Proposed Sugar Sweetened Drinks Tax: Health Impact Assessment (HIA)

IPH

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Foreword

Multiple measures are being considered and undertaken globally to confront the public health challenge of overweight and obesity. One proposal in the Irish context to address this is to introduce a 10% tax on sugar sweetened drinks. I was very pleased to be asked to chair the steering group of a Health Impact Assessment (HIA) for this proposal. Chairing the group demanded that I remove my hat as an advocate for measures to prevent and manage obesity and view the evidence and arguments presented from as impartial a position as possible. That is the essence of a HIA and indeed evidence-based practice. The process has been robust with an extensive literature review, a population profile, a stakeholder consultation, and a very active steering group which met regularly since April. In parallel a modelling exercise to gauge the potential impact on weight at a population level was carried out by Dr. Mike Rayner and his team in Oxford.

What became clear from the start of the process was that the polarised debate on this issue between the "we must do this" camp and the "it definitely won't work" camp would not inform the balanced review that a HIA demands. As the process evolved it was obvious that the reality - as with most situations - lies somewhere in the middle. While there is evidence linking sugar sweetened drinks to energy intake as you progress down the line to establish the link to weight gain the evidence becomes less robust and is suggestive but not conclusive. Certainly, there is no conclusive evidence that a specific tax on sugar sweetened drinks will impact on population weight - but absence of evidence does not mean a measure will not work. While some countries have introduced a tax on sugar sweetened drinks no country has carried out a HIA of this kind to predict its potential effects. If such a measure is introduced in Ireland there would be an opportunity to evaluate its impact prospectively. This would inform international practice by providing conclusive evidence of benefit or otherwise.

Action is needed and where evidence is lacking on measures it should be accumulated, with policies reviewed in that light. Only a sustained effort at a

population and individual level involving a range of initiatives will have any chance of turning the tide of overweight and obesity.

I am grateful to the steering group for their time, enthusiasm and effort and to the Institute of Public Health in Ireland for their coordination of the overall process.

Professor Donal O'Shea, HIA Steering Group Chair
St. Vincent's University Hospital, St. Colmcille's Hospital and University College Dublin

Executive Summary

The Institute of Public Health in Ireland (IPH) was requested by the Department of Health to undertake a Health Impact Assessment (HIA) of a proposed tax on sugar sweetened drinks (SSDs). The public health priority for this proposal is to potentially address overweight and obesity in Ireland. HIA is a combination of procedures, methods and tools by which a policy, programme or project may be judged as to its potential effects on the health of a population and the distribution of those effects within the population. The information presented to the HIA steering group in making their conclusions and remarks to the SAGO group considered; a population profile, a stakeholder consultation and a literature review, while also taking into account parallel modelling work by a University of Oxford team and polling information that paralleled the HIA process.

In 2010, Ireland consumed 83 litres of carbonated beverages[1] per capita, and SSD consumption is currently higher among certain population subgroups than others. For example 37% of 18-64 year olds consume carbonated drinks compared to 9% of those aged 65 and older. Among young people in Ireland aged 5-18 years, 75% and over in each age cohort consume carbonated beverages. In general, males across all age categories are more likely to consume carbonated beverages, and consumption is more prevalent among lower socio-economic groups. Polling information demonstrated that respondents believe that children and young people drink too many SSDs.

Obesity is multifactorial; it is not caused by one facet of an individual's lifestyle, but instead can be caused by environmental, physiological, genetic and lifestyle factors. This complex mix of factors means that solutions to the problem of overweight and obesity are not simple but the food environment will certainly form an integral part of addressing this issue. Some of this complexity is reflected in the stakeholders' consultation where diverging views and uncertainty were

[1] See Appendix 4 for definition of carbonated beverage; in sum, 'carbonates' refer to sweetened non-alcoholic drinks containing carbon dioxide and therefore include artificially sweetened drinks. For a detailed breakdown of SSDs consumption by gender and age, please see table 3.6.

apparent. Overweight and obesity in Ireland have reached concerning levels. In the National Adult Nutrition Survey (IUNA, 2012a), 37% of all adults were overweight and 24% were classified as obese. SLÁN (2007) (Harrington et al, 2008) results state that approximately 2 out of 3 Irish adults are either overweight or obese. Adult males are more likely to be overweight/obese than females across all age cohorts. Results from IUNA (2012c) stated that overall, 15% of children between 2 and 4 years old were overweight and 3% were classified as obese. Among children aged between 5 and 12 years, 17.4% were overweight and 6.7% were classified as obese while for teenagers (13-17 years) 15% were overweight and 3% were obese. The Growing up in Ireland study (2011) reported that 19% of children aged 3 were overweight, with a further 6% measuring as obese. A social gradient occurred for both adults and children with regard to weight – among adults this was not the case for overweight, but was the case for the prevalence of obesity.

The proposal for a tax on SSDs is rooted in concern over the problem of obesity in Irish society, and it is estimated that diseases associated with obesity will become increasingly common. Obesity can lead to serious health problems such as type 2 diabetes and metabolic disorder and although the causes of obesity are multifactorial, diet is one of the key influential factors. SSDs have come under considerable scrutiny for their possible contribution to overweight and obesity. SSDs are considered by some advocates as a good place to start in terms of food taxes as SSDs provide no nutritional benefits to the consumer. However others do not share the enthusiasm for a tax arguing that it is too simplistic a measure and not based on conclusive evidence.

What can be stated conclusively, as with any food/drink commodity, is that if energy intake exceeds energy expenditure there will be weight gain. Several mechanisms have been postulated to explain how consumption of SSD could lead to weight gain and obesity. The mechanism most often cited in the literature is one in which the 'liquid calories' of SSDs do not fully satiate appetite leading to additional consumption of calories in the diet. The evidence supporting this hypothesis is suggestive not conclusive. The question of satiety as unique to SSDs

is mirrored by a possibly unique effect of SSDs on the body; for example, it is hypothesised but not proven that SSDs may contribute to diseases such as type 2 diabetes beyond the interaction with obesity through providing rapidly absorbable carbohydrates. The modelling exercise paralleling the HIA estimated that a 10% tax on the price of SSD, using an own-price elasticity of 0.9 for SSDs, would reduce obesity by 1.25% among adults in Ireland. The reduction in SSD consumption would occur to a slightly greater extent among women than among men but there would be no discernable differences between income groups. If this were the outcome, this would be a major public health achievement but the predictions must be viewed with caution. The modelling exercise has limitations as with most exercises of this nature; these, including assumptions that were made, are outlined in the University of Oxford report. It made an assumption that 90% of the tax would be passed on. It did not take account of switching behaviour i.e. what will the consumer replace the SSD with. It cannot be certain that the predicted weight loss is accurate for smaller energy reductions below the validated range of the equations used in the model. However, equating reduced energy intake from such a measure with weight loss is extremely challenging – especially as this initiative would not be occurring in isolation.

The balance of evidence for a link between SSD consumption and higher energy intake is in favour of a positive relationship. The balance of evidence concerning a link between SSDs consumption and weight gain is less clear. Systematic reviews of published studies on SSDs consumption and weight gain vary greatly in their findings even though they often review the same published studies. However, overall the evidence linking SSDs consumption with weight gain is suggestive of a positive association rather than conclusive.

Meta-analysis of studies on SSDs consumption and increased energy intake show consistent positive relationships with small to medium effects. Small positive relationships also seem to emerge for meta-analyses on studies of SSD consumption and measures of weight gain. However, it also has to be considered that the meta-analyses have been conducted on a suite of studies that have

variously been criticised in the literature for being at the lower end of the quality scale or having design flaws. There are few studies in any research area that do not have limitations, Mattes et al (2010) note that we are faced with *imperfect knowledge*. Most research taking place outside of a controlled laboratory environment has limitations. Compounding this imperfect knowledge is the fact that this is not occurring in a vacuum, there are other policy interventions and wider economic factors that may play a part; for example the potential 36% decrease in sugar prices that may be forthcoming in Europe as outlined in Bonnet et al (2011).

Steering Group Conclusion

The steering group believe the evidence presented to them by the HIA process demonstrated that:

- Obesity is multifaceted with many factors influencing the basic drivers of energy intake and energy expenditure including environment, socio-economic, psychosocial and genetic factors.
- SSDs are a source of energy intake with little or no other nutrient contribution to the diet.
- Price increases tend to decrease demand but the degree to which this happens is variable because consumer behaviour and industry response to a tax is difficult to predict.
- The evidence linking SSDs consumption with increases in energy intake is in favour of a positive relationship.

  The evidence linking SSDs consumption with weight gain is suggestive but not conclusive. The literature is contradictory and study quality tends to be described as low to medium.

There are a number of uncertainties surrounding these agreed points. Many of these uncertainties could be clarified by a comprehensive monitoring and evaluation process to ascertain consumption patterns, population BMI and industry impacts if the proposed tax was introduced. Causality and segmented data may be difficult to assess but the responsibility of planning for this monitoring

and evaluation process lies with the Department of Health prior to introduction of the tax should it proceed. The HIA process was not asked to consider complementary measures and therefore cannot offer recommendations in this regard, however it should be noted that education and accompanying measures to promote physical activity were consistently raised by stakeholders as a necessary component of a suite of measures to address the issue. It should also be noted that the importance of engagement with industry prior to moving forward with a tax has also been consistently raised by stakeholders, with the example of industry collaboration in the area of salt reduction cited as a precedent.

Institute of Public Health in Ireland

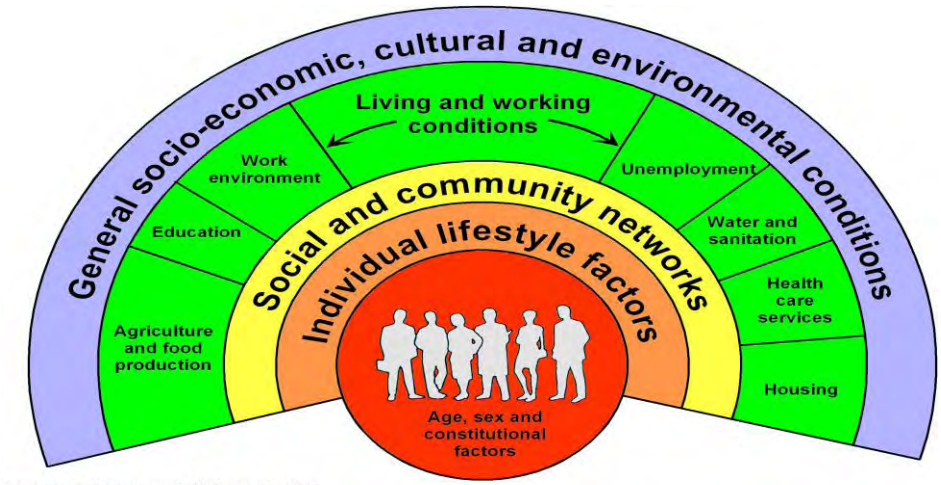
The remit of the Institute of Public Health in Ireland (IPH) is to promote cooperation for public health between Northern Ireland and the Republic of Ireland in the areas of research and information, capacity building and policy advice. Our approach is to support Departments of Health and their agencies in both jurisdictions, and maximise the benefits of all-island cooperation to achieve practical benefits for people in Northern Ireland and the Republic of Ireland.

1. Introduction to Health Impact Assessment (HIA)

HIA is a combination of procedures, methods and tools by which a policy, programme or project may be judged as to its potential effects on the health of a population, and the distribution of those effects within the population.[2]

It is increasingly recognised that many factors outside of the health care sector influence health. The ability to reach and maintain good health is shaped not only by individual lifestyle factors and genetics, but also by the environment within which we live. This is portrayed in Figure 1.1, which illustrates the many layers of influence on people's health.

Figure 1.1: Determinants of Health[3]



Health Impact Assessment (HIA) can help to inform and influence the decision-making process by providing an evidence base on which to make decisions for health and well-being. It can also help to reduce health inequalities by highlighting not only where proposals may impact on the general population, but also within-group differences across the population.

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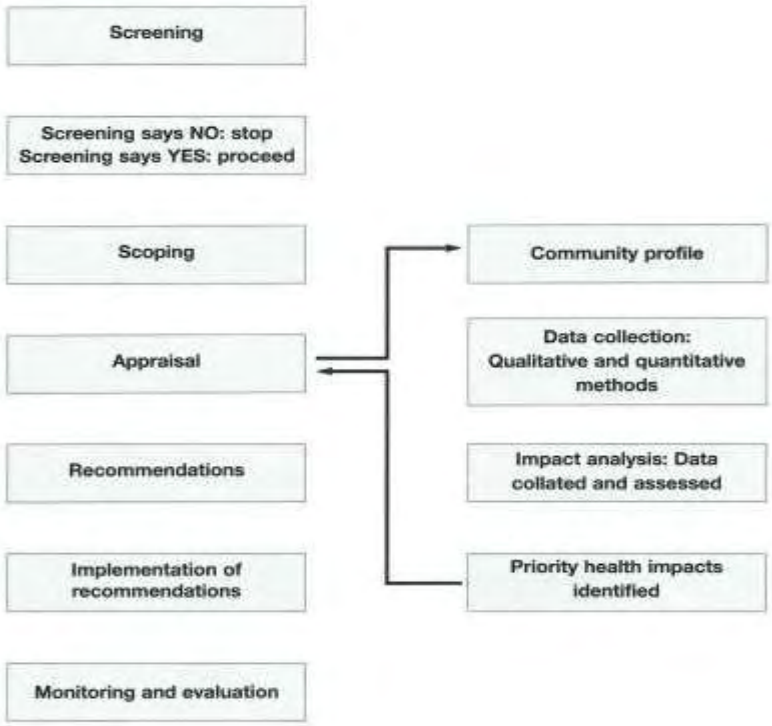
[2] WHO Regional Office for Europe. (1999). *Gothenburg consensus paper: health impact assessment; main concepts and suggested approach.* Brussels: European Centre for Health Policy.
[3] Dahlgren, G. Whitehead, M. (1991). *Policies and strategies to promote social equity in health.* Institute of Futures Studies, Stockholm.

