did not have a university degree (or academic equivalent) compared to 84% in NI. [501]

Living Arrangements

41% of the NI population aged 75 years and over lived alone, compared to 31% in RoI.[502]

Smoking

In a survey undertaken in 2003 more respondents in Northern Ireland (31.2 per cent) said that they smoked than respondents in England (27.9 per cent), but fewer than in Scotland (33.6 per cent). In the Republic of Ireland, 32.5 per cent of respondents said that they were smokers, as did 28.3 per cent of respondents in Wales.[503] A survey conducted in 2007 found that approximately 29 per cent of adults in the RoI were current smokers.[504] For the period 1990-99 the incidence of smoking among males in RoI was significantly less than other EU Countries.

Drinking

In a survey undertaken in 2003, 79.0 per cent of respondents in NI reported that they drank alcohol compared to 85.1 per cent for the RoI. This compares to Wales (75.2 per cent) England (91.0 per cent) and Scotland (90.3 per cent)[505] Mortality rates from alcohol abuse however are 32% higher in the NI compared to RoI.[506] WHO data demonstrates a high consumption of alcohol in Ireland compared to other western European countries but a significantly lower mortality rate from alcohol related diseases. These are all important criteria in examining relative risk of

disease incidence and demonstrate that a higher relative risk of developing disease exists in NI compared to RoI.

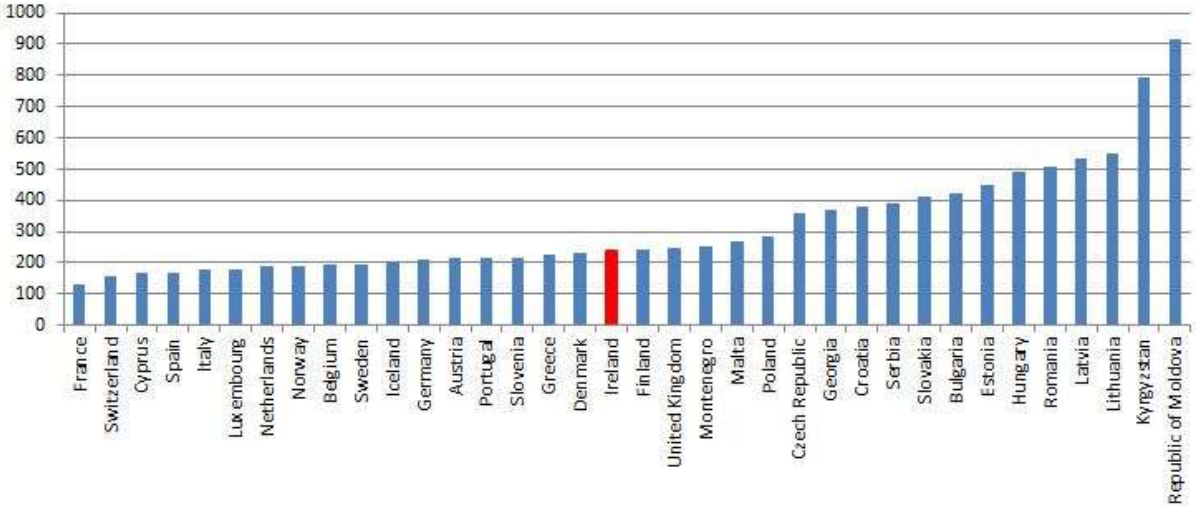
World Health Organization
REGIONAL OFFICE FOR Europe

Prevalence of smoking last available year

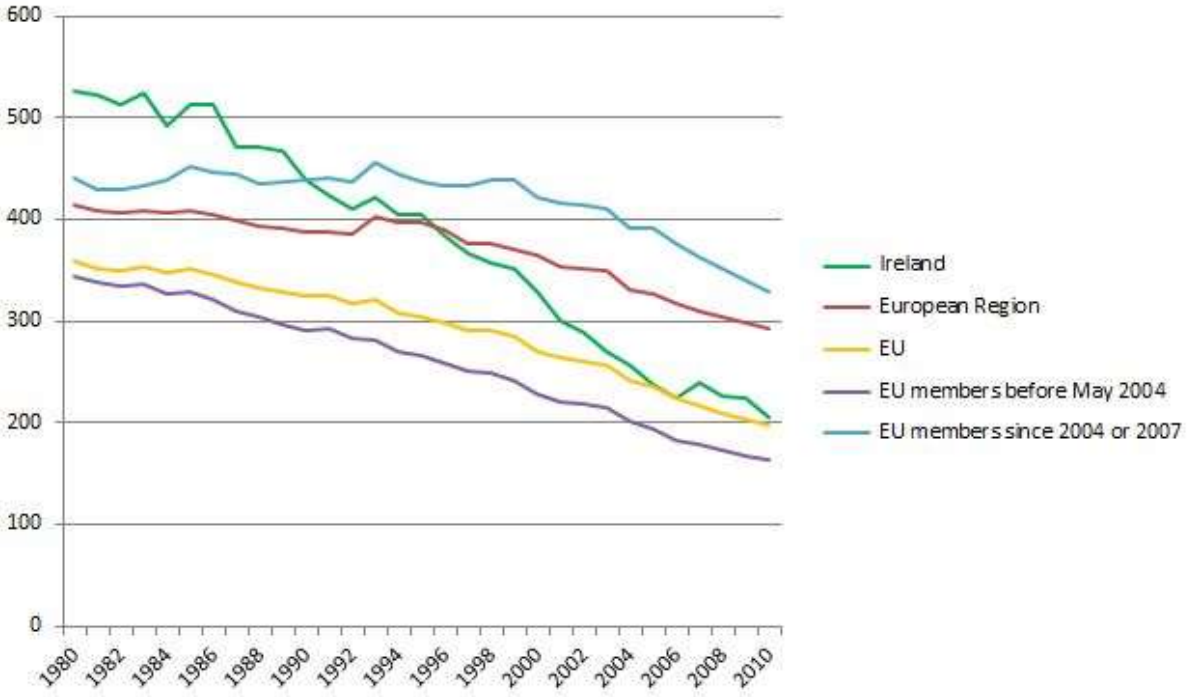
Countries	Men	Woman
Sweden	12	16
Iceland	16	16
Norway	21	20
United Kingdom	22	20
Finland	23	16
Denmark	24	17
Switzerland	24	18
Belgium	25	18
Austria	26	19
Malta	26	16
Luxembourg	27	22
Ireland	27	26
France	30	22
Italy	30	17
Czech Republic	30	18
Portugal	32	13
Spain	32	22
Netherlands	33	24
Poland	34	21
Croatia	35	22
Hungary	36	27
Germany	37	31
Estonia	38	17
Cyprus	40	14
Slovakia	42	16
Bulgaria	44	23
Latvia	45	17
Greece	46	29

