

# Impact of the Make Healthy Normal mass media campaign (Phase 1) on knowledge, attitudes and behaviours: a cohort study

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Mass media campaigns are used widely in response to a range of health issues<sup>1</sup> including overweight and obesity ('obesity'), which affects many adults in Australia<sup>2</sup> and globally.<sup>3</sup> Campaigns can positively affect attitudes and knowledge of obesity and related behaviours such as physical inactivity and sugar-sweetened beverage consumption.<sup>4-6</sup> However, campaign evaluation research is not commonly published, impeding knowledge sharing and dissemination.<sup>7</sup>

In New South Wales (NSW), 63% of the adult population was overweight or obese in 2014-15.<sup>8</sup> Further, significant proportions of the NSW population are not meeting current recommendations for the key modifiable risk factors for obesity,<sup>8,9</sup> physical activity (PA) and diet.<sup>3</sup> In response, the State Government developed the Healthy Eating and Active Living (HEAL) Strategy, which aims to address behavioural and environmental factors that contribute to obesity through cross-government action and partnerships with non-government organisations.<sup>10</sup>

The Make Healthy Normal (MHN) campaign is the major communication element of HEAL. Aimed at challenging the normalisation of being unhealthy and encouraging healthier lifestyles, the campaign's specific objectives are to: (1) increase awareness of the health risks and decreased quality of life associated with obesity; (2) encourage people to make healthy choices by challenging their perception of 'normal';

## Abstract

**Objective:** To determine the impact of the first phase of the Make Healthy Normal mass media campaign on NSW adults' active living and healthy eating knowledge, attitudes, intentions and behaviour.

**Methods:** Cohort design with NSW adults, followed up three times over 12 months, with n=939 participants completing all three waves. We used generalised linear mixed models to examine campaign awareness, knowledge, attitudes, intentions and behaviours over time.

**Results:** Campaign recognition built to a reasonable level (45% at Wave 3), although unprompted recall was low (9% at Wave 3). There were significant increases in knowledge of physical activity recommendations (46% to 50%), the health effects of obesity (52% to 64%), and weight loss benefits (53% to 65%), with stronger effects in campaign recognisers. Conversely, we found declines in self-efficacy and intention to increase physical activity (39% to 31%) and decrease soft drink consumption (31% to 24%).

**Conclusions:** Overall, there are some positives for the campaign but intentions need to be a focus of future campaign phases. Continued investment over the medium- to long-term is needed.

**Implications:** Mass media campaigns can play a role in obesity prevention but robust evaluations are needed to identify the characteristics of effective campaigns.

**Key words:** Mass media campaign, overweight and obesity, health education, social marketing, health communication

(3) drive people toward support programs and tools according to their needs; and (4) lay foundations for long-term changes in awareness, attitudes and behaviour, and the reduction of obesity levels in NSW. The first phase of MHN focused on objectives (1) and (2). It targeted adults aged 18 years and over, particularly those who were overweight or obese and/or at risk of developing chronic disease because they did not meet healthy eating or PA guidelines. Campaign messages encouraged: smaller portions; increased

consumption of fruit and vegetables and water; and sitting less, moving more.

A number of campaigns that have addressed overweight and obesity<sup>4,6</sup> or related behaviours<sup>11</sup> have been run in NSW. These campaigns encouraged people to lose weight, be more physically active, or eat more healthily. Results have been mixed, with significant changes in intermediate outcomes (e.g. knowledge, intentions) but minimal or no changes in behaviours. MHN shares some similar messaging with such campaigns

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but differs in challenging social norms that normalise unhealthy behaviours.

MHN was developed following a rigorous formative evaluation process. Creative agencies submitted draft concepts that were appraised by a panel of experts and focus tested with the target audience. MHN was preferred for its tone of collective responsibility and the novel focus on changing social norms; the attention-grabbing nature of the visceral imagery and descriptions of disease closely linked to positive support messages and easy, actionable tips; and the believability and authority added by the presence of a health care professional for the television commercials (TVCs).

MHN was launched in June 2015 with the bulk of the advertising spend allocated to two TVCs (available at: <https://www.makehealthynormal.nsw.gov.au/>), which aired in five bursts from November 2015 through June 2016 (Supplementary Table 1). The TVCs were supported by community events, press, out-of-home (e.g. billboards), online advertising, public relations, a website and social media. The campaign included 'problem' and 'solution' creative, problematising normalisation

of unhealthy lifestyles and providing suggestions for simple lifestyle changes. The investment in development and first year of implementation was approximately \$AU3.5 million, with \$2.6 million allocated to cover the media costs, with the remainder for evaluation and research, creative design and production.

In this study, we determined the impact of the first phase of MHN on NSW adults' knowledge and attitudes towards active living and healthy eating, and physical activity and dietary intentions and behaviour. Specifically, we asked: 1) to what extent was the target audience aware of the campaign; 2) how did NSW adults' knowledge, attitudes, intentions and behaviour change over time; and 3) did impact differ between adults who were aware of MHN and those who were not?

## Method

The campaign's evaluation framework (Figure 1) was based on a 'hierarchy of effects'. The evaluation study used a cohort design, with participants (NSW adults aged 18+ years) recruited via a research panel and completing three online surveys over approximately 12 months. Quotas were applied at baseline for age, gender and location to reflect the

broader NSW population. Data were collected in June 2015, before the campaign launched (baseline or Wave 1); in March 2016 (Wave 2), following peak campaign activity; and June 2016 (Wave 3), after TV advertising concluded. The study was approved by the University of Sydney Human Research Ethics Committee (Protocol number: 2015/177).

