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SUPPORT FOR, AND PERCEIVED EFFECTIVENESS OF, THE UK SOFT DRINKS INDUSTRY LEVY AMONGST UK ADULTS: CROSS-SECTIONAL ANALYSIS OF THE INTERNATIONAL FOOD POLICY SURVEY

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3 **SUPPORT FOR, AND PERCEIVED EFFECTIVENESS OF, THE UK SOFT DRINKS INDUSTRY LEVY AMONGST**
4 **UK ADULTS: CROSS-SECTIONAL ANALYSIS OF THE INTERNATIONAL FOOD POLICY SURVEY**
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ABSTRACT

Objectives To answer four questions: What are attitudes, knowledge and social norms around sugar-sweetened beverages (SSBs)? What are current levels of trust in messages on SSBs? What is current support for, and perceived effectiveness of, the UK Soft Drinks Industry Levy (SDIL)? What is the association between attitudes, knowledge, social norms, trust, SSB consumption and socio-demographic factors; and support for, and perceived effectiveness of, the SDIL?

Design Cross-sectional on-line survey.

Setting UK

Participants UK respondents to the 2017 International Food Policy Study aged 18-64 years who provided information on all variables of interest (n=3104).

Outcome measures Self-reported perceived effectiveness of, and support for, the SDIL.

Results Most participants supported the SDIL (70%), believed it will be effective (71%), had a positive attitude to SSBs (62%), had knowledge of the link between SSBs and obesity (90%), and trusted messages from health experts (61%), but not those from the food and beverage industry (73%). Nearly half (46%) had negative social norms about drinking SSBs. In adjusted models, older age, non-consumption of SSBs, social norms to not drink SSBs, knowledge of the link between SSBs and obesity and trust in health expert messages were associated with greater support for the SDIL, whereas having dependent children and trusting messages from the food and beverage industry were associated with less support. In adjusted models, older age was associated with lower perceived effectiveness of the SDIL, whereas social norms to not drink SSBs, negative attitudes to SSBs, and trusting messages from health experts and the food and beverage industry were associated with greater perceived effectiveness.

Conclusions There was strong support for the SDIL and belief that it will be effective. Those with more 'public health' orientated norms and trust were generally more likely to support the SDIL or believe that it will be effective.

Keywords: taxation, soda tax, public health, attitudes, nutrition & dietetics

STRENGTHS AND LIMITATIONS OF THE STUDY

- We used a large, population representative sample.
- We were careful to present the SDIL as an intervention targeted at manufacturers rather than consumers, with revenues ear-marked for health-promotion activities.
- This is a cross-sectional analysis and we cannot be sure of the direction of causation between putative explanatory variables and outcomes.
- Whilst all have strong face validity, we have not explored other aspects of validity or reliability of any of the measures used; in many cases it would be hard to know what the 'gold standard' measure should be.
- A high proportion of participants who completed the survey were included in the analysis, but we do not know the response rate.

INTRODUCTION

In his March 2016 Budget Statement, the UK Chancellor of the Exchequer (minister of finance) announced a soft drinks industry levy (SDIL) to be implemented in April 2018.[1] The levy is imposed on industries importing or manufacturing sugar-sweetened beverages (SSBs) and includes two 'tiers'. Drinks with $\geq 8\text{g}$ of sugar per 100ml are charged £0.24 per litre and those with $\geq 5\text{g}$ but $< 8\text{g}$ per 100ml are charged £0.18 per litre. Alcoholic drinks, milk-based drinks and pure fruit juices are exempt irrespective of sugar content. The Chancellor stated that revenue raised would be spent on school sport and school breakfast clubs. An explicit aim of announcing the levy two years in advance of implementation, and defining two levy tiers, was to provide time for manufacturers to reformulate.[1] The nature and intent of the SDIL makes it unique amongst international SSB taxes.

The success or failure of policy interventions is often the result of actions and reactions by many stakeholders including government, civil society, industry, the health sector and consumers. In particular support for the SDIL may both be influenced by the SDIL and modify its effectiveness.

More intrusive public health interventions, like food taxes, generally receive lower levels of public support than less intrusive ones, like information giving.[2] Support for hypothetical SSB taxes has been reported to range from 36-60%.[3-17] Support generally increases when it is proposed that the revenue raised would be used for health promoting purposes.[11 12 18 19]

Previous work has explored differences in support for SSB taxes according to participant socio-demographic characteristics, but findings are not consistent. For example, support has been varyingly reported as higher in younger people,[3 17 20] higher in older people,[18] and not associated with age.[5 10] Associations between support for SSB taxes and both SSB consumption and markers of socio-economic position are similarly variable.[3 5 8 16 18 20] Fewer studies have explored psychological correlates of support for SSB taxes, such as attitudes, social norms, knowledge and trust. Those who felt that SSBs were a major (but not minor) contributor to childhood obesity in the USA were more likely to support an SSB tax.[5] Although trust in government was not associated with support in either the UK or USA,[10] more favourable assessments of soft drinks companies were associated with lower support in the USA.[20]

One reason for low support for SSB taxes commonly found in qualitative work is low perceived effectiveness of small changes in price.[6 7 11 12 19] Perceived effectiveness is less studied in quantitative studies, but has been found to range from 39-58%.[5 12 18] Perceived effectiveness was

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3 found to be an important correlate of support in one quantitative study,[10] and has also been reported
4 to be higher in older people and those with more education; but lower in those consuming more
5 SSBs.[18]
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9 The great majority of work in this area has focused on hypothetical taxes. As support for more intrusive
10 public health interventions often increases after implementation,[2] support for hypothetical SSB taxes
11 may misrepresent support for 'real' taxes. To date, we are aware of only one study that has explored
12 public perceptions of a real tax.[18] This study was conducted in France where an excise tax applies to
13 all sweetened drinks, including those sweetened with artificial sweeteners. Given the difference
14 between the French tax and SSB taxes, which are more specific to drinks sweetened with sugar, the
15 French findings may not be generalisable.
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21 In this study we explored both socio-demographic and psychological correlates of support for, and
22 perceived effectiveness of, a real SSB tax. Using data from UK adults collected 20 months after
23 announcement and four months before implementation of the SDIL, our specific research questions
24 were: 1. What are current attitudes, knowledge and social norms around SSBs? 2. What are current
25 levels of trust in messages on SSBs from different institutions? 3. What is current support for, and
26 perceived effectiveness of, the SDIL? 4. What is the association between attitudes, knowledge, social
27 norms, trust, SSB consumption and socio-demographic factors; and support for, and perceived
28 effectiveness of, the SDIL?
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34 35 **METHODS**

36 37 **Sampling, recruitment and data collection**

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39 Data were from UK participants in Wave 1 of the International Food Policy Study, conducted in Australia,
40 Canada, Mexico, the United Kingdom and the United States. Data were collected via self-completed
41 web-based surveys in December 2017 with adults aged 18-64 years. Respondents were recruited
42 through Nielsen Consumer Insights Global Panel and their partners' panels. Email invitations (with a
43 unique link) were sent to a random sample of panelists (after targeting for age and country criteria);
44 panelists known to be ineligible were not invited. The mean survey time across countries was 33
45 minutes.
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51 Respondents provided consent prior to completing the survey. Respondents received remuneration in
52 accordance with their panel's usual incentive structure (e.g., points-based or monetary rewards, or
53 chances to win prizes). The study was reviewed by and received ethics clearance through a University of
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3 Waterloo Research Ethics Committee (ORE# 21460). A full description of the study methods can be
4 found in the International Food Policy Study: Technical Report – Wave 1 (2017) at
5 www.foodpolicystudy.com/methods.
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8 **Variables used in the analysis**