The first step in a HIA is to screen the proposal to see if a HIA is warranted. If a HIA is warranted, a scoping process is undertaken to plan the HIA process. An appraisal phase follows which generally includes an overview of the population who would potentially be impacted, a review of relevant literature and consultation with stakeholders. The information gathered is typically analysed by the project team in conjunction with a steering group or advisory body. IPH has produced guidance[4] on the HIA process that includes the following main phases:

Figure 1.2: HIA Process



[4] http://www.publichealth.ie/publications/healthimpactsassessmentguidance2009 [Accessed 8 July 2012]

2. Overview of the HIA on the proposed Sugar Sweetened Drinks Tax

IPH received a request from the Department of Health to undertake a Health Impact Assessment (HIA) of a proposal for a sugar sweetened drinks tax. IPH presented an overview of what a HIA involves to the Special Action Group on Obesity (SAGO) in February 2012. A steering group was formed (see appendix 1), and IPH began developing the HIA. Screening and scoping (see appendices 2 and 3) were undertaken by the project team and presented to the steering group for approval. The project team developed a population profile to provide an overview of population health and also undertook a literature review. An important component of HIA is to consult with stakeholders and a stakeholder event was organised in June 2012. The project team identified key themes raised during this process and these served to inform the HIA.

In parallel to this process, the Department of Health requested Dr. Mike Rayner and his team in the University of Oxford to develop a modelling analysis which would also help decision making with regard to the proposal. In addition, the Department of Health asked Ipsos MRBI to poll adults in Ireland about their consumption and opinions of sugar sweetened drinks.

The public health priority for the proposed tax on sugar-sweetened drinks (SSDs) is to address overweight and obesity in Ireland. Therefore, the population profile and the literature principally focussed on the health impacts associated with overweight and obesity, including associated illnesses such as type 2 diabetes. As SSDs may also impact on dental health, the population profile and literature review also considered this potential impact.

As the determinants of health approach (see figure 1.1) is integral to a Health Impact Assessment, this HIA also considered the social gradient health impact of overweight, obesity and the impact of a tax across the population. These were core questions for the stakeholder event, as well as for consideration in the population profile, literature review as well as the work of Dr. Rayner and his team.

The evidence generated by the HIA process served to inform the conclusions for presentation to SAGO.

2.1 Policy Context

The World Health Organisation (WHO) has expressed growing concern over what it refers to as *the global epidemic of overweight and obesity* (WHO/FAO Joint Expert Consultation, 2003). In considering non-communicable diseases associated with overweight and obesity, this WHO/FAO joint expert consultation stated that changes in food consumption and availability as well as lifestyle and environmental factors have all contributed to this growing problem. The World Cancer Research Fund/American Institute for Cancer Research (2009) cites the increase in consumption of sugary drinks and processed energy-dense fast-food alongside the decline in physical activity, as leading to a global overweight/obese public health emergency. These bodies believe that this requires government intervention and sustained support at the highest levels, and that legal and fiscal measures should be designed to make healthier choices more affordable, accessible and acceptable (World Cancer Research Fund/American Institute for Cancer Research, 2009:92).

Goodman et al (2006), in their work for the WHO, considered economic instruments' effectiveness in reducing consumption of foods high in saturated fats and other energy-dense foods to prevent and treat obesity. They concluded that *Available evidence suggests – but does not demonstrate – that introduction of policy-related economic instruments, particularly in the form of taxes and price policies, could reduce food consumption, including of high saturated fat and other energy-dense foods, and increase the purchasing of healthful foods.* (Goodman et al, 2006:21).

The Report of the National Taskforce on Obesity (2005) is the key policy document for Ireland in addressing the growing problem of overweight and obesity among the general population. This Report made 93 recommendations for the prevention and treatment of obesity, one of which was that research should be undertaken to examine the influence of fiscal policies on consumer purchasing and their impact

on overweight and obesity. Certain items, including sugar sweetened drinks (SSDs), have a VAT rate of 23%. The Taskforce report refers to some of the advantages and disadvantages to such taxation; such as making new revenue streams available for addressing obesity while recognising that such taxes are regressive.

A 2009 review of the Taskforce Report found that recommendations were partially implemented, and in response a Special Action Group was established by the Department of Health to work interdepartmentally and across agencies. The Minister for Health has proposed the introduction of a tax on SSDs and SAGO have undertaken a review to explore this proposed measure.

Introduction of such a tax would not be the first soft drink tax in Ireland; from 1916 until 1992 Ireland had a 'table waters' tax (Bahl et al, 2003). During the 1980s this special excise was levied at IR£0.37 per gallon, but reduced to IR£0.29 per gallon in 1990 until abolition in 1992 when it was replaced with the top-tier VAT rate. Bahl et al (2003) estimate the 10% price reduction led to an 11% increase in the number of litres consumed.

The principal reason for the 'table waters' tax was to generate revenue, however the principal reason for proposing to introduce a SSDs tax by the Department of Health is to sway consumer behaviour. This would not be the first fiscal policy which intends to change consumer behaviour in the interests of population health. Ireland places tax on tobacco and alcohol which is in line with many other States. Other countries such as Hungary, France and Denmark all have 'fat taxes' – taxation to deter consumption of fats in the diet and France also has additional duties on soft drinks, while individual U.S. states have beverage taxes on sugar sweetened drinks (see Mytton et al, 2012).[5] Since the introduction of the French beverage tax in January 2012, soft drink sales declined by 3.3% although possibly to the

[5] Hungary intends to undertake a HIA and evaluation process in 2012. Denmark is considering withdrawing its taxes in its forthcoming budget. The FDII note that Ireland's existing 23% VAT applied to SSDs is higher than 'sin' taxes that apply to SSDs in other European jurisdictions.

advantage of supermarket brands.[6] Many countries outside the EU also impose SSD taxes. The rationale for these taxes vary between health and economic considerations, but overall SSD taxes are considered a good source of revenue to the State in a similar vein to tobacco and alcohol – these are not necessities and therefore the population has a choice to pay these taxes.

[6] 'Le marché des soft-drinks a la gueule de bois' by Keren Lentschner in *Le Figaro* (26 July 2012) [http://lequotidien.lefigaro.fr/epaper/viewer.aspx Accessed 31 July 2012].

3. Population Profile: Summary

3.1 Introduction

This summary contains information on: overweight and obesity in all age groups, forecasted prevalence rates of relevant chronic conditions, dental health status, current and emerging trends in the consumption of sugar sweetened beverages, and the sugar sweetened drinks market in Ireland.[7]

3.2 Overweight and Obesity

Overweight and obesity are becoming increasingly prevalent in Ireland and vary considerably according to age, gender and social class. Body mass index (BMI) is used to estimate the prevalence and associated risks of overweight and obesity within a population.[8] The National Adult Nutrition Survey (IUNA, 2012a) and The Survey of Lifestyles, Attitudes and Nutrition (SLÁN) (Morgan et al, 2008) provide the most recent data on overweight and obesity among adults.

Based on anthropometric measures in the IUNA survey[9] (2012a), there was a substantial increase in the prevalence of obesity over the past 20 years in 18-64 year old adults; from 8% to 26% in men and from 13% to 21% in women. The greatest increase has been observed in men aged 51-64 years. Overall, 37.1% of all adults between 16 and 61 years were overweight and 23.4% were classified as obese. There is a clear trend in increasing levels of obesity as adults get older. Among 18-35 year olds, 13.1% were obese compared to 27.3% of 36-50 year olds and 36.4% of 51-65 year olds. The trend reversed in older ages with just under a quarter 24.5% of those over 65 years having a BMI measurement indicating obesity. A similar age trend is observed in the proportion of adults overweight in the sample: 41.5% of 51-64 year olds are overweight compared to 32.5% aged 18-35 years. However, over half of those aged 65 years and over are overweight. A higher

[7] A more detailed description of analysis findings and methodological approaches are provided in the HIA technical report.
[8] Body Mass Index is defined as body mass divided by the square of an individual's height.
[9] Body Mass Index was calculated from anthropometric measurements of weight and height data.

proportion of males are both overweight (44%) and obese (26%) compared to females (31% overweight and 21% obese) in all ages.

Table 3.1: Overweight and obesity among adults by age and gender (IUNA, 2012a)

BMI category	*Age group*	***Characteristic***		
		Males %	Females %	All %
Overweight	***18-64***	43.8	30.7	37.1
	18-35	*39.6*	*25.0*	*32.5*
	36-50	*49.7*	*31.3*	*39.8*
	51-64	*43.6*	*39.6*	*41.5*
	>= 65	58.8	48.5	53.2
Obese	***18-64***	25.7	21.2	23.4
	18-35	*13.0*	*13.3*	*13.1*
	36-50	*31.3*	*23.8*	*27.3*
	51-64	*42.1*	*30.9*	*36.4*
	>= 65	24.7	24.3	24.5

Direct comparison of measured and self-reported data in the SLÁN studies clearly shows that self-reported data underestimate the true prevalence of overweight and obesity when compared to the measured data, providing an underestimation of the true prevalence of overweight and obesity in Ireland (Shiely et al, 2010). Nonetheless, in 2007, approximately 2 out of 3 Irish adults were at an unhealthy weight (either overweight or obese) and almost 1 out of 4 adults were obese (Harrington et al, 2008).

Data supports the trend in higher rates of overweight and obesity among males and older adults up to age 65 years, after which a modest decrease occurs. Overall, 43% of males and 28% of females self-reported a BMI indicating being overweight while 16% of males and 13% of females self-reported a BMI indicating obesity. A social gradient was evident for obesity, although not for overweight levels: respondents from social class 5 and 6 were more likely to be obese than those in social class 1 and 2. A clear social gradient was evident among females: almost 4% more females in social class 5 and 6 were obese compared to those in social class 3 and 4 and 7.2% more than those in social class 1 and 2. Overall obesity rates were higher among males than females, and this trend was particularly evident when comparing men and women in the highest social class.

There is no single source of BMI data on children under 18 years. Data is currently available from five studies citing two different surveys on: children aged 3 and aged 9 (Growing up in Ireland) and aged 2-4, 5-12 and 13-17 (IUNA Pre-School, Children's and Teens Food Surveys). Tables 3.2 and 3.3 show the proportion of children aged between 2 and 17 years classified as overweight and obese based on the International Obesity Task Force (IOTF), age and gender specific cut-offs applied to the IUNA survey data.

Table 3.2: Overweight and obesity among pre-school children by age and gender (IUNA, 2012b)

BMI	***Gender***	**Age*(in years)***		
		2	**3**	**4**
Overweight	Male	13%	21%	6%
	Female	13%	23%	13%
	Both	13%	22%	10%
Obese	Male	5%	5%	0%
	Female	4%	3%	0%
	Both	4%	4%	0%

Overall, 15% of children between 2 and 4 years were overweight and 3% were classified as obese. A slightly higher percentage of girls were classified as overweight or obese (19%) compared to boys (16%). Children aged between 2 and 3 years were more likely to be either overweight or obese compared to those aged 4 years, reflecting rapid fluctuations in BMI that occur during normal growth and development at these ages. Among children aged between 5 and 12 years, 17.4% were overweight and 6.7% were classified as obese. 15.0% of teenagers (13-17 years old) were overweight and 3% were obese. More male teenagers were classified as overweight and obese.

The Growing up in Ireland study (GUI, 2011) reported that 19% of children aged 3 were overweight, with a further 6% measuring as obese according to the IOTF classification of BMI. Children's weight was related to household social class: 9% of 3 year old children from the most disadvantaged social class group were obese compared to 5% of children from the most advantaged social class households. This social gradient was also evident among 9 year olds in the GUI sample (Layte et al, 2011).

Table 3.3: Overweight and obesity among children by age and gender (IUNA, 2005; IUNA, 2008)

BMI category	*Characteristics*				
	Gender	**Age group *(in years)*[10]**			
		5-8	**9-12**	**13-14**	**15-17**
Overweight	Both	18.2	16.7	16.6	13.8
	Males	/	/	16.0	14.7
	Females	/	/	14.2	12.9
Obese	Both	6.7	6.7	4.3	2.0
	Males	/	/	5.3	0.8
	Females	/	/	3.2	3.2

A higher proportion of children from semi-skilled or unskilled backgrounds were classified as overweight (20%) and obese (11%) compared to children from professional/managerial backgrounds. Overall, 19% of 9 year olds were found to be overweight and 7% were obese. Girls were more likely than boys to be classified as overweight (22% compared to 16%) and obese (8% compared to 6%) and the social class gradient was most evident in 9 year old girls.

3.3 Chronic Health Conditions

IPH has estimated and forecast prevalence rates of a range of chronic conditions in adults across the island of Ireland for the years 2010, 2015 and 2020. As undiagnosed cases are generally not recorded in prevalence rates, figures presented here are likely to underestimate the true prevalence of conditions in the population. It was estimated in 2010, that almost two-thirds (62.2%) of adults in ROI have hypertension (IPH, 2012a). It is expected that a 28% increase in rates of clinically diagnosed hypertension will occur by 2020. Prevalence estimates on diabetes include data on type 1 and type 2 diabetes combined (IPH, 2012b). The estimated increases in 2015 and 2020 are largely due to an increase in incidence of type 2 diabetes resulting from an increase in childhood and adolescent obesity. Prevalence is estimated to be higher in females than males and risk of diabetes increases substantially with age. Prevalence in people aged 55 years and over is double that of people aged 45 to 55 years.

[10] Data on gender breakdown for age groups 5-8 and 9-12 are not available.

Overall, mortality rates from CHD (angina and heart attack) have halved in the last number of decades, despite increasing adverse trends in risk factors for CHD including obesity, diabetes and physical activity during this period (IPH, 2012c). In 2010 it was estimated that more than 2.4% of adults aged over 18 years had clinically diagnosed CHD in the previous 12 months. By 2020 the population prevalence of CHD is expected to rise to 2.9%. This represents a 31% increase in the numbers of people living with CHD in 10 years. It is expected that overall population prevalence of stroke will increase by 0.1% by 2020 representing a forecast increase of 6,053 adults with stroke in the population (IPH, 2012d).

3.4 Dental Health

The Oral Health of Irish Adults Report (Department of Health (DOHC), 2007) for the years 2000–2002 showed that the retention of natural teeth in adulthood was substantially lower among those from more disadvantaged backgrounds, as measured by the presence of a medical card, compared to those from more advantaged backgrounds. There is also a slightly higher rate of poorer dental health in 15 year olds with medical cards (3.4) compared to children the same age without a medical card (3.0) (DOHC, 2006). Similar trends are evident in younger age groups; children as young as 5 years with a medical card, drinking from a non-fluoridated water supply, are showing an increased rate of poor dental health.

