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Australians are ready for warning labels, marketing bans and sugary drink taxes: two cross-sectional surveys measuring support for policy responses to sugar-sweetened beverages

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Keywords:	Sugar-sweetened beverages, policy, sugar tax, warning labels

Title: *Australians are ready for warning labels, marketing bans and sugary drink taxes: two cross-sectional surveys measuring support for policy responses to sugar-sweetened beverages.*

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Abstract

Objective: To assess public support for 10 potential policy initiatives aimed at reducing sugar-sweetened beverage (SSB) consumption.

Design: A nationally representative, cross-sectional, computer assisted telephone interviewing (CATI) population survey was administered in 2017. A second historical data set was included for comparative purposes, which employed a face-to-face survey in one Australian state (2014).

Participants: i) South Australians aged 15+ years (n=2,732) (study 1); ii) Australians aged 18+ years (n=3,430) (study2).

Primary outcome measures: Levels of support for SSB-specific policy initiatives in 2017 and 2014. For the 2017 National study (study 2): demographic characteristics, BMI, knowledge of potential harms caused by consuming SSBs, and SSB consumption were included in multivariable regression analyses.

Results: In 2017, all 10 potential policy initiatives received majority support (60-88% either 'somewhat' or 'strongly' in favour). Text warning labels on drink containers had highest support (88%), along with government campaigns warning of adverse health effects (87%). Initiatives with educative elements or focussed on children received high support (>70%). When SSB tax was paired with using funds for obesity prevention, support was 77% compared to 60% for a stand-alone tax. In general, support for policy initiatives was greater among those who believed SSB daily consumption could cause health problems in adults and/or in children, and lower among SSB high consumers (7+ drinks per week). State-specific comparison of data from the 2017 survey and 2014 survey, there was greater indicated support for taxation (55% vs 42%; χ^2=15.7, p<0.001) and graphic health warnings (68% vs 52%; χ^2=23.4. p<0.001).

Conclusions: There is strong public support for government action, particularly regulatory and educational interventions, to reduce SSB consumption. The findings suggest that

framing policies as protecting children, presenting taxation of SSBs in conjunction with other obesity prevention initiatives and education focussed on the harms associated with SSB consumption will optimise support.

Keywords: Sugar-sweetened beverages, policy, sugar tax, warning labels

Strengths and limitations of this study:

- A large nationally representative study of 3,430 Australian adults enabled current (2017) insight into level of support for policy initiatives aimed at reducing sugar sweetened beverage consumption.
- A second large historical data set of 2,732 from one Australian state enabled a historical comparison to provide indication of how opinions have changed over the last three years (2014).
- The study provides current insight into the characteristics of supporters and non-supporters (including knowledge about SSBs) of different policy support options.
- Results are limited by the cross-sectional nature of the surveys, and historical comparison is limited by the methodological differences between the two data sets.
- The surveys were anonymous or de-identified to mitigate the risk of social desirability response bias commonly associated with use of self-reported data.

INTRODUCTION

Excess consumption of sugar-sweetened beverages (SSBs) is causally associated with increased risk of obesity, Type II diabetes, periodontal disease, dental caries, and cardiovascular disease.[1-6] SSB consumption is high in Australia as it is in other countries,[7] with one third of the Australian population (34%) consuming SSBs.[8] SSB consumption is higher among Australian males than females (39% vs 29%), and highest among those from disadvantaged areas (47%) and children and adolescents (47%).[8] Consumption increases with age and peaks among adolescent males aged 14 to 18 years, at 62%. Australian adults who drink SSBs consume an average of 13 teaspoons (54 grams) of sugar from SSBs daily, with adolescent males consuming, on average, 16 teaspoons of sugar (68 grams).[8] SSBs represent a significant source of added sugar in the Australian diet and a readily modifiable risk factor for many prevalent chronic diseases.

Attention has increased on SSB consumption as a target for population- and policy-level interventions worldwide. Policy-level interventions may include taxes or health levies, changes to product (labelling, size restrictions), restricting marketing practices and reducing availability. More than 30 jurisdictions around the world have implemented SSB taxes,[9] and a number of post-implementation studies provide real-world evidence of their effectiveness.[9-11] Implementation of other interventions, such as mandatory menu kilojoule labelling, advertising restrictions, or health warnings, is far less widespread.[12]

Substantial political support is required to implement regulatory interventions due to strong industry opposition.[13-16] It is widely recognised that public support is an important factor influencing political appetite for policy reform and therefore implementation.[17, 18] Policy makers benefit from, and are sensitive to, data on how potential policy initiatives are perceived by the community, in addition to data on effectiveness. In turn, the degree to which people are knowledgeable about a health issue may influence the degree to which they support policy options aimed at changing health behaviours.[19] Identifying levels of public knowledge and support and the characteristics of members of the community who

support various initiatives can also assist public health agencies and advocates in developing effective message framing for encouraging evidence-based policy reform.[20, 21]

Published data on public support for regulatory initiatives specifically aimed at SSB consumption is limited. Studies have mostly reported on US populations,[17, 22-26] with few surveys conducted in other countries.[27-30] Many studies have focussed on taxes, with and/or without complementary funding for obesity prevention or health.[22, 24, 27-29] Few studies have compared levels of support across different SSB policy options.[23, 25, 30, 31] While estimates of support may not be directly comparable across countries and jurisdictions, some general patterns emerge. Overall, initiatives that have been received more positively include those that: couple revenue from tax with investment into the health system or complementary educative initiatives; target consumption in children; and/or educate consumers on health effects of consumption.[23, 25, 28-31] Policy interventions that have received lower levels of support include: stand-alone taxes; and restrictions on SSB availability or promotion.[23, 25, 31]

To date, Australian studies have been conducted on non-representative samples,[29, 31] and/or have focused on foods and beverages concurrently, with few questions directly assessing SSB-specific initiatives.[29, 30] A recent online study[30] indicated that the Australian public is supportive of government regulation to prevent obesity and overweight in general (86%), with substantial support for initiatives to restrict advertising of unhealthy foods and beverages in a number of contexts especially restriction of advertising to children on television (79%) and via the internet (76%). In relation to SSBs specifically, 55% supported a tax on SSBs and 63% supported prohibiting sponsorship of children's sport. A 2010 study of a sample of household grocery buyers found approximately 70% support for a tax on soft drinks if the revenue raised was used to reduce the cost of healthy food, with levels of support higher among parents and those of higher socio-economic status.[29] A study of Australian university students and staff's views on SSB-specific interventions on-campus indicated high support (>75%) for increasing access to free drinking water, lowering the price of water and diet beverages, and educational initiatives (nutrition information, campaigns).[31]

Lower support (<50%) was reported for removing SSBs from display, replacing SSBs with diet or low sugar versions, or restricting sales of SSBs on-campus. A 2016 public opinion poll in Australia indicated 75% would either 'strongly' or 'probably' support a tax on SSBs with 'high levels of sugar if revenues raised were used to fund programs to reduce the damaging health effects of SSB consumption'.[32] In a 2018 Australian poll, where there was no mention of the use of funds raised, 53% indicated they would support a tax on SSBs.[33]

Data on public support for SSB policy initiatives beyond taxation, are very limited. As SSBs have been specifically identified for intervention by the World Health Organization,[34] it is important to gauge public response to other potential SSB-targeted initiatives. A substantial knowledge gap exists around public acceptability of warning labels on SSBs. Warning labels both educate and deter consumers and have shown effectiveness in increasing consumers' understanding of the harm caused by smoking and reducing tobacco consumption.[35] Evidence of the potential effectiveness of warning labels in changing dietary behaviour is increasing.[36-41] Warning labels for SSBs are of growing interest to policy makers. While some estimates of support have been derived from online experiential studies[36, 37, 41] population estimates of the acceptability of warning labels are lacking.

We sought to determine levels of public support for different types of policies targeted specifically at SSBs, and the influence of socio-demographic factors, health risk factors and levels of knowledge. Such data will help inform the political feasibility of the range of potential interventions. This paper presents results from two large, representative population studies: a state-based survey conducted in 2014 and a national survey conducted in 2017. Together, the findings provide a current picture of policy support among Australians as well as an indication how views may have changed in the past 3 years, within one state.

STUDY 1: STATE-BASED POPULATION SURVEY IN 2014

Method

SSB policy support questions were developed and included in the 2014 South Australian Health Omnibus Survey (SAHOS); an annual, representative population survey of residents aged 15 years and over, administered via face-to-face interviews between September and December. Detailed information regarding sampling, recruitment methods and data weighting procedures are available elsewhere.[42] Support for eight policy initiatives was assessed (see Table 1) by asking participants to indicate whether they were in favour of or against each initiative (presented in fixed order due to methodological constraints). Data were weighted to adjust for population characteristics of age, sex and geographical area in South Australia (SA) and probability of selection in the household. The study was approved by the University of Adelaide's Human Research Ethics Committee (HREC).

Results

Of the initial sample drawn (n=5,200), 183 were considered out of scope (vacant houses, businesses). There were 2,732 completed interviews, yielding an American Association for Public Opinion Research (AAPOR) Response Rate 1 (RR1) of 55% (participants completing the survey as a proportion of eligible sample), and a participation rate of 61% (denominator excluded 507 dwellings for which contact could not be established after six attempts).[43] Subgroups within socio-demographic characteristics were appropriately represented.

There was greater than 80% support for five out of the eight policy options (text warning labels; restrictions on advertising to children via television and via websites/games; restrictions on sales in schools; and television campaigns)(see Table 1). Support was lower, but still favoured by the majority, for restricting sugary drink sponsorship of children's sport (70%) and adding graphic warning labels to sugary drink containers (52%). Responses to taxing sugary drinks were mixed.

Table 1: Support for SSB policy options in South Australia (2014 survey, N=2732)

	Proportion strongly/ somewhat in favour (Strongly)		Proportion neither for nor against		Proportion strongly/ somewhat against (Strongly)	
	%	95% CI	%	95% CI	%	95% CI
Government tax on drinks high in added sugar	42 (18)	40-44	11	10-12	45 (25)	43-47
Government funded TV campaigns warning about health effects of obesity	80 (43)	79-81	9	8-10	10 (3)	9-11
Restrictions on the sales of sugary drinks at schools	83 (58)	82-84	6	5-7	10 (3)	9-11
Restrictions on the marketing of sugary drinks to children through websites and computer games	84 (59)	83-85	6	5-7	10 (4)	9-11
Restrictions on sugary drink sponsorship of children's sport	70 (42)	68-72	13	12-14	15 (4)	14-16
Restrictions on advertising sugary drinks to children on television	80 (55)	79-81	8	7-9	11 (4)	10-12
Written labelling on sugary drinks warning about the risk of diabetes, obesity and tooth decay	85 (53)	84-86	6	5-7	8 (3)	7-9
Graphic health warning labels on sugary drinks like those on cigarettes	52 (27)	50-54	13	12-14	34 (12)	32-36

Note. Percentages do not add up to 100% as less than 2% reported 'don't know' or 'refused' for each response. Specific proportions reporting "Strongly in favour" or "Strongly against" are reported in brackets under combined proportions of "Strongly/somewhat".

