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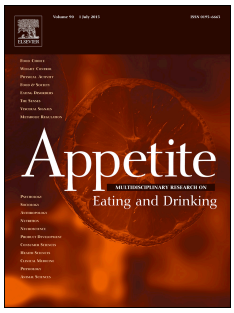

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Title

Reducing Consumption of Confectionery Foods: A post-hoc segmentation analysis using a social cognition approach.

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Abstract

Considering confectionary consumption behaviour this cross-sectional study used social cognition variables to identify distinct segments in terms of their motivation and efforts to decrease their consumption of such foods with the aim of informing targeted social marketing campaigns. Using Latent Class analysis on a sample of 500 adults four segments were identified: unmotivated, triers, successful actors, and thrivers. The unmotivated and triers segments reported low levels of perceived need and perceived behavioural control (PBC) in addition to high levels of habit and hedonic hunger with regards their consumption of confectionery foods. Being a younger adult was associated with higher odds of being in the unmotivated and triers segments and being female was associated with higher odds of being in the triers and successful actors segments. The findings indicate that in the absence of strong commitment to eating low amounts of confectionery foods (i.e. perceived need) people will continue to overconsume free sugars regardless of motivation to change. It is therefore necessary to identify relevant messages or 'triggers' related to sugar consumption that resonate with young adults in particular. For those motivated to change, counteracting unhealthy eating habits and the effects of hedonic hunger may necessitate changes to food environments in order to make the healthy choice more appealing and accessible.

Keywords

Healthy Eating, Sugar, Social Marketing, Social Cognition Models, Audience Segmentation

1. Introduction

Excessive consumption of non-milk extrinsic sugars[1] (often referred to as free or added sugars) is associated with obesity and related illnesses, type 2 diabetes, and dental caries (Malik *et al.*, 2006; Vartanian et al., 2007; Lustig et al., 2012; Te Morenga, et al., 2013). Dietary guidelines across the world recommend that adults and children should consume sparingly foods that contain high amounts of these types of sugars (FSAI, 2011; PHE, 2014; The HHS and USDA, 2015). However, studies show that on average adults are exceeding guidelines set by the WHO to limit intake of free sugars to less than 10% of total energy per day (around 50grams) (WHO, 2015). Moreover, a reduction in intake of free sugars to below 5% of total energy per day (around 25 grams) would have

[1] Sugars that are not incorporated in the cellular structure of foods like fruits and vegetables, whether natural or unprocessed, such as honey, or refined, such as table sugar, and, consequently, may have adverse effects on health (Department of health, 1991). Often referred to as free sugars (i.e. sugars added to foods).

additional health benefits (WHO, 2015). Achieving such a significant change in people's eating behaviours is the challenge facing health experts and policy makers.

Social Marketing is concerned with voluntary behaviour change achieved through the adoption and adaption of contemporary commercial marketing theory and practice (Eagle, et al., 2013). As in commercial marketing theory, market segmentation and targeting is a key concept (Andreasen, 2002; Geier & Bryant, 2005, Dann, 2010). This entails dividing up a large heterogonous market into a number of homogeneous segments and devising customised marketing programmes for one or more target segments (Kotler et al., 2007). Social cognition theories of behaviour are considered a core component of successful social marketing interventions (French & Blair-Stevens, 2006; Luca & Suggs, 2013) as they provide useful insights for elements of the social marketing mix (i.e. product, price, place and promotion) by identifying the key determinants behind overt behaviour (e.g. attitudes or perceived behavioural control). Therefore, the social marketer can make an informed decision on the focus of the intervention, e.g. changing attitudes or increasing behavioural control, directed at behavioural change. In this paper, a latent class analysis approach to segmentation analysis was conducted using social cognition variables to identify different types of people with regards their consumption of confectionery foods.

Segmentation & Behavioural Theory

The identification of homogeneous segments is dependent on the segmentation bases and methods used to divide the market (Wedel and Kamakura, 2000). According to Geier and Bryant (2005) bases such as readiness to change and psychographics (e.g. lifestyle, values) have been commonly used to identify distinct subgroups in social marketing campaigns. These bases are considered to be more effective in identifying differentiated segments compared to demographic bases such as age and ethnicity (Wedel and Kamakura, 2000; Vyncke, 2002; Weinstein, 2004), which are commonly used in health behaviour research (Slater, 1996). In addition to segmentation bases, there are a variety of methods that can be used to group individuals into segments and they can be broadly categorised into a-priori and post-hoc methods. A-priori involves determining the type and number of segments in advance whereas in a post-hoc segmentation approach the type and number of segments emerges from data analysis. Kazbare et al. (2010), using the segmentation evaluation criteria proposed by Kotler and Keller (2009), found that post-hoc segmentation of social cognition variables was more helpful in designing healthy eating campaigns than a-priori segmentation of demographic and behavioural variables as this approach provided more insight on who should be targeted and what should be communicated. Segment evaluation criteria include: measurability, referring to the extent to which segments can be feasibly identified and measured using segmentation variables;

substantiality, meaning segments must be large enough to warrant developing and maintaining a special marketing mix; accessibility, considers the demographic profiling of segments in order that they can be effectively reached/targeted; and differentiability, which means that segments should be genuinely different on measured criteria and therefore should respond to different marketing mix initiatives.

In social marketing interventions audience segmentation must be accompanied by a detailed study of peoples' lives, behaviours, motives, and the environment in which they make choices. The objective is to develop an attractive value proposition based on understanding the costs and benefits associated with a new behaviour (Geier & Bryant, 2005; French & Blair Stevens, 2006). Exchange theory is a fundamental principle of commercial marketing (e.g. consumer receives a product or service for a cash outlay) but social marketing is more complicated as there is rarely an immediate benefit for the adoption of a new behaviour and there are often immediate costs such as time and emotional discomfort (Geier and Bryant, 2005). For this reason, behavioural theories, including social cognition models, are considered a core component of successful social marketing interventions (French & Blair-Stevens, 2006; Luca & Suggs, 2013). According to Gordon et al. (2006), based on a systematic review of studies that evaluate social marketing effectiveness, social marketing provides a very promising framework for improving health but issues related to research design and a lack of conceptual understanding must be addressed. Luca and Suggs (2013) carried out a systematic review on theory and model use in social marketing interventions between 1990 and 2009 and concluded that there was an ongoing lack of use of theory or an underreporting of theory in social marketing campaigns.

