Institution: Teesside University		
Unit of Assessment: 3		
Title of case study: Transforming public health policy and guidelines on the surveillance and treatment of obesity in children and young people in the UK and USA		
Period when the underpinning research was undertaken: 2013-2017		
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:**
Greg Atkinson	Professor of Health Sciences & Biostatistics Research	Mar 2012 to present
Alan M Batterham	Professor of Exercise Science	Sep 2005 to present
Mandy Cheetham	Research Fellow	Mar 2012 to Aug 2020
Louisa Ells	Professor of Public Health & Obesity	May 2012 to May 2020
Period when the claimed impact occurred: 2015-2020		
Is this case study continued from a case study submitted in 2014? N		

1. Summary of the impact (indicative maximum 100 words)

Translational research at Teesside University has transformed UK Government public health policy and guidelines on obesity in the UK and USA. Coproduced research with Public Health England (PHE) led to the development of the sugar reduction programme report and the subsequent implementation of a soft drinks industry levy (sugar tax) in April 2018, and a ban on the advertising of high fat, salt, or sugar food or drink products in children's media from July 2017. Research on the tracking of weight status in children led to the development of an NHS digital protocol to analyse the linked data for the entire National Child Measurement Programme (NCMP) dataset. A Cochrane systematic review of drug interventions for the treatment of obesity in children and adolescents has informed the American Society for Metabolic and Bariatric Surgery (ASMBS) Pediatric Committee guidelines. And research on young people's perceptions of energy drinks has been used to underpin the UK Government's Green Paper on childhood obesity that proposed a ban on the sale of sugar and caffeine 'energy drinks' to the under-16 age group that was subsequently adopted voluntarily by all major supermarkets.

2. Underpinning research (indicative maximum 500 words)

Globally, the prevalence of obesity has approximately tripled since 1975. Given the serious associated health and economic consequences of obesity, finding effective prevention and treatment strategies is both a national and global priority.

Two mixed methods reviews undertaken with PHE drew together evidence on the impact of fiscal measures and marketing strategies on health risk behaviours involving consumption of high-sugar food and non-alcoholic drinks [3.1, 3.2]. The first review combined the findings from peer-reviewed and grey literature with interviews with key stakeholders (n=15, with two additional participants providing written evidence) [3.1]. The triangulated evidence suggested that increased prices on unhealthy food and drink results in a decrease in purchasing and sales. Sales data from five countries indicated that existing taxes reduce purchases. The research concluded that increasing prices of high sugar foods and non-alcoholic drinks, potentially through taxation (10-20%), is likely to reduce purchases of these products in the short term. In a parallel review using identical mixed methods, it was noted that a variety of marketing strategies (price, product, place, promotion) are likely to impact on purchases and consumption in children [3.2]. The research concluded that children are targeted as they are considered more vulnerable to the impact of marketing, and evidence suggests that advertising, advergames, discounting, use of character branding, product size, and supermarket product placement can influence high sugar product selection or consumption.

Research has also been undertaken to predict the weight status of 11-year-old children from measurements at age 5 years in a secondary analysis of data from over 12,000 children in the Millennium Cohort Study using a novel ordinal logistic regression approach [3.3]. The UK 1990 reference data were used to generate clinical weight status categories at each timepoint. We derived the predicted probability (percent chances) of 11-year-old children becoming underweight, normal weight, overweight, obese, and severely obese from their weight status category at age 5 years. We demonstrated that an obese 5-year-old child had a 68.1% (95% confidence interval: 63.8 to 72.5%) chance of remaining obese at 11 years, whereas the chances of becoming obese (including severely obese) at age 11 years were 5.7% (5.2 to 6.2%) for a normal-weight 5-year-old child and 32.3% (29.8 to 34.8%) for an overweight 5-year-old child. There were no substantial differences between sexes. Socioeconomic status influenced the results in boys, with non-deprived obese 5-year-old boys having a lower probability of remaining obese at age 11 years than deprived obese boys: −21.8% (−40.4 to −3.2%).

Our Cochrane systematic review of twenty-one eligible randomised controlled trials of drug interventions for the treatment of obesity in children and adolescents found that pharmacological interventions (metformin, sibutramine, orlistat and fluoxetine) might result in small reductions in body mass index and body weight in obese children and adolescents [3.4]. However, we reported that many of these drugs are not licensed for the treatment of obesity in children and adolescents or have been withdrawn. The included studies were generally of low quality with many having a short or no post-intervention follow-up period and high dropout rates. We concluded that larger trials with long-term follow up are required.