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10 The variables used in the analysis, the survey items they were derived from, response options and how
11 response options were collapsed for analysis are described in Table 1.
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14 Alongside single-item measures of attitudes, knowledge, and social norms related to sugary drinks; we
15 included single items measures of trust in advice on sugary drinks from health experts and the food and
16 beverage industry; and single item measures of support for, and perceived effectiveness of, the SDIL. As
17 previous research has indicated that the acceptability of food taxes varies with the stated intentions of
18 these,[11 12 18 19] we included a preamble to the questions about support for, and perceived
19 effectiveness of, the SDIL outlining the intention of the levy and the stated use of revenue generated.
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23 Sociodemographic variables considered were age in years, sex at birth, whether or not participants had
24 children and socio-economic position. Parental status was a potentially important variable because the
25 SDIL is included as a flagship component of England's Childhood Obesity Plan and has particularly been
26 framed in terms of potential benefits to children.[1 21] Socio-economic position was measured using
27 participants' highest educational qualification and perceived income sufficiency.
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34 The BFQ is a 7-day food record that assesses consumption for 17 beverage categories, including caloric
35 and non-caloric beverages.[22] For each beverage category, respondents report the number of drinks
36 and the usual portion size, using category-specific images of beverage containers, adapted from the
37 ASA24 dietary recall.[23] Participants who reported any consumption of regular fizzy drinks (including
38 alcoholic drinks that contained regular fizzy drinks as a mixer), sweetened fruit drinks, sports drinks, or
39 energy drinks over the previous seven days were considered SSB consumers in the analysis.
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45 **Inclusion criteria**

46 UK resident participants in wave 1 of the International Food Policy Survey, aged 18-64 years, who
47 correctly responding to a data integrity question in which participants were asked to identify the current
48 month, and provided usable information on all other variables of interest were included in the analysis.
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Table 1. Description of items and response options used in the analysis

Concept	Item wording (where applicable)	Response options	
		All	Used in analysis
Age	How old are you?	In years	In years
Sex	What sex were you assigned at birth, meaning on your original birth certificate?	Female	Female
		Male	Male
Education	What is the highest level of education you have completed?	Qualifications not listed below, free-text equivalents, Don't Know, Refuse to answer	≤School leaving
		NVQ Level 4-5, HNC, HND, RSA Higher Diploma, BTEC Higher Level, Degree, Higher Degree, free-text equivalents	>School leaving
Income sufficiency	How easy is it to make ends meet?	Neither easy nor difficult, Difficult, Very difficult, Don't know, Refuse to answer	Not easy
		Very easy, Easy	Easy
Children	Do you have any children (including step-children or adopted children) under the age of 18?	No, Don't know, Refuse to answer	No
		Yes	Yes
SSB consumption	[Calculated from Beverage Frequency Questionnaire: reported consumption over last 7 days]	Any consumption of non-diet Fizzy drinks, Sweetened fruit juice drinks, Regular sports drinks, Regular energy drinks, or Spirits with mixers that have calories	Consumers
		No consumption of above	Non-consumers
Social norms	People important to me try not to drink sugary drinks	Neither agree nor disagree, Disagree, Strongly disagree, Don't know, Refuse to answer	Not agree
		Strongly agree, Agree	Agree
Attitudes	Sugary drinks taste good	Strongly agree, Agree	Agree
		Neither agree nor disagree, Disagree, Strongly disagree, Don't know, Refuse to answer	Not agree
Knowledge	Frequently drinking sugary drinks increases the risk of obesity	False, Don't know, Refuse to answer	Not true
		True	True
Expert trust	I trust messages from health experts on sugary drinks	Neither agree nor disagree, Disagree, Strongly disagree, Don't know, Refuse to answer	Not agree
		Strongly agree, Agree	Agree
Industry trust	I trust messages from the food and beverage industry on sugary drinks?	Neither agree nor disagree, Disagree, Strongly disagree, Don't know, Refuse to answer	Not agree
		Strongly agree, Agree	Agree
Support	In 2018 a new sugary drink tax will be introduced in the UK. This aims to encourage manufacturers to reduce the sugar in drinks. The money will be spent on breakfast clubs, and sports in primary schools. Do you support or oppose this policy?	Strongly support, Support	Support
		Oppose, Strongly oppose, Don't know, Refuse to answer	Oppose
Effectiveness	Preamble as above. How effective do you think these kinds of policies are?	Somewhat effective, Mostly effective, Very effective	Effective
		Not at all effective, Don't know, Refuse to answer	Not effective

Analysis

Data were weighted with post-stratification sample weights constructed using population estimates from the UK census based on age group, sex and region. These sample weights were used throughout the analysis to reduce the effects of non-response and selection bias and return the sample to population representativeness.

Descriptive statistics were used to quantify all variables of interest. Logistic regression models were fitted to explore associations between other variables and support for, and perceived effectiveness of, the SDIL. We used separate models to explore support for the SDIL and perceived effectiveness of the SDIL where support for, or perceived effectiveness of, the SDIL were the outcome variables and all other variables were included as explanatory variables. Unless otherwise noted, adjusted odds ratios (and 95% confidence intervals) of support for, or perceived effectiveness of, the SDIL are presented adjusted for all other variables included.

RESULTS

Of 4276 who took part in the in the UK arm of the International Food Policy Survey in December 2017, 4047 (95%) correctly responded to the data integrity question. Of these, 3104 (77%) provided complete data on all variables of interest and were included the analysis.

Characteristics of the analytical sample (after applying survey weights) are described in Table 2.

Participants had a mean age of 38 (standard deviation 13) years, with a good balance across sex at birth (48% female). The highest level of education that most participants had achieved was the equivalent of school-leaving or lower and around two thirds (61%) did not find it easy to make ends meet. Just over one third (37%) of participants had children under the age of 18 years, and just less than half (47%) reported consuming SSBs in the last seven days.

Around half of participants (54%) agreed that people important to them try not to drink SSBs (social norms), around two thirds (62%) that SSBs taste good (attitudes), and 90% believed that frequently consuming SSBs increases the risk of obesity (knowledge). Whilst more than half (61%) of respondents trusted messages from health experts on SSBs, only one quarter (27%) trusted messages from the food and beverage industry.

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2
3 Table 3 shows the results of logistic regression analyses of associations between socio-demographics,
4 social norms, attitudes, knowledge and trust, and perceived support for, and effectiveness of, the SDIL –
5 adjusted for all other variables in the models.
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9 In adjusted models, older participants were more likely to support the SDIL, but were less likely to
10 consider it effective. Those with dependent children and those who trusted messages from the food and
11 beverage industry on sugary drinks were less likely to support the SDIL. Non-consumers of SSBs, those
12 with social norms to not drink SSBs, those with knowledge of the association between SSBs and
13 obesity, and those who trust messages from health experts on sugary drinks were more likely to support
14 the SDIL than other. Those with high social norms around not drinking SSBs, less positive attitudes to
15 sugary drinks, and those who trusted messages on sugary drinks from health experts and from the food
16 and beverage industry were more likely to consider the SDIL would be effective. There were no
17 differences in support for or perceived effectiveness of the SDIL by sex, education or perceived income
18 sufficiency.
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Table 2. Weighted characteristics of UK participants in the International Food Policy Survey, Dec 2017

