Institution: University of Oxford		
Unit of Assessment: 2 – Public Health, Health Services and Primary Care		
Title of case study: Making the case for sugar taxes: UK, Ireland and Mexico		
Period when the underpinning research was undertaken: 2007 – 2017		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s):	**Role(s) (e.g. job title):**	**Period(s) employed by submitting HEI:**
Jonathan Emberson	Professor of Medical Statistics and Epidemiology	2004 – present
Alastair Gray	Professor of Health Economics	1996 – present
Susan Jebb	Professor of Diet and Population Health	Sept 2013 – present
Mike Rayner	Professor of Population Health	1993 – present
Peter Scarborough	Associate Professor	2003 - present
Adam Briggs	Researcher	Sept 2014 – August 2017
Period when the claimed impact occurred: 2014 – December 2020		
Is this case study continued from a case study submitted in 2014? N		

1. Summary of the impact

Research has shown that regular consumption of sugar-sweetened drinks leads to obesity and overweight in both children and adults, as well as increasing tooth decay. Obesity reduces life expectancy and increases the chance of serious diseases such as cancer, heart disease and type 2 diabetes, and has also been linked to worse outcomes from COVID-19. University of Oxford research contributed directly to the introduction of sugary drinks taxes in the UK, Ireland and Mexico and indirectly to the introduction of similar taxes around the world. The UK and Mexico taxes have already led to demonstrated reductions in the sale of sugary drinks and levels of sugar consumption from these products. Modelling studies based on these results indicate that the resulting health benefits are significant, including reduced incidence of obesity, diabetes and tooth decay.

2. Underpinning research

Overweight and obesity are estimated to account for about 4,000,000 deaths annually worldwide. Obesity is a major cause of diabetes, which is currently estimated to affect 450,000,000 people worldwide (1 in 11 adults) but this is expected to rise to more than 700,000,000 by 2045 as obesity rates continue to increase. Consequently, there is an urgent need for comprehensive national policies aimed at restricting the major environmental determinants of obesity.

Research led by Professor Jonathan Emberson generated clear evidence of the increasing burden of obesity and of type 2 diabetes in Mexico. The Mexico City Prospective Study (MCPS) was initiated in 1994 by Oxford researchers Professor Sir Richard Peto and Professor Sir Rory Collins in collaboration with epidemiologists in Mexico (Professor Roberto Tapia-Conyer, Professor Pablo Kuri-Morales and Doctor Jesus Alegre-Diaz). Professor Emberson joined the team in 2004 and has been the UK Principal Investigator of the study since 2013.The MCPS represents a long-standing collaboration between researchers at the University of Oxford and researchers at the Mexican Ministry of Health and the National Autonomous University of Mexico (Mexico City). Between 1998 and 2004, 150,000 people aged 35 years or older from Mexico City were recruited, interviewed, had measurements and a blood sample taken, and then followed for cause-specific mortality. The University of Oxford researchers designed the questionnaire used in the baseline assessment, assessed the blood samples collected and analysed the data. By the early 2010s, the study was starting to generate reliable evidence regarding the major causes

of premature death in Mexico. In 2016, the study showed that diabetes was responsible for twice as many Mexican deaths as had previously been thought based on studies undertaken in higher income countries [1]. By 60 to 74 years of age, approximately one quarter of the participants in the cohort had a medical diagnosis of diabetes (compared with approximately 7% in an equivalent population in the UK) and diabetes accounted for over a third (35%) of all deaths between 35 and 74 years of age.

In parallel, University of Oxford researchers developed population simulation models to predict the impact of health-related food taxation policies and possible industry responses in various countries including the UK [2, 3, 4, 5], Ireland [6], New Zealand and Denmark. These models incorporated data on sales and consumption of unhealthy foods (high in sugar, salt or saturated fat), price elasticity estimates, and estimates of the association between unhealthy foods and disease outcomes. Collectively, these studies indicated that taxing unhealthy food products could be an effective method to reduce the prevalence of obesity and obesity-related disease outcomes, including type 2 diabetes. In response to a lack of UK data on the possible consequences of a sugary drinks tax, University of Oxford researchers led a study in collaboration with Reading University to develop a model to estimate the effects of a 20% sugary drinks tax on UK purchasing habits, obesity, and expenditure by income [4]. The Oxford researchers designed the study, planned the analyses, built the comparative risk assessment model and published the results. Reading University researchers conducted the econometric work necessary to produce a bespoke price elasticity matrix. The model predicted that once the full effect of the tax was borne out, the prevalence of obesity in adults in the UK would decrease by 1.3% (180,000 people), compared with the situation if the tax had not been introduced. The Oxford researchers then collaborated with the University of Dublin to conduct a similar study for the Irish Government, with comparable results for Ireland [6].