Source: WHO Europe. Health for all Databases (HFA-D5)
Report European Cardiovascular Disease Statistics 2012

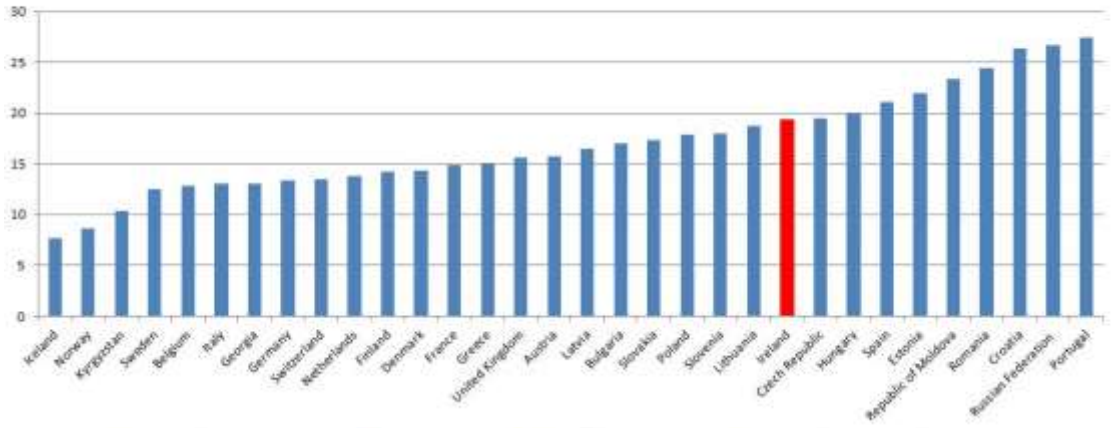
Standardised Death Rates Smoking Related Causes, Deaths per 100,000 Year 2005
WHO Regional Office Europe



Standardised Death Rates Smoking Related Causes, Deaths per 100,000
WHO Regional Office Europe

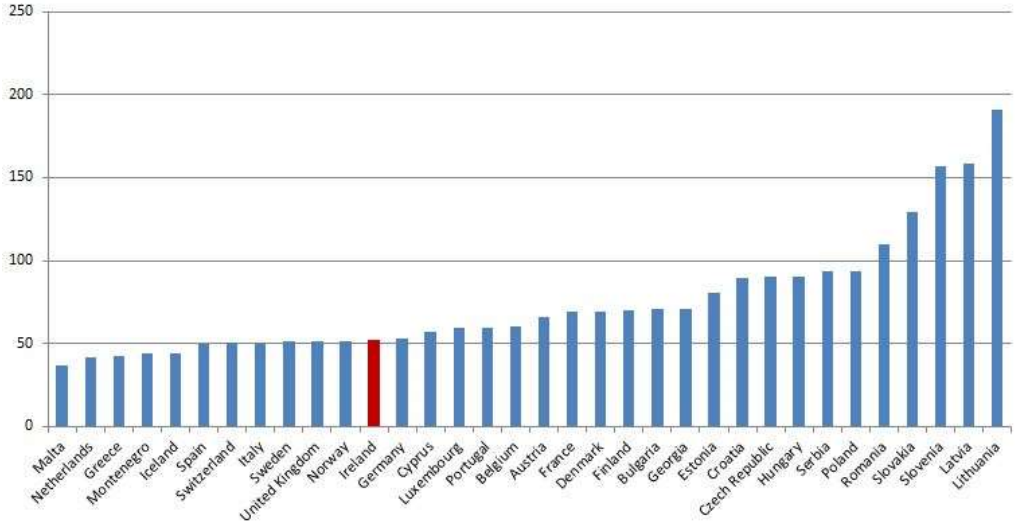


Total (recorded+unrecorded) Adult (15 +Years) per capita consumption of pure alcohol, drinkers only
Global Health Observatory Data Repository (European Region) 2005



Standardised Death Rates Alcohol Related causes, Deaths per 100,000
WHO Regional Office Europe

Standardised Death Rate, Alcohol Related Causes, per 100,000 Year 2005 WHO Regional Office Europe



Undocumented Toxins in Foods and Beverages

The NRC scientific committee acknowledged that silicofluorides may be present in certain foods prepared from fluoridated drinking water and highlighted that biological effects of exposure to these chemicals may occur.

The NRC also highlighted the serious neuro-toxicological impacts of increased exposure to aluminofluorides resulting from artificial fluoridation of drinking water.

This concern was raised in my original report titled *Human Toxicity, Environmental Impact and Legal Implications of Water Fluoridation*. It was also addressed in a follow up report dated September 2102.[507]

This should of course be a major public health concern given the inherent risk of adding significant concentrations of free fluoride ions, in addition to silicofluorides compounds, to beverages such as tea, which already contain elevated levels of aluminium and fluoride as well as other heavy metals. Such a policy clearly exposes consumers to considerable risk and may explain the alarming prevalence of early onset dementia in the population of the ROI compared to non-fluoridated NI.

This concern was previously documented in my original study[508] and in subsequent communications to the Government of Ireland, its agencies as well as the IFA and Consumers Rights Association. I have yet to receive any acknowledgement to the concerns raised.

Given the recent public outcry regarding contamination of foodstuffs with horse meat this should be a cause of major concern for the food processing industry in Ireland.