Concept	Question wording (where applicable)	Response category	n	%
Sex	What sex were you assigned at birth, meaning on your original birth certificate?	Female	1497	48
		Male	1607	52
Education	What is the highest level of education you have completed?	A-Levels or lower	1896	61
		> A-Levels	1208	39
Income sufficiency	How easy is it to make ends meet?	Not easy	1905	61
		Easy	1199	39
Children	Do you have any children (including step-children or adopted children) under the age of 18?	No	1963	63
		Yes	1141	37
SSB consumption	Consumed regular fizzy drinks, sweetened fruit drinks, sports drinks, energy drinks in last 7 days	Consumers	1473	47
		Non-consumers	1631	53
Social norms	People important to me try not to drink sugary drinks	Not agree	1416	46
		Agree	1688	54
Attitudes	Sugary drinks taste good	Agree	1938	62
		Not agree	1166	38
Knowledge	Frequently drinking sugary drinks increases the risk of obesity	Not true	322	10
		True	2782	90
Expert trust	I trust messages from health experts on sugary drinks	Not agree	1213	39
		Agree	1891	61
Industry trust	I trust messages from the food and beverage industry on sugary drinks	Not agree	2267	73
		Agree	837	27
Support	In 2018 a new sugary drink tax will be introduced in the UK. This aims to encourage manufacturers to reduce the sugar in drinks. The money will be spent on breakfast clubs, and sports in primary schools. Do you support or oppose this policy?	Support	2167	70
		Oppose	937	30
Effectiveness	Preamble as above. How effective do you think these kinds of policies are?	Effective	2214	71
		Not effective	890	29

Table 3. Adjusted* odds ratios (95% confidence intervals) of characteristics associated with support for, and perceived effectiveness of, the SDIL

Concept	Question wording (where applicable)	Response category	Support SDIL, n (%)	Adjusted OR (95% CI) of SDIL support	SDIL effective, n (%)	Adjusted OR (95% CI) of SDIL effectiveness
Age	How old are you?	Years	NA	1.01 (1.00 to 1.02)	NA	0.99 (0.98 to 0.99)
Sex	What sex were you assigned at birth, meaning on your original birth certificate?	Female	1083 (72)	Reference	1074 (72)	Reference
		Male	1084 (67)	(0.72 to 1.05)	1140 (71)	1.03 (0.85 to 1.25)
Education	What is the highest level of education you have completed?	A-Levels or lower	1297 (68)	Reference	1352 (71)	Reference
		> A-Levels	870 (72)	1.03 (0.85 to 1.26)	862 (71)	0.90 (0.73 to 1.10)
Income sufficiency	How easy is it to make ends meet?	Not easy	1300 (68)	Reference	1351 (71)	Reference
		Easy	867 (72)	1.01 (0.83 to 1.24)	862 (72)	1.02 (0.83 to 1.25)
Dependent children	Do you have any children (including step-children or adopted children) under the age of 18?	No	1425 (73)	Reference	1369 (70)	Reference
		Yes	741 (65)	0.81 (0.67 to 0.99)	845 (74)	1.16 (0.94 to 1.43)
SSB consumption	Consumed regular fizzy drinks, sweetened fruit drinks, sports drinks, energy drinks in last 7 days	Consumers	925 (63)	Reference	1030 (70)	Reference
		Non-consumers	1241 (76)	1.57 (1.28 to 1.91)	1184 (73)	1.21 (0.99 to 1.48)
Social norms	People important to me try not to drink sugary drinks	Not agree	901 (64)	Reference	952 (67)	Reference
		Agree	1265 (75)	1.39 (1.15 to 1.70)	1262 (75)	1.25 (1.03 to 1.53)
Attitudes	Sugary drinks taste good	Agree	1304 (67)	Reference	1355 (70)	Reference
		Not agree	863 (74)	1.10 (0.89 to 1.36)	859 (74)	1.31 (1.07 to 1.61)
Knowledge	Frequently drinking sugary drinks increases the risk of obesity	Not true	142 (44)	Reference	217 (67)	Reference
		True	2025 (73)	2.34 (1.74 to 3.16)	1997 (72)	1.06 (0.77 to 1.45)
Expert trust	I trust messages from health experts on sugary drinks	Not agree	748 (62)	Reference	753 (62)	Reference
		Agree	1419 (75)	2.01 (1.63 to 2.49)	1461 (77)	1.86 (1.51 to 2.28)
Industry trust	I trust messages from the food and beverage industry on sugary drinks	Not agree	1636 (72)	Reference	1547 (68)	Reference
		Agree	531 (63)	0.55 (0.44 to 0.69)	667 (80)	1.37 (1.08 to 1.75)

*All results are adjusted for all other variables listed; SDIL = soft drinks industry levy; **BOLD** indicates statistically significant at the p<0.05 level

DISCUSSION

Summary of findings

To our knowledge, this is the first study of a range of socio-demographic, consumption and psychological correlates of both support for, and perceived effectiveness of, an SSB tax. Unlike previous studies, our research was conducted in the context of a 'real', rather than hypothetical, SSB tax. We found that the majority of UK adults aged 18-64 years were supportive of the SDIL and believe it will be effective, have a positive attitude to SSBs, have good knowledge about the links between SSBs and obesity, and trust messages from health experts, but not the food and beverage industry, about sugary drinks. Around half reported social norms about not drinking SSBs.

Social norms towards not consuming SSBs and trusting health expert messages on SSBs were both associated with greater support for and perceived effectiveness of the SDIL. In addition, having dependent children and trusting messages from the food and beverage industry on sugary drinks were associated with less support for the SDIL, whilst older age, not consuming SSBs and knowledge of the link between sugary drinks and obesity were associated with greater support. Older age was associated with lower perceived effectiveness of the SDIL, and more negative attitudes towards sugary drinks were associated with greater perceived effectiveness. There were no associations between gender, education or income sufficiency and either support for, or perceived effectiveness of, the SDIL.

Strengths and weaknesses of methods

Key strengths of the analysis are the use of a large, population representative, sample; inclusion of a range of socio-demographic, consumption and psychological variables; and the context of a 'real' SSB tax announced 20 months before data collection (although not implemented until four months after). Given previous findings that support is greater when revenues are used for health-promoting activities,[11 12 18 19] we were careful to present the SDIL as an intervention targeting manufacturers rather than consumers, with revenues ear-marked for health-promotion activities. Social desirability bias may be less likely to occur in more anonymous settings such as on-line surveys.[24]

Participants were not recruited using probability-based sampling meaning the findings do not provide nationally representative estimate, although this was reduced by applying sampling weights. The results are, therefore, likely to be generalizable to the UK, but may not be more widely generalizable. This is a cross-sectional analysis and we cannot be sure of the direction of causation between putative explanatory variables and outcomes. Nor have we explored more complicated causal networks linking

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3 the variables included. All variables were self-reported. Whilst all have strong face validity, we have not
4 explored other aspects of validity or reliability of any of the measures used. However, all were derived
5 from existing instruments in some cases it would be hard to know what a 'gold standard' measure
6 should be. Although a high proportion of participants who completed the survey were included in the
7 analysis, we do not know what proportion of those invited to participate were included.
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10 **Comparison to previous results and interpretation of findings**