There is a clear decline in dental health for every age group according to increased frequency of sweet food/drink consumption. The mean number of natural teeth retained reduces according to the number of times sweet foods or drinks are consumed. This trend is most evident in those over 65 years: those consuming sweet food/drink less than three times a day have on average 6 more natural teeth than those consuming sweet food/drink more than five times a day. This trend is also evident in younger age groups with 16 to 24 year olds who consume sweet foods/drinks more than five times a day having on average one more decayed, missing or filled tooth than those consuming sweet foods/drinks, less than three times per day.

Table 3.4: Dental health among adults by frequency of sweet food/drink and age (DOHC, 2007)

Dental health	*Frequency of sweet foods/drink*	*Characteristics* *Age*		
		16-24	**35-44**	**65+**
Mean number of natural teeth present	Less than 3 times/day	28.2	25.8	14.9
	3-4 times/day	28.3	24.7	13.3
	Five or more times/day	27.9	23.6	9.0
Mean number of decayed, missing, filled teeth	Less than 3 times/day	4.8	14.7	21.3
	3-4 times/day	5.1	15.6	23.8
	Five or more times/day	5.7	15.5	25.9

Poorer dental health was also observed among a sample of children aged 8 years and 15 years consuming sweet snacks more frequently than their counterparts (table 3.5). Fifteen year olds, who consumed a sweet snack more than four times per day, had on average one more missing tooth than those who consumed one or no sweet snacks per day. This trend is evident, although more modest among 8 year olds.

Table 3.5: Dental health among children by frequency of sweet snacks between meals and age (DOHC, 2006)

Characteristics			
Dental health	*Frequency of sweet snacks between meals*	*Age (in years)*	
		8	**15**
Mean number of decayed, missing, filled teeth	Never/once a day	0.4	2.5
	2-3 times a day	0.4	2.8
	4 or more times a day	0.5	3.4

3.5 Current and emerging trends in the consumption of SSDs

Data on the consumption of SSDs are taken from several sources. Information on beverage consumption patterns by age and gender is provided from a series of four national nutritional surveys conducted by the Irish Universities Nutrition

Alliance (IUNA).[11] These are: The National Children's Food Survey (2005) of children aged 5-12 years; The National Teen's Food Survey (2008) of teenagers aged 13-17 years; The National Adult Nutrition Survey (2011) of adults aged 18-90 years; and most recently, The National Pre-School Nutrition Survey (NPNS) of children aged 1-4 years (2011). A comprehensive overview of the soft drinks market in the Republic of Ireland is provided by Canadean (2011). Canadean (2011) provides information on the consumption patterns of a range of SSDs in Ireland. Canadean (2011) also provides industry information on leading beverage companies, the market value of different beverages and some details on distribution patterns of the beverage industry in Ireland; detailed in the next section. For the purpose of this report, discussion is focused on the sales and consumption of non-diet carbonated drinks and other sugar sweetened drinks including: squashes, cordials, syrups, nectars, sports drinks and energy drinks.[12]

Data is presented in tables 3.6 and 3.7 on the percentages in each age cohort consuming different beverage types and the mean beverage consumption levels. The mean level of consumption is presented for consumers only (i.e. those who indicate that they consume the beverage). While mean consumption levels are a good indicator of beverage intake in the groups, it is also important to note that some individuals may be driving the average intake level up through excessively high levels of consumption. Therefore the 5th and 95th percentile for consumption levels are also presented in the tables indicating differences (or variance) in consumption patterns within gender and age groups. For example, the average consumption of carbonated (non-diet) drinks for men aged 18-35 years is 256 grams per day (g/d), however, consumption levels for the highest 5% of consumers (95th percentile) in this group exceeds 651 g/d. Alternatively, the lowest 5th percentile of men in this group consume less than 52 g/d.

[11] Please consult the HIA technical report for detail on methodology applied in all IUNA surveys.
[12] Beverage definitions vary according to data source. See appendix 4 for general definitions of beverage types presented in this summary report. See also appendix 6 for market information relating to sugar sweetened beverages available in Ireland.

The survey on adults found higher consumption of all carbonated (diet and non-diet) drinks among younger adults. There is a gradual decline in the consumption of sugar sweetened carbonated drinks (i.e. non-diet) as age increases, indicating an age effect. For example 61% of men aged 18-35 drink non-diet carbonated drinks compared to 21% aged 51-64 and 10% of those aged over 65 years. Consumption patterns also vary according to gender, especially for carbonated drinks. Young women are far more likely to drink diet carbonated drinks (27%) than their male counterparts (11%), whilst a higher proportion of younger men drink non-diet carbonated drinks (61%) compared to young women (44%). There is a lower level of consumption of squashes, cordials and fruit juice drinks, with a clear pattern of highest consumption among younger adults. Few older adults drink squashes (<6%) and they recorded the lowest average level of carbonated (non-diet) beverage consumption for all adults (<10%). Young adults and males in particular recorded the highest average consumption (256 g/d) compared to any other group. However young women recorded higher consumption levels in the 95th percentile (668 g/d) compared to younger men (651 g/d) indicating that some young women drink substantially high levels of carbonated drinks. Women consumed on average a higher amount of diet carbonated drinks than their male counterparts in the younger age group (18-35), however for every other age group, men consumed more on average than women. Lower levels of intake were recorded for both men and women across all age groups for squashes, cordials and fruit juice drinks compared to carbonates. On average younger men (83 g/d) and women (81 g/d) were the highest consumers of these products.

Percentages of those consuming sugar sweetened carbonated drinks ranged between 75% in girls aged 15-17 to 88% in girls aged 13-14 years (table 3.6). Over 81% of boys aged between 8-17 years drink carbonated (non-diet) drinks. Girls are more likely to drink diet carbonated drinks. High percentages of children aged 5-12 years consume squashes, cordials and juice drinks (>73%). Only small proportions of teens consume diet carbonated drinks (<21%) compared to non-diet carbonated drinks (>75%).

Table 3.6: Beverage consumption patterns among children, teens and adults according to age and gender (IUNA, 2012a; IUNA, 2005; IUNA, 2008)

Beverage	*Gender*	**Age group *(% in years)***							
		5-8	**9-12**	**13-14**	**15-17**	**18-35**	**36-50**	**51-64**	**65+**
Carbonated (non-diet)	Male	81%	84%	86%	81%	61%	37%	21%	10%
	Female	76%	77%	88%	75%	44%	24%	20%	8%
Diet carbonated	Male	20%	20%	15%	16%	11%	9%	5%	3%
	Female	73%	71%	18%	21%	27%	14%	9%	2%
Squashes, cordials, fruit juice drinks	Male	83%	76%	49%	43%	24%	13%	11%	5%
	Female	81%	73%	54%	36%	23%	9%	8%	6%

Teenage boys had the highest recorded level of average carbonated (non-diet) drink consumption (272 g/d) and this reached 723 g/d for the highest (95th) percentile (table 3.7). They also recorded the highest average consumption of diet carbonated drinks (123-141 g/d). Young girls (aged 5-8) had a higher level of consumption of diet carbonated drinks than young boys of the same age. However this trend reversed for girls and boys aged 9-12. Teenage girls on average consumed less squashes, cordial and fruit drinks compared to teenage boys.

Table 3.7: Consumption of beverage type in grams per day (g/d) for children, teens and adults by age, gender and levels of consumption: mean consumption, low consumption (5th percentile) and high consumption (95th percentile) (IUNA, 2012a; IUNA, 2005; IUNA, 2008)

Beverage	***Characteristic***									
	Gender	**Measure**	**Age group *(in years)***							
			5-8	**9-12**	**13-14**	**15-17**	**18-35**	**36-50**	**51-64**	**65+**
Carbonated	Male	Mean	124	207	218	272	256	224	204	103
		Low (5th)	18	29	36	47	*52*	*50*	*61*	*34*
		High (95th)	343	577	550	723	*651*	*649*	*578*	*253*
	Female	Mean	114	165	200	201	230	171	115	71
		Low (5th)	24	29	31	31	*38*	*36*	*22*	*24*
		High (95th)	276	420	583	629	*668*	*624*	*413*	*138*
Squashes, cordials, fruit juice drinks	Male	Mean	94	90	97	85	83	64	76	56
		Low (5th)	9	6	7	6	*13*	*8*	*5*	*10*
		High (95th)	228	269	424	297	*215*	*254*	*300*	*156*
	Female	Mean	89	96	57	64	81	50	56	44
		Low (5th)	6	8	5	6	*7*	*4*	*8*	*10*
		High (95th)	243	245	164	208	*278*	*247*	*124*	*125*

Table 3.8 presents data on the beverage consumption patterns of pre-school children. The mean level of consumption is presented for all pre-school children, including those who do not consume the beverage as well as the average for consumers (i.e. those who do consume the beverage). Consumption of soft drinks

increased as children got older. The percentage of children consuming low calorie soft drinks increased from 29% in 1 year olds to 50-52% in 3 and 4 year olds with average daily intake among consumers of 198-233g. For sugar-containing soft drinks, the percentage of consumers increased from 21% in 1 year olds to 53% in 4 year olds with average daily intake among consumers increasing from 96 to 145g.

Table 3.8: Mean beverage intake in grams per day among all and among consumers only in pre-school children (IUNA, 2012c)

Beverage	***Measure***	**Age *(in years)***			
		1	**2**	**3**	**4**
Soft drinks, not low calorie	Mean (all)	21	49	52	77
	Mean (consumers)	96	117	111	145
	% consumers	21%	42%	47%	53%
Soft drinks, low calorie	Mean (all)	68	103	104	111
	Mean (consumers)	233	228	198	223
	% consumers	29%	45%	52%	50%

The Irish Health Behaviour in School-aged Children (HBSC) 2010 study (Kelly et al, 2012) also provides information on soft drink (carbonated) consumption in children and teenagers (table 3.9). Overall, 21% of children aged 10-17 report drinking soft drinks daily or more often. There are statistically significant differences by gender, age group and social class. Overall, 23% of boys report drinking soft drinks daily or more often compared to 19% of girls. It was also found that older children and those from lower social class groups are significantly more likely to report drinking soft drinks daily or more often. There is an overall decrease in the proportion of children who report drinking soft drinks daily or more often from 26% in 2006 to 21% in 2010. Additional data from the HBSC study on 9 year olds in 3rd and 4th class also found that boys (18%) were significantly more likely to drink soft drinks compared to girls (13%) but did not find any statistically significant differences across age groups (Kelly et al, 2012).

Table 3.9: Soft drinks consumption among children by age, gender and social class (Kelly et al, 2012)

Soft drinks	***Characteristics***					
	Gender	**Social Class (SC)**	**Age group (% in years)**			
			10-11	***12-14***	***15-17***	***All***
	Male	1-2	10%	18%	21%	23%
		3-4	13%	23%	25%	
		5-6	18%	29%	33%	
	Female	1-2	10%	12%	14%	19%
		3-4	15%	19%	21%	
		5-6	21%	24%	26%	
	Both	All SC				21%

Data from the CSO 2009-2010 household budget survey presented in table 3.10, found that the highest average weekly spend on any drink was for soft drinks - not concentrated and not low in calories (€3.14), followed by pure fruit juices and pure fruit smoothies (€1.45). The average household weekly spend increased with levels of affluence for all beverages except vegetable juices. More affluent households showed a higher 'absolute' average spend on soft drinks in general. However, the survey also found that rental households had the highest proportional spend on soft drinks, especially those renting from a local authority (6.3% compared with 3.1% for households owned outright).

Data on the proportional spend of households by income decile highlights the trend in lower income households spending relatively more on all carbonated drinks compared to higher income households (see table 3.11). This trend is evident across both low calorie carbonated drinks and non-low calorie carbonated drinks. In the 2nd to 5th household income deciles, proportional spending on sugar sweetened carbonated drinks ranges between 0.50% of total household weekly income to 0.54%. In the highest three household income deciles, proportional household spend ranges between 0.22% and 0.37% of total weekly spend. In relative terms then, consumption of non-low calorie carbonated drinks is more concentrated in the lowest income households i.e. the less affluent portion of the Irish population, except for the poorest income decile. In terms of implementing a tax on SSDs, data illustrates that the greatest relative burden is likely to be borne

by individuals living in the least affluent households, not the absolute poorest, but certainly not the most affluent.

Industry recorded consumption levels by beverage type is provided in the Canadean report *'Republic of Ireland Soft Drinks Review, 2011 Cycle'* and presented in table 3.12. Estimated forecasts are provided for 2011-2014 for a range of beverages and data are presented by amount of beverage consumed per million litres and also in litres consumed per capita. Overall, there was a steady decline in the consumption of carbonated drinks, nectars and still drinks, and a slight decline in energy drinks, between 2005-2010 although consumption of all other beverages has increased during this period (table 3.12). While consumption levels are decreasing, carbonated drinks continue to be the most consumed beverage in Ireland. In 2010, almost three times more carbonated drink was consumed (379.6 m/l[13] or 83 litres per person) compared to the second most consumed beverage: bottled water (137.1 m/l or 30 litres per person).

Table 3.10: Soft drinks expenditure by gross household income decile in euro (CSO, 2012)

	Average €	***1st*** [14]	***2nd***	***3rd***	***4th***	***5th***	***6th***	***7th***	***8th***	***9th***	***10th***
Soft drinks - not concentrated, not low cal	***3.14***	1.36	2.06	2.41	3.12	3.42	3.79	3.62	3.85	3.92	3.9
Soft drinks - not concentrated, low cal	***0.69***	0.32	0.42	0.56	0.7	0.72	0.77	0.74	0.84	0.88	0.97
Soft drinks - concentrated, not low cal	***0.22***	0.1	0.14	0.18	0.22	0.22	0.21	0.26	0.31	0.28	0.27
Soft drinks - concentrated, low cal	***.09***	0.02	0.06	0.05	0.1	0.1	0.09	0.13	0.09	0.17	0.13

[13] Per million/litres.

[14] First decile has lowest average income (<€238), tenth decile has highest average income (>€2046).

Table 3.11: Soft drinks expenditure as proportion of total weekly expenditure by household income decile (CSO, 2012).