STUDY 2: NATIONAL SURVEY IN 2017

Method

A survey was conducted with a national sample of adults (aged 18 years or older) able to converse in English and living in Australia. The Social Research Centre was commissioned to recruit participants and conduct surveys via Computer-Assisted Telephone Interview. Participants were contacted via random digit dialling to a landline or mobile phone number (ratio 35:65). For landlines, where more than one eligible respondent resided in the household, preference was given to the youngest male, followed by the youngest female, as these groups can be under-represented in telephone surveys.[44] The sample size (n=3,600) was selected to provide an accurate representation of opinions of Australian adults, and also to allow for the detection of differences in knowledge following any future policy adoption in Australia. The study was approved by the University of Adelaide's HREC.

Measures

Policy questions were based on measures used in Study 1 with minor adaptations. To mitigate ceiling effects suggested by the South Australian survey data, some of the initiatives were modified in 2017 to represent a tougher policy stance, e.g., initiatives suggesting 'restriction' were changed to 'banning'. A question was also included to obtain a more nuanced understanding of policy conditions, e.g., an initiative proposing using the funds raised from taxes for obesity prevention was added. One question was amended to reflect the evolution of digital technology.

For ease of interpretation, SSBs were referred to as 'sugary drinks' throughout the survey and were defined as soft drinks, energy drinks, sports drinks, fruit flavoured mineral waters, all types of fruit juice and cordial. Participants were asked to what extent they were in favour or against 10 potential policy initiatives presented in random order, except for the initiative pertaining to a SSB tax that always preceded the extension of this initiative (i.e., using money raised to fund obesity prevention).

Consistent with previous studies,[42, 45, 46] weekly consumption was estimated by asking participants on how many days they had consumed sugary drinks in the past 7 days and how much they normally consumed (number of 250ml cups) on a day when they consumed sugary drinks. To enable a calculation of Body Mass Index (BMI), participants reported their weight and height and were subsequently categorised as either overweight/obese (BMI of 25 or more), or healthy/underweight (BMI under 25). Two knowledge questions, based on measures used previously,[47] asked participants to indicate the likelihood of developing any health problems later in life if (i) an adult and (ii) a child consumed a sugary drink every day. A pilot of 30 interviews was conducted prior to full implementation of the study, and some questions were slightly revised to improve comprehension.

Socio-demographics

Participants' sex, age, education, employment status, postcode and main language spoken at home were recorded. Postcodes were used to calculate level of disadvantage scores according to the Australian Bureau of Statistics' Socio-Economic Indexes for Areas (SEIFA),[48] which were grouped to form 'most disadvantaged' (decile 1-3); 'moderately disadvantaged' (deciles 4-7) and 'least disadvantaged' (deciles 8-10) categories.

Statistical analyses

Data were weighted to adjust for individuals' chances of selection according to relevant population benchmarks for age, sex, location and telephony status sourced from Australian Government data.[49, 50] Wilcoxin Signed Ranks tests were used to compare responses to policy questions. Chi-square tests were conducted to examine differences in support for each initiative between the 2014 sample, and a comparative state subset of the 2017 sample. For multivariable analyses, responses were dichotomised to be either: 'In favour' (Strongly or somewhat) or 'Not in favour' (strongly against, somewhat against or neither for nor against), as a minority (3-4%) indicated they were 'neither for nor against'. Multivariable logistic regression analyses were conducted to identify characteristics of those in favour of

each policy initiative in terms of socio-demographic characteristics, levels of knowledge, SSB consumption and BMI. These analyses were adjusted for all other factors as we were interested in unique variance explained. Only factors found to explain unique variance in any one policy initiative were reported in the multivariable results table (for ease of interpretation). All analyses were conducted on unweighted and weighted data with little difference apparent in results (strength and significance of associations) when weighted versus unweighted data were used, therefore, results of analyses on weighted data are presented here.

Results

The AAPOR Response Rate 3 (RR3) was 16%, that is, the number of completed interviews as a proportion of all interviews (complete and partial), refusals, non-contacts, and those with unknown eligibility that were estimated to be eligible.[43] A participation rate of 44% was achieved (slightly lower than for Study 1: 55%), resulting in 3,430 participants.

Table 2 describes participants' characteristics, SSB knowledge and consumption behaviour. The distribution of the weighted sample was similar to that of 2016 Australian census population data with respect to sex, age and employment status,[51] though participants of the current study had slightly higher levels of education, socio-economic status and English as main language (though survey eligibility required proficiency in English). Sugary drink consumption was higher in the current sample, yet the proportion of overweight/obese participants was slightly lower. These differences are likely due to variation in assessment methods (e.g., current study assessed usual consumption whereas ABS assessed previous day's consumption)[8] and historical nature of the comparative data sets,[52] and therefore, only a general level of comparison can be made. Overall, the sample was considered an adequate representation of the Australian population.

Table 2. Socio-demographic characteristics and prevalence (%) of risk factors and knowledge variables

Socio-demographic characteristics n=3430	% (Weighted)	% (Unweighted)	% Comparative National data
Sex			
Female	49	49	51
Male	51	52	49
Age range			
18-30 years	24	15	24
31-45 years	24	20	27
46-60 years	26	27	24
61+ years	26	37	25
Level of education			
Secondary school or less	27	28	40
Some tertiary education or completed vocational training	34	33	33
Finished university (bachelor degree or higher)	38	37	26
Level of disadvantage (deciles)			
Decile 1-3 (Most disadvantaged)	20	21	29
Decile 4-7 (Mid)	41	40	40
Decile 8-10 (Least disadvantaged)	38	39	31
Employment status			
Work full or part time	60	55	62
Not currently working/ retired	39	45	38
English main spoken language at home			
Yes	92	94	78
No	8	6	22
SSB every day causes health problems in adults			
Not likely	20	22	
Somewhat/Very likely	80	78	
SSB every day causes health problems in children			
Not likely	10	11	
Somewhat/Very likely	90	89	
Sugary drink consumption per week			
None	52	56	69
1-6 times	34	30	
7+ times	14	13	
Body Mass Index (BMI)			
<=25	46	43	37
>25	50	53	63
Don't know	4	4	

Note. Comparisons of sex, age, education, employment status, language spoken at home were made with data sourced from the ABS (51). Where possible data were compared with adults aged 18+ years (age), but in some cases comparisons were made with adults aged 20+ years (gender, education, employment status), or all adults 15+ years (Disadvantage and language spoken at home). Sugary drink consumption comparison was based on data from the 2011-12 Australian Health Survey (9) for adults aged 19+ years and pertained to consumption on the day prior to the interview, whereas in the current study, usual consumption was assessed. BMI comparison was based on data from the National Health Survey 2014-15 for adults aged 18+ years (52).

All policy options received majority support ranging from 60% to 88% (see Table 3). Interventions with a consumer warning or educative focus received very high levels of support. Over 80% of participants reported that they were either strongly or somewhat in favour of: Text warning labels on SSB containers about health risks; Government funded TV campaigns about the health effects of SSBs; Text warning labels on vending machines and other places of sale; and Text warning labels on SSB advertisements (e.g., billboards and television). Potential interventions involving banning marketing or sales also received high levels of support (71-79%). There were significant differences observed in support between all of the policy options assessed. Of particular note, Government tax on drinks high in added sugar, received majority support at 60%; however, support was substantially higher for SSB tax (77%) when paired with the complementary measure of reinvesting revenue into obesity prevention ($Z=-25.0$; $p<.001$).

Table 3. Support for possible policy interventions in Australia (2017 survey, n=3430)

	Proportion strongly/ somewhat in favour (Strongly)		Proportion neither for nor against		Proportion strongly/ somewhat against (Strongly)	
	%	95% CI	%	95% CI	%	95% CI
Text warning labels on SSB containers about health risks	88 (65)	87-89	3	2-4	9 (4)	8-10
Government funded TV campaigns about health effects of SSBs	87 (65)	86-88	4	3-5	9 (5)	8-10
Text warning labels on vending machines and other places of sale	86 (61)	85-87	3	2-4	10 (4)	9-11
Text warning labels on SSB advertisements (e.g. tv, billboards)	84 (59)	83-85	3	2-4	12 (5)	11-13
Bans on SSB advertising during children's TV viewing times	79 (62)	78-80	4	3-5	16 (8)	14-17
Government tax on drinks high in added sugar to fund obesity prevention	77 (55)	76-78	3	2-4	18 (11)	16-19
Bans on SSB marketing on digital platforms popular with children	76 (59)	75-77	4	3-5	19 (8)	18-20
Bans on sales of SSBs in schools	75 (57)	74-77	4	3-5	20 (7)	19-21
Graphic warning labels on SSB containers about health risks	71 (48)	69-72	4	3-5	24 (11)	23-25
Government tax on drinks high in added sugar	60 (39)	59-62	5	4-6	33 (20)	31-35

Note. Percentages do not add up to 100% as less than 2% reported 'don't know' or 'refused' for each response. Specific proportions reporting "Strongly in favour" or "Strongly against" are reported in brackets under combined proportions of "Strongly/somewhat".

The 2017 national sample included data from all Australian states and territories, enabling a comparison between the SA subset (n=247) and the 2014 SA HOS data (previously described study 1; n=2,732). There was a statistically significant difference between the comparably worded initiatives of support for taxation of SSBs (42% in 2014 compared with 55% in 2017; χ^2=15.7, p<.001) and graphic health warnings on SSBs (52% in 2014 and 68% in 2017, χ^2=23.4. p<.001).

Multivariable analyses examined associations between all factors (socio-demographic, knowledge, consumption and BMI) and each of the policy initiatives, with all factors entered simultaneously. Table 4 reports these results for each of the consumer warning/educative policy initiatives. Table 5 reports these results for marketing, sales and taxation policy initiatives.

Socio-demographic predictor variables

There was little variation in support for consumer warning/educative policy initiatives by socio-demographic characteristics (see Table 4). However, there was significantly higher support for graphic warning labels among females than males and among older than younger participants. While support for text warning labels on SSB adverts varied significantly by level of disadvantage, absolute difference in percentages was small.

There was greater socio-demographic variation observed for the marketing, sales and taxation policies (see Table 5). Females reported significantly higher support than males for initiatives aimed specifically at children (i.e., bans on: SSB advertising at children viewing times; SSB marketing on digital platforms popular with children; and the sale of all sugary drinks at schools). Older participants had a significantly lower likelihood than younger participants of favouring a government tax on drinks high in added sugar to fund obesity prevention, but a significantly greater likelihood of favouring the initiatives aimed specifically at children. Participants with higher levels of education were more likely to support all policy initiatives in Table 5.

Knowledge and risk factor predictor variables

Participants with higher knowledge were frequently more likely to support policy initiatives. Significant associations were present between being cognisant of health risk in adults and level of support for 5 out of the 10 policy initiatives. Significant associations were present between being cognisant of health risk in children for 7 out of 10 initiatives.