Social Cognition

Social cognition models can offer value in endeavours to integrate theory into the application of social marketing campaigns. These reductionistic models identify key variables that account for the numerous influences on behaviour (Bagozzi, 1992) with the most frequently used theory in social marketing campaigns being the transtheoretical model (TTM) (Luca and Suggs, 2013). This model is built on the proposition that when addressing a problematic behaviour individuals go through similar stages of change and different influencing variables are important at different stages (Prochaska & DiClemente, 1983). However, a systematic review carried out by Bridle et al. (2005) showed limited evidence to support the effectiveness of health behaviour change interventions based on the TTM. Indeed stage models have been criticised as being too vague in explaining what actually happens in each stage (Povey et al., 1999; Armitage & Conner, 2000). Other social cognition models, such as the theory of planned behaviour (TPB), have been more specific in identifying the

variables that underlie behavioural motivation (Armitage & Conner, 2000). In these models intention to perform a specific behaviour is conceptualised as the most important and most immediate predictor of behaviour (Ajzen, 1991). According to Sheeran et al. (2005) intentions conclude the decision making process by signalling one's commitment towards the performance of a behaviour. However, meta-analysis studies show that behavioural intentions do not correspond strongly with actual behaviour (Armitage & Conner, 2001; Conner and Sparks, 2005). Moreover, evidence suggests that the intention-behaviour discrepancies are largely due to people having good intentions but failing to act on them (Sheeran, 2002).

In the health behaviour literature a number of variables have been identified to explain transitions from intention to action. Research indicates that having a dietary related lifestyle goal (e.g. weight loss) is associated with successfully implementing and maintaining healthy dietary change as individuals are more engaged in the change process and, therefore, more likely to overcome potential barriers to success (Berg-Smith, 1999; Schnoll and Zimmerman, 2001; Nothwehr & Yang, 2006). The concept implementation intention emphasises the significance of planning in translating intentions into behaviour. According to Gollwitzer (1993 pg. 152) "*The purpose of an implementation intention is to lay down a specific plan that helps to promote the initiation and efficient execution of goal-directed activity*". A number of studies have found that healthy dietary change is significantly related to planning over and above the effects of intentions (Scholz *et al.,* 2009; Osch *et al.,* 2010). In addition, perceived behavioural control (PBC) is a central concept in explaining not only the actions a person is motivated to perform but also, once an activity is initiated, the likelihood of maintaining effort in the face of obstacles. It reflects an individual's assessment of external issues such as access to resources and internal issues such as emotions that act as barriers to healthy behaviour (Ajzen, 1991). Numerous studies have demonstrated a significant effect of PBC on dietary change and the concept has been incorporated into dietary change interventions that have yielded favourable outcomes (Steptoe *et al.,* 2004; Linde *et al.,* 2006; Ahluwalia *et al.,* 2007). A less empirical examined concept but potentially important determinant of dietary change is perceived need i.e. whether or not people feel the need to carry out the health behaviour in question (Povey *et al.,* 2000; Payne *et al.* 2004). Evidence indicates that if people perceive a problem to be associated with their diet (e.g. a feeling that one is overweight) then they are more likely to make relevant dietary changes (e.g. reduce fat-intake in their diet) (Glanz *et al.,* 1998; Payne *et al.* 2004). Paisley and Sparks (1998) argue that people's perceptions of need may not be reflected in their attitudes and therefore should be considered separately. For example, a behaviour may be seen as beneficial and wise (i.e. a

positive attitude) but there may be a low perceived need to perform the behaviour because the outcome is not valued and/or the outcome is believed to be attainable through other means. Finally, it is recognised that habits and emotions are powerful determinants of regularly performed behaviours such as food consumption and often act as barriers to change (Verplanken & Aarts, 1999; Macht, 2008; De Bruijn, 2010). As people strive to create heathy eating habits it is likely that they will have to break unhealthy eating habits as human beings are instinctively driven to foods high in fat and sugar (Rozin, 2007). In addition to habits, hedonic hunger, a term used to describe a person's motivation to consume tempting food even if he/she is not hungry. Thus, eating habits and hedonic hunger can result in instinctive unhealthy behavioural choices that are not consistent with a person's dietary intentions (Lowe and Butryn, 2007).

To examine dietary change this study used the following social cognitive variables: lifestyle goal, dietary planning, perceived behavioural control (PBC), perceived need, confectionery habit and hedonic hunger as segmentation bases. Latent class analysis was applied as a post-hoc segmentation method to identify different cohorts of people with regards to confectionery consumption reduction. In taking this approach this study addresses some of the concerns expressed about social marketing health interventions, specifically that interventions lack theoretical foundations and are designed with little appreciation of what empirical research indicates will work best and why.

2. Method

Sample

Data collection was carried out by a market research agency in August 2011 using a stratified random sampling procedure. 500 Irish adult's representative of the population in terms of gender, age, living location (i.e. rural v urban) and social class[2] based on the most recent Irish census data were recruited for the study. The survey instrument was interviewer administered to ensure accuracy and a high completion rate. Ethical approval was sought from and granted by the Social Research Ethics Committee at University College Cork, Ireland. Table 1 provides an overview of the sample characteristics. The distribution of self-reported body mass index (BMI) data compares well with the self-reported BMI data from the SLAN 2007 study, which was a national survey of lifestyle, attitudes and nutrition of the Irish population using a probability sample (Harrington *et al.,* 2008). In the present study there were slightly more individuals classified as normal weight (53% compared to 48%) and slightly less classified as overweight (34% compared to 36%) and

[2] The classification of social class used by the Central Statistics Office in Ireland (O'Hare *et al*., 1991)

obese (12% compared to 14%). The mean BMI for the sample was 25.31 (SD = 4.21), which is similar to that of SLAN 2007 ($\bar{x}$ = 25.52, SD = 4.03 self-reported).