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12 Most people in our survey (90%) knew that there was an association between SSB consumption and
13 obesity. This reflects previous findings where 89-91% agreed that SSB consumption increased the risk of
14 obesity.[3 5] Despite this, there were also high positive attitudes towards SSBs with almost two-third of
15 respondents agreeing that sugary drinks taste good, and less than half had social norms about not
16 drinking SSBs. In the UK, SSBs appear to remain a pleasurable and positive part of life, despite their
17 known health harms.
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21 Similar to previous research which found that only 30% of Americans gave favourable ratings to soda
22 companies,[20] we found low levels of trust in messages about SSBs from the food and beverage
23 industry. Levels of trust in similar messages from health experts were higher, but still less than two
24 thirds. Low levels of trust in experts may reflect a general public mistrust of nutritional
25 epidemiology.[25]
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29 Despite less than perfect trust in messages about SSBs from health experts, there was a high level of
30 support for the SDIL (70%) and even higher belief that it would be effective (71%). This is higher than
31 previous research which, as far as we are aware, reports maximum support of 60%.[8 26] Even in the
32 context of an existing tax on sweetened drinks in France, only 49% supported the tax.[18] The high level
33 of support we found may reflect the combined effect of previous findings that support for public health
34 interventions often increases after implementation,[2] and that support for SSB taxes is often greater
35 when revenues are used for health-promoting activities.[11 12 18 19 26 27] Although the SDIL had not
36 been implemented at the time of data collection, impending implementation had been known of for 20
37 months. Further, we were careful to inform participants that SDIL revenues would be spent on school
38 breakfast clubs and sports activities. In addition, the SDIL is unique in being targeted at manufacturers
39 rather than consumers, and intended to promote reformulation rather than necessarily reduce
40 consumption.[1] Previous qualitative work has found that those who do not support generic SSB taxes
41 often cite excessive personal taxation and government intrusion into individual's lives as reasons for
42 this.[11 28] This is much less applicable to the SDIL than to consumer-facing SSB taxes.
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3 Low acceptability of SSB taxes has previously been ascribed to a perception that they are unlikely to
4 achieve significant behaviour change or public health benefit.[11 28] Previous research has reported
5 perceived effectiveness (to improve population health or decrease SSB consumption) in the range of 39-
6 58%.[5 12 18] In contrast, we found much higher levels of perceived effectiveness (71%). This may again
7 reflect the unique nature of the SDIL with an explicit intention to change manufacturer, rather than
8 consumer, behaviour – and our focus on effects on industry, rather than consumer, behaviour.
9

10 The pattern of associations between attitudes, social norms, trust and support for, and perceived
11 effectiveness of, the SDIL are, for the most part, intuitive. It might be expected that non-consumers,
12 who are less likely to be negatively financially effected by the tax, would be more supportive. In other
13 contexts, those who stand to gain most from financial incentive interventions are most supportive.[29]
14 Social norms to not drink sugary drinks, negative attitudes towards sugary drinks, greater knowledge
15 about the health harms of sugary drinks, greater trust in health experts and less trust in the food and
16 beverage industry all reflect more ‘public health’ orientated patterns that would be expected to be
17 associated with greater support for, or perceived effectiveness, of the SDIL. As described above,
18 previous research on the association between psychological variables and support for, and perceived
19 effectiveness of, SSB taxes is sparse.
20

21 We did not find that gender or markers of socio-economic position were associated with support for, or
22 perceived effectiveness of, the SDIL in mutually adjusted models. This reflects some, but not all,
23 previous findings.[5 8 10 18 20] Unlike most previous work we included a wide range of socio-
24 demographic, consumption and psychological variables in mutually adjusted models and it may be that
25 gender or socio-economic differences operate entirely through the other variables included in our
26 models.
27

28 **Implications of findings**

29 Many structural public health policies require government action, which may be limited by perceptions
30 concerning public acceptability of such policies – often uninformed by evidence. Greater understanding
31 of public acceptability of a range of structural public health policies, and how this changes over time and
32 the course of implementation, may help to develop strategies to address public concerns and build
33 public support.
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CONCLUSIONS

UK adults tend to have positive attitudes to SSBs and do not necessarily have strong social norms about not drinking SSBs, but they generally recognise the link between SSB consumption and obesity. Trust in messages about SSBs from the food and drinks industry is low, but trust in these messages from health experts is not universally high. There was strong support for the SDIL and belief that it will be effective. Those with more 'public health' orientated norms and trust were generally more likely to support the SDIL or believe that it will be effective.

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COMPETING INTERESTS

None declared

AUTHOR STATEMENT

JA, TP & MW conceived the idea for this paper. DP analysed the data. JA drafted the manuscript. All authors read and provided critical comments on the manuscript and approved the final version. DH conceived the idea for the IFPS, secured funding and developed the first draft of survey. TP led the further development of the UK survey instrument, with input from JA and MW.

DATA SHARING

Data is available directly from the International Food Policy Study team on reasonable request (see www.foodpolicystudy.com).

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For peer review only

Reporting checklist for cross sectional study.

Based on the STROBE cross sectional guidelines.

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Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

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		Reporting Item	Page Number
Title	#1a	Indicate the study's design with a commonly used term in the title or the abstract	1
Abstract	#1b	Provide in the abstract an informative and balanced summary of what was done and what was found	2
Background / rationale	#2	Explain the scientific background and rationale for the investigation being reported	4-5
Objectives	#3	State specific objectives, including any prespecified hypotheses	5
Study design	#4	Present key elements of study design early in the paper	5-6
Setting	#5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5-6
Eligibility criteria	#6a	Give the eligibility criteria, and the sources and methods of selection of participants.	6

1		#7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6
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6	Data sources /	#8	For each variable of interest give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group. Give information separately for for exposed and unexposed groups if applicable.	6
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14	Bias	#9	Describe any efforts to address potential sources of bias	8
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17	Study size	#10	Explain how the study size was arrived at	5-6
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19	Quantitative	#11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	8
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24	Statistical	#12a	Describe all statistical methods, including those used to control for confounding	8
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28		#12b	Describe any methods used to examine subgroups and interactions	n/a
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32		#12c	Explain how missing data were addressed	6
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34		#12d	If applicable, describe analytical methods taking account of sampling strategy	8
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38		#12e	Describe any sensitivity analyses	n/a
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40	Participants	#13a	Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed. Give information separately for for exposed and unexposed groups if applicable.	8
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48		#13b	Give reasons for non-participation at each stage	8
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51		#13c	Consider use of a flow diagram	n/a
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53	Descriptive data	#14a	Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders. Give information separately for exposed and unexposed groups if applicable.	10
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5	Outcome data	#15	Report numbers of outcome events or summary measures.	11
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10	Main results	#16a	Give unadjusted estimates and, if applicable, confounder-	11
11			adjusted estimates and their precision (eg, 95% confidence	
12			interval). Make clear which confounders were adjusted for and	
13			why they were included	
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17		#16b	Report category boundaries when continuous variables were	7
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21		#16c	If relevant, consider translating estimates of relative risk into	n/a
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24	Other analyses	#17	Report other analyses done—e.g., analyses of subgroups and	n/a
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28	Key results	#18	Summarise key results with reference to study objectives	12
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31	Limitations	#19	Discuss limitations of the study, taking into account sources of	12-13
32			potential bias or imprecision. Discuss both direction and	
33			magnitude of any potential bias.	
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36	Interpretation	#20	Give a cautious overall interpretation considering objectives,	13-14
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41	Generalisability	#21	Discuss the generalisability (external validity) of the study	12
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BMJ Open

SUPPORT FOR, AND PERCEIVED EFFECTIVENESS OF, THE UK SOFT DRINKS INDUSTRY LEVY AMONGST UK ADULTS: CROSS-SECTIONAL ANALYSIS OF THE INTERNATIONAL FOOD POLICY SURVEY

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Keywords:	taxation, soda tax, PUBLIC HEALTH, attitudes, NUTRITION & DIETETICS

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3 **SUPPORT FOR, AND PERCEIVED EFFECTIVENESS OF, THE UK SOFT DRINKS INDUSTRY LEVY AMONGST**
4 **UK ADULTS: CROSS-SECTIONAL ANALYSIS OF THE INTERNATIONAL FOOD POLICY SURVEY**
5

6
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ABSTRACT

Objectives To answer four questions: What are attitudes, knowledge and social norms around sugar-sweetened beverages (SSBs)? What are current levels of trust in messages on SSBs? What is current support for, and perceived effectiveness of, the UK Soft Drinks Industry Levy (SDIL)? What is the association between attitudes, knowledge, social norms, trust, SSB consumption and socio-demographic factors; and support for, and perceived effectiveness of, the SDIL?

Design Cross-sectional on-line survey.

Setting UK

Participants UK respondents to the 2017 International Food Policy Study aged 18-64 years who provided information on all variables of interest (n=3104).

Outcome measures Self-reported perceived effectiveness of, and support for, the SDIL.