## Measures

### Proximal outcomes – campaign awareness

We operationalised campaign awareness in three ways to capture differing effects by measurement type:<sup>12</sup> unprompted recall; prompted recognition of the MHN tagline; and prompted recognition of campaign advertising. Recall was measured by asking participants whether they had seen, read or heard any advertising or messages about active living, healthy eating or healthy weight in the past month. Those who said 'yes' were asked to describe the advertising or message, with the response retained verbatim. Two coders independently identified those that related to MHN, with differences resolved by discussion or referred to a third coder.

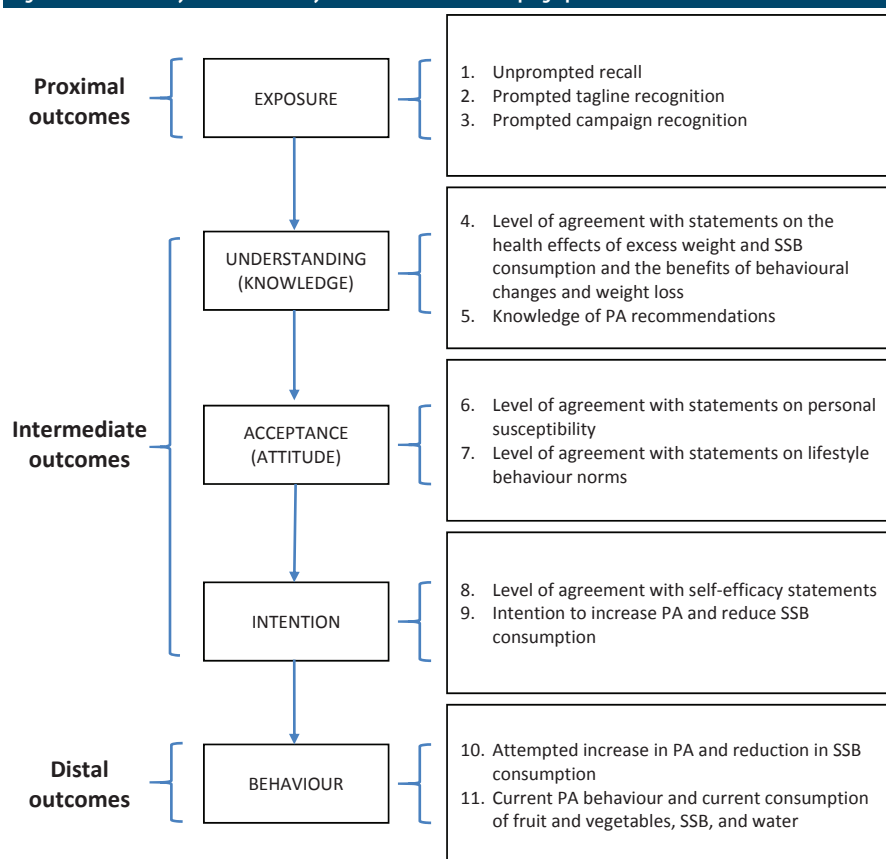
Recognition of the MHN tagline was measured by asking participants at all waves whether they had seen, read or heard any advertising or messages about active living, healthy eating or healthy weight that included the phrase 'make healthy normal'. A 'yes' response at Wave 1 constituted spurious recognition. A programming error at Wave 2 meant this question was asked of only a subset (n=415) instead of all participants, as was done in Waves 1 and 3. We therefore excluded Wave 2 from the relevant analyses here.

During Waves 2 and 3, all participants were shown images from both TVCs and asked whether they had seen them before. Links to the full advertisements were also available. Participants were then asked whether they recalled seeing any advertisements using TVC images on billboards or posters, online, in newspapers or magazines, or at the cinema. Participants who answered 'yes' to at least one of these questions were deemed to have 'recognised' the campaign.

### Intermediate outcomes – Knowledge, attitudes, and intentions

Knowledge was assessed by recall of the PA recommendations (30 minutes of moderate to vigorous PA per day),<sup>13</sup> and level of agreement on a five-point Likert scale with a series of campaign-specific statements, namely that: 'excess belly fat is a sign of toxic fat inside your body'; 'making small

Figure 1: Make Healthy Normal hierarchy of effects model and campaign performance indicators.



changes to what you eat' and 'how physically active you are will decrease your risk of chronic disease', 'losing just a few kilos on the outside will remove toxic fat from inside your body' if you are overweight, 'drinking sugar-sweetened soft drinks is a cause of overweight and obesity', and 'it's alright to be a bit overweight'.

Attitudes were measured through sets of statements on perceived personal susceptibility to lifestyle-related chronic diseases, self-efficacy to change lifestyle-related behaviours and lifestyle behaviour norms with five-point Likert response scales. Subscales were generated through two exploratory principal component analyses (PCAs;  $n=6$  and  $n=7$  statements, respectively) using principal axis factor extraction with varimax rotation (Supplementary Table 2). We retained components with eigenvalues greater than 1, and based our interpretation on statements with factor loadings greater than 0.3.<sup>14</sup> Where statements loaded on more than one component, the question was incorporated into the subscale that had the higher loading. The magnitude and direction of component loadings were consistent when the analyses were repeated separately for wave of survey, gender, age, socioeconomic status and weight status.