Table 1 Sample profile

	%		%		%
Gender		**Social Class**		**Location**	
Male	50	Professional (A)	7.1	Urban	*55*
Female	50	Managerial & technical (B)	27.5	Rural	*45*
Age		Non-manual (C1)	21.2	**Self Reported BMI**	
18-24	13.5	Skilled-manual (C2)	19.3	Underweight (<18.5)	*1*
25-44	43.5	Semi-skilled (D)	12	Normal Weight (18.5 – 24.9)	*53*
45 - 64	33.7	Unskilled (E)	4.1	Overweight (25.0 – 29.9)	*34*
> 65	9.2	Other	8.8	Obese (> 30.0)	*12*

Measures

Consumption of confectionery foods was measured using 12 items selected and adapted from a food frequency questionnaire (FFQ) originally designed for the EPIC-Norfolk study (UK) (EPIC-Norfolk, 2012) (see appendix A for the list of items). These 12 items represent the top sources of free sugars in the British diet (PHE, 2016). Respondents indicated their consumption of these foods on a nine point response grid ranging from 'never or less than once a month' to 'more than six times per day'. The Composition of Foods (1995) by the Food Standards Agency and Food Portion Sizes (1995) by Helen Crawley were used to estimate the grams of free sugar attributed to an average serving of each confectionery food item. For example, an average milk chocolate bar, 54g, contains 286 calories and 31 grams of sugar. Based on these figures an estimate of an individual's total daily consumption of sugars in grams from confectionery food was calculated.

The dietary behaviour of interest in this study is decreasing consumption of confectionery foods and was measured using one question: '*Thinking back over the last six months, have you changed your average weekly intake of confectionery foods?*' Responses were classified into two categories: decreased and did not decrease. In addition, study participants were asked whether they had a lifestyle goal during the previous six months. As this was a cross-sectional study with the aim of assessing change over time, respondents were required to retrospectively reflect on their behaviour over a six-month period (Naughton *et al*., 2015).

Exploratory factor analysis (EFA) using principle components (varimax) was used to test the dimensionality of the combined social cognition variables confectionery habit, hedonic hunger, perceived need, PBC, and dietary planning, as the items used to measure these variables were taken from multiple sources and some items were created for the study in terms of TACT (target, action, context and time), which is a commonly used approach (Ajzen, 2002). Table 2 shows the means,

standard deviations and factor loadings for each measurement item as well as the eigenvalues, percentage of variance explained and reliability scores for each latent variable. Confectionery habit was measured by seven items designed to represent two of the most important characteristics of habitual behaviour: repetition and automaticity. The majority of these items were taken from the self-report habit index (SRHI) (Verplanken & Orbell, 2003). Based on the EFA one item was removed as it failed to meet the criteria of all factor loadings being > 0.4 (Stevens, 2002). Hedonic hunger was measured using the Power of Food Scale (PFS), which is a validated 15 item measurement scale designed to assess the appetitive aspects of eating (Lowe and Butryn, 2007; Cappelleri *et al.,* 2009; Lowe *et al*., 2009). Perceived need was measured by three items adapted from Paisley & Sparks (1998) and Payne *et al.* (2004) and PBC was measured by five items adapted from Armitage and Conner, (1999), and Povey *et al.* (2000). Based on the EFA one PBC item was removed as it failed to meet the criteria of all factor loadings being > 0.4 (Stevens, 2002). The Cronbach's alpha for PBC was 0.55. While this is generally considered low, Kline (1999) notes that for psychological variables, values below 0.7 can be expected because of the diversity of the variables being measured. Nunnally (1967) (as cited in Peterson, 1994) suggested that a reliability score from 0.5 to 0.6 is the minimum acceptable level. The items representing these four variables were measured on seven-point agreement scales (1 = strongly disagree, 4 = neither agree/disagree, 7 = strongly agree). Dietary planning was represented by five items adapted from Luszczynska & Schwarzer (2003), Rise *et al.* (2003), Otis & Pelletier (2008) & Zandstra *et al.* (2010) measured on frequency scales (1 = never, 2 = very rarely, 3 = rarely, 4 = sometimes, 5 = frequently, 6 = somewhat frequently 7 = very frequently). All the variables had eigenvalues over Kaiser's criterion of 1 and in combination explained 61% of the variance.

Table 2 Descriptive statistics, factor loadings and Cronbach's alpha for the study measures

	Mean (SD)	Factor Loading	% of variance	Eigen value	Cronbach's alpha*
Confectionery habit			13.62	4.22	0.85
When I am busy and I am hungry I am very likely to eat Confectionery foods	4.48 (1.89)	0.75			
When I am hungry and I am in a rush, I am very likely to eat Confectionery foods	4.24 (1.93)	0.78			
I would find it difficult not to eat Confectionery foods	4.21 (1.94)	0.72			
Eating Confectionery foods is something I do frequently	4.13 (1.91)	0.77			
Eating Confectionery foods is something I do without thinking	4.02 (1.92)	0.71			
Eating Confectionery foods is something I start doing before I realise I am doing it	3.78 (1.93)	0.74			
Hedonic Hunger			21.45	6.65	0.92
When I know a delicious food is available, I can't help myself from thinking about having some	4.11 (1.81)	0.76			
It's frightening to think of the power that food has over me	3.01 (1.79)	0.72			
It seems like I have food on my mind a lot	3.01 (1.71)	0.76			
Just before I taste a favourite food, I feel intense excitement	3.33 (1.74)	0.74			
If I see or smell a food I like, I get a powerful urge to have some	4.15 (1.75)	0.75			
Hearing someone describing a great meal makes me really want to have something to eat	3.61 (1.80)	0.73			
When I am around a fatting food I love, it's hard to stop myself from at least tasting it	4.22 (1.80)	0.70			
I think that I enjoy eating a lot more than most other people	3.17 (1.67)	0.70			
I love the taste of certain foods so much that I can't avoid eating them even if they are bad for me	3.98 (1.86)	0.60			
I get more pleasure from eating then I do from almost anything else	3.09 (1.72)	0.66			
I find myself thinking about food even when I am not physically hungry	3.59 (1.82)	0.63			
Before I eat a favourite food my mouth starts to water	3.61 (1.79)	0.67			
When I eat delicious food I focus a lot on how good it tastes	4.56 (1.65)	0.64			
Perceived behavioural control (PBC): *Over the last six months, during the course of a typical week…*			5.45	1.70	0.55
I found it easy not to overindulge on Confectionery foods.	4.50 (1.71)	0.38			
I was confident that, if I wanted to, I could avoid eating Confectionery foods.	5.38 (1.38)	0.60			