Between 2013 and the announcement, by the then Chancellor of the Exchequer, of a Soft Drinks Industry Levy for the UK in 2016, University of Oxford researchers developed further evidence to evaluate the effects of health-related food taxes, for example by addressing concerns raised by the Institute of Fiscal Studies' about the efficacy of a sugary drinks tax. In response to the announcement of the Soft Drinks Industry Levy, the researchers developed a bespoke model to understand the impact of different industry responses (e.g. reformulation vs price changes) on obesity, diabetes, and tooth decay [5]. This model indicated that the most effective industry response would be widespread reformulation of sugary drinks, which would significantly decrease the incidence of obesity and type 2 diabetes, as well as reducing the number of decayed, missing, or filled teeth annually.

3. References to the research

(University of Oxford researchers highlighted in bold)

1. Alegre-Díaz J, **Herrington W**, López-Cervantes M, **Gnatiuc L**, Ramirez R, **Hill M, Baigent C, McCarthy MI, Lewington S, Collins R, Whitlock G,** Tapia-Conyer R, Peto R, Kuri-Morales P, **Emberson JR** (2016). Diabetes and cause-specific mortality in Mexico City. *N Engl J Med*, 375 (20), 1961-1971 DOI: 10.1056/NEJMoa1605368
2. Mytton, O., **Gray, A., Rayner, M**., & Rutter, H. (2007). Could targeted food taxes improve health?. *Journal of Epidemiology and Community Health*, 61(8), 689-694 DOI: 10.1136/jech.2006.047746
3. **Nnoaham, K. E.,** Sacks, G**., Rayner, M., Mytton, O., & Gray, A.** (2009). Modelling income group differences in the health and economic impacts of targeted food taxes and subsidies. Int J Epidemiol, 38(5), 1324-1333. DOI:10.1093/ije/dyp214
4. **Briggs ADM*, Mytton O***, Kehlbacher A, Tiffin R, **Rayner M, Scarborough P** (2013). The overall and income specific effect on the prevalence of overweight and obesity of a 20% sugar sweetened beverage tax in the UK: an econometric and comparative risk assessment modelling study. *BMJ* 347: f6189 DOI: 10.1136/bmj.f6189 (*Joint lead authors.)
5. **Briggs ADM,** Mytton O**,** Kehlbacher A, Tiffin R, **Elhussein A, Rayner M, Jebb S,** Blakely T, **Scarborough P** (2017). A health impact assessment of the UK soft drinks industry levy: a comparative risk assessment modelling study. *The Lancet Public Health*, 2017;2(1):e15-e22. doi: 10.1016/S2468-2667(16)30037-8

6. **Briggs ADM*, Mytton O*,** Madden D, O'Shea D, **Rayner M, Scarborough P** (2013). The potential impact on obesity of a 10% tax on sugar-sweetened beverages in Ireland, a comparative risk assessment modelling study. *BMC Public Health* 13:860. DOI: 10.1186/1471-2458-13-860 (*Joint lead authors.)

Funding to the University of Oxford includes British Heart Foundation, to Rayner for Health Promotion Research Group, total GBP1,447,802 (series of awards 2006-2019).

4. Details of the impact

The University of Oxford's research into health-related food and drink taxes has had significant international impact, contributing directly to the introduction of sugary drinks taxes in Mexico (2014), the UK (2018) and Ireland (2018) and influencing the introduction of similar taxes around the world. By December 2020, according to the World Cancer Research Fund, there were sugary drinks taxes in 38 countries [A].

A. Creating a favourable policy environment for new sugary drinks taxes

Mexico: For over 20 years the University of Oxford has worked closely with researchers in Mexico including (during the period 2011 - 2018) the Undersecretary of Prevention and Health Promotion of the Mexican Ministry of Health. As testified by the Undersecretary, this close collaboration and discussion of the research evidence meant that '*even before results were published, the findings from the Mexico City Prospective Study influenced health policy decision making in matters related to non-communicable diseases such as diabetes, hypertension and obesity. In particular, the study influenced both the decision in 2014 to introduce taxes on sugary drinks and the declaration in 2016 of diabetes and obesity as epidemiologic emergencies (the first time this had been done for non-communicable diseases)'* [B]. The 2016 declaration led to the introduction of a wide range of health policies aimed at tackling and treating obesity and diabetes, including healthy eating, on-pack labelling, medical check-ups and physical activity. The introduction of the sugary drinks tax in Mexico was the catalyst for similar adoptions by other countries, as acknowledged by international agencies: *'The passage, implementation and subsequent evaluation of Mexico's SSB (Sugar sweetened beverage) tax (implemented 1 January 2014) acted as a tipping point for global action',* World Cancer Research Fund International [C].