Using the PCA solutions, we generated three subscales: Personal Susceptibility (first PCA: statements 4 to 6, Cronbach's  $\alpha=0.65$ ); Self-Efficacy for Behaviour Change (first PCA: statements 1 to 3, Cronbach's  $\alpha=0.65$ ); and Lifestyle Behaviour Norms (second PCA: statements 1 to 3, Cronbach's  $\alpha=0.71$ ). Raw scores of the constitutive questions forming the subscales were summed to produce a subscale score for each respondent. Only participants who had non-missing values for all statements were included. Scores were coded such that higher scores indicated higher perceived susceptibility and self-efficacy and a stronger perception that other people were adopting healthier lifestyle behaviours.

To assess a possible unintended consequence of the campaign, we measured stigmatisation of obese people through agreement that 'most people I know have no sympathy for people who are overweight or obese'.

Intention to increase PA was measured through asking participants whether they intended to increase the amount of PA they do in the next month, the next six months, or not at all. Responses were dichotomised into 'intend to increase in the next month' and 'does not intend to increase in the next

month'. Participants were also asked the extent to which they were likely to reduce their consumption of sugar-sweetened beverages ('soft drink') in the next six months. Responses were on a five-point scale, ranging from 'likely to decrease a lot' through 'likely to stay the same' to 'likely to increase a lot', dichotomised for analysis into 'likely to decrease' ('likely to decrease a lot' and 'likely to decrease a bit') and 'not likely to decrease'.

#### *Distal outcomes – current behaviour and recent behaviour change*

Total time spent in PA per week was computed in accordance with the Active Australia survey analysis protocol.<sup>15</sup> Sufficient PA (150 minutes of PA a week over at least five sessions), was defined in line with current Australian PA guidelines.<sup>13</sup> Aligning with dietary guidelines,<sup>16</sup> sufficient fruit and vegetable consumption was two or more serves per day and five or more serves per day, respectively. The guidelines also recommend 'limiting' soft drink consumption, which we defined as less than one cup per day, consistent with available evidence.<sup>17</sup> Questions used to assess these measures were based on questions used in other NSW Ministry of Health surveys.<sup>18</sup> We also examined the ratio of cups of water per day to cups of soft drink per day, as one of the campaign's messages was to drink water instead of soft drink. A positive ratio indicates the participant consumes more water than soft drink per day, while a negative ratio indicates more soft drink than water.

Participants were also asked whether they had tried in the last six months to change the amount of PA they do, with response options being 'yes, tried to increase', 'yes, tried to decrease' and 'no, I have not tried to change', in line with other evaluations.<sup>4,6</sup> We dichotomised responses to 'tried to increase' and 'did not try to increase'.

#### *Covariates*

Age and location were dichotomised into 18 to 39 years and 40 years or over (in line with the *Measure Up* campaign)<sup>4</sup> and Sydney and rest of NSW, respectively. Socioeconomic status was operationalised using the Socio-Economic Indexes for Areas (SEIFA), based on participants' postcodes.<sup>19</sup> SEIFA quintiles were then dichotomised into least disadvantaged (quintiles 1 to 3) and most disadvantaged (quintiles 4 and 5).

We dichotomised body mass index (BMI) (healthy weight vs. obese), based on World Health Organization (WHO) categories.<sup>20</sup>

We also generated a lifestyle risk index by summing insufficient PA, insufficient consumption of fruits and vegetables (coded separately), and current smoking, coded as either 'at risk' (1) or 'not at risk' (0), giving a total score between 0 and 4. Participants with missing values for any of the behaviours were excluded. Similar risk indexes usually include alcohol consumption,<sup>21</sup> which we did not measure.

#### **Statistical analysis**

We used generalised linear mixed models in SAS (Version 9.4) to compare awareness of the campaign, knowledge, attitudes, intentions and behaviours across data collection waves. These were preferred over generalised estimating equations so that participants with some missing data could be included in the analysis. Participants were modelled as a random effect to account for the correlations between repeated measures on the same participant. All models were adjusted for gender, age, socioeconomic status, location, BMI group and risk index score. In addition, we tested differential change across waves in awareness, knowledge, attitudes, intentions and behaviours by these factors using interaction terms entered singly into the covariate adjusted model; results are presented only for interactions that were statistically significant ( $p<0.05$ ). Awareness of MHN was also included in all models where awareness was not the dependent variable. We explored differences in outcomes based on participant recognition of MHN at Wave 2 by stratifying Wave 3 outcomes by recognition of the campaign at Wave 2. Additionally, change in behaviour of participants at Wave 3 was stratified by PA intentions at Wave 2. Similar analyses of other outcomes were not possible because comparable questions were not asked.

We conducted sensitivity analyses to ascertain the effect of missing data and whether the results were robust to loss-to-follow-up by comparing the baseline demographic profile, behavioural and knowledge patterns of those who completed the survey at all time-points with those who did not.

#### **Results**

Of the original sample ( $n=2,259$ ), just over half completed Wave 2 ( $n=1,225$ ) and Wave 3 ( $n=1,113$ ). Wave 3 included 174 participants who had not completed Wave 2, meaning 939 participants completed all surveys.