Results Most participants supported the SDIL (70%), believed it will be effective (71%), had a positive attitude to SSBs (62%), had knowledge of the link between SSBs and obesity (90%), and trusted messages from health experts (61%), but not those from the food and beverage industry (73%). Nearly half (46%) had negative social norms about drinking SSBs. In adjusted models, older age, non-consumption of SSBs, social norms to not drink SSBs, knowledge of the link between SSBs and obesity and trust in health expert messages were associated with greater support for the SDIL, whereas having dependent children and trusting messages from the food and beverage industry were associated with less support. In adjusted models, older age was associated with lower perceived effectiveness of the SDIL, whereas social norms to not drink SSBs, negative attitudes to SSBs, and trusting messages from health experts and the food and beverage industry were associated with greater perceived effectiveness.

Conclusions There was strong support for the SDIL and belief that it will be effective. Those with more 'public health' orientated norms and trust were generally more likely to support the SDIL or believe that it will be effective.

Keywords: taxation, soda tax, public health, attitudes, nutrition & dietetics

STRENGTHS AND LIMITATIONS OF THE STUDY

- We used a large, population representative sample.
- We were careful to present the SDIL as an intervention targeted at manufacturers rather than consumers, with revenues ear-marked for health-promotion activities.
- This is a cross-sectional analysis and we cannot be sure of the direction of causation between putative explanatory variables and outcomes.
- Whilst all have strong face validity, we have not explored other aspects of validity or reliability of any of the measures used; in many cases it would be hard to know what the 'gold standard' measure should be.
- A high proportion of participants who completed the survey were included in the analysis, but we do not know the response rate.

INTRODUCTION

In his March 2016 Budget Statement, the UK Chancellor of the Exchequer (minister of finance) announced a soft drinks industry levy (SDIL) to be implemented in April 2018.[1] The levy is imposed on industries importing or manufacturing sugar-sweetened beverages (SSBs) and includes two 'tiers'. Drinks with ≥ 8 g of sugar per 100ml are charged £0.24 per litre and those with ≥ 5 g but < 8 g per 100ml are charged £0.18 per litre. Alcoholic drinks, milk-based drinks and pure fruit juices are exempt irrespective of sugar content. The Chancellor stated that revenue raised would be spent on school sport and school breakfast clubs. An explicit aim of announcing the levy two years in advance of implementation, and defining two levy tiers, was to provide time for manufacturers to reformulate.[1] The nature and intent of the SDIL makes it unique amongst international SSB taxes.

The success or failure of policy interventions is often the result of actions and reactions by many stakeholders including government, civil society, industry, the health sector and consumers. In particular support for the SDIL may both be influenced by the SDIL and modify its effectiveness. More intrusive public health interventions, like food and tobacco taxes, generally receive lower levels of public support than less intrusive ones, like information giving.[2] Support for hypothetical SSB taxes has been reported to range from 36-60%.[3-17]

How a public health intervention is framed may also impact how acceptable it is to stakeholders. The SDIL is specifically framed as a levy on manufacturers, rather than consumers, and as a source of revenue for other health promoting purposes. The importance of framing interventions such that they redefine public health problems has been previously identified.[18] By specifically targeting manufacturers, the SDIL frames excessive SSB consumption, and the resultant health implications, as a problem of drinks manufacturers, rather than consumers. Support for hypothetical food taxes generally increases when it is proposed that the revenue raised would be used for health promoting purposes.[11 12 19 20] There is some wider evidence that public health messages in general framed in terms of gains, rather than losses, to recipients elicit more positive responses from the public.[21] Clearly stating that the SDIL is not targeted at consumers (and hence implying that consumers should not lose) and that revenues will be used for health promotion (and hence implying that consumers stand to gain) may, therefore, increase positive responses and hence support for it. Previous work has explored differences in support for SSB taxes according to participant socio-demographic characteristics, but findings are not consistent. For example, support has been varyingly reported as higher in younger people,[3 17 22] higher in older people,[19] and not associated with age.[5 10] Associations between support for SSB

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3 taxes and both SSB consumption and markers of socio-economic position are similarly variable.[3 5 8 16
4 19 22] Fewer studies have explored psychological correlates of support for SSB taxes, such as attitudes,
5 social norms, knowledge and trust. Those who felt that SSBs were a major (but not minor) contributor to
6 childhood obesity in the USA were more likely to support an SSB tax.[5] Although trust in government
7 was not associated with support in either the UK or USA,[10] more favourable assessments of soft drinks
8 companies were associated with lower support in the USA.[22]
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10 One reason for low support for SSB taxes commonly found in qualitative work is low perceived
11 effectiveness of small changes in price.[6 7 11 12 20] Perceived effectiveness is less studied in
12 quantitative studies, but has been found to range from 39-58%.[5 12 19] Perceived effectiveness was
13 found to be an important correlate of support in one quantitative study,[10] and has also been reported
14 to be higher in older people and those with more education; but lower in those consuming more
15 SSBs.[19]
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17 The great majority of work in this area has focused on hypothetical taxes. As support for more intrusive
18 public health interventions often increases after implementation,[2] support for hypothetical SSB taxes
19 may misrepresent support for taxes that have been announced or implemented. To date, we are aware
20 of only one study that has explored public perceptions of a definite, rather than hypothetical, tax.[19]
21 This study was conducted in France where an excise tax applies to all sweetened drinks, including those
22 sweetened with artificial sweeteners. Given the difference between the French tax and SSB taxes, which
23 are more specific to drinks sweetened with sugar, the French findings may not be generalisable.
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25 In this study we explored both socio-demographic and psychological correlates of support for, and
26 perceived effectiveness of, a definite, rather than hypothetical, SSB tax that has been framed in a unique
27 way. Using data from UK adults collected 20 months after announcement and four months before
28 implementation of the SDIL, our specific research questions were: 1. What are current attitudes,
29 knowledge and social norms around SSBs? 2. What are current levels of trust in messages on SSBs from
30 different institutions? 3. What is current support for, and perceived effectiveness of, the SDIL? 4. What
31 is the association between attitudes, knowledge, social norms, trust, SSB consumption and socio-
32 demographic factors; and support for, and perceived effectiveness of, the SDIL?
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50 **METHODS**

51 The analyses were pre-specified in a protocol.
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53 **Sampling, recruitment and data collection**

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3 Data were from UK participants in Wave 1 of the International Food Policy Study, conducted in Australia,
4 Canada, Mexico, the United Kingdom and the United States. Data were collected via self-completed
5 web-based surveys in December 2017 with adults aged 18-64 years. Respondents were recruited
6 through Nielsen Consumer Insights Global Panel and their partners' panels. Email invitations (with a
7 unique link) were sent to a random sample of panelists (after targeting for age and country criteria);
8 panelists known to be ineligible were not invited. The mean survey time across countries was 33
9 minutes.

10 Respondents provided consent prior to completing the survey. Respondents received remuneration in
11 accordance with their panel's usual incentive structure (e.g., points-based or monetary rewards, or
12 chances to win prizes). The study was reviewed by and received ethics clearance through a University of
13 Waterloo Research Ethics Committee (ORE# 21460). A full description of the study methods can be
14 found in the International Food Policy Study: Technical Report – Wave 1 (2017) at
15 www.foodpolicystudy.com/methods.

16 **Variables used in the analysis**

17 The variables used in the analysis, the survey items they were derived from, response options and how
18 response options were collapsed for analysis are described in Table 1.

19 Alongside single-item measures of attitudes, knowledge, and social norms related to sugary drinks; we
20 included single items measures of trust in advice on sugary drinks from health experts and the food and
21 beverage industry; and single item measures of support for, and perceived effectiveness of, the SDIL. As
22 previous research has indicated that the acceptability of food taxes varies with the stated intentions of
23 these,[11 12 19 20] we included a preamble to the questions about support for, and perceived
24 effectiveness of, the SDIL outlining the intention of the levy and the stated use of revenue generated.