UK: The introduction of a sugary drinks tax in Mexico led to the proposal among UK policy makers for a similar tax for Britain. One of the UK modelling studies conducted by Oxford University [4] was cited in Public Health England (PHE)'s policy document **'***Sugar reduction, Responding to the challenge'* [D] (June 2014) In their subsequent report '*Sugar Reduction, The evidence for action*' [D] (October 2015) PHE specifically recommended the introduction of '*a price increase of a minimum of 10-20% on high sugar products through the use of a tax or levy such as on full sugar soft drinks, based on the emerging evidence of the impact of such measures in other countries*.'

The recommendation from PHE was discussed during the UK Parliamentary Health Select Committee's inquiry into childhood obesity in October 2015. Professors Susan Jebb and Peter Scarborough presented oral evidence to the committee, which included discussing the evidence from Mexico which indicated that such a tax would be effective in the UK. The resulting report '*Childhood obesity – brave and bold action'* (November 2015) [E] recommended a sugary drinks tax in the UK and stated that '*The evidence suggests that increasing the price of high sugar products by 10–20% or more through the use of a tax or levy would be likely to have an effect on purchasing behaviour and therefore sugar consumption at least in the short term'*. During a debate in Parliament on this recommendation (November 2015), the Chair of the Select Committee (Sarah Wollaston MP), said, '*We know from the experience in Mexico that a 10% levy on sugary drinks has led to a 6% reduction in consumption'* [F].

This report had a direct impact on the opinions of MPs, who then spoke in support of the tax in Parliament in November 2015 [F]:

- *'During the Select Committee's inquiry, we heard some compelling evidence calling for brave and bold action on obesity…A few months ago I was against a sugary drinks tax, because I am against extra taxation, but the compelling evidence that we heard changed my mind.'* MP for Erewash, Maggie Throup

- *'Following the introduction of the tax on sugar-sweetened drinks (in Mexico), purchases were reduced by 6% in 2014. We need to be aware of the evidence showing that a tax will actually reduce the purchases of sugary drinks',* MP for Heywood and Middleton, Liz McInnes
- *'As I have looked into the issue more and more, I have reached the position where I find the evidence compelling: something needs to be done.'* MP for St Austell and Newquay, Steve Double.

This increased political support, coupled with greater public acceptance (described below), led to the announcement of the UK Soft Drinks Industry Levy (SDIL) in March 2016.

Ireland: The publication of the modelling studies [2] and [3] led to the researchers being commissioned by the Irish Government's Department of Health in 2011 to carry out a modelling study of a 10% tax. This was incorporated within a health impact assessment (HIA) published by the Irish Institute of Public Health in 2012 and then subsequently in BMC Public Health [6]. This led to a recommendation by the Department of Health for the introduction of '*a graded tax on pre-packaged [sugar-sweetened soft drinks] on sale in Ireland'* in 2016 [G]. As supporting evidence, the Department of Health referenced the HIA: *'[the HIA] found evidence that 'taxation could work to reduce overweight and obesity' depending on the level of tax imposed…[and] concluded that a 10% tax on the price of SSDs [sugary drinks] would reduce obesity by 1.25% among adults in Ireland'* [G]. The recommendation for a tax was acted upon by the Irish Government, which introduced a tax in April 2018.

International: The success of the tax on sugary drinks in Mexico influenced WHO's stance on using fiscal measures to reduce sugar consumption [H]. In their influential report '*Tackling NCDs (Noncommunicable Diseases): Best Buys'* [H], WHO includes as a 'best buy' policy recommendation: '*Reduce sugar consumption through effective taxation on sugar-sweetened beverages.'* This report has contributed to the roll out of sugary drinks taxation policies worldwide. The World Cancer Research Fund tracks international food policies and currently notes sugary drinks taxes 39 countries including 10 in Europe [A]. Of these, 37 have been implemented since the introduction of the tax in Mexico in 2014, with many countries citing evidence of the link between sugar consumption, weight gain, overweight and obesity as a driving factor.

B. Changing public attitudes towards sugary drinks taxes

The work of the researchers resulted in extensive media attention and public discussion of the issue. For example, Professor Mike Rayner appeared in BBC2's Trust Me I'm a Doctor (2014) in a feature exploring the health impacts of excess sugar. Professor Rayner was also interviewed in Jamie Oliver's Sugar Rush Documentary (2015) which was viewed by over 1.2M people in the UK. The celebrity chef Jamie Oliver subsequently went on to be a key advocate for a sugary drinks tax in the UK, contributing to the adoption of the tax by the UK Government and public acceptance. Increased general awareness of the health impacts of sugar led to greater public acceptance of a tax on sugary drinks. In 2013 only about 36% of people in the UK supported the introduction of a tax on sugary drinks. By 2015 this had risen to around 58%, but by March 2016, just after the sugary drinks tax had been announced, 69% supported the introduction [I].