Co-designed with members of Fuse and County Durham Council, research was undertaken on young people's views on energy drinks [3.5]. This study was the first qualitative research on energy drinks to involve primary school children. The study involved children and young people from four schools in County Durham, two primary and two secondary. Semi-structured focus groups were conducted with a total of 37 participants (19 boys and 18 girls, with 20 aged 10–11 years and 17 aged 13–14 years). The research revealed that energy drinks were easily available in local shops; sold for as little as GBP0.25p ('four for GBP1' promotions); targeted at children through online adverts, computer games, television, and sports sponsorship; and linked to extreme sports, gaming, sexuality, gender, and use of sexualised imagery.

3. References to the research (indicative maximum of six references)

[3.1] Ells LJ, Roberts K, McGowan VJ, Machaira T. 2015. Annexe 2: A mixed method review of behaviour changes resulting from experimental studies that examine the effect of fiscal measures targeted at high sugar food and non-alcoholic drink. Public Health England Report. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/470173/Annexe_2._Fiscal_evidence_review.pdf

This output was underpinned by funding from Public Health England. grid.271308.f. 2014. Rapid Review - A mixed method review of behaviour changes resulting from experimental studies that examine the effect of fiscal measures targeted at high sugar food and non-alcoholic drink. Principal Investigator: Ells. GBP76,000.

[3.2] Ells LJ, Roberts K, McGowan VJ, Machaira T. 2015. Annexe 3: A mixed method review of behaviour changes resulting from marketing strategies targeted at high sugar food and non-alcoholic drink. Public Health England Report. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/470174/Annexe_3._Marketing_evidence_review.pdf

This output was supported by funding listed in [3.1].

[3.3] Mead E, Batterham AM, Atkinson G, Ells LJ. 2016. Predicting future weight status from measurements made in early childhood: A novel longitudinal approach applied to millennium cohort study data. Nutrition and Diabetes. 6, e200. DOI: 10.1038/nutd.2016.3 .Cited 11 times (Web of Science).

[3.4] Axon E, Atkinson G, Richter B, Metzendorf MI, Baur L, Finer N, Corpeleijn E, O'Malley C, Ells LJ. 2016. Drug interventions for the treatment of obesity in children and adolescents.

Cochrane Database of Systematic Reviews. 11. Art. No.: CD012436. https://doi.org/10.1002/14651858.CD012436. Cited 37 times (Web of Science). Selected for REF2021.

[3.5] Visram S, Crossley SJ, Cheetham M, Lake A. 2017. Children and young people's perceptions of energy drinks: A qualitative study. PloS One. 12:11, e0188668. https://doi.org/10.1371/journal.pone.0188668. Cited 14 times (Web of Science)

4. Details of the impact (indicative maximum 750 words)

The mixed methods evidence reviews conducted and co-produced through a secondment with Public Health England (PHE) have directly informed the national PHE sugar reduction report published in October 2015 [5.1]. The research [3.1, 3.2] was published within the report as Annexes 2 and 3 and underpinned the specific recommendations for a national sugar tax and changes to marketing and advertising regulations for products aimed at children [5.1]. Drawing on insights from Annexe 2 [3.1], the PHE sugar reduction report states:

> 'Taxes mainly on sugar sweetened drinks have been introduced in a number of countries either for revenue raising or as a way of influencing consumption levels. The latter approach is supported by a number of economic modelling studies…A table setting out details of the level of taxes applied in different countries, and the products that are subject to this tax, is included in Annexe 2 (p. 14-16). Data on the effectiveness of these measures, while not always robustly evaluated, suggests that reductions in sales have been seen as a result of the imposition of taxes in Norway, Finland, Hungary, France and Mexico. Following the introduction of a tax on sugar sweetened drinks of 10% in Mexico, an overall average 6% reduction in purchases of sugar sweetened drinks was seen in 2014, with higher reductions in purchasing of around 9% on average being seen in lower socioeconomic households. Outcomes from the triangulation of results from the primary research and stakeholder interviews show consistency' [5.1, p. 17-23].