Poison Regulations

In the latter report it was highlighted that fluoride ions have a strong tendency to form complexes with heavy metal ions such as aluminium fluoride in water. It is acknowledged that the toxic potential of inorganic fluorides is mainly associated with this behaviour and the formation of insoluble fluorides such as aluminium fluoride (AlF3).[509] In Ireland the POISONS REGULATIONS, 1982 lists alkali metal fluorides as poisons.[510]

By adding Hexafluorosilicic acid to water one is not only creating silicofluoride compounds but alkali metal fluorides compounds that are poisonous to public health. Aluminium fluoride complexes are also created in the stomach at low pH where it acts in competition with hydrofluoric acid. Aluminium fluoride is far more bioavailable than is the free aluminium ion which is quantitatively eliminated out the GI tract. Animal studies have found that aluminium fluoride complexes (AlF3) in

drinking water will result in increased Aluminium levels in the brain and kidney as well as causing significant changes to brain cellular structure and neuronal integrity.[511]

Fluoridation of Water Supplies Regulations

The addition of any substance that is capable of a deleterious or injurious effect upon health is a violation of the Fluoridation of Water Supplies Regulations 2007.[512] Fully or partially dissociated silicofluoride compound may also cause a health hazard because the fluoride ion, the undissociated and the re-associated fluorosilicate and the arsenic and lead present in the chemical are all hazardous to fetal and infant central nervous system development and function.

The addition of water fluoridation chemicals to drinking water results in the formation of hydrofluoric acid in the stomach of consumers. As with Hexafluorosilicic acid the toxicological profile of hydrofluoric acid is also incompletely known.

In the EU, hydrofluoric acid is classified in acute toxicity category 1 (which stands for the highest hazard).[513] It is classified as very toxic according to directive 97/548/EEC or 1999/45/EC and classified as a dangerous chemical according to EC regulation 1272/2008 (CLP). The HF hazard is due to the double presence of H+ and F- in an acidic medium. The chemical materials data safety sheet for HF states that while toxicological data is sparse *"absorbed fluoride can cause metabolic imbalances with irregular heartbeat, central nervous system depression, seizures, and deaths. Long-term exposure may cause osteofluorosis (weakened bone structure), skin disorders, and respiratory, liver and kidney effects. To the best of our knowledge, the chronic toxicity of this substance has not been fully investigated."* It also noted that repeated or prolonged exposure to the substance can produce target organs damage and that repeated exposure to a highly toxic material even at low doses may produce general deterioration of health.[514]

Lack of Toxicological data on Water Fluoridation Chemicals

Hexafluorosilicic acid and hexafluorosilicates are the most commonly used agents in drinking water fluoridation. As noted by the European Commission Scientific Committee on Health and Environmental Risks the toxicology of these compounds is incompletely investigated.[515]

Similarly the NRC Scientific committee found that the toxicity database on silicofluorides is sparse with essentially no studies comparing the toxicity of silicofluorides with that of sodium fluoride.[516]

The U.S EPA found that the kinetics of the dissociation and hydrolysis of hexafluorosilicate are poorly understood from a mechanistic or fundamental perspective. Furthermore they noted that there is considerable debate over the composition and even the existence of some homo- and heteroleptic aquo-, fluoro-, and hydroxo complexes of silicon- (IV), which makes it impossible to predict what species might be found in real potable water supplies that are fluoridated. They highlighted concerns as to whether current instrumentation is capable of detecting residual fluorosilicates or fluorosilicon(IV) complexes, while addressing that there is a need for further study of heteroleptic fluoride complexes (especially with the common anions in drinking water) of aluminum(III) and possibly other metal cations as well as better chemical knowledge of water fluoridation chemicals in general.[517]

U.S. senior EPA personnel have found no evidence Silicofluoride (SiF) was ever tested for adverse health effects.518,519(Fox 1999, Thurnau 2000). The health risk from exposure to SiFc has been acknowledged by the U.S. EPA who tendered for risk management research to be undertaken on fluorosilicates in drinking water in 2002 and again by the U.S. National Research Council who requested animal testing on the health effects of SiFc in 2006. This was confirmed by the formal decision on this part by the US National Toxicology Program in 2002, nominating SiF's for toxicological studies on animals because information on this topic was not sufficiently established.

No data is yet available on the results of the toxicological study despite the formal decision to proceed in 2002.[520]

The European Chemicals Agency have likewise identified the lack of toxicological data on water fluoridation chemicals specifying a lack of that acute toxicity data, respiratory sensitization data, skin sensitization data, reproductive toxicity data, carcinogenicity data, organ toxicity data, and environmental hazard data making it impossible to accurately classify the chemical in accordance with EU regulations.[521]

Hexafluorosilicic acid is listed as a biocidal product is provided in the EU Biocidal Directive (98/8/EC). .The EU banned Hexafluoprosilicic acid (H2SiF6) for use as a biocidal product within the EU due to lack of toxicological data to demonstrate that it was safe for humans and the environment.[522]

In June 2003 the EU prepared a list of Notified substances, including hexafluorosilicic acid, that were subject to new regulation that required detailed supporting information to be provided to the EU, for the protection of human health and the environment by March 2004.[523] Hexafluoorosilicic acid is listed on page 24 of this document. EC number: 241-034-8: CAS number16961-83-4524

Spain as a manufacturer of this biocide was requested to provide a dossier of information to the EU on the toxicology of the substance to include toxicological and metabolic studies, ecotoxicological studies, reproductive toxicity, medical data

including medical surveillance data, epidemiological studies on general population, skin sensitivity studies and allergenicity studies, carcinogenicity studies, mutagenicity studies, sub chronic toxicity studies and measures to protect humans, animals and the environment. A full list of the assessment procedures are provided in pages 33 to 179 of the risk assessment for biocidal products published by the EU.525 Where information was not provided the substance could no longer be used as active substance to be sold or marketed as a biocidal product within the EU market. No information was provided and the substance was subsequently removed as an authorised biocide within EU. The phase out date was set as 01/09/2006.

Despite this, the Health Authority in Ireland continues to source Hexafluorosilicic acid from Spain for injection into public drinking water supplies to be consumed by the public at large. Using a "Dangerous Poison" WITHOUT TESTING for human, animal or environmental safety is clearly illegal and an endangerment to public health.