25 Sociodemographic variables considered were age in years, sex at birth, whether or not participants had
26 children and socio-economic position. Parental status was a potentially important variable because the
27 SDIL is included as a flagship component of England's Childhood Obesity Plan and has particularly been
28 framed in terms of potential benefits to children.[1 23] Socio-economic position was measured using
29 participants' highest educational qualification and perceived income sufficiency.

30 The BFQ is a 7-day food record that assesses consumption for 17 beverage categories, including caloric
31 and non-caloric beverages.[24] For each beverage category, respondents report the number of drinks
32 and the usual portion size, using category-specific images of beverage containers, adapted from the

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3 ASA24 dietary recall.[25] Participants who reported any consumption of regular fizzy drinks (including
4 alcoholic drinks that contained regular fizzy drinks as a mixer), sweetened fruit drinks, sports drinks, or
5 energy drinks over the previous seven days were considered SSB consumers in the analysis.
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8 **Inclusion criteria**

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10 UK resident participants in wave 1 of the International Food Policy Survey, aged 18-64 years, who
11 correctly responding to a data integrity question in which participants were asked to identify the current
12 month, and provided usable information on all other variables of interest were included in the analysis.
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14 Data from countries other than the UK were not included as comparable questions on support for, and
15 perceived effectiveness of, the SDIL were not asked of participants from these countries.
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Table 1. Description of items and response options used in the analysis

Concept	Item wording (where applicable)	Response options		Used in analysis
		All		
Age	How old are you?	In years		In years
Sex	What sex were you assigned at birth, meaning on your original birth certificate?	Female		Female
		Male		Male
Education	What is the highest level of education you have completed?	Qualifications not listed below, free-text equivalents, Don't know, Refuse to answer		≤School leaving
		NVQ Level 4-5, HNC, HND, RSA Higher Diploma, BTEC Higher Level, Degree, Higher Degree, free-text equivalents		>School leaving
Income sufficiency	How easy is it to make ends meet?	Neither easy nor difficult, Difficult, Very difficult, Don't know, Refuse to answer		Not easy
		Very easy, Easy		Easy
Children	Do you have any children (including step-children or adopted children) under the age of 18?	No, Don't know, Refuse to answer		No
		Yes		Yes
SSB consumption	[Calculated from Beverage Frequency Questionnaire: reported consumption over last 7 days]	Any consumption of non-diet Fizzy drinks, Sweetened fruit juice drinks, Regular sports drinks, Regular energy drinks, or Spirits with mixers that have calories		Consumers
		No consumption of above		Non-consumers
Social norms	People important to me try not to drink sugary drinks	Neither agree nor disagree, Disagree, Strongly disagree, Don't know, Refuse to answer		Not agree
		Strongly agree, Agree		Agree
Attitudes	Sugary drinks taste good	Strongly agree, Agree		Agree
		Neither agree nor disagree, Disagree, Strongly disagree, Don't know, Refuse to answer		Not agree
Knowledge	Frequently drinking sugary drinks increases the risk of obesity	False, Don't know, Refuse to answer		Not true
		True		True
Expert trust	I trust messages from health experts on sugary drinks	Neither agree nor disagree, Disagree, Strongly disagree, Don't know, Refuse to answer		Not agree
		Strongly agree, Agree		Agree
Industry trust	I trust messages from the food and beverage industry on sugary drinks?	Neither agree nor disagree, Disagree, Strongly disagree, Don't know, Refuse to answer		Not agree
		Strongly agree, Agree		Agree
Support	In 2018 a new sugary drink tax will be introduced in the UK. This aims to encourage manufacturers to reduce the sugar in drinks. The money will be spent on breakfast clubs, and sports in primary schools. Do you support or oppose this policy?	Strongly support, Support		Support
		Oppose, Strongly oppose, Don't know, Refuse to answer		Oppose
Effectiveness	Preamble as above. How effective do you think these kinds of policies are?	Somewhat effective, Mostly effective, Very effective		Effective
		Not at all effective, Don't know, Refuse to answer		Not effective

Analysis

Data were weighted with post-stratification sample weights constructed using population estimates from the UK census based on age group, sex and region. These sample weights were used throughout the analysis to reduce the effects of non-response and selection bias and return the sample to population representativeness.

Descriptive statistics were used to quantify all variables of interest. Logistic regression models were fitted to explore associations between other variables and support for, and perceived effectiveness of, the SDIL. We used separate models to explore support for the SDIL and perceived effectiveness of the SDIL where support for, or perceived effectiveness of, the SDIL were the outcome variables and all other variables were included as explanatory variables. Unless otherwise noted, adjusted odds ratios (and 95% confidence intervals) of support for, or perceived effectiveness of, the SDIL are presented adjusted for all other variables included.

Data were analysed using R version 3.3.1.

Patient and public involvement

Patients and the public were not involved in design, conduct, analysis or interpretation of the study.

RESULTS

Of 4276 who took part in the in the UK arm of the International Food Policy Survey in December 2017, 4047 (95%) correctly responded to the data integrity question. Of these, 3104 (77%) provided complete data on all variables of interest and were included the analysis.

Characteristics of the analytical sample (after applying survey weights) are described in Table 2.

Participants had a mean age of 38 (standard deviation 13) years, with a good balance across sex at birth (48% female). The highest level of education that most participants had achieved was the equivalent of school-leaving or lower and around two thirds (61%) did not find it easy to make ends meet. Just over one third (37%) of participants had children under the age of 18 years, and just less than half (47%) reported consuming SSBs in the last seven days.

Around half of participants (54%) agreed that people important to them try not to drink SSBs (social norms), around two thirds (62%) that SSBs taste good (attitudes), and 90% believed that frequently consuming SSBs increases the risk of obesity (knowledge). Whilst more than half (61%) of respondents

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3 trusted messages from health experts on SSBs, only one quarter (27%) trusted messages from the food
4 and beverage industry.
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7 Table 3 shows the results of logistic regression analyses of associations between socio-demographics,
8 social norms, attitudes, knowledge and trust, and perceived support for, and effectiveness of, the SDIL –
9 adjusted for all other variables in the models.
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13 In adjusted models, older participants were more likely to support the SDIL, but were less likely to
14 consider it effective. Those with dependent children and those who trusted messages from the food and
15 beverage industry on sugary drinks were less likely to support the SDIL. Non-consumers of SSBs, those
16 with social norms to not drinks SSBs, those with knowledge of the association between SSBs and
17 obesity, and those who trust messages from health experts on sugary drinks were more likely to support
18 the SDIL than other. Those with high social norms around not drinking SSBs, less positive attitudes to
19 sugary drinks, and those who trusted messages on sugary drinks from health experts and from the food
20 and beverage industry were more likely to consider the SDIL would be effective. There were no
21 differences in support for or perceived effectiveness of the SDIL by sex, education or perceived income
22 sufficiency.
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Table 2. Weighted characteristics of UK participants in the International Food Policy Survey, Dec 2017 (N = 3104)

Concept	Question wording (where applicable)	Response category	n	%
Sex	What sex were you assigned at birth, meaning on your original birth certificate?	Female	1497	48
Education	What is the highest level of education you have completed?	A-Levels or lower	1896	61
Income sufficiency	How easy is it to make ends meet?	Not easy	1905	61
Children	Do you have any children (including step-children or adopted children) under the age of 18?	No	1963	63
SSB consumption	Consumed regular fizzy drinks, sweetened fruit drinks, sports drinks, energy drinks in last 7 days	Consumers	1473	47
Social norms	People important to me try not to drink sugary drinks	No agree	1416	46
Attitudes	Sugary drinks taste good	Agree	1938	62
Knowledge	Frequently drinking sugary drinks increases the risk of obesity	Not true	322	10
Expert trust	I trust messages from health experts on sugary drinks	No agree	1213	39
Industry trust	I trust messages from the food and beverage industry on sugary drinks	No agree	2267	73
Support	In 2018 a new sugary drink tax will be introduced in the UK. This aims to encourage manufacturers to reduce the sugar in drinks. The money will be spent on breakfast clubs, and sports in primary schools. Do you support or oppose this policy?	Support	2167	70
Effectiveness	Preamble as above. How effective do you think these kinds of policies are?	Effective	2214	71