Beverage description	***Characteristics*** ***Gross household income decile***										
	1st [15]	***2nd***	***3rd***	***4th***	***5th***	***6th***	***7th***	***8th***	***9th***	***10th***	***State average***
Proportion of household spend on carbonated drinks - not low cal	0.38 %	0.54%	0.50%	0.54%	0.52%	0.49%	0.40%	0.37%	0.32%	0.22%	***0.39%***
Proportion of household spend on carbonated drinks - low cal	0.30 %	0.16%	0.17%	0.18%	0.16%	0.14%	0.13%	0.12%	0.11%	0.08%	***0.12%***
Proportion of household spend on all carbonated drinks	0.68 %	0.70%	0.67%	0.72%	0.68%	0.63%	0.53%	0.48%	0.43%	0.003%	***0.51%***

There has been a notable decline in the consumption of carbonates in the past decade from 101.2m/l in 2005 to 81.4m/l in 2011. However, there has been a levelling off in this decrease in recent years. This trend is expected to continue on to 2014, with the current economic downturn continuing to have a negative impact on carbonates consumption. Nonetheless consumption of carbonates in Ireland is considerably high compared to other beverages. There was also a high consumption level of squashes and syrups in 2010 (128.7m/l) forecast to increase slightly by 2014.

Table 3.12: Consumption of beverages in litres per capita in Ireland (data from 2011-2014 is forecasted) (Canadean, 2011)

	2005	***2006***	***2007***	***2008***	***2009***	***2010***	***2011F***	***2012F***	***2013F***	***2014F***
Carbonates	101.2	99.1	97.3	91.9	85.2	83.0	81.4	79.9	79.8	79.7
Nectars	1.8	1.8	1.8	1.7	1.6	1.4	1.4	1.3	1.3	1.3
Squashes/Syrups	26.2	26.1	26.3	25.4	25.7	28.1	29.1	29.3	29.5	29.8
Sports drinks	2.7	2.9	3.5	3.4	3.2	3.1	3.1	3.0	3.0	3.0
Energy drinks	7.6	7.6	7.6	7.3	7.1	7.2	7.2	7.3	7.4	7.4
Still drinks	6.7	7.2	7.3	6.9	6.0	5.6	5.4	5.4	5.4	5.4

[15] First decile has lowest average income (<€238), tenth decile has highest average income (>€2046).

Consumption of sports drinks has decreased slightly since 2007 and consumption is forecast to remain at current levels in the next 3 years (3.0m/l), while consumption of energy drinks are expected to increase slightly in the same period.

3.6 Current and emerging trends in the beverage market in Ireland

Despite a challenging economic environment in recent years, soft drinks remain a strong industry in Ireland. All data presented in tables 3.13 to 3.16 are sourced from Canadean (2011). These are followed by a detailed discussion of the current and emerging trends in the market for each beverage type.

Table 3.13 provides information on the breakdown of market value for each category of beverage. Clearly, carbonated drinks are the market leader with a market value of €873.32 million in 2010. Energy drinks have claimed a significant share in the market since their introduction reporting a value of €291.37 million in 2010. Leading companies such as Coca-Cola and Britvic maintain a strong position in the beverage market with Private Label companies accounting for only a small proportion of market share.

Table 3.13: Market value of soft drinks by category in Ireland 2010 (Canadean, 2011)

	€million	*€/Litre*
Carbonates	873.32	2.30
Nectars	14.10	2.14
Squashes/Syrups	59.72	0.46
Sports drinks	44.54	3.11
Energy drinks	291.37	8.84
Still drinks	51.03	1.98

Table 3.14 provides a breakdown of market share by leading companies compared to total share by all other companies. Leading companies have a majority share of all beverage markets. Coca-Cola has a majority share of the carbonates market (54.4%). Glaxo Smith Kline have a majority share of both the energy drinks (61.3%) and sports drinks (60.7%) markets and Britvic enjoy a majority share of the squashes/syrups market.

Table 3.14: Total share of beverage market by leading companies and others in Ireland 2010 (Canadean, 2011)

	Carbonates	*Nectars*	*Squashes/ Syrups*	*Sports drinks*	*Energy drinks*	*Still drinks*
Total share by leading companies	**89.4%**	**90.2%**	**79.1%**	**83.1%**	**89.5%**	**67.2%**
Total share by all others	**10.6%**	**9.8%**	**20.9%**	**16.9%**	**10.5%**	**32.8%**
Barry's Tea		12.5%				10.1%
Britvic	9.5%		58.2%	6.9%	2.2%	9.9%
CCHBC		14.3%	5.0%			
Coca-Cola	54.4%		8.6%	14.6%	2.7%	5.8%
Danone Group						
Glaxo Smith Kline			7.3%	60.7%	61.3%	19.0%
Gleeson Group	5.3%					
Ocean Spray		59.3%				
Pepsi-Co	20.1%	4.2%		0.9%		
Red Bull Trading					23.4%	
Suntory Holdings	0.0%					
Wild						22.5%

The proportion of beverage sales by distribution type (off-premises or on-premises) is presented in table 3.15. Between 72.6% and 95.6% of different beverages are sold for off-premises consumption i.e. sold for 'subsequent consumption' away from the place of purchase. This includes sales in supermarkets, convenience stores, pharmacies and off-licences. Energy drinks have the highest proportion of on-premises sales i.e. sold for 'immediate consumption' at the place of purchase. This includes vending machines, EDA (Eat, Drink and Accommodation) establishments, institutions (e.g. workplaces, hospitals, universities) and other venues such as cinemas, leisure facilities and gyms. Almost one fifth of all carbonates (17.8%) are also sold on-premises.

Further breakdown of beverage sales forecasts are presented in table 3.16 by distribution category. Details of distribution category are listed in appendix 5. Over 80% of carbonates are sold through off-premise channels, of which major multiples have a strong market position. In the major supermarkets, multi-pack offerings are a common feature. Manufacturers of still fruit drinks are attempting to drive up volume, particularly in the lunchbox market.

Table 3.15: Distribution of soft drinks by category in Ireland 2010 (Canadean, 2011)

	Off-premises	*On-premises*
Carbonates	82.2%	17.8%
Nectars	88.4%	11.6%
Squashes/Syrups	93.3%	6.7%
Sports drinks	92.7%	7.3%
Energy drinks	72.6%	27.4%
Still drinks	92.9%	7.1%

The majority of sports and energy drinks sales volume currently passes through retail channels, particularly supermarkets, symbol chains, convenience stores and petrol stations. The recession has taken its toll on the on-premise sales of all sugar sweetened drinks.

Table 3.16: Trends in distribution of soft drinks sales per million litres for 2010 and forecast trends for 2011-2012 in Ireland (Canadean, 2011)

	2010	***2011F***	***2012F***
Total soft drinks	***772***	***756.4***	***749.5***
Off premises	670.3	658.5	652.9
Modern Retail	545.0	537.9	533.6
Large Modern	545.0	537.9	533.6
Traditional Retail	123.3	118.8	117.5
Specialist Beverage Retailer	2.0	1.9	1.8
On-Premises	101.8	97.9	96.6
Vending	5.4	5.3	5.1
Quick service restaurants	14.6	14.4	14.2
EDA establishments	77.5	74.9	74.0
Other on-premises (cinemas, street stalls, kiosks)	4.2	3.4	3.2

Carbonates (Canadean, 2011)

Non-diet drinks account for about 75% of the total carbonates market. Carbonates consumption overall declined by only 1% in 2010, compared to a 6% decrease in 2009 at the height of the recession. Poorer than expected summer weather may also be a factor in consumption trends. Price promotions and the supermarket price war has resulted in near price parity between soft drinks in Northern Ireland and the Republic of Ireland, which has brought about a waning in cross-border shopping. The cola segment drives the market and accounted for 52% of the carbonates market in 2010. It grew by 2% in a declining carbonates market due to strong promotional activity for the major brands Coca-Cola and Pepsi-Cola and also for Private Label brands and the discounters Lidl and Aldi. Lemon-lime flavour

is the second largest segment, with 7-Up the market leader followed at some distance by Sprite. The orange flavour segment is the third largest, led by local brand Club from Britvic followed by Fanta. It is expected that the current economic downturn in Ireland will continue to have a negative impact on the carbonates category in the coming years. The forecast is for a further decline in carbonates consumption of around 1%.

4. Literature Review: Summary[16]

4.1 Abstract

The literature review undertook a broad approach to consider published research in this area, and principally concentrated on obesity as the main health impact of concern, however ill-health related to obesity as well as dental health impacts are also briefly considered. After discussing the causes of excess weight gain and associated health risks the review also considers links between sugar sweetened drinks (SSDs)[17] and obesity, taking into brief account some of the literature relating to physiological mechanisms through which SSDs may contribute to excess weight gain. Literature considering the effectiveness of SSD taxation and potential economic impacts are briefly explored. The review also considers systematic reviews and meta-analyses in this area. The review concludes that, much as with research in other fields, there are limitations in the current literature and conclusive answers are not available. Research in this area has been criticised for lacking methodological rigour, but with more rigorous studies demonstrating stronger evidence of SSDs links with weight gain. Although there may be a growing body of evidence implicating SSDs in excess weight gain, currently research in this area provides imperfect knowledge, which is further hampered by a lack of available information on consumer behaviour in response to a SSD tax. Reducing SSD consumption has the potential for improved health outcomes, but not if consumers switch to equally unhealthy or more unhealthy foods or drinks.

4.2 Introduction

The principal questions that guide this review are:

- Does literature in this area demonstrate any links between SSDs and health impacts?

  These impacts could be positive or negative, and the definition of a health impact is broad to encompass the wider determinants of health.
- Does literature in this area provide any evidence that fiscal policies can influence health outcomes?

The chief health concern that such a tax is intended to target is obesity. The literature reflects this in concentrating on obesity as being the principal public health focus of fiscal policies in this regard. This review discusses obesity and potential associations with SSDs and also considers fiscal policies' role in changing

[16] Full text of the literature review is available in the HIA technical report.
[17] The term sugar sweetened drink (SSD) or sugar sweetened beverage (SSB) is used throughout to refer to drinks with added sugar.

consumption habits. The review concludes with an overview of systematic reviews in this area, and a brief note on potential economic impacts.

4.3 Methods

The literature review search strategy began with trying to identify other HIAs that dealt with sugar sweetened drinks (SSDs); the only HIA that came close to this area identified was a Californian HIA for calorie-labelling of restaurant menus (Simon et al, 2008). Literature was then searched for systematic reviews, randomised controlled trials (RCTs), intervention studies, observational studies and modelling analysis in peer-reviewed journals where SSDs and obesity and obesity associated illnesses, as well as dental health were considered. Initial searches demonstrated a wealth of information was available on this topic, and as literature was reviewed a snowballing technique was used by checking reference lists. IPH received instructions to chiefly address obesity in the review as this is the principal issue that the proposed tax would intend to address. Systematic literature reviews are not frequently used in HIA as they can take many person-months or years to complete and require resources and capacity not generally available to those conducting HIA (Mindell et al, 2006). However, systematic literature reviews undertaken by others in this field were identified and are included in this review; when strict exclusion criteria were applied in these published reviews there were very few studies that could be included. These reviews tend to consider few aspects in a very detailed way, for example if there are relationships between satiety and weight gain for SSDs whereas a broader approach encompassing many aspects of a SSD tax was considered desirable for this HIA literature review. The decision was taken that a systematic review was too narrow for the task at hand, and that the snowballing technique would be preferable although it would also be limited by only being able to search for literature available in English. Cautionary notes must be made when considering available research. The principal obstacle is establishing causality which is an onerous task when dealing with populations rather than laboratory based and contained experiments; the problem of methodological rigour is also an issue, for example, self-reported heights and weights may bias results and estimates of weight reduction frequently do not account for metabolic

changes – weight loss does not have a consistently downward trajectory in a linear relationship with energy reduction.[18] Modelling is frequently used, and analysis of this nature is only as robust as current knowledge and assumptions are used to account for variables where data is unavailable. Modelling must be treated with caution due to these assumptions and uncertainties. In addition, it should also be remembered that evidence from the U.S. may not transpose to Europe as the U.S. is more reliant on high-fructose corn syrup (HFCS) for its sugar content rather than sucrose[19] as is the case in Europe, though this may be changing. A small number of included studies declared industry funding; authors funded by industry declared their independence and lack of interference by funding bodies.

4.4 Health Risks of Overweight and Obesity

The causes of overweight and obesity are multifactorial, and blame cannot be apportioned to one particular cause.[20] Principally, nutrition and physical activity are the two broad categories under which overweight and obesity can be considered; too much of one, too little of the other while environmental, physiological and genetic factors also have their part to play (Kopelman, 2007; Swinburn et al, 2011; Qi et al, 2012).[21] Table 4.1 outlines just some of the health risks associated with overweight and obesity.

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[18] The composition of weight loss depends nonlinearly on the body fat mass which also depends on age, sex and body weight. Thus calorie-to-weight loss conversion (3500 calories to one pound of weight) is not a constant. Also, the energy requirement of the body is determined by body weight among other factors; as body weight decreases so does the energy requirement. This dynamic relationship means that a constant rate of weight loss would require an ever increasing reduction of energy intake over time. For a constant reduction of energy intake, weight loss slows and a body-weight plateau is eventually reached. (Lin et al, 2011:338).

[19] These may not necessarily have different impacts on the body, but the fact that they are different should be noted.

[20] Foresight (2007) developed a comprehensive map outlining the complexity of obesity: [http://webarchive.nationalarchives.gov.uk/+/http://www.bis.gov.uk/foresight/our-work/projects/current-projects/tackling-obesities/reports-and-publications Accessed 30 July 2012]

[21] Qi et al (2012) undertook analysis of 3 large datasets and concluded that genetic association with adiposity appeared to be more pronounced with greater intake of SSDs.

Table 4.1: Health risks associated with increasing BMI (abbreviated; Kopelman, 2007:14)

Metabolic syndrome	30% of middle-aged people in developed countries have features of metabolic syndrome
Type 2 diabetes	90% of type 2 diabetics have a BMI of >23 kg m-2
Hypertension	5 x risk in obesity 66% of hypertension is linked to excess weight 85% of hypertension is associated with a BMI >25 kg m-2
Coronary Artery Disease and stroke	Dyslipidaemia progressively develops as BMI increases from 21 kg m−2 with rise in small particle low-density lipoprotein Obesity is a contributing factor to cardiac failure in >10% of patients Overweight/obesity plus hypertension is associated with increased risk of ischaemic stroke
Respiratory effects	Neck circumference of >43 cm in men and >40.5 cm in women is associated with obstructive sleep apnoea, daytime somnolence and development of pulmonary hypertension
Cancers	10% of all cancer deaths among non-smokers are related to obesity (30% of endometrial cancers)
Osteoarthritis	Frequent association in the elderly with increasing body weight – risk of disability attributable to OA equal to heart disease and greater to any other medical disorder of the elderly
Liver and gall bladder disease	Overweight and obesity associated with non-alcoholic fatty liver disease and non-alcoholic steatohepatitis (NASH). 40% of NASH patients are obese; 20% have dyslipidaemia 3× risk of gall bladder disease in women with a BMI of >32 kg m−2; 7× risk if BMI of >45 kg m−2

Choudhary et al (2007) in their study of diseases associated with childhood obesity state that obesity causes serious complications in nearly every organ system. For example concurrent with Table 4.1, Choudhary et al (2007) state that paediatric metabolic syndrome includes factors such as insulin resistance and hypertension, and is present in almost half of all severely obese children.