In Australia, Hexafluorosilicic acid is explicitly listed in the Australian classification of toxins as a "DANGEROUS POISON" using the criteria in the Standard for the Uniform Scheduling of Drugs and Poisons (SUSDP). The "Material Safety Data Sheet" (MSDS11) published in Australia for the compound H2SiF6 specifically lists this chemical as a poison.[526]

In the USA, Fluorosilicic compounds were used as pesticides up to 1999. In August 1995, the pesticides act was amended, eliminating fluorosilicate compounds from the registration list and their sale for pesticide use (40CFR153, Subpart H) (U.S. EPA, 1995). In the United States, all pesticide uses have been cancelled (U.S. EPA, 1999). Fluorosilicic acid is listed in Section 8(b) of the USA Toxic Substances Control Act (TSCA; chemical inventory section).[527]

Accordingly to Roholm's data on the toxicological profile of inorganic fluorines, Hexafluorosilicic/Hydrofluorosilicic acid is classified as extremely toxic and is 25 times more lethally toxic than naturally occurring Calcium Fluoride. [528] Calcium fluoride occurs naturally in many places in groundwater principally in hard waters. In trace amounts this is harmless. Fluoride is not found in naturally in soft waters. In a survey of 650 water samples taken in Ireland prior to commencement of fluoridation in the 1960's fluoride was found in only six water samples.

Fluorosilicates are derivative compounds of hexafluorosilicic acid in water,

[11] An MSDS is needed for selling in commerce chemicals that may be dangerous.

fluorosilicates are classified as a health, physicochemical and/or ecotoxicological hazard, according to the National Occupational Health and Safety Commission (NOHSC) Approved Criteria for Classifying Hazardous Substances.

It is clear that available scientific information on water fluoridation chemicals added to public water supplies and ingested by consumers does not even meet the minimum toxicological requirements for cosmetic ingredients that are applied to the surface of the skin. When a cosmetic ingredient is submitted to the EU Scientific committee on consumer products the manufacture is required to provide the Commission with the information set out below:

- Acute toxicity
- Irritation and corrosivity;
- Skin sensitisation;
- Dermal / percutaneous absorption;
- Repeated dose toxicity;
- Mutagenicity / genotoxicity;
- Carcinogenicity;
- Reproductive toxicity;
- Toxicokinetics;
- Photo-induced toxicity;
- Human data.

Together with the relevant experimental investigations, the following information should also be available to the Commission:

- any report on epidemiological and/or observational experiences;
- description of all available ecological and environmental effects of the respective substance/compound/preparation;
- all relevant published literature;
- a description of the bibliographical methods used;
- any useful finding to the applicant's best ability;
- any "grey material" available elsewhere.

Subsequently, any new information acquired by industry and/or relevant agencies, should be transmitted to the Commission for review [SCCNFP/0461/01]. These are considered the minimal base set of requirements, when considerable oral intake is expected, as is the case with consuming fluoridated water, specific additional genotoxicity and/or mutagenicity data if required.

From the EU legislative point of view competent authorities are required to keep readily available information on the assessment of the safety for human health of chemicals including the toxicological profile of the product ingredients, their chemical structure and their level of exposure. The name and address of the qualified person or persons responsible for the assessment must be provided and the individual must be qualified in the field of pharmacy, toxicology, dermatology, medicine or a similar discipline.

Under the EU regulatory framework for the Registration, Evaluation and Authorization of Chemicals (REACH) the above-mentioned toxicological data set is mandatory for dangerous substances produced / imported at tonnage levels between 1 and 10 tonnes/year.[529] According to Oireachtas records the RoI imports 720,000 gallons of hydrofluorosilicic acid from Spain each year.[530]

As of 2013 no toxicological data is available. This information was sought by the EU in 2003 from the manufacturer of this chemical in Spain.

Importantly the EU REACH scheme makes increased transparency a key objective, and acknowledges consumers 'right to know'. That is, a right to access information about the chemicals to which the public are exposed that will enable them to make informed choices and to avoid products containing harmful chemicals.

Under the Reach scheme all chemicals must undergo a Registration, Evaluation and Authorization process. Authorization of substances of very high concern must be obtained before they can be used for a particular purpose, marketed as such or as a component of a product. These are substances that are either, carcinogenic, mutagenic or toxic to reproduction (CMRs classification categories 1 and 2), persistent organic pollutants (POPs) or other substances demonstrated to be of equivalent level of concern, such as endocrine disruptors.

No data is available on the carcinogenic, mutagenic or reproduction toxicity of water fluoridation chemicals used in the RoI.[531] A recent scientific review by Vandenberg et al. (2012) examining low dose exposures to endocrine-disrupting chemicals (EDCs) lists water fluoridation additives added to prevent dental caries as EDCs with reported low dose effects in animals or humans.

Under REACH there are specific legal obligations for downstream users such as local authorities in charge of water fluoridation schemes. Before commencing a particular use of a registered substance, downstream users are obliged to assess the safety of their uses of substances and to take appropriate risk management measures. Downstream users are also obliged to provide specific information and proposals for additional testing where this is considered necessary by the downstream user to complete his chemical safety assessment.

I have previously highlight in communications to every Local Authority in the RoI their legal requirements and requesting of them to seek and provide the necessary toxicologically data demonstrating that Hexafluorosilicic acid injected into public water supplies under their management is safe both for consumers and the environment.

Revisions of Standards to Protect Public Health

It is noteworthy that both the Republic of Ireland[532] and the U.S. Department of Health and Human Services (HHS)[533] recently revised their drinking water guidelines for artificial fluoridation in order to minimise the harm caused by fluoride overexposure to the population and to prevent unwanted health effects. Prior to undertaking such reviews public health authorities in both jurisdictions claimed that water fluoridation at the previous historical optimal levels was safe.

Supreme Court Judgment of Ryan v. A.G

The Supreme Court Judgment of Ryan v. A.G. (1965) specifically forbids the addition of any amount of substances to water that may be harmful to human health including lead or arsenic.[534] Both arsenic and lead are known to be present in water fluoridation chemicals.

Current Status of Fluoridation in Europe

At present almost none of the public water supplies in Albania, Andorra, Armenia, Austria, Azerbaijan, Belarus, Belgium, Belorussia, Bosnia & & Herzegovina Bulgaria, Croatia, Cyprus, Czech Republic Denmark, Estonia, Finland, France, Germany, Georgia, Hungary, Iceland, Italy, Kazakhstan, Kosovo Kyrgyzstan, Latvia, Liechtenstein, Lithuania, Luxembourg, Macedonia, Malta, Moldavia, Monaco, Montenegro, the Netherlands, Norway, Poland, Portugal, San Marino, Serbia, Slovakia, Slovenia, Sweden and Switzerland are artificially fluoridated.