Whether I did or did not eat Confectionery foods was entirely up to me.	5.86 (1.20)	0.74			
There were plenty of opportunities for me to choose healthier alternatives to Confectionery foods.	5.37 (1.21)	0.48			
Dietary Planning: *Over the last six months, during the course of a typical week…*			13.40	4.14	0.93
I would plan ahead how often I could eat Confectionery foods in a day.	3.09 (1.73)	0.71			
I had plans in place to avoid Confectionery foods whenever I felt bored.	3.18 (1.80)	0.83			
I had plans in place to avoid Confectionery foods whenever I felt stressed.	3.01 (1.74)	0.92			
I had plans in place to avoid Confectionery foods whenever I felt in bad mood.	2.97 (1.74)	0.91			
I had plans in place to avoid Confectionery foods whenever I felt tempted.	3.41 (1.81)	0.92			
Perceived Need			7.40	2.30	0.81
Eating Confectionery foods is something I need to avoid doing as part of my diet.	5.19 (1.80)	0.81			
I need to stay away from Confectionery foods in order to have a healthy lifestyle.	5.40 (1.61)	0.87			
In order to have a healthy diet, it is important that I have a low intake of Confectionery foods.	5.79 (1.37)	0.80			

Reliability test: > 0.7 is generally considered acceptable (Kline, 1999). For psychological variables, values below
0.7 can be expected because of the diversity of the variables being measured (Kline, 1999)

Data Analysis

Latent class analysis was performed using PROC LCA in SAS 9.3 (Lanza *et al.,* 2007). This is a statistical procedure used to identify a set of discrete, mutually exclusive latent classes of individuals based on responses to categorical variables (Lanza *et al.,* 2007). In the present study two variables are categorical; confectionery consumption decrease and lifestyle goal. All of the social cognitive variables used are continuous. Therefore, in order to run the latent class analysis, the overall mean score for confectionery habit, hedonic hunger, perceived need, and PBC was calculated and each variable was recoded to create three categories representing strong, moderate and weak. Strong represents respondents that on average agreed with the statements (≥ 5 on the likert scale). Weak represents respondents who on average disagreed with the statements (< 4 on the likert scale). Moderate represents respondents nether agreed nor disagreed with the statements on average (4 – 4.9 on the likert scale). As dietary planning was measured on a frequency scale this variable was recoded into three categories: never, rarely, and sometimes/frequently. The split points were: < 2 = never, rarely = 2 - 3.9; sometimes/frequently ≥ 4.

Latent class analysis (LCA) identifies one categorical latent variable with several categories or classes to explain the relationship between the measured variables (i.e. confectionery consumption decrease, lifestyle goal, strong confectionery habit, strong hedonic hunger, strong perceived need, strong perceived behavioural control and sometimes/frequently planned). The objective is to identify a parsimonious model that uses as few latent classes as possible to explain the data (Geiser, 2010). Model selection was determined by examining Alaike information criteria (AIC) and Bayesian Information criteria (BIC), with lower values representing better suitability based on model fit and parsimony, as well as model interpretability based on theoretical knowledge (Collins & Lanza, 2010). An easy to interpret solution is characterised by the majority of conditional response probabilities being close to 1 or close to 0 with few medium sized conditional response probabilities (Geiser, 2010). Sugar consumption g/d from confectionery foods was examined across the segments identified from the latent class analysis using one-way ANOVA analysis. In addition, multi-nominal logistic regression was run to predict segment membership based on socio-demographics and BMI. This entails examining the change in odds (i.e. the odds ratio) of belonging to a particular segment relative to a reference segment from a unit change in the predictor. Data screening using box-plots identified extreme outliers in the total sugar consumption variable, which reflected unrealistic daily intake of added sugar from confectionery foods. These cases were removed resulting in a final sample of n= 477.

3. Results

The descriptive statistics show that 38% of the total study sample (n = 477) decreased their intake of sugar in the preceding six months and 42% of the sample had a lifestyle goal related to sugar consumption during that six-month period. The most mentioned goals were to improve health and protect against illness. On average, people were consuming 52.45 grams of free sugar per day from confectionery foods alone, which is greater than the 50g limit of total free sugar consumption specified by the WHO. A comparison of the observed means for the social cognition variables with the scale midpoints for each of these variables (i.e. 4) shows that people were moderately disposed to habitually consume confectionery foods, and hedonic hunger also had a moderate influence on their diet. PBC towards the consumption of confectionery foods was generally strong, indicating that in general people felt they had control over their consumption. Similarly, people agreed that they needed (i.e. perceived need) to regulate the amount of confectionery foods they consumed. However, people's tendency to plan consumption of confectionery was only moderate.

