



Using behavioural insights to reduce sugar consumption in Liverpool

Literature Review

One of the most important public health problems for the world today is the obesity epidemic.ⁱ Globally over 1.9 billion adults are overweight, 600 million of whom are obese.ⁱⁱ In the UK in 2014, over 60% of adults and over 30% of children were overweight or obese.ⁱⁱⁱ This represents a 25 percentage point rise in the number of overweight and obese adults since 1980.^{iv} One of the reasons that seems to have contributed to this rise in obesity, as we will explain, is the increased availability and consumption of energy dense products, in particular sugary drinks.

Being obese or overweight can lead to serious health consequences such as cardiovascular disease, type 2 diabetes, asthma in children,^v and premature death.^{vi vii} Over a quarter of cancer cases can be attributed to obesity,^{viii} and being obese increases one's vulnerability to discrimination as well as to mental health issues such as anxiety and depression.^{ix x} If we do not change the trends of rising obesity, we may see an additional 500,000 cases of diabetes, 400,000 cases of heart disease and strokes, and 100,000 cases of cancer in the UK by 2030.^{xi} This would lead to between 2.2 and 6.3 million life years lost.^{xii} It is crucial to reduce obesity levels, and we believe that this can be accomplished with relatively minor changes to people's daily behaviours.

Weight gain is the result of a net positive calorie intake - meaning that you consume more calories than you use. In recent years, a commonly accepted explanation was that decreasing levels of physical activity must be causing the rise in obesity. This was the result of a reported decline in calorie consumption in official statistics.^{xiii xiv xv} However, this conclusion is at odds with the consensus of expert opinion, which points to rising calorie intake as the main cause of obesity.^{xvi}

Based on this seeming discrepancy, BIT conducted in-depth analysis of the official statistics and found that the reported decline in calorie intake while obesity rose implied implausible

reductions in physical activity.^{xvii} Rather, there seems to have been an increase in the under-reporting of calorie intake in official statistics (which are largely self-reported). Taking this trend into account, official statistics fall closer in line with other studies that find that increased calorie intake - instead of decreasing physical activity - seems to be the main cause for the rising trend in obesity.

This review of the literature tries to answer the question of what behavioural interventions in shops, supermarkets, cafes and restaurants would be most effective in reducing calorie consumption, in particular of sugary soft drinks. The findings from this literature review will be used to inform the design of an intervention in hospital cafes. We expect the hospital cafe environment to be largely comparable to other purchasing environments, however acknowledge that there may be some characteristics of people purchasing drinks in hospital cafes that differ from those in other environments. It is possible, for example, that people making purchasing choices in hospital may be more health conscious.

Sugar-sweetened beverages

Excessive consumption of sugary items is a major contributing factor to obesity.^{xviii} People of all ages and backgrounds in the UK consume more than the recommended amounts of sugar, and reducing sugar intake has become a government priority. The government published a plan for action in August 2016 aimed at significantly reducing childhood obesity.^{xix} One of the key features of this childhood obesity strategy is the introduction of a Soft Drinks Industry Levy (SDIL), encouraging producers and importers of high sugar drinks to reduce the amount of sugar in their products.^{xx}

In the context of reducing obesity, there has been significant attention on sugar-sweetened beverages (SSBs). This includes high sugar soft drinks, but also sugary fruit juices and iced teas which can easily be mistaken for 'healthy' options. In the UK, people drank 5,730 million litres of high sugar drinks in 2011 (193 litres per person per year).^{xxi} There has been a massive increase in the consumption of high sugar drinks over the past forty years. UK household consumption of SSBs doubled between 1975 and 2000 and in 2015 adolescents consumed the equivalent of a bathtub full of high sugar drinks in the UK (234 cans) according to Cancer Research UK.^{xxii} There are major negative health impacts from such excessive consumption of high sugar drinks,^{xxiii} and reducing consumption will help prevent people from becoming obese.^{xxiv} There is evidence that switching consumption to low sugar alternatives (such as diet soft drinks) reduces body weight, although academics are not unanimous on this point; the effect appears to be stronger for individuals who were already overweight.^{xxv}