Water fluoridation was previously practised in a few countries in mainland Europe but was discontinued following a review of policy and over concerns regarding ethical and legal issues, health concerns (precautionary principle) and environmental sustainability.

This included the Czech Republic (discontinued in 1989), Finland (discontinued 1992), Hungary (discontinued 1960), the Netherlands (discontinued 1976), the Federal Republic of Germany (West Germany-discontinued in 1950's), German Democratic Republic (East Germany-discontinued in 1990), Sweden (discontinued in 1971) and Switzerland (Basel the last city in Switzerland to be fluoridated discontinued in 2003).

Figure 28. Map of Fluoridated Areas of Regions of Europe

Ireland remains the only country within the European region with a legislative mandatory policy requiring the fluoridation of all public water supplies. Water fluoridation is also practised in a limited area of England and to a smaller extent in Spain, principally in the Basque region of Northern Spain.

EU Member States Scientific and Technical Reviews of Water Fluoridation

Independent risk assessments concerning water fluoridation have been undertaken in the Netherlands[535], Germany, France, Denmark, Sweden, the Czech Republic and more recently in the city of Brisbane Australia[536], Basel Switzerland[537] and Romania[538].

The Netherlands 1976

In 1952, Dutch health authorities, following the lead of the United States, began fluoridating the public water supply in the city of Tiel with Culemborg as the control city. On March 20th, 1972, the city of Amsterdam began fluoridating its water supplies. This had a widespread effect on surrounding communities who derived their drinking water from the Amsterdam water suppliers, such as Heemstede, Bennebroek, Hoofddorp, Haarlemmerliede and many others.

Dr. Moolenburgh organized a group of practitioners and researchers to study the effects of fluoridation on health. All the doctors came from fluoridated communities and many did not believe in the existence of the side-effects, as the health authorities had emphatically denied their existence. In addition to the original 12 physicians practicing in Haarlem and some of its surrounding fluoridated areas, various individuals with training in biology, chemistry, and neurology also participated in the above study.

To obtain unassailable proof that nothing but fluoride in the water was responsible and that the ill effects were not imaginary, Dr. Moolenburgh's group conducted a double-blind experiment, the results of which were published in a noted journal.[539]
The list of the most common complaints they could readily identify with the exposure to fluoridation included;

- Stomach and intestinal pains
- Mouth ulcers
- Excessive thirst
- Skin irritation and eczema
- Migraine-like headaches
- Visual disturbances (blurred vision)
- Worsening of known allergic complaints
- Mental depression
- Stomatitis
- Joint pains
- Muscular weakness, and extreme tiredness.

A definite relationship between the symptoms and fluoride in water was clearly established.[540]

Dr. Moolenburgh concluded *"As a summary of our research, we are now convinced that fluoridation of the water supplies causes a low grade intoxication of the whole population, with only the approximately 5% most sensitive persons showing acute symptoms. The whole population being subjected to low grade poisoning means that their immune systems are constantly overtaxed. With all the other poisonous influences in our environment, this can hasten health calamities. It is in the light of this constant low grade poisoning that the substantial evidence of increased cancer death rate due to fluoridation needs to be considered and understood."* Following publication of their research results water fluoridation in Holland was discontinued in 1976.

Denmark 1977

Denmark did not accept fluoridation when its National Agency for Environmental Protection, after consulting the widest possible range of scientific sources, pointed out that the long-term effects of low fluoride intakes on certain groups in the population (for example, persons with reduced kidney function), were insufficiently known.[541]

Sweden 1970's

In Sweden, the Government sought the advice of the Nobel Institute. A research group including Dr. Anders Thylstrup, PhD, Cariology Professor at the University of Copenhagen, Dr. Gillberg, Dr. Jan Sallstrom- Associate Professor of Experimental Pathology and Dr Agnetha Sallstrom revealed that the Government experts of the National Board of Health and Welfare who were advocating fluoridation of water were both ignorant concerning basic physiological knowledge and were providing misleading statistics on caries reduction and fluorosis. The review group advised against continuing with water fluoridation and subsequently the Swedish Government discontinued the policy[542] Sweden ultimately rejected water fluoridation on the recommendation of a special Fluoride Commission, which included among its reasons that: "(t)*he combined and long-term environmental effects of fluoride are insufficiently known*"[543]

Germany 1950's & 1990 on reunification

In Germany the Government sought the advice of the oldest technical and scientific water association in the world, the DVGW, who represent 13,000 professionals, with a full time staff of 400 centered in three research institutes.[544] Germany rejected water fluoridation on multiple grounds including concerns regarding adding medicinal chemicals to public drinking water supplies, the risk of potential long term health effects on the population from the uncontrolled intake of fluorides, the safety of lifelong accumulation of fluorides from consumption of fluoridated water, it's unacceptable ecological impact and the violation of bodily integrity.

Czeck Republic 1993

The Czech Republic undertook water fluoridation of water supplies for a period up to 1993 when the practice was terminated on the ground of being uneconomical (only 0.54 per cent of fluoridated water was used for drinking) the policy being environmentally unsustainable, unethical (forced medication of the population) and over concerns that with water fluoridation it is not possible to control the individual dose or dietary fluoride intake of individuals which can lead to health risks for certain individuals.

Switzerland 2003

Following a cost benefit analysis and scientific review Basel was the last city in Switzerland to discontinue water fluoridation in 2003.

United Kingdom

In the UK approximately 10% of the population are provided with fluoridated water. Independent reviews undertaken in the UK[545] on behalf of the NHS[546] and individual reviews undertaken by Local authorities[547].

NHS Centre for Reviews and Dissemination the University of York, Systematic Review of Public Water Fluoridation, September 2000

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.

The review found that whilst there is evidence that water fluoridation is effective at reducing caries, the quality of the studies was generally moderate and the size of the estimated benefit, only of the order of 15%, is far from "massive".

The review found water fluoridation to be significantly associated with high levels of dental fluorosis which was not characterised as "just a cosmetic issue". The prevalence of fluorosis at a water fluoride level of 1.0 ppm was estimated to be 48% and for fluorosis of aesthetic concern it was predicted to be 12.5%

The review found that there was little evidence to show that water fluoridation has reduced social inequalities in dental health. There appears to be some evidence that water fluoridation reduces the inequalities in dental health across social classes in 5 and 12 year-olds, using the dmft/DMFT measure, however this effect was not seen in the proportion of caries-free children among 5 year-olds and the data for the effects in children of other ages did not show an effect.