Higher SSB consumption (7+ drinks per week) was significantly associated with decreased likelihood of support for all but one policy initiative. There were few associations with BMI, although those in the overweight or obese range were significantly less likely to report being in favour of government-funded TV campaigns about health effects of SSBs.

Table 4. Multivariable associations between socio-demographic characteristics, knowledge and risk factors, and support for regulatory interventions (consumer warning/educative) aimed at reducing the consumption of sugary drinks

Socio-demographics characteristics	Gov. funded TV campaigns on health effects of SSBs		Text warning labels on vending machines and other places of sale		Text warning labels on SSB advertisements (e.g. tv, billboards)		Text warning labels on SSB containers about health risks		Graphic warning labels on SSB containers about health risks	
	%	OR (95%CI)	%	OR (95%CI)	%	OR (95%CI)	%	OR (95%CI)	%	OR (95% CI)
Sex										
Male	87	1.00	86	1.00	83	1.00	88	1.00	67	1.00
Female	88	0.87 (0.70-1.09)	87	0.97 (0.78-1.20)	87	1.17 (0.95-1.43)	89	1.00 (0.80-1.26)	75	1.31 (1.11-1.54)*
Age range										
18-30 years	90	1.00	85	1.00	84	1.00	86	1.00	64	1.00
31-45 years	88	0.91 (0.65-1.26)	85	0.96 (0.72-1.28)	84	0.91 (0.68-1.21)	88	1.05 (0.78-1.43)	67	1.06 (0.85-1.32)
46-60 years	88	1.05 (0.75-1.46)	89	1.34 (0.98-1.81)	88	1.25 (0.92-1.68)	89	1.22 (0.89-1.68)	71	1.31 (1.05-1.64)
61+ years	85	0.77 (0.55-1.08)	88	1.27 (0.92-1.75)	84	0.95 (0.71-1.29)	90	1.47 (1.04-2.06)	81	2.48 (1.92-3.20)**
Level of disadvantage										
Decile 1-3 (Most disadv.)	86	1.00	89	1.00	88	1.00	90	1.00	74	1.00
Decile 4-7 (Mid disadv.)	88	1.08 (0.82-1.44)	86	0.75 (0.56-1.01)	84	0.72 (0.55-0.96)	88	0.76 (0.56-1.03)	71	0.85 (0.68-1.05)
Decile 8-10 (Least disadv.)	87	0.91 (0.68-1.22)	86	0.71 (0.53-0.96)	84	0.63 (0.48-0.84)*	88	0.74 (0.54-1.01)	70	0.77 (0.61-0.96)
Knowledge and risk factors										
SSB every day causes health problems in adults										
Not likely	79	1.00	83	1.00	79	1.00	85	1.00	61	1.00
Somewhat/Very likely	90	1.48 (1.12-1.97)*	87	1.16 (0.87-1.55)	86	1.28 (0.98-1.68)	89	1.09 (0.80-1.48)	74	1.59 (1.28-1.98)**
SSB every day causes health problems in children										
Not likely	74	1.00	79	1.00	75	1.00	82	1.00	59	1.00
Somewhat/Very likely	89	2.09 (1.49-2.94)**	87	1.54 (1.08-2.20)	86	1.58 (1.14-2.20)*	89	1.48 (1.02-2.15)	72	1.33 (1.00-1.76)
Sugary drink consumption per week										
None	88	1.00	89	1.00	87	1.00	91	1.00	76	1.00
1-6 times	90	1.04 (0.81-1.35)	85	0.79 (0.63-1.01)	85	0.87 (0.70-1.10)	86	0.67 (0.53-0.86)*	68	0.81 (0.68-0.97)
7+ times	78	0.53 (0.39-0.71)**	80	0.59 (0.44-0.80)*	78	0.60 (0.45-0.79)**	82	0.52 (0.38-0.70)**	60	0.62 (0.49-0.79)**
BMI										
<=25	90	1.00	88	1.00	85	1.00	88	1.00	72	1.00
>25	85	0.63 (0.50-0.79)**	87	0.94 (0.76-1.17)	85	1.05 (0.85-1.29)	89	1.03 (0.82-1.30)	70	0.86 (0.73-1.01)
Don't know	87	0.79 (0.44-1.42)	73	0.47 (0.30-0.75)*	77	0.73 (0.45-1.19)	82	0.72 (0.43-1.21)	70	0.93 (0.60-1.44)

Note. % is the percentage of respondents (unadjusted for other variables) from each category reporting they were in favour of the policy initiative. Employment and education were not significantly associated with any policy initiative in this table and were not reported in the table for ease of interpretation. Missing data resulted in 3.9-4.2% of cases excluded from any one analysis. OR= Odds ratio (adjusted for all other socio-demographic characteristics, knowledge and risk factors); CI=Confidence Interval. Statistical significance is denoted by asterisk(s) according to the following levels: *p<.01, **p<.001.

Table 5. Multivariable associations between socio-demographic characteristics, knowledge and risk factors, and perceptions of selected regulatory interventions (marketing, sales, taxation) aimed at reducing the consumption of sugary drinks

Socio-demographic characteristics	Bans on SSB advertising during children's tv viewing times		Bans on SSB marketing on digital platforms popular with children		Bans on sales of SSBs at schools		Gov. tax on drinks high in added sugar to fund obesity prevention		Gov. tax on drinks high in added sugar	
	%	OR (95%CI)	%	OR (95%CI)	%	OR (95%CI)	%	OR (95%CI)	%	OR (95%CI)
Sex										
Male	75	1.00	73	1.00	69	1.00	77	1.00	58	1.00
Female	85	1.70 (1.41-2.05)**	82	1.49 (1.24-1.78)**	82	1.70 (1.43-2.03)**	81	1.11 (0.92-1.33)	64	1.02 (0.87-1.19)
Age range										
18-30 years	76	1.00	70	1.00	64	1.00	83	1.00	57	1.00
31-45 years	81	1.14 (0.88-1.47)	80	1.46 (1.14-1.86)*	80	2.14 (1.68-2.72)**	80	0.74 (0.56-0.97)	64	1.25 (1.01-1.56)
46-60 years	81	1.24 (0.96-1.60)	81	1.76 (1.37-2.26)**	79	2.08 (1.63-2.65)**	76	0.58 (0.45-0.76)**	61	1.14 (0.92-1.42)
61+ years	82	1.51 (1.15-1.99)*	79	1.81 (1.40-2.35)**	79	2.35 (1.82-3.05)**	77	0.64 (0.48-0.85)*	63	1.35 (1.03-1.71)
Level of education										
Secondary school or less	75	1.00	72	1.00	72	1.00	75	1.00	55	1.00
Some tertiary/completed vocational training	79	1.30 (1.05-1.62)	77	1.30 (1.05-1.60)	77	1.37 (1.11-1.70)*	79	1.32 (1.06-1.64)	58	1.15 (0.95-1.38)
Finished university (bachelor deg. or higher)	84	1.62 (1.29-2.04)**	82	1.63 (1.31-2.04)**	77	1.11 (0.89-1.38)	82	1.37 (1.09-1.72)*	70	1.73 (1.43-2.11)**
Knowledge and risk factors										
SSB every day causes health problems in adults										
Not likely	74	1.00	70	1.00	63	1.00	66	1.00	47	1.00
Somewhat/Very likely	81	0.98 (0.76-1.26)	79	1.28 (1.02-1.62)	79	1.43 (1.14-1.81)*	82	1.50 (1.18-1.89)*	65	1.50 (1.22-1.85)**
SSB every day causes health problems in children										
Not likely	64	1.00	63	1.00	52	1.00	58	1.00	41	1.00
Somewhat/Very likely	82	2.16 (1.60-2.93)**	79	1.70 (1.26-2.28)**	78	2.47 (1.85-3.28)**	81	2.05 (1.54-2.75)**	64	1.86 (1.41-2.45)**
Sugary drink consumption per week										
None	82	1.00	80	1.00	80	1.00	81	1.00	69	1.00
1-6 times	80	1.03 (0.84-1.26)	78	1.08 (0.88-1.31)	74	0.87 (0.72-1.06)	81	0.92 (0.75-1.13)	59	0.68 (0.57-0.80)**
7+ times	71	0.72 (0.56-0.94)	66	0.68 (0.53-0.87)*	62	0.57 (0.44-0.73)**	64	0.45 (0.35-0.58)**	40	0.38 (0.30-0.47)**
BMI										
<=25	80	1.00	77	1.00	76	1.00	81	1.00	65	1.00
>25	80	1.05 (0.87-1.27)	79	1.09 (0.91-1.30)	76	0.95 (0.79-1.13)	77	0.96 (0.80-1.16)	59	0.82 (0.70-0.96)
Don't know	67	0.57 (0.37-0.87)	65	0.59 (0.38-0.89)	66	0.57 (0.37-0.87)*	71	0.75 (0.48-1.19)	58	0.85 (0.57-1.27)

Note. % is the percentage of respondents (unadjusted for other variables) from each category reporting they were in favour of the policy initiative. Level of disadvantage and employment were not significantly associated with any policy initiatives in this table and were not reported in the table for ease of interpretation. Missing data resulted in 3.8-4.5% of cases excluded from any one analysis. OR= Odds ratio (adjusted for all other socio-demographic characteristics, knowledge and risk factors); CI=Confidence Interval. Statistical significance is denoted by asterisk(s) according to the following levels: *p<.01, **p<.001.

DISCUSSION

The study results show high community support for a range of SSB-specific policy initiatives, suggesting strong community appetite for government action around SSB consumption, with indications that this support is growing over time. Very high support was expressed for interventions warning consumers about the potential health effects of SSB consumption, with the highest support for text warning labels on sugary drink containers (88%) and government-funded campaigns warning of health effects (87%), closely followed by warnings on vending machines and other places of sale (86%), and on advertisements (84%). Consumers have the right to be informed about both the contents of the food and beverages they consume and the established health risks associated with frequent consumption. Governments have an important role in ensuring consumers have ready access to this information. Previous research shows information deficits exist regarding the sugar content of and health risks associated with SSBs.[42] There is a clear need for, and public receptiveness to, government interventions warning of the health effects of frequent SSB consumption. Televised campaigns and text warning labels are prime opportunities given the very high levels of public support for these initiatives.

While front-of-pack label systems based on nutrient profiles are widespread on food and beverages, very few jurisdictions have implemented any form of warning label system. An exception is Chile, which has “high in sugar” black stop-sign style warning labels that apply to foods and beverages which are high in sugar, with equivalent warnings for sodium, saturated fat and energy.[53] Other South American countries, Israel and Canada have all foreshadowed their interest in similar warning label schemes. The City of San Francisco passed legislation for health effect warning labels on SSB advertisements, but it was blocked by sustained litigation from industry.[54] Despite low real-world implementation, experimental studies continue to demonstrate the likely impact of SSB warning labels on knowledge and consumption.[36-38, 41, 55, 56] Of note, recent experimental research in Australia has found that

graphic warning labels on food products tip consumers towards making healthier food choices,[56] and reduce automatic appetitive neural responses towards food cues.[57]

There was relatively high Australian population-level support for graphic health warnings on SSBs (71% in 2017), compared to US-based experimental samples (51%-63%). On-product health warnings are familiar to Australian consumers. Text warning labels have been in place on tobacco products for several decades. Australia was one of the first nations to introduce graphic health warnings on cigarette packets in 2006, with over 100 jurisdictions having advanced to graphic warnings internationally.[58-61] Familiarity and awareness of impact may underpin Australians' level of support for graphic health warnings on SSBs. It also appears there may be increasing receptiveness among Australians to this form of government intervention.