C. Industry responses and product reformulation

The SDIL succeeded in prompting widespread product reformulation. All major brands of soft drinks (including supermarket brands) launched new sugar-free versions. This increased access to low-sugar drinks and allowed consumers to reduce their sugar consumption without compromising their preferences or brand loyalties. In an evaluation of the UK SDIL, the Oxford University researchers demonstrated that the proportion of soft drinks containing >5g/100ml of sugar available on the UK market fell from 49% in 2015 to 15% in 2019 [J]. In addition, the majority of new products had a sugar level between 4.5 and 5.0 g per 100 mL, suggesting they the 5.0g threshold of the levy had guided the reformulation. In contrast, drinks exempt from the SDIL (such as 100% fruit juice and milk-based drinks), saw no reduction in average sugar content, reinforcing that the levy was the motivating factor for change [J].

D. Impacts on sugar consumption and health

A review by Public Health England (PHE) in October 2020 concluded that between 2015 and 2019 in England, there was a 43.7% reduction in the total sugar content per 100ml for retailer and manufacturer branded drinks subject to the SDIL [K]. This meant that although sales in all

soft drinks increased by 14.9% during this time, the total sugar purchased per household from drinks subject to the SDIL decreased across all socio-economic groups (between 38.5% - 35.1%). Reduced purchasing of sugar ultimately led to reduced sugar consumption. An analysis conducted by the University of Oxford researchers found that between 2015 and 2018, total sugar consumption from soft drinks declined by 29% despite soft drink consumption rising during this period. Further preliminary results of the evaluation of the levy indicate that compared to the pre-announcement, the amount of sugar purchased in drinks by a household each week reduced by 29.5g (9.8%) one year after the introduction of the levy. The 2017 modelling study [5] suggested that the observed reformulation and reduced sugar consumption due to the levy will ultimately result in 140,000 fewer people with obesity and 19,000 fewer incident cases of type 2 diabetes per year in the UK, as well as nearly 270,000 fewer decayed, missing, or filled teeth annually. According to PHE data, the number of 0-5 year olds being admitted to hospital in England for tooth extractions fell by 20.9% between 2014/15 (16,591) and 2018/19 (13,120). Between April-October 2018, the levy raised almost GBP154,000,000 for programmes to support pupil health and well-being, including primary physical education and the Healthy Pupils Capital Fund.

An evaluation of the tax in Mexico (introduced in 2014) shows that purchases of taxed beverages fell by 7.6%, between 2014 and 2016 [L]. In a modelling study, the Oxford University researchers estimated that this would lead to a projected reduction in new cases of diabetes by 189,300 for the time period 2013 to 2022, amounting to total savings between USD769million to USD1.2billion in direct healthcare costs.

5. Sources to corroborate the impact

A. World Cancer Research Fund International: NOURISHING and MOVING policy databases https://policydatabase.wcrf.org/level_one?page=nourishing-level-one#step2=2#step3=315 (i) list of countries with sugar taxes; (ii) database entries (downloaded 08/03/2021).

B. Letter from Mexican Undersecretary for Health 2011-2018 (27/10/2020).

C. 'Building momentum: lessons on implementing a robust sugar sweetened beverage tax' (2018). World Cancer Research Fund International.. www.wcrf.org/buildingmomentum

D. 'Sugar Reduction: Responding to the Challenge'. Public Health England. June 2014; and Sugar Reduction: The evidence for action. Public Health England. October 2015

E. 'Childhood obesity – brave and bold action'. House of Commons Health Select Committee. UK Parliament. November 2015.

F. Sugary Drinks Tax: House of Commons Debate. Hansard, 30 November 2015.

G. Department of Health (Ireland). Introducing a tax on sugar-sweetened drinks. Health rationale, options and recommendations. DH: Dublin, 2016.

H. 'Taxes on sugary drinks: Why do it?' World Health Organisation, 2017; and Tackling NCDs. Best buys. World Health Organisation, 2017.

I. Three surveys of public attitudes to a UK Sugary Drinks Tax: (i) 'Understanding Society: Keeping Fit'. Ipsos MORI (Dec 2013); (ii) 'Attitudes to obesity. Findings from the 2015 British Social Attitudes survey', Public Health England (2015); (iii) Political Monitor Topline Results, Ipsos MORI (March 2016).

J. Scarborough, P., et al. (2020), The impact of the announcement and implementation of the UK Soft Drinks Industry Levy on sugar content, price, product size and number of available soft drinks in the UK, 2015-19: a controlled interrupted time series analysis. *PLOS Med.* 17, e1003025. DOI: 10.1371/journal.pmed.1003025

K. 'Sugar reduction. Report on progress between 2015 and 2019.' Public Health England, October 2020.

L. Colchero, M. Arantxa, et al. In Mexico, evidence of sustained consumer response two years after implementing a sugar-sweetened beverage tax. *Health Affairs* 36.3 (2017): 564-571. DOI: 10.1377/hlthaff.2016.1231