The review did not show water fluoridation to be safe. The quality of the research was too poor to establish with confidence whether or not there are potentially important adverse effects in addition to the high levels of fluorosis. The report recommended that more research was needed.

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.

Hampshire County Council, United Kingdom. 2008

Recent independent scientific reviews undertaken by Hampshire County Council rejected artificial fluoridation of water on the precautionary principle owing to the lack of scientific evidence available to prove that fluoridation does not impact negatively on individual health and the plausibility that it may result in serious health impacts on the population.[548] In regard to the lack of available information examining the potential health impacts of fluoridation the review panel noted in particular the following *"It is of serious concern that, despite this point being made repeatedly in the literature, credible research is still not available."*

The review raised concerns regarding the misrepresentation of the NHS York review by proponents of water fluoridation and raised concerns regarding the lack of accurate scientific information on what is a safe 'optional dose' particular for bottle fed infants where fluoridated water is used to prepare infant formula.

The review found that the inconclusive evidence of fluoridation impacts on human health requires that a precautionary approach be adopted and that the balance of risks and benefits of such a policy had not been properly explained to the public.

The review found that

- Adding fluoride to drinking water has the potential to result in an increase in moderate to severe fluorosis in the communities affected.
- There may be harms other than fluorosis as a result of adding fluoride to drinking water.
- The plausibility of other serious health impacts from the fluoridation of water reinforces the view of the Review Panel that a precautionary approach is needed until such time as additional research has been done. It is of serious concern that, despite this point being made repeatedly in the literature, credible research is still not available.
- Evidence has not been provided to demonstrate that adding fluoride to water equates to individuals receiving an optimal therapeutic dose. Current daily intake of fluoride from other sources may already exceed the recommended level in drinking water.
- Individual exposure will be affected by the addition of fluoride to drinking water as well as other sources, i.e. fluoridated water being used for cooking or for preparation of food or beverages.
- Taking account of the plausibility of harm a precautionary approach to the addition of fluoride to water be adopted until such time that clear evidence of benefit and harm has been established.
- Concerns regarding infant formula reinforce the need to adopt a precautionary approach.

- There is not sufficient evidence to show how individuals vary in the way in which they retain and excrete fluoride, or the impact that hard or soft water may have on this.
- There is not sufficient evidence to show that artificial fluoride acts in the same way as natural fluoride.

The Review panel concluded: *"Most significantly the Review Panel has been persuaded not to support the proposal by the lack of robust and reliable scientific evidence produced to support this proposal. It is clear that scientists and health professionals recognise that there are 'unknowns' with regard to the need to understand the effect of fluoride on the body (not just teeth). This work has simply not taken place. In the absence of scientific evidence of sufficient quality the Review Panel based its evaluation on the findings of the York Review informed by the work of the Nuffield Council on Bioethics."*

European Commission Scientific Committee on Health and Environmental Risks (SCHER) Critical review of any new evidence on the hazard profile, health effects, and human exposure to fluoride and the fluoridating agents of drinking water, May 2010

The SCHER review concluded the following:

- Independent of the fluoridation policies across European countries, there has been a consistent decline over time in tooth decay in 12 years old children from the mid-seventies, regardless of whether drinking water, milk or salt are fluoridated.
- The predominant beneficial cariostatic effects of fluoride in erupted teeth occur locally at the tooth surface. A vast number of clinical studies have confirmed that topical fluoride treatment in the form of fluoridated toothpaste has a significant cariostatic effect. SCHER agrees that topical application of fluoride is most effective in preventing tooth decay.
- The caries preventive effect of systemic fluoride treatment from fluoridation of community drinking water is rather poor. In countries not using such additives, the improved dental health can be interpreted as the result of the introduction of topical fluoride preventive treatment, oral hygiene, changes in nutrition or care system practices, or any change that may result from an improved wealth and education in these countries. This suggests that water fluoridation plays a relatively minor role in the improved dental health.
- Water fluoridation was considered likely to have a beneficial effect, but the range could be anywhere from a substantial benefit to a slight risk to

children's teeth with a the narrow margin between achieving the maximal beneficial effects of fluoride in caries prevention and the adverse effects of dental fluorosis.

- The benefits of preventive systemic treatments (community water fluoridation) are not proven.
- There is a risk for dental fluorosis in children in EU countries with systemic fluoride exposure, but a threshold cannot be detected.
- In children a very narrow margin exists between achieving the maximal beneficial effects of fluoride in caries prevention and the adverse effects of dental fluorosis.
- There is equivocal evidence linking fluoride in drinking to the development of Osteosarcoma
- A few water fluoridation discontinuation studies do not suggest significant increases in dental caries. The benefits of fluoridation to adult and elderly populations in terms of reductions in coronal and root decay are limited.
- There is not enough quality data on sources and levels of fluoride to perform a full uncertainty analysis within the European context.
- For children between 1-6 yrs the Upper limit is exceeded if they consume more than 500ml a day of fluoridated water.

Fort Collins, Colorado, United States of America 2003

A review undertaken by the Fort Collins Technical Study Group in Colorado, U.S.A.[549]raised the following consideration mong its findings:

Total Fluoride Exposure

Total fluoride exposure must be considered when evaluating health effects. The amount of total fluoride ingested will vary between individuals and is not precisely known. **For infants fed formula reconstituted with optimally fluoridated water the total dietary exposures of fluoride can exceed the upper limit set by the Institute of Medicine.** The dietary reference intake established by the Institute of Medicine (IOM, 2000) for infants new-born to six-months old is 0.01 mg/day.

Cancer

Although a small increase in cancer risk cannot be excluded, there is no consistent evidence from human or animal studies that exposure to optimally fluoridated drinking water and other sources causes any form of cancer in humans, including bone and joint cancer. The agreement between the epidemiological and toxicological literature reduces the uncertainty associated with any one line of evidence finding.

Additional research is needed to address the remaining uncertainty whether community water fluoridation may cause cancer in humans following long-term exposures of greater than 40 years.