Mass media campaigns rarely focus on the harmful health effects of unhealthy food or beverages, and more frequently have taken a soft (e.g. 'nudge') approach and/or promote fruit or vegetable consumption or physical benefits of healthier lifestyles. However, recent Australian state-based campaigns warning about specific serious health harms linked to SSBs have demonstrated effectiveness in changing beliefs, attitudes, behavioural intentions and behaviour.[45, 62, 63] These campaigns are reminiscent of the high quality government-funded campaigns warning of the serious harms of tobacco which are long standing in Australia, and internationally, and have helped drive enormous shifts in behaviour (tobacco consumption) and social norms about smoking.[64] A national campaign focussed on increasing awareness of and concern about the serious health risks of frequent SSB consumption is now warranted.

In the present study, Australians expressed majority support for regulatory initiatives that would curb children's exposure to SSBs and their promotion via television advertising (79%), marketing on digital platforms (76%) and sales in schools (75%). Our findings are consistent with support observed previously for the regulation of television and online marketing of unhealthy food *and* beverages targeting children.[30] Support for restrictions on industry's

ability to market to children likely reflects a recognition that children are more vulnerable as consumers and warrant greater protection. Given that Australian children are high consumers of SSBs and levels of childhood overweight and obesity are unacceptably high, government interventions to protect children from the heavy promotion of SSBs are overdue. Contextualising initiatives as protective of children's health would likely enhance community receptiveness.

Sugar sweetened beverage or "soda" taxes have been implemented in more than 30 jurisdictions around the world,[9] have demonstrated effectiveness in changing consumption[65] and have prompted reformulation by industry.[66] While support in the present study for the taxation of drinks that are high in sugar was lowest among all the policies presented to participants, there was still majority support (60% in 2017). Comparison with the 2014 survey data indicated an absolute increase in support in the order of 10-15% over 3 years in one state, suggestive of growing public concern and receptiveness to this form of intervention. When taxation was linked to the provision of obesity prevention, public support was substantially higher (77%), consistent with other studies,[28, 30] offering some insight into the relative increase in support that may occur with different policy framing. The approach of coupling taxation with other preventive interventions has demonstrated success in tobacco.[64] Australian advocates are calling for a 'health levy' on SSBs as part of a broader suite of interventions.[67, 68] Taking a 'comprehensive approach' has demonstrated effectiveness in tobacco control, is consistent with the evidence in obesity prevention and may also align well with community preferences.

Overall, people who understood that daily SSB consumption by adults and/or children is likely to lead to health harms were more likely to support all forms of policy action. Continuing to raise community awareness of the health effects of frequent SSB consumption, which is important in its own right, may also increase community support for policy intervention. This is consistent with results from tobacco control and alcohol research

showing increased support for policies after exposure to campaigns explaining health risks.[19, 47, 69]

High consumers of SSBs were somewhat less receptive to policies in this study which was not surprising given that pricing policies would impact directly on them. It is notable that despite lower levels of support relative to non-users, the majority of SSB consumers supported all proposed initiatives except stand-alone taxation (40%). Taxation coupled with prevention had majority support (64%).

Limitations

Cross-sectional population surveys can only capture the public's responses at one point in time, and reasons for support or lack of support for policy initiatives were not identified. However, characteristics of supporters and non-supporters (including knowledge about SSBs) provide insight into the identified differences in support. While some measures (e.g., knowledge of harms of SSB consumption) had not been extensively validated, they were based on existing measures.[47] Furthermore, while self-reported height and weight provide only an estimate of BMI, this is a frequently used method to approximate BMI, and quantifies body size appropriately in Australians.[70, 71] To mitigate the risk of any social desirability response bias, the surveys were anonymous or de-identified. Overall, the 2017 survey yielded high-quality, nationally-representative data that provide reliable evidence of the public's response to SSB policy options. The state-based survey (2014) provided insight into the views of those who resided in one state of Australia, and therefore, cannot be considered nationally representative. While comparisons were made between the state-based data of both samples for comparably worded policy initiatives only, differences in methodology as detailed in the method section need to be taken into account. Despite these limitations, the state-based data provided a historical reference and a valuable indication of how opinions towards an important health topic have changed over the last three years.

CONCLUSIONS

There is immediate public readiness for government action to reduce SSB consumption. The findings indicate very strong public support for multiple regulatory and educational interventions. There are indications that support for some initiatives has increased markedly over a short time frame. Framing policies as protecting children will likely result in greater levels of support, as will increasing knowledge of the harms associated with SSB consumption. Presenting taxation of SSBs in conjunction with other prevention initiatives is fundamental to community support.

Australia has a strong track record of intervening to change consumption behaviour in tobacco control. This success was underpinned by a comprehensive approach combining educative approaches with a strong regulatory framework. Australia should continue this successful approach to address SSBs. Given the Australian public's receptiveness, Australia would be well placed to be the first country in the world to introduce a comprehensive suite of interventions to address SSBs, including health warning labels, marketing restrictions, taxation and accompanying public education mass media campaigns.

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Author's contributions: CM conceptualised and led the design of the study with advice from all co-authors. JD coordinated the National study and KE coordinated questions for state-based study. KE and JD conducted analyses. CM, KE and JD drafted the manuscript. All authors contributed to the development of the National survey and drafting of the publication. All authors contributed to and approved the final manuscript.

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STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-6
Objectives	3	State specific objectives, including any prespecified hypotheses	6
Methods			
Study design	4	Present key elements of study design early in the paper	7,9,10
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	7, 9
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	7,9
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7,9,10
Data sources/ measurement	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	7,9, 10
Bias	9	Describe any efforts to address potential sources of bias	10
Study size	10	Explain how the study size was arrived at	7, 9
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	7,10,11
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	7,10,11
		(*b*) Describe any methods used to examine subgroups and interactions	7,10,11
		(*c*) Explain how missing data were addressed	8,14
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	7,10
		(*e*) Describe any sensitivity analyses	NA
Results			

Participants	13*	(a) 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	7,11
		(b) Give reasons for non-participation at each stage	7,11
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	12
		(b) Indicate number of participants with missing data for each variable of interest	8,14,17,18
Outcome data	15*	Report numbers of outcome events or summary measures	12-19
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	8,14,17,18
		(*b*) Report category boundaries when continuous variables were categorized	NA
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	NA
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	NA
Discussion			
Key results	18	Summarise key results with reference to study objectives	20,21,22
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	23
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	23
Generalisability	21	Discuss the generalisability (external validity) of the study results	23
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	25

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

Are Australians ready for warning labels, marketing bans and sugary drink taxes? Two cross-sectional surveys measuring support for policy responses to sugar-sweetened beverages.

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Title: *Are Australians ready for warning labels, marketing bans and sugary drink taxes? Two cross-sectional surveys measuring support for policy responses to sugar-sweetened beverages.*

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Abstract

Objective: To assess public support for 10 potential policy initiatives to reduce sugar-sweetened beverage (SSB) consumption.

Design: A 2014 historical data set, which employed a face-to-face survey in one Australian state (study 1), provided the basis for comparison with our 2017 nationally representative, cross-sectional, computer assisted telephone interviewing (CATI) population survey (study 2).

Participants: Study 1: South Australians, 15+ years (n=2,732); Study 2: Australians, 18+ years (n=3,430).

Primary outcome measures: Levels of support for SSB-specific policy initiatives. For the 2017 National study (study 2), demographic characteristics, BMI, knowledge of potential harms caused by consuming SSBs, and SSB consumption were included in multivariable regression analyses.

Results: In 2017, all 10 potential policy initiatives received majority support (60-88% either 'somewhat' or 'strongly' in favour). Initiatives with educative elements or focussed on children received high support (>70%), with highest support observed for text warning labels on drink containers (88%) and government campaigns warning of adverse health effects (87%). Higher support was observed for SSB tax paired with using funds for obesity prevention (77%) than a stand-alone tax (60%). Support for policy initiatives was generally greater among those who believed SSB daily consumption could cause health problems in adults (4-18% absolute difference) and/or in children (8-26% absolute difference), and lower among SSB high consumers (7+ drinks p/week; 9-29% absolute difference). State-specific data comparison indicated increased support from 2014 to 2017 for taxation (42% vs 55%; χ^2=15.7, p<0.001) and graphic health warnings (52% vs 68%; χ^2=23.4. p<0.001).

Conclusions: There is strong public support for government action, particularly regulatory and educational interventions, to reduce SSB consumption, which appears to have

increased since 2014. The findings suggest that framing policies as protecting children, presenting taxation of SSBs in conjunction with other obesity prevention initiatives and education focussed on the harms associated with SSB consumption will increase support.

Keywords: Sugar-sweetened beverages, policy, sugar tax, warning labels

Strengths and limitations of this study:

- A large nationally representative study of 3,430 Australian adults enabled current (2017) insight into level of support for policy initiatives specifically aimed at reducing sugar sweetened beverage consumption.
- A second large historical data set of 2,732 from one Australian state enabled a historical comparison to provide indication of how opinions have changed over the last three years (2014).
- The study provides current insight into the characteristics of supporters and non-supporters (including knowledge about SSBs) of different policy support options.
- Results are limited by the cross-sectional nature of the surveys.
- Historical comparison is limited by the methodological differences between the two data sets.

INTRODUCTION

Excess consumption of sugar-sweetened beverages (SSBs) is causally associated with increased risk of obesity, Type II diabetes, periodontal disease, dental caries, and cardiovascular disease.[1-6] SSB consumption is high in Australia as it is in other countries,[7] with one third of the Australian population (34%) reporting they had consumed SSBs on the day prior to the National Health Survey.[8] SSB consumption (prior day) was found to be higher among Australian males than females (39% vs 29%), and highest among those from disadvantaged areas (47%).[8] Consumption increased with age and peaked at 62% among adolescent males aged 14 to 18 years. Australian adults who consumed SSBs on the day prior to the National Health Survey ingested an average of 13 teaspoons (54 grams) of sugar from SSBs daily, and adolescent males consumed, on average, 16 teaspoons of sugar (68 grams).[8] This is concerning given the World Health Organization recommends limiting *total* daily free sugar consumption to 10% of total energy intake, which equates to approximately 13 teaspoons.[9] SSBs represent a significant source of added sugar in the Australian diet and a readily modifiable risk factor for many prevalent chronic diseases.