Although they are major contributors to energy intake, SSBs provide little or no nutritional value.^{xxxii} SSBs also do not diminish hunger, and therefore do not make us substantially reduce our consumption of other foods.^{xxxiii} For most SSBs there are obvious non-sugar alternatives, so it is easier for consumers to switch. The soft drinks industry is already producing sugar-free versions of its products and voluntarily experimenting with mixed sugar-sweetener versions. This means that it would be easier for people to find a low-sugar alternative that they enjoy, and that it may thus be easier to encourage people to shift their consumption to low-sugar items.

As we hope to achieve small but repeated reductions in the number of calories consumed, there is a strong case to focus on SSBs specifically.

Justification for government to intervene

While consumers seem generally aware of the link between diet and health, nutrition is often not the first thing on their mind when choosing food.^{xxxiv} Taste and satisfaction are often the main drivers for consumption decisions and can move people towards unhealthy options. However, a large part of our perception of things like taste, and how satisfying food is, is determined by psychology more than it is by the objective contents of food.

One might think that people choose unhealthy foods because they prefer these, and that this is based on careful consideration of how much we need to eat to feel full. However, studies have shown that serving meals where energy density (a measure of the amount of calories per bite) has been reduced by 25% led people to reduce their energy intake by the same amount.^{xxxv} In other words, people ate the same amount; it just had fewer calories.

Crucially, this change in calorie content did not affect people's ratings of hunger or fullness: they were just as sated as those who had ingested more calories.^{xxxvi} There was also little impact on perceived taste, which suggests that approaches such as reformulation (reducing the contents of sugar and fat in existing products) or substitution for similar but healthier alternatives can produce large changes without affecting acceptability.^{xxxvii} In other words, switching people to consume food and drinks with lower energy density does not need to affect the aspects of food that they care about, but it can help to reduce the undesirable side effect of becoming obese. This finding demonstrates how calorie intake can be reduced without reducing people's enjoyment of food and drink. Given the social and economic costs of obesity, this presents a strong rationale for government intervention.

Report structure

In this review of the literature, we will first discuss the approaches government has taken to countering obesity - leveraging economic incentives and providing consumers with

nutritional information. The continuing rise in obesity suggests that these approaches have not been sufficiently successful, and we describe the behavioural barriers that limit their efficacy. We consider the barriers to success in these approaches, including the evidence around mindless eating and other behaviours related to eating and choosing food. Finally, we focus the report on two distinct behavioural approaches from existing literature that can be effective in promoting healthier eating habits:

- 1) Changing the choice architecture; and
- 2) Improving the efficacy of information provision by using heuristic labelling.

Government Responses

The government has tried to intervene in the rise of obesity in several ways. Two prominent policy levers are information and economic incentives, and both have been applied to fighting obesity on a national level. People are taught to eat healthily by their teachers and healthcare professionals as well as through public information campaigns. It is safe to say that most people know that they should eat more vegetables and less chocolate to stay healthy, suggesting that these public health campaigns have been somewhat effective in informing people. However, there are different approaches to providing information, ranging from using simple rules-of-thumb^{xxxviii} to more complex (and accurate) nutritional labelling.^{xxxix} On the other hand, the use of financial incentives in promoting healthy eating is less ingrained in our daily lives. However, a specific form of this – taxing high sugar drinks – is becoming increasingly common across the globe. In this section, we describe the impact to date of these two approaches and the pros and cons of each.

Taxing sugary drinks

When trying to encourage people to behave in a certain way, governments and firms frequently provide a financial incentive for a particular behaviour. Retailers frequently use price promotions to incentivise people to purchase certain items. However, this is rarely done to encourage healthier eating which is the focus of this review. Provision of such incentives is likely to be expensive (in the case of a subsidy) or require quite significant interference in how firms operate (in the case of a tax) and therefore has not been widely taken up.