Bone Effects

The FTSG agrees with the conclusion of the Medical Research Council of Great Britain that states, "The possibility of an effect on the risk of hip fracture is the most important in public health terms. The available evidence on this suggests no effect, but cannot rule out the possibility of a small percentage change (either an increase or a decrease) in hip fractures" (Medical Research Council 2002, page 3).

Skeletal Fluorosis

Additional research is needed to reduce the remaining uncertainty if cumulative exposure to all sources of fluoride (including drinking water fluoride at levels of 1 mg/L) over a lifetime may lead to pre-clinical or milder forms of skeletal fluorosis in some sensitive populations.

Dental Fluorosis

At the concentrations of fluoride provided in Fort Collins water, in combination with other sources of fluoride, as many as one in four children under age 8 may develop very mild to mild dental fluorosis.

Thyroid Effects

The absence of our finding any conclusive evidence that drinking water fluoride exposures causes increased risk to thyroid function does not prove that fluoride can not affect thyroid function. The available data are consistent with a finding of a low likelihood of risk to human thyroid function from water fluoridation.

Immunological Effects

Overall, evidence is lacking that exposure to fluoride through drinking water causes any problems to the human immune system. The absence of our finding any conclusive evidence that drinking water fluoride exposures causes increased risk to human immune system function does not prove that fluoride is harmless to the human immune systems

Other Health Effects

There was not adequate evidence to consider any of these other potential adverse effects a concern with respect to fluoridation of Fort Collins water supplies. The absence of our finding any conclusive evidence that drinking water fluoride

exposures causes other potential health effects does not prove that fluoride cannot cause other potential health effects.

Brisbane Australia 1997

The review of fluoridation undertaken in Brisbane City Council in Australia noted in particular the following observation*: "Many Taskforce members were profoundly concerned about the impact that water fluoridation might have on the total intake level of fluoride by babies and young children, and also the lifetime effects of the accumulation of fluoride in the body. Expert opinion on these issues was ambivalent. In 1991, the NHMRC Working Group called for a multidisciplinary group to investigate total fluoride intake in Australia, and examine the differences between fluoridated and unfluoridated areas. Many members of the Taskforce were dismayed that apparently, this research has still not been carried out."*[550]

The review examined among other criteria human health risks as well as environmental impacts of fluoridation. It is interesting to note that prior to commencement of the review the majority of taskforce members were supportive of fluoridation, however when the review was concluded the majority were opposed and voted not to fluoridated the city water supplies. The report concluded

- That many Taskforce members were unconvinced by assurances that serious risks to health were negligible or non-existent.
- There was considerable concern amongst many Taskforce members that water fluoridation could increase the total intake of fluoride in excess of a safe level for babies and young children. The final report noted that higher incidence of SIDs was reported in Australian studies for fluoridated compared to non-fluoridated communities.
- The Taskforce expressed considerable concern about the fact that it could not point to a single Australian study which had monitored adequately the impact of possible adverse consequences of fluoridation.
- There was also concern about the lack of scientific research on the lifetime effects of an accumulation of fluoride in the body.

In light of the above the majority of Taskforce members did not support the introduction of water fluoridation to Brisbane until further research was undertaken that would conclusively demonstrate its safety. A particular interest is that one of the review task force members was Dr. Kevin Balanda, Medical School, University of Queensland. Dr. Balanda is the co-author of the All Ireland study on Inequalities in Mortality between ROI and NI (2001) and Director of the Institute of Public Health.

Two recently studies from Australia published in international journals also highlight the public health, food safety and legal concerns regarding fluoridation of drinking water.[551],[552]

Windsor City, Ontario, Canada 2013

The City of Windsor, Ontario, Canada had a public review of the evidence on fluoridation examining over 180 written submissions provided over the previous year, including evidence submitted by proponents of water fluoridation such as Health Canada, in addition to hearing oral testimony. Following a public review the City Council voted overwhelming to end the practice of fluoridation 51 years after it fist commenced in Windsor. The lord Mayor of Windsor is Biochemist and Lawyer and therefore well qualified to examine the evidence. In his own words the City Council *"made the best decision based on the best information available and whenever you make the best decision with the best information and as long as its an informed decision with good intentions centred around public good, then you cannot go wrong."*

The Lord Mayor noted in particular the following *"Hexafluorosilicic acid is a chemical and medicating the public water supply is adding a chemical to your food, people have a right to know what chemicals they are exposed to."* The Mayor also said *"People today are more informed, and more in tune with and more aware of what it is in that's in their food supply, and with the growing level of concerns that have been raised more and more people and becoming active to become more knowledgeable about the different things that are added to their food supply."*

Fluoridation has reduced by over 25% in Canada in the past few years with approximately 30% of the population of Canadian currently exposed to fluoridated water. Reviews of fluoridation are on-going in the remaining few cities that still practice this policy and it is expected that shortly Fluoridation will no longer be practised in Canada, as in most other countries worldwide.

Israel 2013

A High Court action is currently taking place to end fluoridation in Israel taken by the former senior water and sanitation officer for the State who was responsible for introducing fluoridation in 2000

Internationally the tide has also been against fluoridation with countries such as China and Japan ceasing to support such a policy in the 1970's and 80's while in

Canada following public reviews[553] fluoridation of has now reduced to approximately 30% of public water supplies. Fluoridation is also on the decline in the U.S, New Zealand and Australia.

Examples of Legal Examination of Water Fluoridation in US Courts

There are a number of important international judicial findings regarding fluoridation of water.[554],[555],[556],[557],[558] An excellent case study of North American litigation on artificial fluoridation of public water supplies has been published by John Remington Graham B.A., LL.B., and Dr. Pierre-Jean Morin.[559] Included in this publication is a detailed review of the Epidemiological Evidence provided in court proceedings as well as the Judicial Findings Condemning Fluoridation in three different states in North America.

The Alton Case

Judge Niemann who presided over the *Illinois Pure Water Committee v. Director of Public Health* legal proceedings for almost two years entered judgment in February 24, 1982, Judge Niemann specifically found, *"[This legislation] exposes the public to the risk, uncertain in its scope, of unhealthy side effects of artificial fluoridation of public water supplies, is unreasonable, and [is] a violation of the due process clause of the Illinois Constitution of 1970."* He added with disappointment, *"This record is barren of any credible and reputable scientific epidemiological studies and/or analysis of statistical data which would support the Illinois Legislature's determination that fluoridation of public water supplies is both a safe and effective means of promoting public health."*

The Pittsburgh Case

In Pittsburgh, the honourable Judge Flaherty on hearing the evidence of both sides including expert witnesses from the National Cancer Institute, the National Academy of Sciences, the Royal Statistical Society, and the Royal College of Physicians defined the sole issue of fact in the case as "whether fluoride may be a carcinogen."