Attention has increased on SSB consumption as a target for population- and policy-level interventions worldwide. Policy-level interventions may include taxes or health levies (taxes imposed on products coupled with investment in prevention programs and/or health costs associated with obesity), changes to product (labelling, size restrictions), restricting marketing practices and reducing availability. More than 30 jurisdictions around the world have implemented SSB taxes,[10] and a number of post-implementation studies provide real-world evidence of their effectiveness.[10-12] Implementation of other interventions, such as mandatory menu kilojoule labelling, advertising restrictions, or health warnings, is far less widespread.[13]

Substantial political support is required to implement regulatory interventions due to strong industry opposition.[14-17] It is widely recognised that public support is an important factor influencing political appetite for policy reform and therefore implementation.[18-21] Policy

makers benefit from, and are sensitive to, data on how potential policy initiatives are perceived by the community, in addition to data on effectiveness.[22-24] In turn, the degree to which people are knowledgeable about a health issue may influence the degree to which they support policy options aimed at changing health behaviours.[25, 26] Identifying levels of public knowledge and support and the characteristics of members of the community who support various initiatives can also assist public health agencies and advocates in developing effective message framing for encouraging evidence-based policy reform.[27, 28]

Published data on public support for regulatory initiatives specifically aimed at SSB consumption is limited in the Australian context. The majority of studies including data relating specifically to support for SSB policy initiatives have reported on US populations,[18, 29-33] with some surveys also conducted in other high income countries.[34-38] Many of these studies have focussed on taxes, with and/or without complementary funding for obesity prevention or health.[29, 31, 34-36] Few studies have compared levels of support across different SSB policy options.[30, 32, 37, 39] While estimates of support may not be directly comparable across countries and jurisdictions, some general patterns emerge. Overall, initiatives that have been received more positively include those that are less intrusive and incorporate elements of 'nudge' strategies. These include coupling revenue from tax with investment into the health system or complementary educative initiatives; targeting consumption in children; and/or educating consumers on health effects of consumption.[30, 32, 35-37, 39, 40] Policy interventions that have received lower levels of support include: stand-alone taxes; and restrictions on SSB availability or promotion.[30, 32, 39]

To date, Australian studies have been conducted on non-representative samples,[36, 39] and/or have focused on foods and beverages concurrently, with few questions directly assessing SSB-specific initiatives.[36, 37] A recent online study[37] indicated that the Australian public is supportive of government regulation to prevent obesity and overweight in general (86%), with substantial support for initiatives to restrict advertising of unhealthy foods and beverages in a number of contexts, especially restriction of advertising to children on

television (79%) and via the internet (76%). In relation to SSBs specifically, 55% supported a tax on SSBs and 63% supported prohibiting sponsorship of children's sport. A 2010 study of a sample of household grocery buyers found approximately 70% support for a tax on soft drinks if the revenue raised was used to reduce the cost of healthy food, with levels of support higher among parents and those of higher socio-economic status.[36] A study of Australian university students and staff's views on SSB-specific interventions on-campus indicated high support (>75%) for increasing access to free drinking water, lowering the price of water and diet beverages, and educational initiatives (nutrition information, campaigns).[39] Lower support (<50%) was reported for removing SSBs from display, replacing SSBs with diet or low sugar versions, or restricting sales of SSBs on-campus. A 2016 public opinion poll in Australia indicated 75% would either 'strongly' or 'probably' support a tax on SSBs with 'high levels of sugar if revenues raised were used to fund programs to reduce the damaging health effects of SSB consumption'.[41] In a 2018 Australian poll, where there was no mention of the use of funds raised, 53% indicated they would support a tax on SSBs.[42]

Data on public support for SSB policy initiatives beyond taxation, are very limited. As SSBs have been specifically identified for intervention by the World Health Organization due to their significant contribution to free sugar intake and the over consumption of energy,[9] it is important to gauge public response to other potential SSB-targeted initiatives. Assessing public levels of support for policy initiatives aimed at reducing consumption of unhealthy food within the same question as SSBs, may obscure the level of support evident for SSB-targeted initiatives. While experimental evidence regarding effectiveness of SSB warning labels is increasing[43-46], a substantial knowledge gap exists around public acceptability of warning labels on SSBs as a policy initiative relative to other SSB policy initiatives such as taxation. Warning labels both educate and deter consumers and have shown effectiveness in increasing consumers' understanding of the harm caused by smoking and reducing tobacco consumption.[47] Evidence of the potential effectiveness of warning labels in changing dietary behaviour is increasing.[46, 48-52] Warning labels for SSBs are of growing

interest to policy makers. While some estimates of policy support have been derived from online experiential studies,[46, 48, 49] population estimates of the acceptability of warning label policies are lacking.

We sought to determine levels of public support for different types of policies targeted specifically at SSBs, and how levels of support vary according to socio-demographic factors, health risk factors and levels of knowledge. Such data will help inform the political feasibility of the range of potential interventions. This paper presents results from two large, representative population studies: a state-based survey conducted in 2014 and a national survey conducted in 2017. Together, the findings provide a current picture of policy support among Australians as well as an indication how views may have changed in the past 3 years, within one state.

METHOD

Study 1: 2014 State-based population survey

SSB policy support questions were developed and included in the 2014 South Australian Health Omnibus Survey (SAHOS); an annual, representative population survey of residents aged 15 years and older, administered via face-to-face interviews between September and December. The survey employed a multi-stage, stratified, random sampling strategy to identify households in South Australia, with one interview conducted per household with the person who had the most recent birthday. An approach letter detailing study information was sent to the house two weeks prior to the interview, and up to six follow up visits were made to secure the interview. Further detail regarding sampling, recruitment methods and data weighting procedures have been previously published.[53]

The policy support questions were based on similar measures successfully used to explore support for policies in tobacco and food contexts, [36, 54] with content developed in consultation with co-authors and in consultation with Obesity Policy Coalition (a leading Australian advocacy organisation in obesity) (see supplementary material for a fully copy of

the measure; Table S1). Support for eight policy initiatives was assessed (see Table 1 and Table S1) by asking participants to indicate whether they were in favour of or against each initiative (presented in fixed order due to methodological constraints). For example, participants were asked "Are you in favour or against the government taxing drinks that are high in added sugar?" with possible responses: *Strongly against, somewhat against, neither in favour or against, Somewhat in favour, Strongly in favour*. Data were weighted to adjust for (inverse) probability of selection in the household (chance of selection given the number of eligible people in the household) and response rate (metropolitan and country regions). Data were then re-weighted to reflect population characteristics of age, sex and geographical area in South Australia (SA).[55] The study was approved by the University of Adelaide's Human Research Ethics Committee (HREC).

Study 2: 2017 National survey

A survey was conducted with a national sample of adults, with the following eligibility criteria applied: aged 18 years or older, able to converse in English and living in Australia. The Social Research Centre was commissioned to recruit participants and conduct surveys via Computer-Assisted Telephone Interview (CATI). Participants were contacted via random digit dialling to a landline or mobile phone number at a ratio of 35:65, which is in accordance with Australians' use of communication.[56] For landlines, where more than one eligible respondent resided in the household, preference was given to the youngest eligible male, followed by the youngest eligible female, as these groups can be under-represented in telephone surveys.[57] The person who answered the phone was the selected respondent from the mobile sample provided they met the eligibility criteria. Interviewers provided a brief introduction to the study and then ascertained participants' eligibility and willingness to continue in the study. The sample size (n=3,600) was selected to provide an accurate representation of opinions of Australian adults, and also to allow for the detection of differences in knowledge following any future policy adoption in Australia. The study was approved by the University of Adelaide's HREC.

Measures

Policy questions were based on measures used in Study 1 with minor adaptations. To mitigate ceiling effects suggested by the South Australian survey data and based on consultation with an obesity advocacy expert from the Obesity Policy Coalition, some of the initiatives were modified in 2017 to represent a tougher policy stance, e.g., initiatives suggesting 'restriction' in 2014 were changed to 'banning' in 2017. A question was also included to obtain a more nuanced understanding of policy conditions, e.g., an initiative proposing using the funds raised from taxes for obesity prevention was added. One question was amended to reflect the evolution of digital technology (see Table S1 in supplementary material for a full description of wording changes from 2014 to 2017).

For ease of interpretation, SSBs were referred to as 'sugary drinks' throughout the survey and were defined as soft drinks, energy drinks, sports drinks, fruit flavoured mineral waters, all types of fruit juice and cordial. Participants were asked to what extent they were in favour or against 10 potential policy initiatives presented in random order, except for the initiative pertaining to a SSB tax that always preceded the extension of this initiative (i.e., using money raised to fund obesity prevention) (see Table S1, supplementary material, for all policy options presented). For example, participants were asked, "Are you in favour or against government funded TV campaigns educating people about the health effects of sugary drinks?" with possible responses: *Strongly against, Somewhat against, neither in favour or against, Somewhat in favour, Strongly in favour*.

Consistent with previous studies,[53, 58, 59] weekly consumption was estimated by asking participants on how many days they had consumed sugary drinks in the past 7 days and how much they normally consumed (number of 250ml cups) on a day when they consumed sugary drinks. To enable a calculation of Body Mass Index (BMI), participants reported their weight and height. For ease of interpretation, were subsequently categorised as either overweight/obese (BMI of 25 or more), or healthy/underweight (BMI under 25) as we were interested in perceptions of policies among those who were overweight/obese, and those in

the underweight range comprised only 3% of the sample. Two knowledge questions, based on measures used previously in a US sample,[60] asked participants to indicate the likelihood of developing any health problems later in life if (i) an adult and (ii) a child consumed a sugary drink every day. A pilot of 30 interviews was conducted prior to full implementation of the study, and some questions were slightly revised to improve comprehension. Specific questions assessing SSB consumption, BMI and knowledge are available from Table S2 in supplementary material.

Socio-demographics

Participants' sex, age, education, employment status, postcode and main language spoken at home were recorded. Postcodes were used to calculate level of disadvantage scores according to the Australian Bureau of Statistics' Socio-Economic Indexes for Areas (SEIFA),[61] which were grouped to form 'most disadvantaged' (deciles 1-3); 'moderately disadvantaged' (deciles 4-7) and 'least disadvantaged' (deciles 8-10) categories.

Statistical analyses

Data were weighted to adjust for individuals' chances of selection according to relevant population benchmarks for age, sex, location and telephony status sourced from Australian Government data.[62, 63] Wilcoxin Signed Ranks tests were used to compare responses to policy questions. Chi-square tests were conducted to examine differences in support for each initiative between the 2014 sample, and a comparative state subset of the 2017 sample. For multivariable analyses, responses were dichotomised to be either: 'In favour' (Strongly or somewhat) or 'Not in favour' (strongly against, somewhat against or neither for nor against), as a minority (3-4%) indicated they were 'neither for nor against'. Multivariable logistic regression analyses were conducted to identify characteristics of those in favour of each policy initiative in terms of socio-demographic characteristics, levels of knowledge, SSB consumption and BMI. These analyses were adjusted for all other factors as we were interested in unique variance explained. Only factors found to explain unique variance in any

one policy initiative were reported in the multivariable results table (for ease of interpretation). All analyses were conducted on unweighted and weighted data with a small degree of variation apparent in results: the strength and significance of associations changed slightly for a minority of results, with no change at the conventional $p<0.05$ level. Due to the small degree of difference in results, results of analyses on weighted data are presented here.