The principal reason for loss-to-follow-up appeared to be panel dynamics; that is, participants had become non-responsive to surveys generally ( $n=728$ ) or had left the panel entirely ( $n=126$ ).

Despite high loss-to-follow-up, the demographic profile remained relatively unchanged across the waves (Table 1) except for a significant decline in younger participants (18 to 39 years;  $p<0.001$ ). Participants who completed all three waves (completers) were more likely to be overweight or obese ( $p=0.007$ ) and less likely to intend to increase PA ( $p<0.001$ ), decrease soft drink consumption ( $p=0.039$ ), have tried to increase their PA ( $p<0.001$ ),

and to be meeting the PA guidelines ( $p=0.027$ ) compared to non-completers (Supplementary Tables 3 and 4). The highest percentage of missing data on any given outcome was 2.4%. Thirteen per cent of participants were missing BMI at baseline, predominantly younger females.

### Proximal outcomes – campaign awareness

Awareness of MHN increased over time for all three measures (Figure 2). Participants at Wave 3 had significantly higher adjusted odds of recalling MHN unprompted (AOR 2.71, 95% CI 1.91-3.84,  $p<0.001$ ) at Wave 3 compared to Wave 2 and of recognising the MHN tagline at

Wave 3 compared to Wave 1 (3.73, 3.07-4.54,  $p<0.001$ ). Similarly, participants at Wave 3 had significantly higher adjusted odds of recognising the MHN campaign, compared to Wave 2 (1.54, 1.36-1.76,  $p<0.001$ ).

Significant interactions between covariates and survey wave showed that, while both male and female and younger and older participants exhibited increased recognition of the tagline between Waves 1 and 3, the effect was stronger among females and those aged 40 years or over (Table 2). The odds of unprompted recall and recognition of the tagline at Wave 3 were over five times greater for those who recognised MHN at Wave 2 than those who did not (Table 3).

### Intermediate outcomes – knowledge, attitudes and intentions

Participants at Wave 3 had significantly higher odds of correctly recalling the Australian PA recommendations, compared to baseline (Table 4). Similarly, participants at Wave 2 and Wave 3 had higher odds of agreeing that “excess belly fat is a sign of toxic fat inside your body” and that “losing just a few kilos on the outside will remove toxic fat from inside your body” if you are overweight. Recognition of MHN at Wave 2 was associated with higher odds of agreeing with both statements at Wave 3 (Table 3).

Participants had a lower mean Self-Efficacy for Behaviour Change score at Wave 2 and Wave 3, compared to Wave 1 (Table 4). Odds of intending to increase the amount of PA in the next month and decrease consumption of soft drink in the next six months were lower at Wave 3 compared to baseline. Participants who recognised MHN at Wave 2 had higher adjusted mean Personal Susceptibility and Self-Efficacy scores at Wave 3 compared with those who did not (Table 3).

Although the odds of agreeing with the statement “excess belly fat is a sign of toxic fat inside your body” increased for both age groups over time, the effect was stronger in participants aged 40 years and over (Table 2). The odds of agreeing that “drinking sugar-sweetened soft drinks is a cause of overweight and obesity” declined significantly over time for healthy weight participants, compared to no significant change among obese participants.

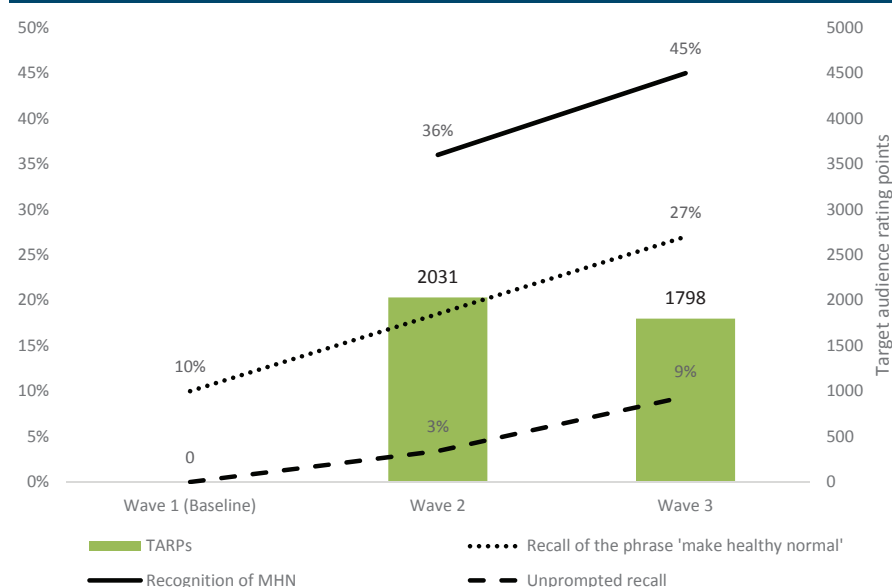
### Distal outcomes – current behaviour and recent behaviour change

At Waves 2 and 3 participants had significantly increased mean ratios of cups

Table 1: Sample demographics by wave.