Table 3 Descriptive statistics for the behavioural social cognition variables N = 477

	%		$\bar{X}$ (SD)
Decrease in confectionery consumption	37.7	Sugar from confectionery foods g/d	52.45 (40.52)
Lifestyle goal (yes)	42.3	Confectionery Habit	4.23(1.40)
Lose weight	31.0	Hedonic Hunger	3.70 (1.24)
Improve Health	81.7	Perceived Need	5.46(1.37)
Protect against illness	54.2	Perceived Behavioural Control (PBC)	5.28 (0.90)
Enhance appearance	21.8	Dietary Planning	3.20 (1.40)

Note: the scale midpoint is 4

An examination of the model fit statistics from the latent class analysis indicate that a 3 - 6 class/segmentation[3] solution provides the best model fit; while the BIC values indicate that a 3 segmentation solution is optimal the AIC values indicate a 6 segmentation solution (Table 4). In LCA the interpretability of a solution is equally important as the model fit statistical criteria (Collins & Lanza, 2010). An inspection of the proportional probabilities of the 3, 4, 5 and 6 segment models suggest that the 4 segment model provides the best fit as the segments are substantial and distinguishable labels can be assigned to each (Table 5 & Figure 1). As table 5 shows the largest segment, segment 4 (unmotivated), represented 35% of the sample and was characterised by having no lifestyle goals and virtually no decrease in confectionery consumption. This segment had high probabilities for confectionery habits and hedonic hunger and low probabilities for perceived need, PBC and dietary planning. A second segment, segment 3 (thrivers), representing 28% of the sample was distinguished by virtually nobody having strong confectionery habits and hedonic hunger. The remaining two segments were characterised by high probabilities for having lifestyle goals related to sugar consumption. Segment 2 (successful actors), representing 17% of the population, was distinguished by high probabilities for perceived need, PBC and dietary planning. The majority of people in this segment (92%) decreased their sugar consumption over the previous six months and nearly everybody (96%) had a sugar related lifestyle goal. Triers (Segment 1), representing 20% of the sample, were less likely to have decreased sugar consumption (67%) despite everybody having a sugar related lifestyle goal. This segment was characterised by having a low probability for strong PBC and compared to successful actors a lower probability for strong perceived need and higher probabilities for strong habit and strong hedonic hunger. The relationship between sugar consumption in grams per day from confectionery foods and segment membership was significant (F (3, 473) = 24.600, p < 0.001).

[3] In this paper the term segment is used rather than class

Post-hoc tests (Tukey HSD test) revealed that triers consumed the most sugar in grams per day, significantly more than thrivers and successful actors but there were no significant differences between triers and the unmotivated segment and no differences between thrivers and successful actors.

Table 4 Model Fit information for competing latent class models (n = 477)

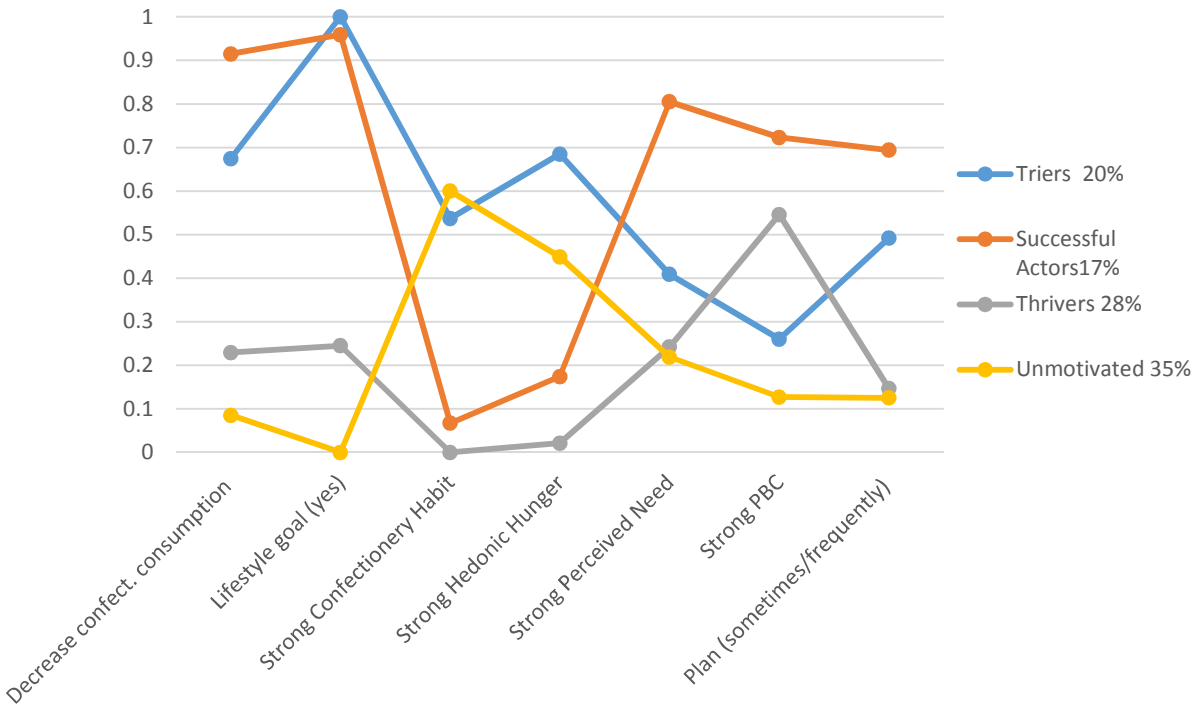
Number of segments	G^2	df	AIC	BIC	Entropy
1	1370.96	959	1394.96	1444.97	1.0
2	973.08	946	1023.08	1127.27	0.84
3	834.29	933	910.29	1068.66	0.80
4	764.41	920	866.41	1078.95	0.81
5	710.89	907	838.89	1105.68	0.81
6	680.33	894	834.33	1155.23	0.81

Table 5 Conditional response probabilities for each social cognitive variable as a function of segment membership and sugar consumption g/d from confectionery foods across the segments (n = 477)