The court found that the evidence presented demonstrated beyond any reasonable doubt that fluoride was a carcinogen.

The Houston Case

In Texas, the honourable Judge Anthony Farris ruled that the plaintiffs had proven harm by a fair preponderance of the evidence and that the artificial fluoridation of

public water supplies, may cause or contribute to the cause of cancer, genetic damage, intolerant reactions, and chronic toxicity, including dental mottling, in man; that artificial fluoridation may aggravate malnutrition and existing illnesses in man; and that the value of artificial fluoridation is in some doubt as to the reduction of tooth decay in man.

The court findings of Judge Flaherty, Judge Niemann, and Judge Farris all agreed that fluoridation endangered the public with cancer and other ailments which cannot be justified by a dubious possibility of reducing tooth decay.

Conclusions

This report as with my previous report titled *Human Toxicity, Environmental Impact and Legal Implications of Water Fluoridation* has addressed many serious and alarming aspects of artificial fluoridation and its contribution to disease burdens and mortality in the ROI and elsewhere. Since writing my original report I have submitted numerous independent studies to the Government of Ireland and the Minister for Health that have addressed in great detail some of the individual concerns raised in my original report.

I have provided a detailed reply to the inadequate and unscientific appraisal of my initial report for which I have yet to even receive an acknowledgement or reply. It is evident that in the few countries where water fluoridation still operates that the public health authorities who continue to promote this blunt and dangerous practice do so in a manner whereby they censor scientific information that is in any way damaging to their continued support for such a policy. This has not happened in Europe where numerous scientific assessments have all found fluoridation to be unsafe, unlawful and a violation of human rights.

What is absolutely certain is that in the RoI the public health authorities have pursued a policy of medicating the population with fluoridation chemicals for half a century without undertaking any clinical trials, medical, toxicological, scientific or epidemiological studies to examine how exposure to such chemicals may be impacting on the general health of the population. In the absence of any scientific data they continue to believe that the policy is both safe and effective for all sectors of society regardless of the age, nutritional requirements, medical status or total dietary intake of fluoride of individuals. Causal inference is not done directly from the epidemiological study results; instead, it is done via combining information from the epidemiological observations with findings from the detailed studies of pathways such as the impact of EDCs, risk of exposures as well as human and animal studies.

This study clearly demonstrates that there is sufficient evidence to conclude from a wide range of human health endpoints that fluoridation of public water supplies has resulted in increased fluoride exposure of the population in the RoI with wide ranging adverse effects on health.

This evidence can clearly no longer be ignored. In the words of Winston Churchill:

> *"Want of foresight, unwillingness to act when action would be simple and effective, lack of clear thinking, confusion of counsel until the emergency comes, until self-preservation strikes its jarring gong - these are the features which constitute the endless repetition of history."*

The Government must act immediately in the public interest and end this policy as a matter of urgency to protect not only the current generation but future generations from unnecessary harm.

The principles of good governance including transparency and accountability; fairness and equity; efficiency and effectiveness; respect for the rule of law; and high standards of ethical behaviour; represent the basis upon which to build open government.

The ethics of water fluoridation violate each and every one of these very pillars of democracy.

Open government strengthens democracy by enabling public scrutiny of policies and strengthening public trust in government as a necessary precondition for effective public policy. When this is lacking the fundamental that underpin the legitimacy and credibility of democracy as a form of government are endangered.

The history of water fluoridation has allowed special interest groups to misuse and suppress scientific information and in doing so undermine the credibility of scientific analysis.

There is no credible science to support such a policy, which in reality in the absence of proper scientific assessment provides a clear example of human experimental toxicology on a population level, one which violates the very basis of the precautionary principle which demands a clear burden of scientific proof that this it is not in any way contributing to ill-health. Astonishingly in countries which fluoridate the public health authority have neither provided the necessary scientific evidence nor provided funding for such studies to commence, despite the many recommendations from many learned scientific bodies over the past number of decades.

If the public health authorities are intend on continuing to support such a policy in light of the evidence provided in this report they have a duty of care to provide evidence based toxicological and epidemiological data to establish beyond any reasonable doubt that fluoridation of drinking water and the subsequent increased dietary exposure of the population is not contributing the diseases noted in this report.

The consequences of inaction and ignoring the growing health disadvantages are predictable. The RoI as with other fluoridated countries with high disease burdens will continue to fall further behind comparable countries on health outcomes and mortality.

Based on the European model of risk assessment and management another review of this policy is unnecessary. The evidence presented in this report is considerable, clearly identifying the complex causal pathways that link exposure to fluoride with health determinants and health outcomes, and how these pathways differ between people living in fluoridated compared to non-fluoridated communities.

In light of this new evidence strikingly consistent and pervasive patterns of higher mortality and inferior health are evident in fluoridated countries compared to non-fluoridated. More specifically within the one island of Ireland between two similar communities the Republic of Ireland fares worse in almost every single health domain, despite higher levels of educational attainment and social and economic wellbeing compared to non-fluoridated Northern Ireland.

The results of this study are largely comparable with the findings of a recent publication by the U.S National Academy of Sciences and Institute of Medicine report[560] titled *"US Health in International Perspectives, Shorter lives, Poorer Health".* This study compared health inequalities and burdens of disease between the US and Austria, Denmark, Finland, France, Germany, Italy, Japan, Norway, Portugal, Spain, Sweden, Switzerland, the Netherlands (all non-fluoridated) and the United Kingdom (<10% fluoridated).

The findings of this study demonstrated that although the "United States spends much more money on health care than any other country American's die sooner and experience more illness than residents in many other countries. While the length of life has improved in the United States, other countries have gained life years even faster than the US and the US relative standing in the world has fallen over the past half century."

The last half century happens to coincide with the period of artificial fluoridation in the US, as well as Ireland. The NRC study however did not examine nor discuss artificial fluoridation nor increased fluoride exposure of the population to a low dose endocrine disruptor through water fluoridation chemicals as a likely contributor to the health inequalities.

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