	Baseline N=2,259 n (%)	Wave 2 N=1,225 n (%)	Wave 3 N=1,113 n (%)	P value
<b>Gender</b>				
Male	1,025 (45.4)	570 (46.5)	529 (47.5)	0.119
Female	1,234 (54.6)	655 (53.5)	584 (52.5)	
<b>Age (years)</b>				
18–39	775 (34.2)	284 (23.2)	258 (23.2)	<0.001
40 and over	1486 (65.8)	941 (76.8)	855 (76.8)	
<b>Location</b>				
Sydney	1,181 (52.3)	617 (50.4)	580 (52.1)	0.996
Rest of NSW	1,078 (47.7)	608 (49.6)	533 (47.9)	
<b>Socioeconomic status</b>				
Least disadvantaged	1,674 (74.2)	915 (74.7)	830 (74.6)	0.353
Most disadvantaged	583 (25.8)	310 (25.3)	283 (25.4)	
<b>Body Mass Index (BMI)</b>				
Healthy weight	788 (40.0)	413 (38.7)	355 (37.0)	0.359
Overweight or obese	1183 (60.0)	655 (61.3)	605 (63.0)	
<b>Risk index score</b>				
0–1 (low risk)	725 (33.3)	440 (36.6)	381 (35.4)	0.745
2–4 (high risk)	1,451 (66.7)	763 (63.4)	694 (64.6)	

Figure 2: Awareness of MHN campaign and total target audience rating points (TARPs) by wave.



of water to soft drink per day compared with baseline (Table 4). Overall, participants had lower odds of trying to increase PA over the past 6 months as the campaign progressed but those who recognised MHN at Wave 2 had higher odds of trying to increase their PA than those who did not recognise the campaign at Wave 3. Further, these participants had higher odds of meeting PA and fruit consumption recommendations at Wave 3 (Table 3).

There was a significant interaction between age and wave for the mean ratio of water to sugar-sweetened beverages, with older participants having a higher adjusted mean at both Wave 2 and Wave 3, compared to baseline (Table 2). Participants who intended to increase their PA at Wave 2 had significantly higher odds of reporting having tried to increase their PA at Wave 3 compared to those who did not intend to increase their PA (AOR 3.79, 95% CI 2.72-5.28,  $p < 0.001$ ). However, there was no difference in the odds of actually meeting PA recommendations at Wave 3 between those who did and did not intend to change their PA at Wave 2 (1.17, 0.78-1.76,  $p = 0.446$ ).

### Sensitivity analysis

The sensitivity analysis conducted using only data from completers showed no major differences to the results presented in Tables 2 to 4, with the direction of effect remaining consistent for all outcomes. Further, a sensitivity analysis adjusting for age and sex only, and therefore including participants missing BMI data, yielded similar results to the main analysis. This indicates that the missing BMI data were unlikely to have biased the results presented.

### Discussion

This study evaluated the first phase of the MHN mass media campaign and suggests that the campaign has achieved a reasonable level of awareness among the target population and has had some impact on knowledge. Continuing investment in the campaign will be necessary if these early impacts are to be sustained and built upon. It also highlights the need to continue to monitor relevant outcomes, particularly behaviour, even after campaign activity ceases in order to capture any longer-term impacts like those seen in similar campaigns.<sup>22,23</sup> The results provide valuable insights into campaigns of this nature, especially given that evaluations of this kind are rarely published.<sup>7</sup>

**Table 2: Adjusted odds ratios (AOR) where interactions between covariates and waves were significant for awareness, knowledge, attitudes, intentions, and behaviours.**

	Covariate	Category	Wave	Frequency [n (%)] or Mean	AOR/ Adjusted Mean	Lower CL	Upper CL	P value
<b>Awareness</b>								
Prompted recognition of MHN tagline	Sex	Male	Wave 1	110 (10.9)				
			Wave 3	125 (24.1)	2.73	2.08	3.58	<0.001
		Female	Wave 1	109 (9.0)				
	Age (years)	18–39	Wave 3	168 (19.3)	5.12	3.87	6.77	<0.001
			Wave 1	97 (12.8)				
		40+	Wave 1	122 (8.3)				
Prompted recognition of MHN campaign	Age (years)	18–39	Wave 3	54 (21.8)	2.11	1.42	3.14	<0.001
			Wave 2	99 (36.7)				
		40+	Wave 1	122 (8.3)				
	Age (years)	18–39	Wave 3	239 (28.3)	4.57	3.62	5.77	<0.001
			Wave 2	85 (34.6)	0.96	0.70	1.32	0.798
		40+	Wave 2	333 (35.7)				
Agree that "excess belly fat is a sign of toxic fat inside your body"	Age (years)	18–39	Wave 3	411 (48.3)	1.71	1.48	1.97	<0.001
			Wave 2	333 (35.7)				
		40+	Wave 1	384 (50.1)				
	Age (years)	18–39	Wave 2	141 (51.3)	1.07	0.81	1.41	0.650
			Wave 3	142 (56.1)	1.37	1.01	1.86	0.046
		40+	Wave 1	783 (53.4)				
Agree that "drinking sugar-sweetened soft drinks is a cause of overweight and obesity"	Weight status	Healthy weight	Wave 2	588 (62.8)	1.55	1.33	1.81	<0.001
			Wave 3	562 (66.1)	1.92	1.61	2.27	<0.001
		Overweight or obese	Wave 1	668 (85.2)				
	Weight status	Healthy weight	Wave 2	341 (83.0)	0.79	0.58	1.38	0.129
			Wave 3	281 (79.6)	0.61	0.45	0.82	0.001
		Overweight or obese	Wave 1	1,001 (85.1)				
Meeting physical activity recommendations	Sex	Male	Wave 2	556 (85.8)	0.94	0.73	1.20	0.596
			Wave 3	524 (87.3)	1.06	0.81	1.38	0.693
		Female	Wave 1	668 (65.8)				
	Age group	18–39	Wave 2	381 (67.3)	1.05	0.80	1.38	0.714
			Wave 3	341 (65.5)	1.05	0.80	1.37	0.744
		40+	Wave 1	712 (58.5)				
Meeting fruit consumption recommendations	Age group	18–39	Wave 2	360 (55.3)	0.70	0.54	0.91	0.007
			Wave 3	312 (64.4)	0.76	0.59	0.99	0.090
		40+	Wave 1	634 (48.0)				
	Age group	18–39	Wave 2	137 (48.6)	0.66	0.45	0.97	0.036
			Wave 3	138 (53.5)	1.40	0.95	2.06	0.091
		40+	Wave 1	712 (48.8)				
Mean water to SSB ratio	Age group	18–39	Wave 2	511 (54.5)	1.29	1.05	1.58	0.017
			Wave 3	423 (50.0)	1.02	0.84	1.25	0.838
		40+	Wave 1	4.8 (3.3)				
	Age group	18–39	Wave 2	5.1 (3.5)	0.28	-0.04	0.60	0.086
			Wave 3	4.9 (3.8)	0.22	-0.10	0.53	0.181
		40+	Wave 1	4.2 (2.8)				
Age group	40+	Wave 2	4.8 (3.0)	0.77	0.60	0.94	<0.001	
		Wave 3	4.4 (2.7)	0.30	0.14	0.46	<0.001	