	Segment 1 Triers 20% (n = 97)	Segment 2 Successful Actors 17% (n = 79)	Segment 3 Thrivers 28% (n = 134)	Segment 4 Unmotivated 35% (n = 168)
Decrease confectionery consumption	0.674	0.915	0.229	0.085
Lifestyle goal (yes)	1.000	0.959	0.245	0.000
Strong Confectionery Habit	0.537	0.067	0.000	0.600
Strong Hedonic Hunger	0.685	0.174	0.021	0.449
Strong Perceived Need	0.409	0.805	0.242	0.219
Strong PBC	0.260	0.723	0.546	0.127
Planning (sometimes/freq.)	0.492	0.694	0.147	0.125
Sugar consumption g/d (??, sd)	68.04 (45.12)a	34.53 (27.33)b	36.96 (27.03)b	61.23 (43.47)a

Note: ab subscripts denote statistically significant differences between segments for sugar consumption g/d

Figure 1 Line graph of proportional probabilities



The results of the multinomial logistic regression analysis are presented in tables 6, 7 and 8. Gender, age and BMI were significant predictors of segment membership but social class was not. Table 6 shows that compared to adults over 55 years of age, 18-34 year olds and 35 – 54 year were less likely to be in the successful actors segment (OR = 0.25, $p < 0.05$ & OR = 0.46, $p < 0.05$ respectively) and thrivers segment (OR = 0.33, $p < 0.05$ & OR = 0.30, $p < 0.05$ respectively) than be in the unmotivated segment, indicating a negative relationship between sugar consumption levels and age i.e. sugar consumption decreases with increasing age. Similarly, Table 7 shows that compared to adults over 55 years of age, 18-34 year olds were less likely to be in the successful actors segment (OR = 0.16, $p < 0.05$) and thrivers segment (OR = 0.22, $p < 0.05$) than be in the triers segment. Regarding gender, men were half as likely to be in the successful actors segment (OR = 0.41, $p < 0.05$) than be in the unmotivated segment, reflecting a greater propensity among women to try to reduce sugar consumption (table 6). However, men were also 2.21 times more likely to be in the thrivers segment than the triers segment ($p < 0.05$) (Table 7) and three times more likely to be in the thrivers segment than the successful actors segment ($p < 0.05$) (Table 8). This reflects the dichotomy among the male population as they are either successfully consuming low intakes of sugar g/d from confectionery foods in line with the guidelines or they are consuming excessive amounts with less inclination than women to make a change. An examination of BMI suggests that the unmotivated and triers segments represent 'at risk' groups. Compared to obese adults, adults with normal BMI were 2.66 times more likely to be in the thrivers segment than the unmotivated segment ($p < 0.05$) (table 6) and 4.45 times more likely to

be in the thrivers segment than the triers segment ($p < 0.05$) (table 7). BMI may also explain the higher ratings for perceived need among successful actors as people with normal BMI compared to obese adults are 3.4 times more likely to be in the thrivers segment than the successful actors segment ($p < 0.05$) (table 8). There were no differences between the unmotivated segment and the Triers segment in terms of gender, age, social class and BMI.

Table 6 Multi-nominal logistic regression analysis for the influence of socio-demographics and BMI on segment membership with segment 4 unmotivated as the reference category

	Segment 1 Triers OR (95% CI)	Segment 2 Successful Actors OR (95% CI)	Segment 3 Thrivers OR (95% CI)	Segment 4 Unmotivated 35% (REF)	Overall pvalue [a]
Gender (Male)	0.57 (0.32, 1.01)	0.41 (0.22, 0.78)*	1.27 (0.75, 2.13)	REF.	<0.01
Age (18-34 years)	1.52 (0.65, 3.56)	0.25 (0.10, 0.60)*	0.33 (0.16, 0.66)*	REF.	<0.01
Age (35-54 years)	0.70 (0.30, 1.64)	0.46 (0.22, 0.98)*	0.30 (0.15, 0.58)*	REF.	
Age (over 55 years)	.	.	.	REF.	
Social class (AB)	1.12 (0.49, 2.54)	0.84 (0.36, 1.95)	1.50 (0.72, 3.13)	REF.	0.92
Social class (C1C2)	1.08 (0.49, 2.39)	0.84 (0.37, 1.88)	1.26 (0.61, 2.60)	REF.	
Social class (DE)	.	.	.	REF.	
BMI (Normal)	0.60 (0.25, 1.44)	0.77 (0.31, 1.93)	2.66 (1.05, 6.79)*	REF.	0.06
BMI (Overweight)	0.50 (0.20, 1.22)	0.70 (0.28, 1.76)	1.68 (0.66, 4.30)	REF.	
BMI (Obese)	.	.	.	REF.	

[a] p-value reflects test of overall association between predictor and segment membership based on likelihood ratio difference * *p < 0.05*

Table 7 Multi-nominal logistic regression analysis for the influence of socio-demographics and BMI on segment membership with segment 1 triers as the reference category

	Segment 1 Triers (REF)	Segment 2 Successful Actors OR (95% CI)	Segment 3 Thrivers OR (95% CI)	Segment 4 Unmotivated 35% (95% (CI)	Overall pvalue [a]

Gender (Male)	REF.	0.72 (0.35, 1.46)	2.21 (1.21, 4.06)*	1.75 (0.99, 3.11)	<0.01
Age (18-34 years)	REF.	0.16 (0.06, 0.43)*	0.22 (0.09, 0.50)*	0.66 (0.28, 1.55)	<0.01
Age (35-54 years)	REF.	0.66 (0.27, 1.62)	0.43 (0.18, 0.99)*	1.43 (0.61, 3.37)	
Age (over 55 years)	REF.	.	.		
Social class (AB)	REF.	0.75 (0.29, 1.97)	1.34 (0.56, 3.24)	0.90 (0.39, 2.03)	0.92
Social class (C1C2)	REF.	0.77 (0.31, 1.97)	1.17 (0.49, 2.79)	0.93 (0.42, 2.06)	
Social class (DE)	REF.	.	.		
BMI (Normal)	REF.	1.30 (0.48, 3.46)	4.45 (1.61, 12.29)*	1.67 (0.70, 4.00)	0.06
BMI (Overweight)	REF.	1.42 (0.51, 3.91)	3.40 (1.20, 9.63)*	2.01 (0.82, 4.96)	
BMI (Obese)	REF.	.	.		