Patient and public involvement

Patients and members of the public were not involved in the development of the research question, outcome measures, study design, recruitment or conduct of the studies. Results will be disseminated to participants of the 2017 National Survey who registered their interest in receiving a report at the completion of the project.

RESULTS

2014 State-based population survey results

Of the initial sample drawn (n=5,200), there were interviews completed for 2,732 participants with 183 considered out of scope (vacant houses, businesses). According to the American Association for Public Opinion Research (AAPOR) , which offers standardised formulas for calculating appropriate responses to surveys, this yields a Response Rate 1 (RR1: participants completing the survey as a proportion of eligible sample) of 55%, and a participation rate of 61% (denominator excluded 507 dwellings for which contact could not be established after six attempts).[64] The sample had a good representation of socio-demographic characteristics (i.e., gender, age, education and socio-economic disadvantage) which has been published previously.[53]

There was greater than 80% support for five out of the eight policy options (text warning labels; restrictions on advertising to children via television and via websites/games; restrictions on sales in schools; and television campaigns)(see Table 1). Support was lower, but still favoured by the majority, for restricting sugary drink sponsorship of children's sport

(70%) and adding graphic warning labels to sugary drink containers (52%). Responses to taxing sugary drinks were mixed, with approximately equivalent proportions in favour and against taxation.

Table 1: Support for SSB policy options in South Australia (2014 survey, N=2732)

Policy option	Proportion in favour		Proportion neither for nor against	Proportion against	
	Strongly	Strongly/ Somewhat		Strongly	Strongly/ Somewhat
	% (95% CI)	% (95% CI)	% (95% CI)	%	95% CI
Government tax on drinks high in added sugar	18 (17-19)	42 (40-44)	11 (10-12)	25 (23-27)	45 (43-47)
Government funded TV campaigns warning about health effects of obesity	43 (41-45)	80 (79-81)	9 (8-10)	3 (2-4)	10 (9-11)
Restrictions on the sales of sugary drinks at schools	58 (56-60)	83 (82-84)	6 (5-7)	3 (2-4)	10 (9-11)
Restrictions on the marketing of sugary drinks to children through websites and computer games	59 57-61()	84 (83-85)	6 (5-7)	4 (3-5)	10 (9-11)
Restrictions on sugary drink sponsorship of children's sport	42 (40-44)	70 (68-72)	13 (12-14)	4 (3-5)	15 (14-16)
Restrictions on advertising sugary drinks to children on television	55 (53-57)	80 (79-81)	8 (7-9)	4 (3-5)	11 (10-12)
Written labelling on sugary drinks warning about the risk of diabetes, obesity and tooth decay	53 (51-55)	85 (84-86)	6 (5-7)	3 (2-4)	8 (7-9)
Graphic health warning labels on sugary drinks like those on cigarettes	27 (25-29)	52 (50-54)	13 (12-14)	12 (11-13)	34 (32-36)

Note. Percentages do not add up to 100% as less than 2% reported 'don't know' or 'refused' for each response. "Strongly/somewhat" reflects the cumulative proportion of those reporting they were either strongly or somewhat in favour, or strongly or somewhat against.

2017 National survey results

The AAPOR Response Rate 3 (RR3) for this study was 16%, that is, the number of completed interviews as a proportion of all interviews (complete and partial), refusals, non-contacts, and those with unknown eligibility that were estimated to be eligible.[64] A participation rate of 44% was achieved (slightly lower than for Study 1: 55%), resulting in 3,430 participants.

Table 2 describes participants' characteristics, SSB knowledge and consumption behaviour. The distribution of the weighted sample was similar to that of 2016 Australian census population data with respect to sex, age and employment status,[65] though participants of the current study had slightly higher levels of education, socio-economic status and English as main language (survey eligibility required proficiency in English). Sugary drink consumption was higher in the current sample, yet the proportion of overweight/obese participants was slightly lower. These differences are likely due to variation in assessment methods (e.g., current study reported usual consumption whereas the Australian Bureau of Statistics reported previous day's consumption)[8] and historical nature of the comparative data sets,[66] and therefore, only a general level of comparison can be made. Overall, the sample was considered representative of the Australian population, as it was equivalent to census data in terms of age, sex and employment status, and approximated level of education and socio-economic status.

Table 2. Socio-demographic characteristics and prevalence (%) of risk factors and knowledge variables

Socio-demographic characteristics	Current study (n=3430)		Comparative national data
	Proportion (%) of participants (Weighted)	Proportion (%) of participants (Unweighted)	Proportion (%) of participants
Sex			
Female	49	49	51
Male	51	52	49
Age range			
18-30 years	24	15	24
31-45 years	24	20	27
46-60 years	26	27	24
61+ years	26	37	25
Level of education			
Secondary school or less	27	28	40
Some tertiary education or completed vocational training	34	33	33
Finished university (bachelor degree or higher)	38	37	26
Level of disadvantage (deciles)			
Decile 1-3 (Most disadvantaged)	20	21	29
Decile 4-7 (Mid)	41	40	40
Decile 8-10 (Least disadvantaged)	38	39	31
Employment status			
Work full or part time	60	55	62
Not currently working/ retired	39	45	38
English main spoken language at home			
Yes	92	94	78
No	8	6	22
SSB every day causes health problems in adults			
Not likely	20	22	
Somewhat/Very likely	80	78	
SSB every day causes health problems in children			
Not likely	10	11	
Somewhat/Very likely	90	89	
Sugary drink consumption per week			
None	52	56	69
1-6 times	34	30	
7+ times	14	13	
Body Mass Index (BMI)			
<=25	46	43	37
>25	50	53	63
Don't know	4	4	

Note. Comparisons of sex, age, education, employment status, language spoken at home were made with data sourced from the ABS (51). Where possible data were compared with adults aged 18+ years (age), but in some cases comparisons were made with adults aged 20+ years (gender, education, employment status), or all adults 15+ years (Disadvantage and language spoken at home). Sugary drink consumption comparison was based on data from the 2011-12 Australian Health Survey

(9) for adults aged 19+ years and pertained to consumption on the day prior to the interview, whereas in the current study, usual consumption was assessed. BMI comparison was based on data from the National Health Survey 2014-15 for adults aged 18+ years (52).

All policy options received majority support ranging from 60% to 88% (see Table 3). Interventions with a consumer warning or educative focus received very high levels of support. Over 80% of participants reported that they were either strongly or somewhat in favour of: Text warning labels on SSB containers about health risks; Government funded TV campaigns about the health effects of SSBs; Text warning labels on vending machines and other places of sale; and Text warning labels on SSB advertisements (e.g., billboards and television). Potential interventions involving banning marketing or sales also received high levels of support (71-79%). There were significant differences observed in support between all of the policy options assessed. Of particular note, Government tax on drinks high in added sugar, received majority support at 60%; however, support was substantially higher for SSB tax (77%) when paired with the complementary measure of reinvesting revenue into obesity prevention ($Z=-25.0$; $p<.001$).

Table 3. Support for possible policy interventions in Australia (2017 survey, n=3430)

Policy options	Proportion in favour		Proportion neither for nor against	Proportion against	
	Strongly	Strongly/ Somewhat		Strongly	Strongly/ Somewhat
	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)
Text warning labels on SSB containers about health risks	65 (63-67)	88 (87-89)	3 (2-4)	4 (3-5)	9 (8-10)
Government funded TV campaigns about health effects of SSBs	65 (63-67)	87 (86-88)	4 (3-5)	5 (4-6)	9 (8-10)
Text warning labels on vending machines and other places of sale	61 (59-63)	86 (85-87)	3 (2-4)	4 (3-5)	10 (9-11)
Text warning labels on SSB advertisements (e.g. tv, billboards)	59 (57-61)	84 (83-85)	3 (2-4)	5 (4-6)	12 (11-13)
Bans on SSB advertising during children's TV viewing times	62 (60-64)	79 (78-80)	4 (3-5)	8 (7-9)	16 (14-17)
Government tax on drinks high in added sugar to fund obesity prevention	55 (53-57)	77 (76-78)	3 (2-4)	11 (10-12)	18 (16-19)
Bans on SSB marketing on digital platforms popular with children	59 (57-61)	76 (75-77)	4 (3-5)	8 (7-9)	19 (18-20)
Bans on sales of SSBs in schools	57 (55-59)	75 (74-77)	4 (3-5)	7 (6-8)	20 (19-21)
Graphic warning labels on SSB containers about health risks	48 (46-49)	71 (69-72)	4 (3-5)	11 (10-12)	24 (23-250
Government tax on drinks high in added sugar	39 (37-41)	60 (59-62)	5 (4-6)	20 (19-21)	33 (31-35)

Note. Percentages do not add up to 100% as less than 2% reported 'don't know' or 'refused' for each response. "Strongly/somewhat" reflects the cumulative proportion of those reporting they were either strongly or somewhat in favour, or strongly or somewhat against.

The 2017 national sample included data from all Australian states and territories, enabling a comparison between the SA subset (n=247) and the 2014 SA HOS data (previously described study 1; n=2,732). There was a statistically significant difference between the comparably worded initiatives of support for taxation of SSBs (42% in 2014 compared with 55% in 2017; χ^2=15.7, p<.001) and graphic health warnings on SSBs (52% in 2014 and 68% in 2017, χ^2=23.4. p<.001).

Socio-demographic predictors of support for SSB policy options

There was little variation in support for consumer warning/educative policy initiatives by socio-demographic characteristics (see Table 4). However, there was significantly higher support for graphic warning labels among females than males and among older than younger participants. While support for text warning labels on SSB adverts varied significantly by level of disadvantage such that support was slightly lower among those from least disadvantaged areas, absolute difference in percentages was small.

There was greater socio-demographic variation observed for the marketing, sales and taxation policies (see Table 5). Females reported significantly higher support than males for initiatives aimed specifically at children (i.e., bans on: SSB advertising at children viewing times; SSB marketing on digital platforms popular with children; and the sale of all sugary drinks at schools). Older participants had a significantly lower likelihood than younger participants of favouring a government tax on drinks high in added sugar to fund obesity prevention, but a significantly greater likelihood of favouring the initiatives aimed specifically at children. Participants with higher levels of education were more likely to support all policy initiatives in Table 5.

Knowledge and risk factor predictors of support for SSB policy options

Participants with higher knowledge were frequently more likely to support policy initiatives. Significant associations were present between being cognisant of health risks of consuming SSBs in adults and level of support for 5 out of the 10 policy initiatives. Significant

associations were present between being cognisant of health risks of consuming SSBs in children for 7 out of 10 initiatives.

Higher SSB consumption (7+ drinks per week) was significantly associated with decreased likelihood of support for all but one policy initiative. There were few associations with BMI, although those in the overweight or obese range were significantly less likely to report being in favour of government-funded TV campaigns about health effects of SSBs.