4.5 Sugar Sweetened Drinks (SSDs) and Health

There is scant evidence of any nutritional benefits to sugar consumption, although it may not be inherently problematic in moderation. Bachman et al (2006) outline 4 main mechanisms through which it is hypothesised that SSDs could lead to obesity:

- Accumulation of total caloric intake, including SSDs increases obesity risk.
- Glycemic index/load from SSDs exacerbates circulating insulin and adiposity risk.

- 'Liquid calories'[22] induce lower satiety which leads to higher caloric intake.
- The consumption of SSDs displaces milk in the diet, decreasing calcium intake that has obesity-lowering properties.

Bachman et al (2006) undertook a review of studies relating to each of these and concluded that the strongest evidence supports the excess calorie intake hypothesis although a number of studies showed no association. Bachman et al (2006) also note that assessing the contribution of one food group to obesity is a difficult task, because energy balance is a function of the total caloric intake and expenditure (see also McCarthy et al, 2006).

Maersk et al (2012)[23] undertook a study with 47 overweight subjects given one litre of four different drink types for six months (a cola drink, an artificially sweetened cola drink, still mineral water, semi-skimmed milk) and the cola drinkers did reduce energy from other sources. However, overall the cola drinkers had the least advantageous results. The participants who drank the SSD had higher relative changes in liver fat, skeletal muscle fat and visceral adipose tissue compared with the other three drinks. Dental hygiene instruction was given and supported by toothpaste among the SSD drinkers – no detrimental effects were found. Sartor et al (2012) also undertook a small sample experiment[24] whereby 11 subjects with sporadic SSD consumption undertook a 4 week SSD supplementation (2 drinks per day). This small study concluded that regular SSD consumption may increase fat gain, inhibit fat metabolism, increases blood glucose in the body and overall,

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[22] SSDs are hypothesised to occur in the diet as 'liquid calories' - energy-dense products that are consumed but may not satiate appetite meaning that at the next meal or snack there is not a proportionate reduction in food intake to account for the liquid calories (Brownell et al, 2009). Bachman et al (2006) state that evidence in this regard is conflicting and note that other factors influence satiation such as palatability, texture and viscosity. (See also DiMeglio et al, 2000; Mrdjenovic et al, 2003; Libuda et al, 2009; Olsen et al, 2009).

[23] This study has acknowledged limitations: unblinded, small sample size, no information about fruit juices. This study did measure physical activity and usual diet to ensure that no other changes were taking place during the intervention period. Malik et al (2010) note that there is growing concern about excessive fruit juice intake; alongside some vitamins and nutrients they also have a high sugar and calorie content. However, Malik et al (2010) note evidence in this regard is still limited and further research is needed.

[24] This small sample size must be noted, replication on a larger scale is required for confirmation.

change the way muscles use food as a fuel, making muscle burn sugar rather than fats.

Other studies have recorded, among large sample sizes, a negative impact of SSD on hypertension (Brown et al, 2011), asthma and chronic pulmonary disease (Shi et al, 2012); type 2 diabetes (Schulze et al, 2004); coronary heart disease (De Koning et al, 2012); gout (Choi et al, 2008). With regard to type 2 diabetes and also cardiovascular heart disease other work has suggested that SSDs may have an independent effect beyond associated weight gain (Brownell et al, 2009; Malik et al, 2010). Pancreatic cancer incidence has also been considered with regard to SSD consumption, and mixed results have been demonstrated among large samples (Schernhammer et al, 2005; Bao et al, 2008; Mueller et al, 2010). However, among these samples there may be other lifestyle factors that contribute to incidence of these diseases that cannot be entirely discounted. Research among children has shown relationships between SSD consumption and elevated BMI (for example, Ludwig et al, 2001; Tam et al, 2006). De Ruyter et al (2012) undertook an 18-month trial with 641 primarily normal weight children (age 4-12 years), randomly assigning them to receive artificially sweetened drinks or a SSD. De Ruyter et al (2012) concluded that masked replacement of an SSD with a sugar free beverage significantly reduced weight gain and body fat gain in healthy children. Ebbeling et al (2012) undertook a similar intervention with 224 overweight and obese adolescents which found that after a 1-year intervention to reduce the consumption of SSDs the BMI increase in the experimental group was smaller than that of the control group. However this was not sustained at the 2-year follow up; possibly due to an increase in consumption of SSDs in year 2 among the experimental group, and/or due to efforts to eliminate SSDs among the control group – for example in schools.[25] Vanselow et al (2009) in a 5 year longitudinal cohort of U.S. adolescents (n=2294) found no association between SSDs and weight gain, although adolescents who consumed little or no white milk gained significantly more weight than their milk-drinking peers. Vanselow et al (2009) note the variation in outcomes in the literature which makes conclusive statements on

[25] Limitations include: self reported data, use of BIA to estimate body fat and small sample size.

the contribution of SSDs to obesity difficult particularly with regard to research artefacts such as adolescents at different growth stages and self-reported consumption and quantities.

These links between SSDs and obesity etiology are difficult to establish in a robust way as Pereira's (2006) review of cross-sectional studies, prospective studies and RCTs explored. Pereira (2006) was unconvinced that SSDs are non-satiating, leading to no compensating calorie reduction, due to their high water content and volume. The chief complaint about studies in this area is that methodologies are flawed or not sufficiently scientifically robust. However, considering the outcomes of RCTs, which are the gold-standard of scientific research, Pereira (2006:S34) acknowledged there is *growing evidence to date for the hypothesis that manipulating intake of SSB may cause important changes in habitual energy intake that could lead to increased obesity risk over an extended period of time*. Pereira (2006) concludes that there are plausible mechanisms that may support a causal link between SSDs and obesity risk but the pathway that sets SSDs apart from its solid-food counterparts in this regard remains to be determined. The evidence may be probable rather than convincing, as the potential impact of recommendations to reduce intake of SSDs on obesity rates is difficult to predict (Pereira, 2006:S35). Weed et al (2011)[26] also criticise the methodological robustness of reviews in this area in their systematic review of quality of reviews on sugar sweetened beverages and health outcomes. They also note that the problem of rigour in published reviews is not confined to the issue of SSDs.

It is widely accepted that sugar is bad for the teeth so a direct relationship is recognised, but the damage may be limited by other factors in the developed world environment such as access to water for teeth-cleaning, and good brushing practices. A systematic review of sugar consumption and caries risk (Burt et al, 2001) demonstrated that where there is ample exposure to fluoride (i.e. through

[26] This study was funded by a beverage company. Authors assert their independence.
The 17 reviews that met their inclusion criteria were assessed as receiving moderately low-quality scores by the instrument used – AMSTAR; a one-page tool of 11 questions.

drinking water), sugar becomes a mild to moderate risk factor for dental caries. Therefore, the role of sugar should not be the only focus in prevention of caries but excessive consumption of sugar should still be a consideration in dental health promotion (Burt et al, 2001). However, the WHO, through expert consultation, found the evidence for an association between free sugars, soft drink and fruit juice consumption and dental erosion and caries to be probable (WHO/FAO Joint Expert Consultation, 2003). In this same report, soft drinks were also considered as a probable cause of excess body weight among consumers, while links were also made between soft drink consumption and bone mineral density. This could be due to displacement of milk consumption in the diet in favour of SSDs and could have serious consequences for children and older women in particular (WHO/FAO Joint Expert Consultation, 2003).[27] A recent national survey of children in Scotland (where water is not fluoridated) found that intake of SSDs had a positive association with tooth decay. This was particular to non milk extrinsic sugars, of which SSDs accounted for the highest proportion at 23%, not total sugars. This analysis concluded that increasing brushing frequency would not compensate for high intakes of non milk extrinsic sugars (Masson et al, 2010). The Irish Dental Association (November 2011) have called for public health warnings to be placed on soft drinks given Ireland's high per capita consumption and in light of data showing that half of all Irish 12 year olds and 75% of all 15 year olds have some decay in their permanent teeth.[28]

As most SSDs do not contain useful nutrients, their exclusion from the diet is not a health concern. However, discouraging SSD consumption may lead to switching to other energy-dense products thereby neutralising the original intent, but it may also discourage consumption of co-consumed 'unhealthy' foods (Allais et al, 2010; Duffey et al, 2010). Diet substitution is an important issue in considering taxation policy; consumers may select healthier options but they may also switch to produce that may not be healthier, for example, a lower priced SSD or full fat milk

[27] See also McGartland et al, 2003; Mrdjenovic et al, 2003; Keller et al, 2009 for research on displacement of milk in the diets of children who consume SSDs.
[28] [http://www.dentist.ie/resources/news/showarticle.jsp?id=1162 Accessed 4 May 2012]

that is healthier but may not reduce obesity (see Fletcher et al, 2010). Dharmasena et al (2012) use a model considering demand inter-relationships between various beverages, to consider impacts of a 20% tax on SSDs.[29] While the consumption of drinks with added sugar are negatively impacted, the consumption of juices, low-fat milk, coffee and tea are positively affected. Interestingly, Dharmasena et al (2012) also note that diet soft drinks, high-fat milk and bottled water consumption decreases. These authors also estimate the body weight reduction to be between 1.54 and 2.55 pounds per year.

The average price elasticity[30] of demand for soft drinks is estimated to be -0.79 (Andreyeva et al, 2010) whereby a 10% tax on SSDs could lead to a 8-10% purchase reduction and this is frequently cited in the literature albeit with the usual caveats for modelling exercises (see Fletcher et al, 2010; Finkelstein et al, 2010).[31] Duffey et al (2010) note that children, teenagers and older people are the most effected by price elasticity of tobacco and a similar pattern could be transferred to SSDs.[32] Examining data from a 20 year longitudinal Coronary Artery Risk Development in Young Adults Study, Duffey et al (2010) found that an increase in the price of SSDs and pizza was associated with a significant decrease in daily energy intake from these products and lower body weight. Increasing the price of these two products had a greater than sum effect of increasing the price of one or other only. Lin et al (2011) noted that reduced consumption of SSDs is mirrored by diet drinks, which appears counter-intuitive, while demand for juice rises across all households. Demand for bottled water and lower-fat milk rises among high-income households. The modelled decline in population BMI and/or obesity related

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[29] Noted limitations of this study include limitation to at-home consumption, the assumption of separability of non-alcoholic beverages from food and other beverage categories, and concentration on per-person basis rather than on children or individuals above/below poverty thresholds.

[30] Price elasticity of demand has been defined as the way in which demand changes as a result of price changes, calculated as the percentage change in the quantity demanded divided by the percentage change in price. Elasticities are always expressed as negatives and the 'more negative' elasticity is the smaller price increase needed to reduce consumption (Leicester et al, 2004).

[31] This estimate has been critiqued for not taking into account cross-price responsiveness (Edwards, 2011, 2012; Lin et al, 2011) while Lin et al (2011) state that there is evidence to suggest that the demand for SSDs is more price elastic than this range.

[32] See section 4.7 for a brief discussion of SSDs and tobacco taxation parallels. The HIA technical report provides further discussion.

disease based on a hypothesised SSD price increase has not been unanimous among researchers (see Duffey et al, 2010; Wang, 2010; Finkelstein et al, 2010; Lin et al, 2011; Andreyeva et al, 2011; Chaloupka et al, 2011a) principally due to the way weight loss is calculated (dynamic versus static modelling) and due to the lack of available evidence about consumer switching. Fletcher et al (2009, 2010) analysed data on U.S. state soft drinks taxes and noted that although welcome observations can be seen, effects are small in magnitude and could be ineffective. However, existing U.S. state soft drink taxes are much lower than those proposed in modelling studies. Such taxes are often considered regressive as they will absorb more of the low-income household food budget as the greater consumers of such drinks. However, this may only be a small amount of their food budget and the tax could also be progressive in targeting the group that should be reducing such consumption (Warner, 2000). It is often cited that subsidising healthier foods would be a more palatable way to introduce such taxation. Ring-fencing of revenue raised for health promotion has also been suggested. However, hypothecation may be difficult and not ideal in terms of strict economic principles, while taxation may also mean that low-income households keep buying SSDs and sacrifice other (potentially, more healthy) food basket items. (See Leicester et al, 2004; Brownell et al, 2009a; Finkelstein et al, 2010; Lin et al, 2010, 2011).

Jou et al (2012) reviewed the application of a SSD tax for obesity reduction in 19 countries to assess factors that may influence policy effectiveness in country-specific contexts. Jou et al (2012) noted 3 key points that may influence the effectiveness of a volume-based excise tax; population obesity prevalence, SSD consumption levels, and existing baseline tax rates. Data suggests that where the obesity prevalence and SSD consumption rates are high, such a tax would be more effective. However, where the baseline tax rate is already high, there may not be a noticeable impact on consumption patterns or obesity prevalence and there may also be negative feedback from the public and industry. Jou et al (2012) caution that Ireland (among others) should be mindful that a volume-based excise tax would not undermine the existing price based tax, and should also be sure that the

efforts to implement are justified against the benefits. Ireland already has a high tax on SSDs, so consumption may not be altered.

4.6 Systematic Reviews and Meta-Analysis

A small number of key meta-analyses and systematic reviews that were repeatedly identified in the literature are discussed in this section; focussing on the impact of SSDs on health, and fiscal policies and their potential to influence health.

A systematic review by Gibson (2008)[33] included 44 studies[34] and outlined some of the difficulties with methodological rigour in these types of studies. Cross-sectional studies are prone to confounding and reverse causality. Longitudinal studies are also prone to confounding from concurrent changes in other aspects of diet and lifestyle and can contain attrition bias. While intervention studies have difficulties with ensuring comparability at baseline, compliance in the intervention group, non-contamination of the control group and adequate monitoring of diet and lifestyle during the trial period. Gibson (2008) also highlights publication bias – studies that do not demonstrate sizable impacts may not be published. This review concluded that avoiding SSDs could help prevent further weight gain in overweight people but further evidence is needed to prove that any impact is experienced by people with healthy BMIs, while there is little evidence that SSD are more obesogenic than any other source of energy.