[a] p-value reflects test pf overall association between predictor and segment membership based on likelihood ratio difference ** p < 0.05*

Table 8 Multi-nominal logistic regression analysis for the influence of socio-demographics and BMI on segment membership with segment 2 successful actors as the reference category

	Segment 1 Triers OR (95% CI)	Segment 2 Successful Actors REF.	Segment 3 Thrivers OR (95% CI)	Segment 4 Unmotivated 35% (95% (CI)	Overall pvalue [a]
Gender (Male)	1.39 (0.68, 2.84)	REF.	3.08 (1.60, 5.96)*	2.44 (1.29, 4.61)*	<0.01
Age (18-34 years)	6.19 (2.31,16.59)*	REF.	1.33 (0.56, 3.17)	4.08 (1.67, 9.94)*	<0.01
Age (35-54 years)	1.51 (0.62, 3.70)	REF.	0.65, (0.31, 1.35)*	2.17 (1.02, 4.61)*	
Age (over 55 years)	.	REF.	.	.	
Social class (AB)		REF.			0.92
Social class (C1C2)		REF.			
Social class (DE)		REF.	.	.	
BMI (Normal)	0.77 (0.29, 2.06)	REF.	3.43 (1.22, 9.59)*	1.29 (0.52, 3.20)	0.06
BMI (Overweight)	0.71 (0.26, 1.94)	REF.	2.40 (0.85, 6.77)	1.42 (0.57, 3.56)	
BMI (Obese)	.	REF.	.		

[a] p-value reflects test pf overall association between predictor and latent segment membership based on likelihood ratio difference * p < 0.05

4. Discussion

The post-hoc segmentation analysis suggests that there are four cohorts of people with regards the probability of reducing consumption of confectionery foods; triers, successful actors, thrivers, and unmotivated. These segments can be considered operationally useful as they are measurable using social cognition variables, substantial regarding the relative size of each segment,

differentiable across sugar consumption g/d from confectionery foods, and accessible based on the demographic profiles of each segment (Kotler & Keller, 2009). The unmotivated and thrivers segments are the least likely to decrease their consumption of confectionery foods but while people in the thrivers segment are adhering to dietary guidelines people in the unmotivated segment are consuming over 50 g/d, which is the guideline limit on free sugar intake set by the WHO (WHO, 2015). People in the triers segment are more likely to decrease their consumption of confectionery foods but are less likely than people in the successful actors segment and are consuming comparable amounts of sugar to people in the unmotivated segment. The findings provide insights for social marketing interventions targeting changes in individual behaviour by addressing downstream influences (e.g. people's lack of perceived need and dietary planning) and the upstream influences (e.g. the food environment) that promote the consumption of confectionery foods.

The triers and the unmotivated segments reported low levels of perceived need compared to the successful actors segment. For the unmotivated segment this finding is consistent with no segment member having a lifestyle goal and achieving a decrease in confectionery consumption. This is a concern from a health policy perspective considering that the unmotivated segment contains significantly more obese people compared to the thrivers segment. In the triers segment 100% of the sample had a lifestyle goal related to sugar consumption but the rate of successful change was 67% compared to 92% for the successful actors segment. While it is well documented that setting goals at the outset of a behaviour change process is important in achieving the desired behavioural change (Schnoll & Zimmerman, 2001; Nothwehr & Yang, 2006; Papies *et al.,* 2007) it is possible that perceived need (in addition to PBC discussed below) may act as a boundary condition on the likelihood of successful change. According to Paisley and Sparks (1998), even if a behaviour is seen as beneficial and wise, indicating a positive attitude, there may be a low perceived need to perform the behaviour because a person perceives that it is not necessary for him-or herself to carry out the behaviour and the outcome (i.e. the lifestyle goal) is attainable through other means. Therefore, social marketing interventions will need to address the lack of perceived need by identifying triggers that move people from pre-contemplation via contemplation to action (Andreasen, 2003). This findings indicates that such interventions should be targeted predominately at men as perceived need may explain the gender differences between the segments with men more likely to be in the unmotivated segment compared to the motivated segments (i.e. successful actors and triers). This corresponds with previous studies that show women are more concerned about their diet and more motivated to make dietary changes (Wardle *et al.,* 2004; Davey *et al.* 2006; Hearty *et al.,* 2007). Regarding sugar specifically, Davey *et*

al. (2006) found that a significantly higher percentage of women agreed that they had too much sugar in their diets. However, while men are more likely to be in the unmotivated segment compared to the motivated segments (i.e. successful actors and triers) they are also more likely to be in the thrivers segment, which is characterised by low ratings on confectionery habit and hedonic hunger. This finding may be explained by research which suggests that men are less ambivalent towards nutrition and restraint eating, dieting and eating disorders are less common (Kiefer, *et al*., 2005).

Compared to the successful actors and thrivers segments, the triers and the unmotivated segments reported high levels of confectionery habit and hedonic hunger in addition to weak levels of PBC. A key component of habitual behaviour is automaticity or a lack of conscious thought, which often leads to environmentally cued behaviour that is not consistent with ones' behavioural intentions (Verplanken and Aarts, 1999). Similarly, hedonic hunger is driven by affective rather than cognitive responses to food stimuli which results in people failing to control consumption when presented with tempting foods (Lowe and Butryn, 2007). Furthermore, PBC, confectionery habit and hedonic hunger may explain the age differences between the identified segments in this study as successful actors and thrivers were significantly older than both the triers and the unmotivated segments. Studies have consistently shown a positive correlation between stronger PBC and increasing age with younger adults more likely to list barriers to eating healthily (Kearney and McElhone, 1999; Escoto *et al.,* 2012). Therefore, in addressing the consumption of confectionery foods among younger adults it is important to consider upstream influences such as the food environment (Hasting's *et al*., 2000). According to Swinburn *et al.* (2011 pg. 804) the increasing availability of cheap, high energy, nutrient poor foods, has resulted in a '*passive overconsumption of energy'*. Social marketers could target stakeholders interested in promoting healthier eating aimed at limiting the availability of confectionery food displays (e.g. end-of-aisle displays & island displays) within stores and workplaces as these displays may promote habitual and hedonic consumption and override self-control (Thornton *et al.,* 2012). Research has shown that situational changes (e.g. expanding the availability of healthy products in work canteens and moving healthier products to the point of purchase) have positive effects on people's food choices and eating patterns (Engbers *et al.,* 2005; Gittelsohn *et al.,* 2012).