Notes:

a: Interactions for sex not included because they were not significant

Awareness of MHN has built steadily over time to a level comparable with that of a similar recent Australian campaign, *LiveLighter*<sup>5</sup> but below that of other campaigns with similar Target Audience Rating Point (TARP; a measure of exposure) weights.<sup>4,6,22</sup> The relatively low proportion (9%

at Wave 3) who recalled MHN is noteworthy as this measure indicated the proportion of the audience that had both seen the campaign and stored the memory of it, which others have argued makes it more likely to influence behaviour.<sup>24</sup> A possible explanation for the lower than expected recall

is the increasingly fractured and cluttered media environment, even though television remains the dominant form of media.<sup>25</sup> The TARP weighting for the MHN TVCs was in line with best practice guidelines from tobacco control mass media campaigns<sup>26</sup> so increased investment in other communication channels may be required to increase awareness, particularly recall, which in turn would be expected to lead to increased campaign impact.<sup>27</sup> However, others have argued that using mass media campaigns to address obesity is more difficult than for other health issues, including smoking,<sup>1</sup> which may reduce the applicability of these guidelines to MHN and similar campaigns.

Campaign awareness was comparable among men and women, as with the *Measure-Up* campaign,<sup>12</sup> but this runs counter to prevailing evidence that women are generally

more receptive to health messages than men.<sup>28</sup> We speculate that the MHN campaign creative, which does feature a number of male characters, appeals to men in a way that other campaigns have not, although further research would be required to confirm this. Nonetheless, this is a positive finding for the campaign, given the higher prevalence of obesity in men in NSW.<sup>9</sup>

We observed some consistent increases in knowledge of the benefits of lifestyle changes and the risks of overweight between Baseline and Wave 3, similar to other campaigns.<sup>4,6</sup> Notably, effects were stronger among participants who recognised the campaign, which supports the first stage of the hierarchy of effects framework.<sup>27</sup> However, social norms did not change over time, which is significant given MHN is one of very few campaigns to attempt to address these directly.<sup>29</sup> Further,

we observed a consistent decline in PA and soft drink intentions, as well as a reduction in Self Efficacy for behaviour change. We did find that participants who reported intending to increase their PA at Wave 2 had significantly higher odds of reporting having tried to do so at Wave 3 but no change in behaviour. This may reflect environmental barriers, making it harder for people who intend to change to do so, or responses to this question may have been subject to social desirability bias. Converting intentions into behaviour may be a task for later campaign phases but it will be important to understand why intentions have moved in an undesired direction, especially considering *Measure-Up* found an increase in intentions.<sup>4</sup> Obesity is considered a complex problem, underscoring the need for comprehensive strategies, of which mass media campaigns are just one component.<sup>1</sup> Addressing the decline in intentions may therefore be addressed through the coordinated approach underpinning the HEAL Strategy, which reinforces the importance of evaluating the Strategy as a whole, especially considering that mass media campaigns can prompt regulatory and environmental changes.<sup>1</sup>

Although behaviour change was not expected after only the first phase of the campaign, we observed a consistent increase in the ratio of water to soft drink consumption, in line with campaign messages. However, the lack of change in soft drink consumption and the decline in intentions to decrease consumption of soft drink suggest that participants were simply consuming more water, rather than replacing soft drink with water, and that this was confined to participants aged 40 years and over. Given younger Australians are known to drink more soft drink than older Australians,<sup>30</sup> changing this behaviour in younger adults may require other, complementary strategies, such as those targeting availability or price.<sup>31</sup> Other campaigns have similarly found mixed results with distal outcomes.<sup>4,6,22</sup>