Malik et al (2010a) undertook a meta-analysis[35] that included 11 studies relating to SSDs and risk of metabolic syndrome and type 2 diabetes, concluding that in

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[33] This review was funded by a European beverage association union. The author declared independence.

[34] To include the following studies already mentioned: Ludwig et al (2001), Mrdjenovic et al (2003), Schulze et al (2004).

[35] To include the following studies already mentioned: Schulze et al (2004), and later published works by De Koning et al (2012). Eight studies related to type 2 diabetes, 3 related to metabolic syndrome.
Significant heterogeneity was noted among both type 2 diabetes and also the metabolic syndrome studies. Malik et al (2010) note that meta-analysis can be less robust than individual prospective cohort studies and outline how they attempted to overcome problems associated with heterogeneity (p.2480).

addition to weight gain, higher consumption of SSDs is associated with development of both these chronic illness types. Malik et al (2010a) note that SSDs association with increased risk of metabolic syndrome and type 2 diabetes is in part due to weight gain, but an independent effect may stem from the high levels of rapidly absorbable carbohydrates in the form of added sugars. Three prospective cohort studies with 19,431 participants and 5,803 cases of metabolic syndrome comparing the lowest quartile with highest quartile consumers found a 20% greater risk for metabolic syndrome. For the 8 prospective cohort studies (310,819 participants, 15,043 cases of type 2 diabetes) the highest quartile consumers had a 26% greater risk of developing the disease than the lowest quartile of SSD consumers.

Vartanian et al (2007) undertook a meta-analysis of 88 studies and noted a clear association between soft drink intake and; absence of dietary nutrients, increased risk of health problems, increased energy intake, and body weight. The design of studies influenced these results; for example more robust designs (longitudinal and experimental, rather than cross-sectional) and those not funded by industry,[36] having stronger effect sizes. A relationship between soft drink consumption and energy intake was found across almost all studies considered. Vartanian et al (2007), in their meta-analysis, considered an effect size of 0.1 or less as small, an effect size of 0.25 as medium and an effect size of 0.4 or above as large. The overall effect size across all studies for the relation between soft drink consumption and energy intake was 0.16. However, the more methodologically robust studies within this group had stronger effect sizes. The 12 cross-sectional studies effect size was 0.13; for the 5 longitudinal studies this was 0.24; while the long term experimental studies and the short term experimental studies also had stronger effect sizes; 0.3 and 0.21 respectively. For soft drink consumption and body weight, larger effect

[36] Lesser et al (2007) undertook a review of interventional studies, observational studies and scientific reviews on soft drinks, juice and milk (published January 1999-December 2003) to ascertain if nutrition research shows signs of bias when funded by industry. This study found that industry funded scientific articles in this area were approximately 4 to 8 times more likely to be favourable to the financial interests of the sponsors than articles without industry related funding. None of the intervention studies with all industry support had an unfavourable conclusion. Lesser et al (2007) acknowledge that financial bias is not the only cause of bias; for example the a priori hypothesis indicates a preconceived notion of how an experiment will unfold.

sizes were observed in experimental studies than in cross-sectional or longitudinal studies. Vartanian et al (2007) conclude that the data provided clear links between soft drinks and increased energy intake which were stark given this is just one source of energy in the diet, and noted that there were few parallel nutritional advantages to consumption of these drink forms.

Woodward-Lopez et al (2011) undertook a systematic literature review[37] to determine if sweetened beverage intake increases the risk for obesity and the extent to which it has contributed to recent increases in energy intake and adiposity in the U.S.[38] Woodward-Lopez et al (2011) concluded that while more research was required (in particular RCTs) the evidence is extensive and in general supports SSD consumption as a risk factor for obesity – and it has made a contribution to the obesity rates recently experienced in the U.S. However, causality is difficult to establish in the latter case.

Sievenpiper et al (2012)[39] undertook a systematic review and meta-analysis of the effect of fructose on body weight in controlled feeding trials. In total, 41 trials were included; they tended to include small numbers of participants, were short in duration and of low quality. This study concluded that fructose does not appear to cause weight gain above and beyond what would occur when energy intake exceeds expenditure.

Forshee et al (2008)[40] undertook a meta-analysis[41] of sugar sweetened beverages and BMI in children and adolescents to ascertain if SSD consumption is associated with increased BMI among young people and, if so, the magnitude of that effect.

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[37] PubMed database, January 1970-March 2010, English language.
[38] To include Vartanian et al (2007), DiMeglio et al (2000), Tam et al (2006), Vanselow et al (2009), Schulze et al (2004), Forshee et al (2008).
[39] These authors declared a long list of potential conflicts of interest in a very transparent manner, to include makers of SSDs. This particular study was not industry funded and authors declare their independence.
[40] This study was supported by a grant from the American Beverage Association. The research centre which the authors are affiliated with has received funding from 2 of the major beverage labels and the third author accepted a post with the American Beverage Association after her involvement with the manuscript. Authors declare their independence.
[41] To include the following studies already mentioned: Ludwig et al (2001), Mrdjenovic et al (2003).

Eight longitudinal studies and two RCTs were incorporated into the meta-analysis which concluded that the association between SSDs and BMI was near zero. These authors disagree with Malik et al (2006) by considering later reviews and their own meta-analysis concluding that Malik et al (2006) did not consider magnitude or links between SSDs and obesity other than that may be associated with energy content.[42] Forshee et al (2008) stated that to the best of their knowledge, none of the included 12 studies were funded by industry. Forshee et al (2008) are criticised by Malik et al (2009) for analytic errors in their meta-analysis which Forshee et al (2009) counter while also noting that they did make errors, however rectifying these makes no difference to outcome. Malik et al (2009) in their reanalysis of the Forshee et al (2008) meta-analysis instead conclude that results suggest a positive association between SSD intake and children's BMI. The meta-analysis by Forshee et al (2008) is also criticised by Mattes et al (2010:360) for inconsistent arguments regarding validity of methods, concluding that *some might argue that the burden of proof of the validity of measurements lies more heavily with those reporting no effect, because large random error will often (though not always)[43] obscure associations and account for the lack of effect.*

Mattes et al (2010)[44] undertook a systematic review and meta-analysis of RCTs to consider nutritively sweetened beverage[45] consumption and body weight. Mattes et al (2010:347) are particularly aware of the problems associated with evidence-based research in this area generally; there are considerable differences in study outcomes so we are *faced with imperfect knowledge*. This meta-analysis concludes there is not strong evidence that reducing consumption of nutritively sweetened beverages reduces BMI; however effectiveness trials reviewed did demonstrate that programmes to discourage consumption may have had modest beneficial effects on BMI change among people in the top third of BMI distribution. Mattes et

[42] This disagreement is discussed in Woodward-Lopez et al (2011:504).
[43] Authors' reference: Brenner, H. Loomis, D. (1994). 'Varied forms of bias due to nondifferential error in measuring exposure'. *Epidemiology* 5:510-17.
[44] Authors have received industry funding, however this study was not directly funded by industry.
[45] Authors use this term rather than SSDs or SSBs to focus on the property of delivering energy rather than the energy source.

al (2010:363) believe that RCT research is required to confirm/dispute these relevant research questions.

Already mentioned by several cited studies - Andreyeva et al (2010) undertook a systematic review of research on the price elasticity of food demand. All published U.S. studies of food price elasticity of demand were identified and criteria applied for inclusion; 160 studies were reviewed. Assuming no substitution with other calorific beverages and no changes in other factors affecting purchasing behaviour, soft drinks were found to be among the most responsive product to price changes. The price elasticity of soft drinks suggest that a 10% tax could lead to an 8-10% consumption reduction as already outlined. The overall concern with regard to price sensitivity is that given the current economic climate that people will purchase low cost food which are frequently processed and energy dense. Andreyeva et al (2010) suggest that regressive taxation be off-set by price incentives for fruit and vegetables as well as public education. The authors conclude that studies estimating substitution effects from unhealthy to healthy food and price responsiveness among at-risk populations are particularly needed.

Throw et al (2010) undertook a systematic review on the effect of fiscal policy on diet, obesity and chronic disease, with 24 studies meeting the inclusion criteria. Throw et al (2010) concluded that, in general, taxation and subsidies influenced consumption in the desired direction with larger taxes being associated with more significant changes in consumption, body weight and disease incidence. However, the authors felt that studies that focussed on a single target for taxation overestimated the tax impact by not taking into account the shift to other products. It was felt that the quality of the evidence was generally low.

4.7 A Brief Note on Potential Economic Impacts

The loss of jobs and damage to the Irish economy is relevant to the HIA due to the links between ill-health, poverty and unemployment. However, figures related to economic impacts specific to SSDs (disaggregated from artificially sweetened beverages, other beverages, and alcoholic beverages) makes estimations on

employment (direct and indirect), revenues and cross border shopping difficult to assess. As already outlined, unknown consumer responses compounds difficulty. Much as a robust evidence base for direct health impacts is required, so are precise and transparent figures for the economic impacts.

Food and Drink Industry Ireland (FDII, 2012) estimate their sector's potential jobs dividend up to 2020 to be 30,000 jobs across the entire economy (direct, indirect, induced). This industry is the largest manufacturing sector in Ireland, with exports of almost €9 billion in 2011, with a target of €12 billion by 2020. There are currently 43,111 people working in the food and beverage industry. FDII recommend that government and the food industry work together in a multi-stakeholder evidence-based platform of cooperation to reduce obesity levels; to protect reputation, competitiveness and employment claiming that advertising restrictions and discriminatory taxes are ineffective policies.

There are few parallels between tobacco taxation and the proposed SSDs tax.[46] However given the longevity and experience with tobacco taxation, some research will be briefly considered as parallels can be made between the debates around both tobacco and SSDs taxation (Chaloupka et al, 2011). Impacts on the economy and jobs are frequently cited; inhibiting consumer spending, direct and indirect redundancies, as well as cross border trade. The tobacco industry argues that taxation and its intended impact to curb smoking will lead to a loss of jobs. However, this argument rests on the assumption that the money will disappear, rather than be spent in other sectors of the economy.
Ongoing research looking at the employment of SSB taxes that accounts for the job gains in other sectors due to changes in consumer and government spending, as well as the substitution to other untaxed beverages produced and bottled by the same companies, is likely to produce findings similar to those that demonstrate that higher tobacco taxes do not result in significant job losses and could even lead to a net increase in jobs. (Chaloupka et al, 2011:3).

[46] In an invited commentary, Winkler (2012) notes the parallel made between SSD and tobacco taxation must be set in context; tobacco taxes in the UK add 348% to the retail price – it would not be possible to do this with a food item.

4.8 Final considerations

Research in all fields, not just SSDs, has limitations. This review mirrors much of the discussion in the literature cited in not being able to provide clear answers. From a policy point of view decisions may need to be taken in the absence of complete knowledge, as action is needed to address the growing problem of obesity; absence of evidence is not evidence of absence.

One strand of evidence can be stated with relative confidence; excess sugar in the diet can cause weight gain. There are other health issues that could be positively impacted by dietary sugar reduction such as dental health. In considering SSDs specifically, health problems associated with obesity such as metabolic syndrome and type 2 diabetes were shown in some research to have an independent relationship with SSDs while controlling for obesity. The most consistent evidence does show that SSDs provide energy that, if not compensated for by reducing/expending energy in other ways, can cause weight gain. But do SSDs do this above and beyond other consumed food/drink? Therefore, is it fair to target this one source of energy? Many reviewed studies advocate for SSD taxation as it is considered a good place to start. It is one energy source that provides no other nutritional benefits, and may cause dietary displacement of other more healthful drinks. This may not be an issue among people who rarely consume a SSD, but may be a problem for people who are frequent consumers. These latter consumers may be the target group for such a tax, but it is unknown if they will simply pay more or switch to a similar (or cheaper) product. The greatest unknown is around consumer substitution; what will consumers switch to if they are not drinking SSDs? There may be implications across the board with market reforms at EU level.[47]

With regard to taxation effecting positive behavioural change, the research is also not conclusive. Basic economics informs that if price goes up, consumption will go down. But again, the great unknown is what will consumers switch to, assuming the proposed tax would be passed on to the consumer at least in part by industry?

[47] Bonnet et al (2011) estimate a SSD price reduction of 3% due to sugar market reforms. These reforms may lead to a 36% decrease of sugar price in the EU.

In addition, there is the question of social justice; would such a tax be regressive? Reflecting the fact that SSDs consumption is common among low income households, a tax would have a disproportionate burden on these lower income households. However, if there were health benefits to the tax, these health benefits would also disproportionately fall on low income households. From a health benefits perspective, such a tax could be considered progressive. In addition, SSDs are not an essential household item with currently free alternatives available (water). However, it could mean that the low income food basket will absorb more of the household budget, or that other items, possibly healthier options, could be dropped in favour of SSD purchases and keeping within the typical weekly budget. Consumption of SSDs may be a proxy for a generally unhealthy lifestyle which may make targeting them unfair; however by taxing them there is also an opportunity to raise awareness, generate innovative reformulation and perhaps provide an opportunity to create dents in the armour of obesity.

Mytton et al (2012) argue that taxing a wide range of unhealthy foods/nutrients is likely to result in greater health benefits than would accrue from narrow taxes, but the strongest evidence base is for a tax on SSDs, however this tax needs to be at least 20% to have a significant effect on obesity and cardiovascular disease. In addition, Mytton et al (2012) echo a sentiment throughout the literature that taxes on unhealthy food should ideally be supported with subsidies on healthy foods such as fruit and vegetables. This would also assist in making these forms of taxation more palatable – although hypothecating of revenue generated by a tax is not recommended in pure economics terms it may be necessary to ensure it is not seen as yet another method of revenue generation.

5. Stakeholder Consultation: Summary

An important component of a HIA is to consult with stakeholders and a stakeholder event was organised for 12th June 2012 in the Department of Health. The purpose of the stakeholder meeting was:

- To inform stakeholders of the process to date.
- To provide an opportunity for stakeholders to share their knowledge and opinions on potential health impacts of the proposal, both positive and negative.
- To provide an opportunity for stakeholders to make recommendations on how the proposal could be enhanced for better health.