Dietary planning has been proposed as a means to facilitate people to take more control of their diet and consequently avoid unhealthy eating practices (Armitage, 2004; Scholz *et al.,* 2009; Naughton *et. al.* 2015). In this study there was a 20% difference in planning between triers and successful actors, which suggests the importance of social marketing interventions targeting

young adults who are motivated to reduce their consumption of confectionery foods with initiatives that promote dietary planning. According to Gollwitzer (1993) a specific plan helps to promote the initiation and efficient execution of goal-directed activity by laying down 'if-then' contingencies between situational cues and goal fulfilling responses. Once such contingencies are present, actions that lead to goal fulfilment gain a degree of automaticity by being under the control of relevant situational cues. Therefore, planning can help break the influence of habits on future behaviour. Verplanken and Faes (1999) found that individuals had formed implementation intentions ate healthily irrespective of their level of unhealthy eating habits.

Interestingly, social class was not associated with segment membership as research indicates that lower social class groupings are least likely to adhere to dietary guidelines (Parmenter *et al*., 2000; Harrington *et al.,* 2008), are less likely to be concerned about their health and healthy eating (Wardle & Steptoe, 2003; Dibsdall, *et al.,* 2003; Hearty *et al.,* 2007) and less likely to implement healthy lifestyle changes (NHF, 2007). However, Darmon & Drenowski (2008) in a review of the epidemiological data on the relationship between diet quality and social class, found there was less evidence that social class was related to confectionery consumption in comparison with the other food groupings (i.e. fruit and vegetables, fatty meats etc.). It may be the case that in general people are more perceptive to the message on the importance of reducing fat consumption, the predominant focus of dietary guidelines for the last three decades (Hite *et al.,* 2010), rather than the message on limiting sugar intake. Carrillo *et al.* (2011), found that consumers associated the items 'low in calories', and 'helps me control my weight' more strongly with the label 'is low in fat' than the label 'is low in sugar'.

Conclusion

In support of Lefebvre's (2000) and more recently Luca & Suggs's (2013) call to action for the increased use of theory to guide social marketing interventions, this paper provides theoretical support for the potential utility of using behavioural theory in social marketing campaigns. Using a social cognition approach, a number of important variables underlying food choice and healthy eating were identified and selected as segmentation bases. Further, in line with best practice a post-hoc segmentation method (i.e. Latent Class Analysis) was applied. This resulted in the identification of four segments that are operationally useful with respect to informing the design of effective and tailored social marketing strategies. The unmotivated segment and triers segment are the concern from a public health perspective and the defining demographic characteristic of both these segments is the disproportionately high percentage of young and middle aged adults. The social cognition findings indicate a lack of perceived need and perceived behavioural control

related to sugar intake among this cohort of adults. Therefore, a marketing strategy that can identify relevant messages or 'triggers' related to sugar consumption that resonate with the target segment will be an important step towards addressing the low ratings in perceived need. As the behaviour been promoted is likely to be unpalatable to the target market (i.e. reducing sugar consumption) it may be important to go beyond simply communicating the consequences associated with a diet high in free sugars (Peattie and Peattie, 2009). In addition, dietary change and maintenance entails improved self-control to counteract unhealthy eating habits and the effects of hedonic hunger. This may require a focus on the food environment by targeting stakeholders interested in promoting healthier eating with the aim of addressing structural barriers to healthy eating including the ease and availability of confectionery foods relative to the availability and cost of nutritious foods.

Study Limitations

While this study contributes to and builds on existing literature in the domain of health behaviour change and the use of segmentation and theory to guide social marketing campaigns there are nonetheless some limitations. Firstly, in order to examine causality the current study adopted a retrospective approach in the data collection. Retrospective studies provide cost and time efficiencies over longitudinal (prospective) studies, but there are drawbacks to this method of data collection particularly linked to the potential for recall bias and the impact of one set of answers effecting the answers to other questions in the survey. To limit this possibility the survey was designed to present the multiple questions measuring each variable in a random order (i.e. the same types of questions were not presented consecutively). Therefore, it would have required substantial cognitive effort to manipulate one's answers to all the questions. Secondly, this study used a food frequency measure of confectionery food consumption in order to calculate consumption of sugars g/d from confectionery food items. Research indicates that food frequency questionnaires tend to produce an underestimation of true dietary intake and a food diary is a more valid measure of consumption (Bedard, *et al.*, 2004; Day et al., 2001). A food diary measure of consumption pre and post study would have also provided a more accurate estimate of confectionery consumption change. Finally, it should be clarified that while the measure of sugar intake used in this study relates to the main sources of free sugars, it does not represent all the identified sources of free sugars, for example free sugars from alcohol and savoury items such as sauces.

Appendix A

Items measuring confectionery food consumption
Chocolate biscuits, e.g. digestive, cookies
Plain biscuits e.g. Nice, ginger (one)
Cakes e.g. fruit, sponge, chocolate
Buns, pastries e.g. croissants, doughnuts, muffins
Fruit pies, tarts, crumbles
Milk pudding e.g. rice, custard, trifle
Ice cream and flavoured yogurts
Sweets e.g. chocolates, toffees, mints, jellies
Chocolate snack bars e.g. Mars, Crunchie (standard size)
Sugar added to Tea, Coffee, cereal (teaspoon)
Fizzy soft drinks, e.g. Coca cola, lemonade (glass)
Jam, marmalade, honey, syrup (teaspoon)

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