Table 4. Multivariable logistic regression analyses with socio-demographic characteristics, knowledge and risk factors as predictors of support for regulatory interventions (consumer warning/educative) aimed at reducing the consumption of sugary drinks

Socio-demographics characteristics	Somewhat or Strongly in favour (cumulative): Gov. funded TV campaigns on health effects of SSBs		Text warning labels on vending machines and other places of sale		Text warning labels on SSB advertisements (e.g. tv, billboards)		Text warning labels on SSB containers about health risks		Graphic warning labels on SSB containers about health risks	
	%	OR (95%CI)	%	OR (95%CI)	%	OR (95%CI)	%	OR (95%CI)	%	OR (95% CI)
Sex										
Male	87	1.00	86	1.00	83	1.00	88	1.00	67	1.00
Female	88	0.87 (0.70-1.09)	87	0.97 (0.78-1.20)	87	1.17 (0.95-1.43)	89	1.00 (0.80-1.26)	75	1.31 (1.11-1.54)*
Age range										
18-30 years	90	1.00	85	1.00	84	1.00	86	1.00	64	1.00
31-45 years	88	0.91 (0.65-1.26)	85	0.96 (0.72-1.28)	84	0.91 (0.68-1.21)	88	1.05 (0.78-1.43)	67	1.06 (0.85-1.32)
46-60 years	88	1.05 (0.75-1.46)	89	1.34 (0.98-1.81)	88	1.25 (0.92-1.68)	89	1.22 (0.89-1.68)	71	1.31 (1.05-1.64)
61+ years	85	0.77 (0.55-1.08)	88	1.27 (0.92-1.75)	84	0.95 (0.71-1.29)	90	1.47 (1.04-2.06)	81	2.48 (1.92-3.20)**
Level of disadvantage										
Decile 1-3 (Most disadv.)	86	1.00	89	1.00	88	1.00	90	1.00	74	1.00
Decile 4-7 (Mid disadv.)	88	1.08 (0.82-1.44)	86	0.75 (0.56-1.01)	84	0.72 (0.55-0.96)	88	0.76 (0.56-1.03)	71	0.85 (0.68-1.05)
Decile 8-10 (Least disadv.)	87	0.91 (0.68-1.22)	86	0.71 (0.53-0.96)	84	0.63 (0.48-0.84)*	88	0.74 (0.54-1.01)	70	0.77 (0.61-0.96)
Knowledge and risk factors										
SSB every day causes health problems in adults										
Not likely	79	1.00	83	1.00	79	1.00	85	1.00	61	1.00
Somewhat/Very likely	90	1.48 (1.12-1.97)*	87	1.16 (0.87-1.55)	86	1.28 (0.98-1.68)	89	1.09 (0.80-1.48)	74	1.59 (1.28-1.98)**
SSB every day causes health problems in children										
Not likely	74	1.00	79	1.00	75	1.00	82	1.00	59	1.00
Somewhat/Very likely	89	2.09 (1.49-2.94)**	87	1.54 (1.08-2.20)	86	1.58 (1.14-2.20)*	89	1.48 (1.02-2.15)	72	1.33 (1.00-1.76)
Sugary drink consumption per week										
None	88	1.00	89	1.00	87	1.00	91	1.00	76	1.00
1-6 times	90	1.04 (0.81-1.35)	85	0.79 (0.63-1.01)	85	0.87 (0.70-1.10)	86	0.67 (0.53-0.86)*	68	0.81 (0.68-0.97)
7+ times	78	0.53 (0.39-0.71)**	80	0.59 (0.44-0.80)*	78	0.60 (0.45-0.79)**	82	0.52 (0.38-0.70)**	60	0.62 (0.49-0.79)**
BMI										
<=25	90	1.00	88	1.00	85	1.00	88	1.00	72	1.00
>25	85	0.63 (0.50-0.79)**	87	0.94 (0.76-1.17)	85	1.05 (0.85-1.29)	89	1.03 (0.82-1.30)	70	0.86 (0.73-1.01)
Don't know	87	0.79 (0.44-1.42)	73	0.47 (0.30-0.75)*	77	0.73 (0.45-1.19)	82	0.72 (0.43-1.21)	70	0.93 (0.60-1.44)

Note. % is the percentage of respondents (unadjusted for other variables) from each category reporting they were in favour of the policy initiative. Employment and education were not significantly associated with any policy initiative in this table and were not reported in the table for ease of interpretation. Missing data resulted in 3.9-4.2% of cases excluded from any one analysis. OR= Odds ratio (adjusted for all other socio-demographic characteristics, knowledge and risk factors); CI=Confidence Interval. Hosmer-Lemeshow Goodness of Fit values indicated good support for all models.
Statistical significance is denoted by asterisk(s) according to the following levels: *p<.01, **p<.001.

Table 5. Multivariable logistic regression analyses with socio-demographic characteristics, knowledge and risk factors, as predictors of support for selected regulatory interventions (marketing, sales, taxation) aimed at reducing the consumption of sugary drinks

Socio-demographic characteristics	Somewhat or Strongly in favour (cumulative): Bans on SSB advertising during children's tv viewing times		Bans on SSB marketing on digital platforms popular with children		Bans on sales of SSBs at schools		Gov. tax on drinks high in added sugar to fund obesity prevention		Gov. tax on drinks high in added sugar	
	%	OR (95%CI)	%	OR (95%CI)	%	OR (95%CI)	%	OR (95%CI)	%	OR (95%CI)
Sex										
Male	75	1.00	73	1.00	69	1.00	77	1.00	58	1.00
Female	85	1.70 (1.41-2.05)**	82	1.49 (1.24-1.78)**	82	1.70 (1.43-2.03)**	81	1.11 (0.92-1.33)	64	1.02 (0.87-1.19)
Age range										
18-30 years	76	1.00	70	1.00	64	1.00	83	1.00	57	1.00
31-45 years	81	1.14 (0.88-1.47)	80	1.46 (1.14-1.86)*	80	2.14 (1.68-2.72)**	80	0.74 (0.56-0.97)	64	1.25 (1.01-1.56)
46-60 years	81	1.24 (0.96-1.60)	81	1.76 (1.37-2.26)**	79	2.08 (1.63-2.65)**	76	0.58 (0.45-0.76)**	61	1.14 (0.92-1.42)
61+ years	82	1.51 (1.15-1.99)*	79	1.81 (1.40-2.35)**	79	2.35 (1.82-3.05)**	77	0.64 (0.48-0.85)*	63	1.35 (1.03-1.71)
Level of education										
Secondary school or less	75	1.00	72	1.00	72	1.00	75	1.00	55	1.00
Some tertiary/completed vocational training	79	1.30 (1.05-1.62)	77	1.30 (1.05-1.60)	77	1.37 (1.11-1.70)*	79	1.32 (1.06-1.64)	58	1.15 (0.95-1.38)
Finished university (bachelor deg. or higher)	84	1.62 (1.29-2.04)**	82	1.63 (1.31-2.04)**	77	1.11 (0.89-1.38)	82	1.37 (1.09-1.72)*	70	1.73 (1.43-2.11)**
Knowledge and risk factors										
SSB every day causes health problems in adults										
Not likely	74	1.00	70	1.00	63	1.00	66	1.00	47	1.00
Somewhat/Very likely	81	0.98 (0.76-1.26)	79	1.28 (1.02-1.62)	79	1.43 (1.14-1.81)*	82	1.50 (1.18-1.89)*	65	1.50 (1.22-1.85)**
SSB every day causes health problems in children										
Not likely	64	1.00	63	1.00	52	1.00	58	1.00	41	1.00
Somewhat/Very likely	82	2.16 (1.60-2.93)**	79	1.70 (1.26-2.28)**	78	2.47 (1.85-3.28)**	81	2.05 (1.54-2.75)**	64	1.86 (1.41-2.45)**
Sugary drink consumption per week										
None	82	1.00	80	1.00	80	1.00	81	1.00	69	1.00
1-6 times	80	1.03 (0.84-1.26)	78	1.08 (0.88-1.31)	74	0.87 (0.72-1.06)	81	0.92 (0.75-1.13)	59	0.68 (0.57-0.80)**
7+ times	71	0.72 (0.56-0.94)	66	0.68 (0.53-0.87)*	62	0.57 (0.44-0.73)**	64	0.45 (0.35-0.58)**	40	0.38 (0.30-0.47)**
BMI										
<=25	80	1.00	77	1.00	76	1.00	81	1.00	65	1.00
>25	80	1.05 (0.87-1.27)	79	1.09 (0.91-1.30)	76	0.95 (0.79-1.13)	77	0.96 (0.80-1.16)	59	0.82 (0.70-0.96)
Don't know	67	0.57 (0.37-0.87)	65	0.59 (0.38-0.89)	66	0.57 (0.37-0.87)*	71	0.75 (0.48-1.19)	58	0.85 (0.57-1.27)

Note. % is the percentage of respondents (unadjusted for other variables) from each category reporting they were in favour of the policy initiative. Level of disadvantage and employment were not significantly associated with any policy initiatives in this table and were not reported in the table for ease of interpretation. Missing data resulted in 3.8-4.5% of cases excluded from any one analysis. OR= Odds ratio (adjusted for all other socio-demographic characteristics, knowledge and risk factors); CI=Confidence Interval. Hosmer-Lemeshow Goodness of Fit values indicated good support for all models. Statistical significance is denoted by asterisk(s) according to the following levels: *p<.01, **p<.001.

DISCUSSION

The study results show high community support for a range of SSB-specific policy initiatives, suggesting strong community appetite for government action around SSB consumption, with indications that this support is growing over time. Very high support was expressed for interventions warning consumers about the potential health effects of SSB consumption, with the highest support for text warning labels on sugary drink containers (88%) and government-funded campaigns warning of health effects (87%), closely followed by warnings on vending machines and other places of sale (86%), and on advertisements (84%). Consumers have the right to be informed about both the contents of the food and beverages they consume and the established health risks associated with frequent consumption. Governments have an important role in ensuring consumers have ready access to this information. Previous research shows information deficits exist regarding the sugar content of and health risks associated with SSBs.[53] There is a clear need for, and public receptiveness to, government interventions warning of the health effects of frequent SSB consumption. Televised campaigns and text warning labels are prime opportunities given the very high levels of public support for these initiatives.

While front-of-pack label systems based on nutrient profiles are widespread on food and beverages, very few jurisdictions have implemented any form of warning label system. An exception is Chile, which has “high in sugar” black stop-sign style warning labels that apply to foods and beverages which are high in sugar, with equivalent warnings for sodium, saturated fat and energy.[67] Other South American countries, Israel and Canada have all foreshadowed their interest in similar warning label schemes. The City of San Francisco passed legislation for health effect warning labels on SSB advertisements, but it was blocked by sustained litigation from industry.[68] Despite low real-world implementation, experimental studies continue to demonstrate the likely impact of SSB warning labels on knowledge and consumption.[44, 46, 48-50, 69] Of note, recent experimental research in Australia has found that

graphic warning labels on food products tip consumers towards making healthier food choices,[69] and reduce automatic appetitive neural responses towards food cues.[70]

There was relatively high Australian population-level support for graphic health warnings on SSBs (71% in 2017), compared to US-based experimental samples (51%-63%). On-product health warnings are familiar to Australian consumers. Text warning labels have been in place on tobacco products for several decades. Australia was one of the first nations to introduce graphic health warnings on cigarette packets in 2006, with over 100 jurisdictions having advanced to graphic warnings internationally.[71-74] Familiarity and awareness of impact may underpin Australians' level of support for graphic health warnings on SSBs. It also appears there may be increasing receptiveness among Australians to this form of government intervention.