The intention was to invite stakeholders from as wide a spectrum of interest as possible to include; business and industry groups, representatives from health organisations and agencies, consumers, young people and representatives of youth and children organisations, representatives of disadvantaged groups, representatives from academia and the food sector. In total, 92 people were invited, 56 responded and 50 people attended on the day. Over two weeks notice was given, and a reminder email was circulated. The project team identified six key themes raised during this process and these served to inform the HIA. These key themes emerged during analysis and are broad headings under which the main commentary from stakeholders could be placed. Under each theme, key points raised are outlined in table 5.1.

Table 5.1: Stakeholder Consultation: Key Themes

Key Themes:	
Employment/ Industry impacts	• The tax may have negative impacts on industry. • Compliance with the proposed tax should be ensured through rigorous consideration of all potential responses. • It may be better to involve industry, a good example being salt reduction. • The tax could lead to innovation and reformulation.
Tax implementation	• Concern over how the tax will be implemented and who will carry/absorb the cost? • What monitoring will be undertaken? • Should the tax be ring-fenced for health promotion/prevention initiatives; arguments for and against.
Methodology & Evidence	• Is there enough evidence? Or is 'lack of evidence' something to hide behind. However, should not be doing something just to make it seem like 'something' is being done. • Why focus on this one sugar source? Do we know what will happen to consumption patterns? Concern about the sugar-fat see-saw coming down on the side of fat. • Will it really make any difference at 10%? • One stakeholder believed that the consumption of low calorie drinks has gone up while SSD consumption has gone down – but asked if we have we seen any evidence of this on obesity yet? • This is about more than obesity – CVD, dental health etc. Also, obesity is multi-factorial.
Potential Inequalities	• It will affect the poor and young people most. • Poorer people may drop SSDs from their baskets in favour of equally, or more harmful, products. • Importance of education consistently highlighted. • Poverty Impact Assessment is also needed. • Issue of subsidising healthier alternatives raised. • Will it impact the target group significantly in the right direction?
Alternative/ Additional suggestions	• A full range of interventions is need. We need to think about – education; portion size; salt intake; advertising; subsidies; calorie posting; food labelling; community food initiatives; availability. • Trade unions and employer organisations need to be involved. • This is demonising a product type, possibly without foundation. • This proposal will need to deal with multipacks and promotions. • Are people drinking SSDs because of cost – unlikely, what are the reasons?
Consumer Response	• Consumers may shift to unhealthy products. • Consumers may think that they are doing well if they cut down on/cut out SSDs alone. • It could encourage cross-border shopping.

6. Parallel Information

In parallel to the HIA, the Department of Health undertook 2 supplementary pieces of research. A team in the University of Oxford undertook an exercise to model the effects of a 10% SSDs tax in Ireland on obesity and overweight. This work and key findings are outlined below. In addition, the Department of Health obtained polling information on opinions and attitudes towards SSDs. This information is available in appendix 7.

6.1 Summary: Modelling Exercise

In parallel to the HIA process, Dr. Mike Rayner and his team in the University of Oxford were invited by the Department of Health to model the effects of a 10% tax on SSDs in Ireland on obesity and overweight, and to describe the effects by age, income group and consumption (regular versus low consumers). The full report, including limitations associated with modelling exercises of this nature, is available in the appendices of the HIA technical report and key headline results are outlined below:

- A 10% tax on the price of SSDs is predicted to reduce the number of obese adults (BMI≥30kg/m^2) by approximately 10,000 (95% credible intervals: 7,000-13,000) and the number of adults who are overweight, including obese, (BMI≥25kg/m^2) by 14,000 (10,000-18,000). This represents a reduction in obesity of 1.25% and in overweight, including obese, of 0.67%. Of the estimated 10,000 fewer obese adults, approximately 80% are regular SSD consumers.

- The impacts on men and women are similar (predicted reduction of 5,300 fewer obese women and 4,600 fewer obese men).

- The average reduction in energy intake in the adult population of Ireland as a result of a 10% tax is predicted to be 2.1kcal per week; the predicted reduction is greater among younger people and in regular SSD consumers.

- While obesity shows a gradient across income groups, this is slight. The impact of the tax on obesity across income groups is expected to be broadly similar. Different price responses by different economic groups are not modelled.

7. Conclusions

This section summarises the key information presented to the HIA steering group for consideration in making their conclusions and remarks to the SAGO group. In this it considers; the population profile, stakeholder consultation and literature review, while also taking into account the modelling work, stakeholder views and noting the polling information that paralleled the HIA process.

In 2010, Ireland consumed 83 litres of carbonated beverages[48] per capita, and SSD consumption is currently higher among certain population subgroups than others. For example 37% of 18-64 year olds consume carbonated drinks compared to 9% of those aged 65 and older. Among young people in Ireland aged 5-18 years, 75% and over in each age cohort consume carbonated beverages. In general, males across all age categories are more likely to consume carbonated beverages, and consumption is more prevalent among lower socio-economic groups. Polling information demonstrated that respondents believe that children and young people drink too many SSDs.

Obesity is multifactorial; it is not caused by one facet of an individual's lifestyle, but instead can be caused by environmental, physiological, genetic and lifestyle factors. This complex mix of factors means that solutions to the problem of overweight and obesity are not simple but the food environment will certainly form an integral part of addressing this issue. Some of this complexity is reflected in the stakeholder consultation where diverging views and uncertainty were apparent. Overweight and obesity in Ireland have reached concerning levels. In the National Adult Nutrition Survey (IUNA, 2012a), 37% of all adults were overweight and 24% were classified as obese. SLÁN (2007) results state that approximately 2 out of 3 Irish adults are either overweight or obese (Harrington et al, 2008). Adult males are more likely to be overweight/obese than females across all age cohorts. Results from IUNA (2012c) stated that overall, 15% of children between 2 and 4

[48] See Appendix 4 for definition of carbonated beverage; in sum, 'carbonates' refer to sweetened non-alcoholic drinks containing carbon dioxide and therefore include artificially sweetened drinks. For a detailed breakdown of SSD consumption by gender and age, please see table 3.6.

years old were overweight and 3% were classified as obese. Among children aged between 5 and 12 years, 17.4% were overweight and 6.7% were classified as obese while for teenagers (13-17 years) 15% were overweight and 3% were obese. The Growing up in Ireland study (2011) reported that 19% of children aged 3 were overweight, with a further 6% measuring as obese. A social gradient occurred for both adults and children with regard to weight – among adults this was not the case for overweight, but was the case for the prevalence of obesity.

The proposal for a tax on SSDs is rooted in concern over the problem of obesity in Irish society, and it is estimated that diseases associated with obesity will become increasingly common. Obesity can lead to serious health problems such as type 2 diabetes and metabolic disorder and although the causes of obesity are multifactorial, diet is one of the key influential factors. SSDs have come under considerable scrutiny for their possible contribution to overweight and obesity. SSDs are considered by some advocates as a good place to start in terms of food taxes as SSDs provide no nutritional benefits to the consumer. However others do not share the enthusiasm for a tax arguing that it is too simplistic a measure and not based on conclusive evidence.

What can be stated conclusively, as with any food/drink commodity, is that if energy intake exceeds energy expenditure there will be weight gain. Several mechanisms have been postulated to explain how consumption of SSD could lead to weight gain and obesity. The mechanism most often cited in the literature is one in which the 'liquid calories' of SSDs do not fully satiate appetite leading to additional consumption of calories in the diet. The evidence supporting this hypothesis is suggestive not conclusive. The question of satiety as unique to SSDs is mirrored by a possibly unique effect of SSDs on the body; for example, it is hypothesised but not proven that SSDs may contribute to diseases such as type 2 diabetes beyond the interaction with obesity through providing rapidly absorbable carbohydrates. The modelling exercise paralleling the HIA estimated that a 10% tax on the price of SSD, using an own-price elasticity of 0.9 for SSDs, would reduce obesity by 1.25% among adults in Ireland. The reduction in SSD consumption

would occur to a slightly greater extent among women than among men but there would be no discernable differences between income groups. If this were the outcome, this would be a major public health achievement but the predictions must be viewed with caution. The modelling exercise has limitations, as with most exercises of this nature; these, including assumptions that were made, are outlined in the University of Oxford report. It made an assumption that 90% of the tax would be passed on. It did not take account of switching behaviour i.e. what will the consumer replace the SSD with. It cannot be certain that the predicted weight loss is accurate for smaller energy reductions below the validated range of the equations used in the model. However, equating reduced energy intake from such a measure with weight loss is extremely challenging – especially as this initiative would not be occurring in isolation.

The balance of evidence for a link between SSD consumption and higher energy intake is in favour of a positive relationship. The balance of evidence concerning a link between SSD consumption and weight gain is less clear. Systematic reviews of published studies on SSD consumption and weight gain vary greatly in their findings even though they often review the same published studies. However, overall the evidence linking SSD consumption with weight gain is suggestive of a positive association rather than conclusive.

Meta-analysis of studies on SSD consumption and increased energy intake show consistent positive relationships with small to medium effects. Small positive relationships also seem to emerge for meta-analyses on studies of SSD consumption and measures of weight gain. However, it also has to be considered that the meta-analyses have been conducted on a suite of studies that have variously been criticised in the literature for being at the lower end of the quality scale or having design flaws. There are few studies in any research area that do not have limitations, Mattes et al (2010) note that we are faced with *imperfect knowledge*. Most research taking place outside of a controlled laboratory environment has limitations. Compounding this imperfect knowledge is the fact that this is not occurring in a vacuum, there are other policy interventions and

wider economic factors that may play a part; for example the potential 36% decrease in sugar prices that may be forthcoming in Europe as outlined in Bonnet et al (2011).

Steering Group Conclusion

The steering group believe the evidence presented to them by the HIA process demonstrated that:

- Obesity is multifaceted with many factors influencing the basic drivers of energy intake and energy expenditure including environment, socio-economic, psychosocial and genetic factors.
- SSDs are a source of energy intake with little or no other nutrient contribution to the diet.
- Price increases tend to decrease demand but the degree to which this happens is variable because consumer behaviour and industry response to a tax is difficult to predict.
- The evidence linking SSD consumption with increases in energy intake is in favour of a positive relationship.

  The evidence linking SSD consumption with weight gain is suggestive but not conclusive. The literature is contradictory and study quality tends to be described as low to medium.

There are a number of uncertainties surrounding these agreed points that have been discussed earlier. Many of these uncertainties could be clarified by a comprehensive monitoring and evaluation process to ascertain consumption patterns, population BMI and industry impacts if the proposed tax was introduced. Causality and segmented data may be difficult to assess but the responsibility of planning for this monitoring and evaluation process lies with the Department of Health prior to introduction of the tax should it proceed. The HIA process was not asked to consider complementary measures and therefore cannot offer recommendations in this regard, however it should be noted that education and accompanying measures to promote physical activity were consistently raised by stakeholders as a necessary component of a suite of measures to address the issue.

It should also be noted that the importance of engagement with industry prior to moving forward with a tax has also been consistently raised by stakeholders, with the example of industry collaboration in the area of salt reduction cited as a precedent.

Appendix 1: Steering Group Membership and Terms of Reference

Chair: Professor Donal O'Shea, St. Vincent's University Hospital, St. Colmcille's Hospital, and University College Dublin.

Members:
Ms. Ursula O'Dwyer, Department of Health
Dr. Pat Doorley, HSE
Dr. Teresa Bennett, HSE
Dr. Wayne Anderson, Food Safety Authority of Ireland
Dr. Cliodhna Foley-Nolan, Safefood
Ms. Marian Byrne, Department of Agriculture, Food and the Marine
Ms. Anne-Marie Brooks, Department of Children & Youth Affairs
Dr. Mike Rayner, British Heart Foundation Health Promotion Research Group and University of Oxford
Professor David Madden, School of Economics, University College Dublin
Mr. Owen Metcalfe, Institute of Public Health in Ireland (Project Team)
Dr. Noëlle Cotter, Institute of Public Health in Ireland (Project Team)
Ms. Teresa Lavin, replaced by Ms. Olga McDaid from July 2012, Institute of Public Health in Ireland (Project Team)

Objective

- To provide governance for the health impact assessment (HIA) of the proposal to place a tax on sugar sweetened drinks purchased in the Republic of Ireland.

Terms of reference

- To oversee the HIA and guide the project team as necessary.
- To hold meetings at regular intervals and to read and comment on any materials in advance.
- To approve each phase of project development; literature review, consultation process and draft documents.
- To ensure that the project is progressing at an appropriate pace given the short timescale.
- To provide support to the project team as required.

Appendix 2: Screening Tool

Introduction

Health is determined not only by access to quality healthcare services and lifestyle choices but also by the social and economic conditions in which people live. These include many factors which lie outside the healthcare sector, such as housing, employment, transport and access to fresh food. Policies and actions formulated in these non-healthcare sectors can have a significant impact on people's health and wellbeing.

Assessment of the potential impacts on health of a proposal should include consideration of physical, mental and social health. Health Impact Assessment (HIA) is a combination of procedures, methods and tools that *systematically* assesses the potential effects of a proposal on the health of a population. It also considers the *distribution* of those effects within the population and can be a useful mechanism for highlighting where the health of some groups may be affected more than others if the proposal is implemented.[49] The Institute of Public Health in Ireland (IPH) has developed tools to support HIA in practice.

Screening

Screening is the first step in a HIA and its purpose is to determine whether or not to proceed further with HIA. It does so by quickly and systematically highlighting the potential impacts of the proposal on health. Screening may be undertaken by a single person or as a group exercise. The length of time required for screening will depend on the scale of the proposal and the amount of information available. If screening is undertaken by a group, this should ideally include stakeholders (those likely to be affected by the proposal) and decision-makers.

The IPH screening tool comprises three sections:

- Section one records background and context.
- Section two considers the potential impact of the proposal on a range of health determinants, for the population as a whole and for groups within the population.
- Section three documents the outcome of screening.

[49]International Association for Impact Assessment. *Best practice guidelines for HIA 2005.* http://www.iaia.org.

Section one: Background and context

Title of proposal being screened	Proposed Sugar Sweetened Drinks (SSD) Tax
Date screening conducted	1st March 2012
Person(s) involved in the screening process (name, organisation represented and job title if applicable)	Noelle Cotter & Teresa Lavin Public Health Development Officers, IPH
What stage of development is the proposal at?	Very early stage, no documents available yet but the proposed tax is being explored by the Special Advisory Group on Obesity chaired by the Department of Health.
Briefly outline the importance of the proposal from: *An economic/ business perspective* *A political perspective* *A community perspective*	A change in SSD consumption may have implications for employment and revenue. The above issues have a political dimension as does the current level of obesity and related healthcare costs. Potential to affect all consumers of soft drinks.
What resources are available to conduct a HIA? (Consider both human and financial)	Two staff from the Institute of Public Health in Ireland on a part-time basis.
Are decision-makers likely to be open to recommendations to amend the proposal?	The HIA was requested by the Department of Health and therefore it is likely that the decision makers will be receptive.