The PHE sugar reduction report lists eight 'areas for action' given the evidence. The fifth of these was based directly on the underpinning research [3.1]: '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 [5.1, p. 7-8].

Consequent to this recommendation, in March 2016 the UK Government (HM Treasury) announced the Soft Drinks Industry Levy (sugar tax), to take effect from 6 April 2018. In advance of the implementation of the levy, over 50% of manufacturers had voluntarily reduced the sugar content of their soft drinks since 2016 – equivalent to 45,000,000kg of sugar annually [5.2]. The levy was GBP0.24 per litre of drink if it contains 8g of sugar per 100ml or GBP0.18 per 1l of drink if it contains between 5–8g of sugar per 100ml. The tax was expected to raise approximately GBP240,000,000 annually, with the funds destined for the Primary Sports Premium, the creation of a Healthy Pupils Capital Fund to help schools upgrade their sports facilities and PE equipment, and to support healthy school breakfast clubs [5.2]. Importantly, a controlled interrupted time series analysis of sugar content, price, product size, and number of available soft drinks in the UK before and after the announcement of the sugar tax concluded that the sugar tax incentivised manufacturers to reduce sugar in soft drinks and could reduce population exposure to liquid sugars and associated health risks [5.3]. In short, this co-produced research [3.1] led directly to co-produced impact that resulted in the implementation of the sugar tax [5.2] leading to a reduction in the sugar content of soft drinks and potential benefits to public health (to be evaluated in future longitudinal studies) [5.1, 5.2, 5.3].

The mixed methods review of behaviour changes resulting from marketing strategies targeted at high sugar food and non-alcoholic drink [3.2] also informed the PHE sugar reduction report impact [5.1] directly. Referring to Annexe 3 [3.2] the report states: 'the evidence demonstrates that although TV remains a dominant marketing technique effective at influencing food preferences, many different types of marketing – including advergames, advertising, use of characters and spokespeople, branding, product size, supermarket product placement and

discounting – can all influence preference for high sugar product selection or consumption' [5.1, p.20].

Based directly on this underpinning research, the second of the eight areas for action in the PHE sugar reduction report was to: 'Significantly reduce opportunities to market and advertise high sugar food and drink products to children and adults across all media including digital platforms and through sponsorship' [5.1, p.7]. This recommendation led to a full public consultation and the subsequent announcement of new rules banning the advertising of high fat, salt, or sugar (HFSS) food or drink products in children's media, or in other media where children make up over 25% of the audience, taking effect 1 July 2017 [5.4]. The rules apply across all non-broadcast media including in print, cinema and, crucially, online and in social media. The rules included a ban on the use of promotions, licensed characters, and celebrities popular with children to advertise HFSS products.

Research on the tracking of weight status in children, coproduced with Public Health England [3.3], resulted in in a national case study that evaluated changes in the weight status of children between the first and final years of primary school using data from the National Child Measurement Programme (NCMP) in four local authorities in England between 2006-2007 and 2014-2015 [5.5]. This case study directly informed the protocol developed by NHS digital to analyse the linked data for the entire NCMP dataset. In the case study, it states: 'the most recent tracking analysis was conducted using the Millennium Cohort Study (MCS) data (Mead, 2016), and used ordinal regression to derive the predicted probability of an 11-year-old child becoming underweight, healthy weight, overweight, obese or severely obese from their weight status at age 5…The study provides a robust and easily interpreted methodology that could be applied to other longitudinal datasets, such as the NCMP' [5.5, p.11]. In the Data Analysis section of Appendix 1 of the report, there are direct references to our underpinning research [3.3] and to the analysis code [5.5, p.41]. Making the code open access facilitated direct use by Public Health England/ NHS Digital, as well as reproducibility efforts and application to any longitudinal data set with an ordinal outcome [5.6].

Our Cochrane Review of Drug Interventions for the Treatment of Obesity in Children and Adolescents directly informed the American Society for Metabolic and Bariatric Surgery (ASMBS) Pediatric Committee guidelines. Citing [3.4] the guidelines concluded: 'overview of pharmaceuticals: medications have a useful role as adjunct therapy for the treatment of adolescents with severe obesity who undergo MBS. The medication choice, dosage, and timing will require further research in the adult and pediatric populations' [5.7, p. 893].