Table 3. Adjusted* odds ratios (95% confidence intervals) of characteristics associated with support for, and perceived effectiveness of, the SDIL

Concept	Question wording (where applicable)	Response category	Adjusted OR (95% CI) of SDIL support	Adjusted OR (95% CI) of SDIL effectiveness
Age	How old are you?	Years	1.01 (1.00 to 1.02)	0.99 (0.98 to 0.99)
Sex	What sex were you assigned at birth, meaning on your original birth certificate?	Female	Reference	Reference
		Male	(0.72 to 1.05)	1.03 (0.85 to 1.25)
Education	What is the highest level of education you have completed?	A-Levels or lower	Reference	Reference
		> A-Levels	1.03 (0.85 to 1.26)	0.90 (0.73 to 1.10)
Income sufficiency	How easy is it to make ends meet?	Not easy	Reference	Reference
		Easy	1.01 (0.83 to 1.24)	1.02 (0.83 to 1.25)

Dependent children	Do you have any children (including step-children or adopted children) under the age of 18?	No	Reference	Reference
		Yes	0.81 (0.67 to 0.99)	1.16 (0.94 to 1.43)
SSB consumption	Consumed regular fizzy drinks, sweetened fruit drinks, sports drinks, energy drinks in last 7 days	Consumers	Reference	Reference
		Non-consumers	1.57 (1.28 to 1.91)	1.21 (0.99 to 1.48)
Social norms	People important to me try not to drink sugary drinks	Not agree	Reference	Reference
		Agree	1.39 (1.15 to 1.70)	1.25 (1.03 to 1.53)
Attitudes	Sugary drinks taste good	Agree	Reference	Reference
		Not agree	1.10 (0.89 to 1.36)	1.31 (1.07 to 1.61)
Knowledge	Frequently drinking sugary drinks increases the risk of obesity	Not true	Reference	Reference
		True	2.34 (1.74 to 3.16)	1.06 (0.77 to 1.45)
Expert trust	I trust messages from health experts on sugary drinks	Not agree	Reference	Reference
		Agree	2.01 (1.63 to 2.49)	1.86 (1.51 to 2.28)
Industry trust	I trust messages from the food and beverage industry on sugary drinks	Not agree	Reference	Reference
		Agree	0.55 (0.44 to 0.69)	1.37 (1.08 to 1.75)

*All results are adjusted for all other variables listed; SDIL = soft drinks industry levy; **BOLD** indicates statistically significant at the p<0.05 level

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DISCUSSION

Summary of findings

To our knowledge, this is the first study of a range of socio-demographic, consumption and psychological correlates of both support for, and perceived effectiveness of, an SSB tax. Unlike previous studies, our research was conducted in the context of a definite, rather than hypothetical, SSB tax. We found that the majority of UK adults aged 18-64 years were supportive of the SDIL and believe it will be effective, have a positive attitude to SSBs, have good knowledge about the links between SSBs and obesity, and trust messages from health experts, but not the food and beverage industry, about sugary drinks. Around half reported social norms about not drinking SSBs.

Social norms towards not consuming SSBs and trusting health expert messages on SSBs were both associated with greater support for and perceived effectiveness of the SDIL. In addition, having dependent children and trusting messages from the food and beverage industry on sugary drinks were associated with less support for the SDIL, whilst older age, not consuming SSBs and knowledge of the link between sugary drinks and obesity were associated with greater support. Older age was associated with lower perceived effectiveness of the SDIL, and more negative attitudes towards sugary drinks were associated with greater perceived effectiveness. There were no associations between gender, education or income sufficiency and either support for, or perceived effectiveness of, the SDIL.

Strengths and weaknesses of methods

Key strengths of the analysis are the use of a large, population representative, sample; inclusion of a range of socio-demographic, consumption and psychological variables; and the context of a definite, rather than hypothetical, SSB tax announced 20 months before data collection (although not implemented until four months after). Given previous findings that support is greater when revenues are used for health-promoting activities,[11 12 19 20] we were careful to present the SDIL as an intervention targeting manufacturers rather than consumers, with revenues ear-marked for health-promotion activities. Social desirability bias may be less likely to occur in more anonymous settings such as on-line surveys.[26]

Participants were not recruited using probability-based sampling meaning the findings do not provide nationally representative estimate, although this was reduced by applying sampling weights. The results are, therefore, likely to be generalizable to the UK, but may not be more widely generalizable. This is a cross-sectional analysis and we cannot be sure of the direction of causation between putative

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3 explanatory variables and outcomes. Nor have we explored more complicated causal networks linking
4 the variables included. All variables were self-reported. Whilst all have strong face validity, we have not
5 explored other aspects of validity or reliability of any of the measures used. However, all were derived
6 from existing instruments in some cases it would be hard to know what a 'gold standard' measure
7 should be. Although a high proportion of participants who completed the survey were included in the
8 analysis, we do not know what proportion of those invited to participate were included.

13 **Comparison to previous results and interpretation of findings**

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16 Most people in our survey (90%) knew that there was an association between SSB consumption and
17 obesity. This reflects previous findings where 89-91% agreed that SSB consumption increased the risk of
18 obesity.[3 5] Despite this, there were also high positive attitudes towards SSBs with almost two-third of
19 respondents agreeing that sugary drinks taste good, and less than half had social norms about not
20 drinking SSBs. In the UK, SSBs appear to remain a pleasurable and positive part of life, despite their
21 known health harms.

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24 Similar to previous research which found that only 30% of Americans gave favourable ratings to soda
25 companies,[22] we found low levels of trust in messages about SSBs from the food and beverage
26 industry. Levels of trust in similar messages from health experts were higher, but still less than two
27 thirds. Low levels of trust in experts may reflect a general public mistrust of nutritional
28 epidemiology.[27]

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31 Despite less than perfect trust in messages about SSBs from health experts, there was a high level of
32 support for the SDIL (70%) and even higher belief that it would be effective (71%). This is higher than
33 previous research which, as far as we are aware, reports maximum support of 60%.[8 28] Even in the
34 context of an existing tax on sweetened drinks in France, only 49% supported the tax.[19] The high level
35 of support we found may reflect the combined effect of previous findings that support for more
36 intrusive public health interventions such as taxes on food and tobacco often increases after
37 implementation,[2] and that support for SSB taxes is often greater when revenues are used for health-
38 promoting activities.[11 12 19 20 28 29] Although the SDIL had not been implemented at the time of
39 data collection, impending implementation had been known of for 20 months. Further, we were careful
40 to inform participants that SDIL revenues would be spent on school breakfast clubs and sports activities.
41 In addition, the SDIL is unique in being targeted at manufacturers rather than consumers, and intended
42 to promote reformulation rather than necessarily reduce consumption.[1] Previous qualitative work has
43 found that those who do not support generic SSB taxes often cite excessive personal taxation and
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3 government intrusion into individual's lives as reasons for this.[11 30] This is much less applicable to the
4 SDIL than to consumer-facing SSB taxes.