The use of a cohort design is a strength of this study, providing greater ability to understand the determinants of the observed changes, notwithstanding the possible priming effects.<sup>34</sup> Without a comparison group we cannot attribute the findings entirely to the campaign. In addition, our study relied on self-report and thus may have been subject to recall and social desirability bias and the Susceptibility, Self-Efficacy, and Lifestyle Behaviour Norm scores have not been tested

**Table 3: Adjusted odds ratios (AOR) and adjusted means for knowledge, attitudes, intentions, and behaviours stratified by participants' recognition of the MHN campaign at Wave 2.**

Response at Wave 3	AOR/ Adjusted Mean <sup>a</sup>	Lower 95% CL	Upper 95% CL	P value
<b>Awareness</b>				
Unprompted recall	5.95	3.50	10.10	<0.001
Recognition of the MHN tagline	5.66	4.02	7.97	<0.001
<b>Knowledge</b>				
Correctly recalled the physical activity recommendations	0.89	0.66	1.19	0.427
Agree that "excess belly fat is a sign of toxic fat inside your body"	1.62	1.18	2.24	0.003
Agree that "making small changes to what you eat will decrease your risk of chronic disease"	1.51	1.00	2.27	0.049
Agree that "making small changes how physically active you are will decrease your risk of chronic disease"	0.98	0.65	1.49	0.936
Agree that "losing just a few kilos on the outside will remove toxic fat from inside your body" if you are overweight	1.75	1.27	2.40	0.001
Agree that "drinking sugar-sweetened soft drinks is a cause of overweight and obesity"	1.15	0.76	1.72	0.508
Agree that "it's alright to be a bit overweight"	1.30	0.89	1.91	0.174
<b>Attitudes</b>				
Mean susceptibility score <sup>b</sup>	0.46	0.45	0.78	0.004
Mean self-efficacy score <sup>b</sup>	0.36	0.06	0.67	0.020
Mean social norm score <sup>b</sup>	0.13	-0.16	0.42	0.375
Agree that "most people I know have no sympathy for people who are overweight or obese"	1.11	0.82	1.50	0.496
<b>Intentions</b>				
Intends to increase the amount of physical activity they do in the next month	1.00	0.73	1.37	0.983
Intends to reduce consumption of sugar-sweetened beverages in the next six months	1.05	0.75	1.46	0.790
<b>Behaviour change</b>				
Tried to increase physical activity in the last six months	1.46	1.09	1.94	0.010
<b>Current behaviour</b>				
Meeting physical activity recommendations	1.35	1.01	1.81	0.043
Meeting fruit consumption recommendations	1.32	1.00	1.74	0.048
Meeting vegetable consumption recommendations	1.29	0.81	2.07	0.285
Less than one cup of soft drink per day	0.71	0.48	1.05	0.089
Mean ratio of cups of water per day to cups of soft drink per day*	-0.39	-0.79	0.01	0.054

Notes:

a: Comparing those who recognised the campaign at Wave 2 to those who did not recognise the campaign.

b: Linear mixed models were used to analyse outcomes on a continuous scale.

outside of this study. Another limitation was the high loss-to-follow-up between baseline and Wave 2. An unforeseen delay in the commencement of television advertising was responsible for the prolonged inter-survey period and may have contributed to the loss of almost half the sample, particularly younger participants. This, combined with the selection bias inherent in using an online research panel, reduced the generalisability of our findings. In addition, the loss of younger participants was undesirable but not unexpected given younger participants are generally harder to recruit, illustrated by the use of age quotas in other public health campaign evaluations.<sup>4,5</sup> However, our sensitivity analyses yielded similar results, suggesting that the conclusions reached in this paper are robust to the high loss-to-follow-up. In addition, external factors may have influenced the outcomes we examined. For example, during the campaign there were public discussions about introducing a tax on sugar-sweetened beverages<sup>32</sup> and the NSW Premier announced that childhood obesity was to be one of 12 'Premier Priorities' for the Government.<sup>33</sup> We were unable to account for these effects in our analyses. Finally, mass media campaigns are context-specific, hence our results may not be generalisable to populations outside of NSW.

## Conclusion

Overall, the evaluation of the first phase of the MHN campaign found some positive results. This includes the increase in knowledge, especially among participants who recognised the campaign. Awareness of the campaign also built to a reasonable level but should continue to be a focus in subsequent phases, particularly in generating higher levels of unprompted recall. There were, however, mixed findings in relation to soft drink consumption, with intentions to decrease consumption declining over time, while at the same time the ratio of water to soft drink consumption improved. Taken together, these results suggest that the complex nature of obesity requires a multi-faceted response, of which mass media campaigns are only one component. Increased focus on shifting intermediate outcomes, including social norms, will be necessary to build on the gains in knowledge noted here.