Mass media campaigns rarely focus on the harmful health effects of unhealthy food or beverages, and more frequently have taken a soft (e.g. 'nudge') approach and/or promote fruit or vegetable consumption or physical benefits of healthier lifestyles. However, recent Australian state-based campaigns warning about specific serious health harms linked to SSBs have demonstrated effectiveness in changing beliefs, attitudes, behavioural intentions and behaviour.[58, 75, 76] These campaigns are reminiscent of the high quality government-funded campaigns warning of the serious harms of tobacco which are long standing in Australia, and internationally, and have helped drive enormous shifts in behaviour (tobacco consumption) and social norms about smoking.[77] A national campaign focussed on increasing awareness of and concern about the serious health risks of frequent SSB consumption is now warranted.

In the present study, Australians expressed majority support for regulatory initiatives that would curb children's exposure to SSBs and their promotion via television advertising (79%), marketing on digital platforms (76%) and sales in schools (75%). Our findings are consistent with support observed previously for the regulation of television and online marketing of unhealthy food *and* beverages targeting children.[37] Support for restrictions on industry's

ability to market to children likely reflects a recognition that children are more vulnerable as consumers and warrant greater protection. Given that Australian children are high consumers of SSBs (47%)[8] and levels of childhood overweight and obesity are unacceptably high (26%)[78], government interventions to protect children from the heavy promotion of SSBs are overdue. Contextualising initiatives as protective of children's health would likely enhance community receptiveness.

While support in the present study for the taxation of drinks that are high in sugar was lowest among all the policies presented to participants, there was still majority support (60% in 2017). Comparison with the 2014 survey data indicated an absolute increase in support in the order of 10-15% over 3 years in one state, suggestive of growing public concern and receptiveness to this form of intervention. When taxation was linked to the provision of obesity prevention, public support was substantially higher (77%), consistent with other studies,[35, 37] offering some insight into the relative increase in support that may occur with different policy framing. The approach of coupling taxation with other preventive interventions has demonstrated success in tobacco.[77] Australian advocates are calling for a 'health levy' on SSBs as part of a broader suite of interventions.[79, 80] Sugar sweetened beverage or "soda" taxes have already been implemented around the world,[10] have demonstrated effectiveness[81] and have prompted reformulation by industry.[82] Taking a 'comprehensive approach' that includes multiple policy components has demonstrated effectiveness in tobacco control, is consistent with the evidence in obesity prevention and may also align well with community preferences.

Overall, people who understood that daily SSB consumption by adults and/or children is likely to lead to health harms were more likely to support all forms of policy action. Continuing to raise community awareness of the health effects of frequent SSB consumption, which is important in its own right, may also increase community support for policy intervention. This is consistent with results from tobacco control and alcohol research

showing increased support for policies after exposure to campaigns explaining health risks.[25, 60, 83]

High consumers of SSBs were somewhat less receptive to policies in this study which was not surprising given that pricing policies would impact directly on them. It is notable that despite lower levels of support relative to non-users, the majority of SSB consumers supported all proposed initiatives except stand-alone taxation (40%). Taxation coupled with prevention had majority support (64%).

Limitations

Cross-sectional population surveys can only capture the public's responses at one point in time, and reasons for support or lack of support for policy initiatives were not identified. However, characteristics of supporters and non-supporters (including knowledge about SSBs) provide insight into the identified differences in support. While some measures (e.g., knowledge of harms of SSB consumption) had not been extensively validated, they were based on existing measures.[60] Furthermore, while self-reported height and weight provide only an estimate of BMI, this is a frequently used method to approximate BMI, and quantifies body size appropriately in Australians.[84, 85] To mitigate the risk of any social desirability response bias, the surveys were anonymous or de-identified. Overall, the 2017 survey yielded high-quality, nationally-representative data that provide reliable evidence of the public's response to SSB policy options. The state-based survey (2014) provided insight into the views of those who resided in one state of Australia, and therefore, cannot be considered nationally representative. While comparisons were made between the state-based data of both samples for comparably worded policy initiatives only, differences in methodology as detailed in the method section need to be taken into account. Notably, the two methodological approaches resulted in different response rates with a lower rate observed for the CATI survey (which employed random digit dialling) versus the household face-to-face survey. Despite these limitations, the state-based data provided a historical reference

and a valuable indication of how opinions towards an important health topic have changed over the last three years.

CONCLUSIONS

There is immediate public readiness for government action to reduce SSB consumption. The findings indicate very strong public support for multiple regulatory and educational interventions. There are indications that support for some initiatives has increased markedly over a short time frame. Framing policies as protecting children will likely result in greater levels of support, as will increasing knowledge of the harms associated with SSB consumption. Presenting taxation of SSBs in conjunction with other prevention initiatives is fundamental to community support.

Australia has a strong track record of intervening to change consumption behaviour in tobacco control. This success was underpinned by a comprehensive approach combining educative approaches with a strong regulatory framework. Australia should continue this successful approach to address SSBs. Given the Australian public's receptiveness, Australia would be well placed to be the first country in the world to introduce a comprehensive suite of interventions to address SSBs, including health warning labels, marketing restrictions, taxation and accompanying public education mass media campaigns.

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Supplementary material.

Table S1. Differences in wording of questions and topics regarding policy options to curb SSB consumption between 2014 and 2017 surveys

2014 State HOS survey[i]	2017 National Survey[ii]
INTRO: Sugary drinks or sugar-sweetened drinks are non-alcoholic water based drinks with added sugar, including soft drinks, energy drinks, fruit drink, sports drinks and cordial. Are you in favour or against…	INTRO: This question relates to sugary drinks that are non-alcoholic water based drinks with added sugar, including soft drinks, energy drinks, sports drink, fruit flavoured drinks, all types of fruit juice and cordial. Are you in favour or against…
1. The Government taxing drinks that are high in added SUGAR?	A1.The Government taxing drinks that are high in added SUGAR?
Not assessed	A2.The Government taxing drinks that are high in added SUGAR and using the money for obesity prevention?
2. Government funded TV campaigns warning about the health effects of obesity	B.Government funded TV campaigns educating people about the health effects of sugary drinks?
3. Restrictions on the sales of sugary drinks at schools	C.Banning the sale of all sugary drinks at schools?
4. Restrictions on the marketing of sugary drinks to children through websites and computer games?	D.Banning the marketing of sugary drinks on digital platforms popular with children such as Apps, websites, games, Facebook, Snapchat?
6. Restriction on advertising sugary drinks to children on television	E.Banning sugary drink advertising at times when large numbers of children are watching TV?
7. Written labelling on sugary drinks warning about the risk of diabetes, obesity and tooth decay	F1.Text warning labels on sugary drinks about the risk of diabetes, obesity and tooth decay?
Not assessed	F2.Text warning labels on vending machines and other places where drinks are sold?
Not assessed	F3.Text warning labels on sugary drink advertisements such as billboards and television?
8. Graphic health warnings on sugary drinks a bit like those on cigarettes	G.Graphic health warnings on sugary drink containers about the risks of diabetes, obesity and tooth decay, a bit like those on cigarettes
5. Restrictions on sugary drink sponsorship of children's sport?	Not assessed

Note. Underlining depicts differences in wording. Shading indicates the initiative was not assessed in that given year. Response options: Strongly against, somewhat against, neither in favour or against, somewhat in favour, strongly in favour, don't know, refused.

[i] Number indicates order that interviewer read out the statement.

[ii] Statements were randomised; Questions A and F remained grouped and presented in the same order.

Table S2. The order and wording of questions for knowledge and risk factors (SSB National Survey)

Topic	Question	Response
C) Risk factor: Sugary drink consumption	The next series of questions ask about **sugary drinks**. This means soft drinks like coke and lemonade, energy drinks like Red Bull, sports drinks like Gatorade, fruit flavoured drinks like Schweppes mineral waters and mixers, all types of fruit juice and cordial. It excludes artificially sweetened drinks and those mixed with alcohol. 1. During the **past 7 days**, on how many days did you drink at least one 250ml cup of a sugary drink? 2. On days when you do drink sugary drinks, how many cups per day do you usually have?	Days (Range 0-7):_____ Cups per day (range 1-40)_____
E) Knowledge of health effects	1. If an **average adult** drank a sugary drink every day, would they be likely or unlikely to have health problems later in life? 2. If a **child** drank a sugary drink every day, would they be likely or unlikely to have health problems later in life?	1. Very unlikely 2. Somewhat unlikely 3. Neither likely or unlikely 4. Somewhat likely 5. Very likely 6. (Don't know/Can't say) 7. (Refused)
F) Risk factor: Body Mass Index (BMI)	1. What is your height without shoes? 2. What is your weight (undressed) in the morning?	Centimetres/feet and inches:_____ Kilograms/stone and pounds/pounds:_____ (BMI calculated using formula: kg/m^2)
G) Policy support –see Table S1		

Other topics that were included but are reported elsewhere: A) Parental status; B) Knowledge of sugar guidelines; C) Consumption of soft drink, energy drinks, sports drinks, fruit juice, artificially sweetened soft drinks, bottled water, alcoholic beverages; D) Knowledge about sugar intake in sugary drinks; E) Knowledge of illness associated with drinking soft drinks and artificially sweetened soft drinks; relative healthiness of sports drinks, fruit juice and artificially sweetened drinks compared to soft drinks; F) Availability of soft drinks, fruit juice and artificially sweetened soft drinks in the home; Take away food consumption; frequency of physical activity; sleep; current health conditions.

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-6
Objectives	3	State specific objectives, including any prespecified hypotheses	6
Methods			
Study design	4	Present key elements of study design early in the paper	7,9,10
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	7, 9
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	7,9
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7,9,10
Data sources/ measurement	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	7,9, 10
Bias	9	Describe any efforts to address potential sources of bias	10
Study size	10	Explain how the study size was arrived at	7, 9
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	7,10,11
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	7,10,11
		(*b*) Describe any methods used to examine subgroups and interactions	7,10,11
		(*c*) Explain how missing data were addressed	8,14
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	7,10
		(*e*) Describe any sensitivity analyses	NA
Results			

Participants	13*	(a) 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	7,11
		(b) Give reasons for non-participation at each stage	7,11
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	12
		(b) Indicate number of participants with missing data for each variable of interest	8,14,17,18
Outcome data	15*	Report numbers of outcome events or summary measures	12-19
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	8,14,17,18
		(*b*) Report category boundaries when continuous variables were categorized	NA
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	NA
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	NA
Discussion			
Key results	18	Summarise key results with reference to study objectives	20,21,22
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	23
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	23
Generalisability	21	Discuss the generalisability (external validity) of the study results	23
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	25

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.