Our work has also contributed to the UK government's proposed ban on the sale of sugar and caffeine 'energy drinks' to Under-16s. In March 2018, the UK Science and Technology Select Committee launched an inquiry into energy drinks, directly referencing the underpinning research [3.5] [5.8]. In June 2018, Cheetham's research, along with other evidence, was presented to the Select Committee by Amelia Lake (who joined Teesside University in November 2018) [5.9]. Later the same month, the UK Government's Green Paper was published proposing a ban on the sale of energy drinks to under children under 16-years old [5.10]. One of the key findings of the research [3.5] was cited directly in the Green Paper: 'evidence tells us that one of the reasons energy drinks are so appealing to children is that they are often cheaper than other soft drinks; in some outlets it is possible to buy four 250ml cans of energy drink for £1' [5.10, p. 15]. In response to the Green Paper, in 2018 all the major UK supermarkets (Aldi, Asda, Boots, Lidl, Morrisons, Sainsbury's, Tesco, the Co-Op Group and Waitrose) introduced voluntary bans on the sale of energy drinks to under 16s [5.11]. In summary, the underpinning research and its presentation at the Select Committee stimulated policy discussion and directly informed the Green Paper proposing a ban on sales of 'energy drinks' to children and young people, resulting in a voluntary ban in the major UK supermarkets.

5. Sources to corroborate the impact (indicative maximum of 10 references)

[5.1] Report (pdf and link). Public Health England. 2015. Sugar reduction: The evidence for action. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/470179/Sugar_reduction_The_evidence_for_action.pdf

[5.2] News Item (pdf and link). UK Government. 6 April 2018. Soft Drinks Industry Levy comes into effect (6 April 2018). Available at: https://www.gov.uk/government/news/soft-drinks-industry-levy-comes-into-effect

[5.3] Research Paper (pdf). Scarborough P, Adhikari V, Harrington RA, Elhussein A, Briggs A, Rayner M, Adams J, Cummins S, Penney T, White M. 2020. 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 Medicine. 17(2): e1003025. https://doi.org/10.1371/journal.pmed.1003025.

[5.4] Statement (pdf and link). Advertising Standards Agency. 2016. Food and soft drink advertising to children consultation and regulatory statement (CAP). Available at: https://www.asa.org.uk/resource/food-and-soft-drink-advertising-to-children-consultation.html

[5.5] Report (pdf and link). Copley V, Ells L, Bray C, Strugnell C, Mead E, Taylor R, Manners R, Johal G and Perkins P. 2017. Changes in the weight status of children between the first and final years of primary school. Public Health England. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/609093/NCMP_tracking_report.pdf

[5.6] Open access analysis code linked to underpinning research output 3.3 and impact 5.5 (pdf and link). Available at: https://static-content.springer.com/esm/art%3A10.1038%2Fnutd.2016.3/MediaObjects/41387_2016_BFnutd20163_MOESM246_ESM.docx

[5.7] Research Paper (pdf). Pratt JSA, Browne A, Browne NT, Bruzoni M, Cohen M, Desai A, Inge T, Linden BC, Mattar SG, Michalsky M et al. 2018. American Society for Metabolic and Bariatric Surgery (ASBMS) pediatric metabolic and bariatric surgery guidelines, 2018. Surgery for Obesity and Related Diseases. 14:7, 882-901.

[5.8] News Item (pdf and link). Parliament UK. 2018. Energy drinks inquiry launched. Available at: https://old.parliament.uk/business/committees/committees-a-z/commons-select/science-and-technology-committee/news-parliament-2017/energy-drinks-launch-17-19/

[5.9] Parliament TV (video download and link). 2018. Study findings presented to Science and Technology Select Committee (12 June 2018): https://parliamentlive.tv/Event/Index/0e3e78d8-a516-4005-b897-8be0857c6801

[5.10] UK Government Green Paper (pdf and link). 2018. Childhood obesity: a plan for action. Paper proposes a ban on the sale of energy drinks to under 16s (research referenced on page 15, note 21). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/718903/childhood-obesity-a-plan-for-action-chapter-2.pdf

[5.11] Report (pdf and link). House of Commons Science and Technology Committee. 2018. Energy Drinks and Children, Thirteenth Report of Session 2017–19. Available at: https://publications.parliament.uk/pa/cm201719/cmselect/cmsctech/821/821.pdf