**Table 4: Adjusted odds ratios (AOR)/Adjusted Means for knowledge, attitudes, intentions, and behaviours by wave (n=1,868).**

	Wave	Frequency [n (%) or Mean	AOR/ Adjusted Mean	Lower 95% CL	Upper 95% CL	P value
<b>Knowledge</b>						
Correctly recalled the physical activity recommendations	1	1,013 (45.9)				
	2	578 (47.3)	1.03	0.90	1.19	0.635
	3	554 (50.0)	1.18	1.02	1.37	0.022
Agree that "excess belly fat is a sign of toxic fat inside your body"	1	1,167 (52.2)				
	2	729 (60.2)	1.40	1.23	1.61	<0.001
	3	704 (63.8)	1.75	1.52	2.03	<0.001
Agree that "making small changes to what you eat will decrease your risk of chronic disease"	1	1,844 (82.3)				
	2	977 (80.4)	0.84	0.7	1.00	0.056
	3	891 (80.7)	0.93	0.77	1.12	0.463
Agree that "making small changes how physically active you are will decrease your risk of chronic disease"	1	1,908 (85.0)				
	2	996 (82.0)	0.77	0.65	0.93	0.005
	3	916 (83.0)	0.85	0.69	1.04	0.110
Agree that "losing just a few kilos on the outside will remove toxic fat from inside your body" if you are overweight	1	1,174 (52.8)				
	2	707 (58.6)	1.26	1.09	1.45	0.001
	3	712 (64.6)	1.62	1.39	1.88	<0.001
Agree that "drinking sugar-sweetened soft drinks is a cause of overweight and obesity"	1	1,866 (83.4)				
	2	1,010 (83.4)	0.86	0.72	1.05	0.133
	3	904 (82.0)	0.85	0.69	1.03	0.097
Agree that "it's alright to be a bit overweight"	1	426 (19.1)				
	2	210 (17.5)	0.93	0.78	1.10	0.387
	3	187 (17.1)	0.83	0.69	1.00	0.050
<b>Attitudes</b>						
Mean Personal Susceptibility score <sup>a</sup>	1	9.42 (2.60)				
	2	9.13 (2.60)	-0.13	-0.26	-0.01	0.040
	3	9.20 (2.57)	-0.09	-0.22	0.04	0.161
Mean Self-Efficacy for Behaviour Change score <sup>a</sup>	1	11.04 (2.25)				
	2	10.99 (2.20)	-0.21	-0.34	-0.08	0.002
	3	11.28 (2.25)	-0.20	-0.33	-0.07	0.003
Mean Lifestyle Behaviour Norms score <sup>a</sup>	1	9.55 (2.11)				
	2	9.53 (2.10)	0.08	-0.06	0.21	0.251
	3	9.45 (2.04)	-0.03	-0.17	0.11	0.684
Agree that "most people I know have no sympathy for people who are overweight or obese"	1	876 (39.1)				
	2	491 (40.5)	1.10	0.97	1.25	0.134
	3	405 (36.8)	0.90	0.78	1.04	0.165
<b>Intentions</b>						
Intends to increase the amount of physical activity they do in the next month	1	873 (39.0)				
	2	402 (33.0)	0.87	0.76	1.00	0.051
	3	343 (31.0)	0.83	0.72	0.96	0.012
Intends to reduce consumption of sugar-sweetened beverages in the next six months	1	691 (31.3)				
	2	333 (27.8)	0.95	0.83	1.09	0.484
	3	258 (23.6)	0.74	0.63	0.87	<0.001
<b>Behaviour change</b>						
Tried to increase physical activity in the last six months	1	1,336 (59.6)				
	2	648 (53.3)	0.86	0.75	0.98	0.024
	3	578 (52.2)	0.85	0.74	0.97	0.014
<b>Current behaviour</b>						
Meeting physical activity recommendations	1	1,380 (61.8)				
	2	741 (60.9)	1.01	0.89	1.14	0.922
	3	653 (59.6)	0.93	0.82	1.06	0.297
Meeting fruit consumption recommendations	1	1,076 (48.5)				
	2	648 (53.2)	1.18	1.06	1.32	0.003
	3	561 (50.8)	1.09	0.97	1.22	0.150

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**Table 4 cont.: Adjusted odds ratios (AOR)/Adjusted Means for knowledge, attitudes, intentions, and behaviours by wave (n=1,868).**

	Wave	Frequency [n (%)] or Mean	AOR/ Adjusted Mean	Lower 95% CL	Upper 95% CL	P value
Meeting vegetable consumption recommendations	1	195 (8.8)				
	2	117 (9.6)	1.07	0.87	1.32	0.540
	3	105 (9.5)	1.10	0.88	1.38	0.392
Less than one cup of soft drink per day	1	1,799 (80.8)				
	2	1,013 (83.4)	1.06	0.92	1.23	0.430
	3	930 (84.4)	1.13	0.96	1.32	0.138
Mean ratio of cups of water per day to cups of soft drink per day <sup>a</sup>	1	4.40 (2.96)				
	2	4.89 (3.10)	0.67	0.52	0.82	<0.001
	3	4.52 (3.01)	0.27	0.13	0.42	<0.001

Notes:

a: Linear mixed models were used to analyse outcomes on a continuous scale.

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## Supporting Information

Additional supporting information may be found in the online version of this article:

**Supplementary Table 1:** Planned and delivered Target Audience Rating Points (TARPs)\* for television advertising bursts, November 2015-June 2016.

**Supplementary Table 2:** Statements used in principle component analyses and component loadings.

**Supplementary Table 3:** Missingness by demographic factors at Wave 1, comparing those who completed all three waves against those that did not.

**Supplementary Table 4:** Missingness by outcome at Wave 1, comparing those who completed all three waves against those that did not.