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7 Low acceptability of SSB taxes has previously been ascribed to a perception that they are unlikely to
8 achieve significant behaviour change or public health benefit.[11 30] Previous research has reported
9 perceived effectiveness (to improve population health or decrease SSB consumption) in the range of 39-
10 58%.[5 12 19] In contrast, we found much higher levels of perceived effectiveness (71%). This may again
11 reflect the unique nature of the SDIL with an explicit intention to change manufacturer, rather than
12 consumer, behaviour – and our focus on effects on industry, rather than consumer, behaviour.

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15 Higher support for, and perceived effectiveness of, the SDIL here compared to previous work may also
16 reflect cultural differences between the UK and other countries where previous data has been collected.
17 Unlike previously, we used population weighting which increases confidence that results are population
18 representative. Finally, it is possible that the unique design and framing of the SDIL makes it more
19 acceptable and increases perceived effectiveness compared to previous taxes proposed to research
20 participants.

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23 The pattern of associations between attitudes, social norms, trust and support for, and perceived
24 effectiveness of, the SDIL are, for the most part, intuitive. It might be expected that non-consumers,
25 who are less likely to be negatively financially effected by the tax, would be more supportive. In other
26 contexts, those who stand to gain most from financial incentive interventions are most supportive.[31]
27 Social norms to not drink sugary drinks, negative attitudes towards sugary drinks, greater knowledge
28 about the health harms of sugary drinks, greater trust in health experts and less trust in the food and
29 beverage industry all reflect more 'public health' orientated patterns that would be expected to be
30 associated with greater support for, or perceived effectiveness, of the SDIL. It is somewhat surprising
31 that those with children under the age of 18 years were less supportive of the SDIL than those without.
32 The SDIL was particularly framed in terms of potential benefits to children.[1 23] If one's own
33 consumption is likely to influence support for the SDIL, then parents' support for the SDIL may also be
34 influenced by their children's consumption. If children are greater consumers of sugary drinks,[32] then
35 this may explain why parents with children under the age of 18 years were less supportive. As described
36 above, previous research on the association between psychological variables and support for, and
37 perceived effectiveness of, SSB taxes is sparse.

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40 We did not find that gender or markers of socio-economic position were associated with support for, or
41 perceived effectiveness of, the SDIL in mutually adjusted models. This reflects some, but not all,
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3 previous findings.[5 8 10 19 22] Unlike most previous work we included a wide range of socio-
4 demographic, consumption and psychological variables in mutually adjusted models and it may be that
5 gender or socio-economic differences operate entirely through the other variables included in our
6 models.
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10 **Implications of findings**

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12 Many structural public health policies require government action, which may be limited by perceptions
13 concerning public acceptability of such policies – often uninformed by evidence. Greater understanding
14 of public acceptability of a range of structural public health policies, and how this changes over time and
15 the course of implementation, may help to develop strategies to address public concerns and build
16 public support.
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20 **CONCLUSIONS**

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22 UK adults tend to have positive attitudes to SSBs and do not necessarily have strong social norms about
23 not drinking SSBs, but they generally recognise the link between SSB consumption and obesity. Trust in
24 messages about SSBs from the food and drinks industry is low, but trust in these messages from health
25 experts is not universally high. There was strong support for the SDIL and belief that it will be effective.
26 Those with more ‘public health’ orientated norms and trust were generally more likely to support the
27 SDIL or believe that it will be effective, although those with dependent children were less likely to
28 support the SDIL.
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39
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COMPETING INTERESTS

None declared

AUTHOR STATEMENT

JA, TP & MW conceived the idea for this paper. DP analysed the data. JA drafted the manuscript. JA, TP, MW, DH and LV read and provided critical comments on the manuscript and approved the final version. DH conceived the idea for the IFPS and secured funding. DH and LV developed the first draft of survey. TP led the further development of the UK survey instrument, with input from JA, MW, DH and LV.

DATA SHARING

Data is available directly from the International Food Policy Study team on reasonable request (see www.foodpolicystudy.com).

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Reporting checklist for cross sectional study.

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		Reporting Item	Page Number
Title	#1a	Indicate the study's design with a commonly used term in the title or the abstract	1
Abstract	#1b	Provide in the abstract an informative and balanced summary of what was done and what was found	2
Background / rationale	#2	Explain the scientific background and rationale for the investigation being reported	4-5
Objectives	#3	State specific objectives, including any prespecified hypotheses	5
Study design	#4	Present key elements of study design early in the paper	5-6
Setting	#5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5-6
Eligibility criteria	#6a	Give the eligibility criteria, and the sources and methods of selection of participants.	6

1		#7	Clearly define all outcomes, exposures, predictors, potential	6
2			confounders, and effect modifiers. Give diagnostic criteria, if	
3			applicable	
4				
5				
6	Data sources /	#8	For each variable of interest give sources of data and details of	6
7	measurement		methods of assessment (measurement). Describe	
8			comparability of assessment methods if there is more than one	
9			group. Give information separately for for exposed and	
10			unexposed groups if applicable.	
11				
12				
13				
14	Bias	#9	Describe any efforts to address potential sources of bias	8
15				
16				
17	Study size	#10	Explain how the study size was arrived at	5-6
18				
19	Quantitative	#11	Explain how quantitative variables were handled in the	8
20	variables		analyses. If applicable, describe which groupings were chosen,	
21			and why	
22				
23				
24	Statistical	#12a	Describe all statistical methods, including those used to control	8
25	methods		for confounding	
26				
27				
28		#12b	Describe any methods used to examine subgroups and	n/a
29			interactions	
30				
31				
32		#12c	Explain how missing data were addressed	6
33				
34		#12d	If applicable, describe analytical methods taking account of	8
35			sampling strategy	
36				
37				
38		#12e	Describe any sensitivity analyses	n/a
39				
40	Participants	#13a	Report numbers of individuals at each stage of study—eg	8
41			numbers potentially eligible, examined for eligibility, confirmed	
42			eligible, included in the study, completing follow-up, and	
43			analysed. Give information separately for for exposed and	
44			unexposed groups if applicable.	
45				
46				
47				
48		#13b	Give reasons for non-participation at each stage	8
49				
50				
51		#13c	Consider use of a flow diagram	n/a
52				
53	Descriptive data	#14a	Give characteristics of study participants (eg demographic,	10
54			clinical, social) and information on exposures and potential	
55			confounders. Give information separately for exposed and	
56			unexposed groups if applicable.	
57				
58				
59				

1		#14b	Indicate number of participants with missing data for each	6
2			variable of interest	
3				
4				
5	Outcome data	#15	Report numbers of outcome events or summary measures.	11
6			Give information separately for exposed and unexposed	
7			groups if applicable.	
8				
9				
10	Main results	#16a	Give unadjusted estimates and, if applicable, confounder-	11
11			adjusted estimates and their precision (eg, 95% confidence	
12			interval). Make clear which confounders were adjusted for and	
13			why they were included	
14				
15				
16				
17		#16b	Report category boundaries when continuous variables were	7
18			categorized	
19				
20				
21		#16c	If relevant, consider translating estimates of relative risk into	n/a
22			absolute risk for a meaningful time period	
23				
24	Other analyses	#17	Report other analyses done—e.g., analyses of subgroups and	n/a
25			interactions, and sensitivity analyses	
26				
27				
28	Key results	#18	Summarise key results with reference to study objectives	12
29				
30				
31	Limitations	#19	Discuss limitations of the study, taking into account sources of	12-13
32			potential bias or imprecision. Discuss both direction and	
33			magnitude of any potential bias.	
34				
35				
36	Interpretation	#20	Give a cautious overall interpretation considering objectives,	13-14
37			limitations, multiplicity of analyses, results from similar studies,	
38			and other relevant evidence.	
39				
40				
41	Generalisability	#21	Discuss the generalisability (external validity) of the study	12
42			results	
43				
44				
45	Funding	#22	Give the source of funding and the role of the funders for the	15
46			present study and, if applicable, for the original study on which	
47			the present article is based	
48				
49				

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