Section two: Potential impacts on health determinants

Instructions for completing the table

The first column contains a list of issues that are known to influence health (health determinants). These are grouped into social and economic conditions, structural issues, and individual and family issues.

STEP 1: Assess the likelihood of the proposal impacting on this health determinant and record as:

- **Likely** (it is likely that the proposal will impact on this health determinant).
  Code as L
- **Unlikely** (it is unlikely that the proposal will impact on this health determinant).
  Code as U
- **Not known** (there is insufficient information in the proposal to assess whether or not it will impact on this health determinant).
  Code as NK

*If the health impact is considered **likely**, continue to step 2. If the health impact is considered **unlikely** or is **not known**, proceed to step 3 or move on to the next health determinant.*

STEP 2: List the groups most likely to be affected by the proposal. Examples of different population groups are given below (this is not intended to be a complete list).

- Infants and toddlers
- Children and young people
- Working age people
- Older people
- Rural population
- Urban population
- Males/ females
- Single/ married people
- Gay/ lesbian people
- People with dependants
- Racial and ethnic groups (particularly minority groups)
- People with particular religious beliefs
- People with particular political opinions
- People with disabilities
- Chronically ill people
- Homeless people
- Unemployed people
- Economically disadvantaged people
- Others

Social and economic conditions that influence health		
Likelihood that the proposal will impact on this health determinant (L/ U/ NK)		***Groups most likely to be affected by the proposal***
Education	U	
Employment	L	Those employed in the sector
Childcare	U	
Crime and fear of crime	U	
Community interaction	U	
Access to fresh food	U	
Access to sports and other opportunities for physical activity	U	
Access to cultural and other recreational activities	U	
Access to healthcare services	U	
Access to social welfare services	U	
Access to other community services	U	
Access to public transport	U	
Other social or economic conditions (list)		
Structural issues that influence health		
Likelihood that the proposal will impact on this health determinant (L/ U/ NK)		***Groups most likely to be affected by the proposal***
Housing	U	
Public buildings	U	
Commercial buildings	U	
Green space (including parks)	U	
Other public spaces	U	
Road safety	U	
Transport infrastructure	U	
Communications infrastructure (internet/telephone)	U	
Energy sources	U	
Waste management infrastructure	U	
Water quality	U	
Air quality (indoor and outdoor)	U	
Soil quality	U	
Noise	U	
Light	U	
Other structural issues (list)		
Individual and family issues that influence health		
Likelihood that the proposal will impact on this health determinant (L/ U/ NK)		***Groups most likely to be affected by the proposal***
Diet	L	All consumers of soft drinks especially frequent consumers
Physical activity	U	
Substance use (legal and illegal)	U	
Sexual activity	U	
Household income	L	Low income groups
Family cohesion	U	
Other individual and family issues (list)		

Section three: Screening outcome

Tick the appropriate outcome

Overall, health impacts are unlikely or relatively minor and easy to address.	Where appropriate, make recommendations to decision-makers on how such impacts may be addressed. Do not proceed with HIA.	
Overall, health impacts are likely or unknown.	Taking into account issues raised in section one, proceed with HIA.	✓

Appendix 3: Scoping Tool

Scoping tool[50]	
Title of the proposal on which the HIA is being conducted	Proposed tax on Sugar Sweetened Drinks (SSD)
Aim of the HIA	The proposed tax, to be applied to SSDs, may affect health and health inequalities. The HIA will assess potential impacts of the proposal in a systematic and transparent way.
Values underpinning the HIA	Equity Transparency
Objectives of the HIA (Consider core values)	Contribute to ensuring maximum health benefits are realised from the introduction of this policy and any potential health inequalities are minimised. Opportunity for broad stakeholder involvement and awareness of the rationale for introduction of the policy.
Boundaries of the HIA (e.g. geographical, population)	National policy
Time scale for the HIA	Final recommendations and report to be presented to Department of Health in September 2012
Non-negotiable aspects of the proposal	To be advised
Steering group membership • Suggest maximum of 12 members • Include decision-makers of the policy, programme or project on the group	See attached lisr
Main stakeholders: • Who is likely to be affected by the proposal? • Are key stakeholders represented on the steering group?	Consumers Soft drinks industry Health professionals – represented Food and agriculture sector - represented
Key informants for the HIA: • Who can provide useful information on how the proposal is likely to impact on health?	Above groups
Who will be responsible for gathering evidence in the following areas? • Literature review • Community profile • Stakeholder workshops • Proposal and policy analysis	Project Team
Who will be responsible for appraising the evidence and forming recommendations?	Steering Group and SAGO
How will the results of the HIA be presented and disseminated?	Results presented to Department of Health Wider dissemination process to be advised
What measures will be put in place to facilitate evaluation of the HIA?	Impact / Outcome evaluation to be advised

[50] Adapted from a tool developed by Erica Ison.

How will the HIA budget be spent? Consider: • Human resources • Venue hire, catering and travel costs for meetings and workshops • Costs associated with dissemination of the results • Evaluation costs	In kind
Operating arrangements for the steering group including: • Chair • Date and location of meetings • Secretariat	Meetings will be chaired by Professor Donal O'Shea and held in Hawkins House, approximately once a month for five months. IPH will act as secretariat.

Appendix 4: Beverage definitions

The following definitions are based on those provided in the Canadean Report (2011).

Carbonates: Sweetened, non-alcoholic drinks containing carbon dioxide.

Other sweetened drinks:

Nectars
Diluted fruit/vegetable juice and pulp, to which sweetening agents (e.g. sugar, honey, syrups and/or sweeteners), permitted minerals and vitamins for the purpose of fortification and permitted additives may be added.

Squash/Syrups
Non-ready-to-drink (non-rtd) products, marketed as concentrates for home consumption. The category includes fruit and non-fruit based products and flavours. All market figures shown in Canadean database and reports are expressed in ready to drink (rtd) volumes. Dilution ratio varies from country to country.

Still Drinks
Flavoured ready to drink, non-carbonated products, which may be fruit or non-fruit flavoured and have a juice content of 0-24.9%. Sugar, artificial flavouring and colouring may be added.

Sports Drinks
Performance-enhancing products, described as 'isotonic', 'hypertonic' or 'hypotonic', meaning 'in balance with', 'lighter than' and 'heavier than' body fluids, respectively. Products contain B complex group vitamins, such as:

- B1 Thiamin
- B2 Riboflavin
- B3 Niacin/niacinamide
- B5 Pantothenic acid
- B6 Pyridoxine hydrochloride
- B7 Biotin
- B12 Cyanocobalamin
- Choline

As well as vitamin E (i.e. antioxidant), and vitamin C (ascorbic acid), along with key electrolytes such as calcium, potassium, magnesium, sodium, glucose syrup, maltodextrin, sweeteners and acidity regulators (e.g. sodium citrate, calcium carbonate, calcium hydroxide).

Energy Drinks
Energy-enhancing products, mainly carbonated and containing stimulants such as caffeine, taurine, guarana (the guarana seed has a higher caffeine content than coffee), glucuronolactone, yerba mate, along with glucose syrup (corn syrup) and maltodextrin. Includes B complex group vitamin combinations, typical examples include:

- B2 Riboflavin
- B3 Niacin/niacinamide
- B5 Pantothenic acid
- B6 Pyridoxine hydrochloride
- B7 Biotin
- B9 Folic acid
- B12 Cyanocobalamin
- Inositol

As well as vitamins A and E (i.e. antioxidants); vitamin C (ascorbic acid); L-carnitine; exotic herbs and substances, such as gingko biloba, ginseng, milk thistle; acidity regulators. Products may also contain juice e.g. Rockstar Juiced (70% juice content), Coca-Cola's Burn Juiced (20% juice content).

Calorie Rating

Low Calorie
Reduced calorie products marketed on a diet, reduced or low calorie platform and sweetened with high intensity agents, either single or blended. Will be highlighted on the product label as:

- diet/light/low calorie (<20 kcal/100ml)
- mid calorie (50% less calories than normal)
- sugar-free/zero/calorie free (<4kcal/100ml)
- no (added)/low/reduced sugar (4g sugar per 100ml/approx <20kcal per 100ml)

Appendix 5: Distribution definitions

The following definitions are based on those provided in the Canadean Report (2011).

Off-premise

Volume sold for 'subsequent consumption' away from the place of purchase, comprising:

Modern Retail:

- ***Large Modern:*** Supermarkets, hypermarkets, department stores (Karstadt): modern facilities, typically with electronic tills, barcode scanning and multiple checkout
- ***Convenience:*** Stores such as 7-11, garage forecourts - typically small food stores with long opening hours, often selling ready meals and fast food
- ***Discount:*** Hard discounter stores, such as Lidl and Aldi, where focus is on low pricing.

Traditional Retail:
Traditional food stores: 'mom & pop' style, CTNs, delis, pharmacies/drugstores. Street stalls and kiosks (not for immediate consumption).

Specialist Beverage Retailer:
Off-licences, liquor stores, specialist drinks shops.

Home Delivery: On-line/telephone/mail order, deliveries to home address.

On-premise

Volume sold for 'immediate consumption' at the place of purchase, comprising:

Vending: Automatic merchandising machines selling (usually) branded beverages.

QSR: Quick service restaurants; payment is made prior to consumption.

EDA establishments: Eating, Drinking & Accommodation. Eating: establishments where beverage consumption is generally an accompaniment to a meal. Payment is made after consumption. Drinking: establishments primarily engaged in the sale of drinks for consumption on premise. Accommodation: establishments where the primary function is to provide accommodation facilities

Institutions: Workplaces, hospitals, nursing homes, schools, universities, prisons, military.

Other On-premise: Such as cinemas, street stalls and kiosks, travel and transport, leisure (including gyms/health clubs etc) and events.

Appendix 6: Information on other sweetened drinks in Ireland (Canadean, 2011)

Nectars

In 2010 consumption of nectars fell back by 7%. Nectars growth has been impacted by the trend away from sugar-containing beverages but also due to a lack of innovation. In the past few years the nectars category has seen innovation in PET bottles, with Tropicana Go (relaunched in 2009 as Tropicana Kids) and Fruice Juicy aimed at the school lunchbox market and 'on the go' consumption. Britvic Ireland launched a higher juice content variant of its Robinsons Fruit Shoot range in 20cl PET in 2010, in an effort to attract parents to buy the drink for their children as one of their five portions of fruit or vegetables each day. Nectars consumption is forecast to decline by around 3% in the coming years. Although, given the current economic climate, there may be more switching away from fruit juice towards nectars.

Still drinks

Overall still drinks consumption was down by 4% in 2010, not helped by the fourth poor summer in a row. Some consumers may have switched to squash as a cheaper alternative during the recession as family budgets became stretched. The children's segment is fiercely competitive, with major brands like Ribena, Robinsons Fruit Shoots and Mi-Wadi Juice Boost competing for the lunchbox trade in the major supermarkets. No added sugar (NAS) or lower sugar formulations are becoming more prominent as a result of consumer demand for healthier drinks. Still drink sales are expected to decline further by around 3% in the coming years.

Squashes/Syrups

Squash/syrups are very popular in Ireland. They have been revitalised in recent years by no added sugar (NAS) offerings from all the major manufacturers. In 2010, the category grew 11%, the strongest growth of any soft drinks category. In times of economic austerity the squash market becomes more attractive as a source of inexpensive refreshment. NAS products now account for around 57% of all squash/syrups, as the consumer trend away from added sugar beverages gathers pace. Squash/syrups prices remain very competitive in the grocery trade with special offers; BOGOFs (buy one get one free) and 'extra free' promotions quite commonplace. In recent years discounters Aldi and Lidl have been over-trading in the market at the expense of supermarkets and traditional retailers. Canadean forecasts further growth of 5% for squash/syrups as the economy remains weak and consumer spending is restricted.

Sports drinks

Sports drinks consumption declined by 1% in 2010 as the poor summer weather and the economic downturn had an impact on consumption. This was despite strong promotional activity from the major brands i.e. Lucozade Sport, Powerade and Club Energise Sport. Private Label brands have taken advantage of the economic situation with their low price offerings to grow market share. Although a relatively small category, there is a great deal of marketing support from the

leading companies in order to maintain brand awareness. As well as above the line activity, sponsorship plays a key role in brand building. The sports drinks category is forecast to decline by around 1% in 2011 but the major brands are expected to maintain strong promotional activity, especially on multi-pack offers.

Energy Drinks

Energy drinks returned to growth in 2010, with consumption up by 2% due to strong promotional support for the major brands and growth coming from Private Label brands. There are two types of energy drinks competing in the market. Firstly, there is the traditional glucose-energy low caffeine containing drinks often referred to as the 'daytime' energy drinks. Secondly, there is the high caffeine, guarana and taurine containing energy drinks. Lucozade Original and its flavour variants continue to dominate the 'day-time' segment whilst Red Bull leads the 'night-time' segment. Strong marketing activity backed by heavy-weight promotional activity by the leading brands has been crucial in this category. Average retail prices edged up slightly in 2010 but there were considerable multi-pack offers and 'extra fill free' promotions from the major brands to try and off-set price rises. The energy drinks market is expected to show further growth of around 2% even though the economy is still fragile; constraints on disposable income may force many consumers to seek cheaper alternatives in the form of low priced energy brands (such as Boost) or Private Label brands.

Appendix 7: Ipsos MRBI Polling Information

In parallel to the HIA process, the Health Research Board on behalf of the Department of Health, commissioned Ipsos MRBI to undertake an opinion poll on SSDs with adults in Ireland (n=1020). The headline results are outlined below, while further details are available in the appendices of the HIA technical report.

- 91% think that children and young people in Ireland drink too many SSDs.
- 87% believe that SSDs significantly contribute to obesity among children and young people in Ireland.
- 73% had purchased SSDs in the past year; purchasing was more common among young age groups and women.
- 44% of purchasers said they would buy SSDs less frequently if the price increased by 10%, but 34% said it would not change their purchasing behaviour. Women are more likely to respond to a 10% price increase than men.
- 40% stated they would switch to diet drinks if they were cheaper than SSDs while 38% said they would not.
- 60% of purchasers of SSDs said they would drink water if they drank less SSDs.

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