Nonetheless, national governments are in a unique position to intervene in this space, and over the past years several countries have considered and/or implemented so-called ‘sugar taxes’ – often levies on SSBs. A meta-analysis on the effect of taxing SSBs found that increasing the price of SSBs reduces consumption, and that it could lead to a small decrease in BMI.^{xl} BIT recently ran a trial in Australia that tested the impact of increasing the price of full-sugar drinks in hospital vending machines by 20%. We observed a statistically significant reduction in the proportion of high calorie “red” drinks sold (from 49% to 44%). It is important to note that this effect occurred without attention being drawn to the price increase or, crucially, providing any information on why it had been applied. Moreover, there was not a significant decrease in overall sales, so the retailer did not lose out.^{xli}

France introduced a tax of €7.16 per hectolitre of high sugar drinks in January 2012, which led to 5% price increases. High sugar drinks sales fell 3.3% between January and May 2012,^{xlii} as the increased cost was passed onto consumers almost entirely.^{xliii} Sales data from Norway, Finland, Hungary, France and Mexico suggests that a tax on SSBs broadly decreases sales

of these products by up to 12%.^{xliv} A recent evaluation of the tax on SSBs in Mexico found that it also promoted substitution behaviour as purchases of untaxed beverages increased.^{xlv}

Strong evidence also comes from Ireland, where the high-sugar drinks taxation that existed in the 1980s showed a 10% decrease in consumption for every 11% increase in price.^{xlvi} In the US, 28 states have higher sales taxes on high sugar drinks than on other food items. The average size of these taxes is 5%, and the highest rate is 7%.^{xlvii} A study found that the states without such a tax were more likely to have seen a high relative increase in obesity.^{xlviii}

One recent UK study found that a 20% price increase (due to tax) of SSBs would reduce the prevalence of obesity by 0.5% (roughly 81,500 adults and children) and reduce type 2 diabetes prevalence by 17.7% (roughly 10,800 cases).^{xlix} Younger people would reduce their consumption more, but there does not appear to be a greater effect on consumption amongst lower income groups.^l ^{li} The outcomes were even larger if the price increases lead to reformulation of the drinks' contents (namely by reducing the amount of sugar).^{lii} A US study, based on actual purchases, showed that a 20% tax would reduce obesity and overweight prevalence by three percentage points.^{liii} Others, however, have suggested that the impact would be much smaller.^{liv}

Food and beverage taxes are likely to have an impact, but we cannot be sure about the scale of this impact. There is still a scarcity of evidence for the effects on overall calorie consumption, although this is primarily due to the fact that only few countries have introduced these taxes. A national levy on SSBs has been discussed and will be implemented in the UK in April 2018.^{lv}

Informing consumers

One of the most intuitive approaches to getting people, at least those who want to do so, to eat healthily is simply to inform them about what is healthy. Food items such as snacks and drinks are legally required to contain labels with nutritional information to help people make informed decisions about how healthy food is.

There is strong evidence that informing consumers of the nutritional value of products can change some purchasing behaviour. However, we find that purely informational approaches such as nutritional labels are not easily interpretable by those with the highest needs, and that the impact of purely informational approaches is therefore limited. Behaviourally informed approaches that help consumers interpret nutritional information can enhance the impact of informational approaches. A systematic review of studies that tested behavioural interventions to promote healthy choices in supermarkets found that the majority of high-quality studies resulted in healthier purchases.^{lvi} Government programmes have focused on

nutritional information as well as providing numeric calorific information, and we describe the evidence for each below.

Nutritional guideline labels

Nutrition labelling on products is required under EU regulation.^{lvii} Most packaged food in the UK contains a table with nutritional guideline labels (as absolutes as well as the percentage of the daily recommended amount) meaning that a lot of the information that consumers need to choose the healthier option is actually readily available. However, nutrition tables can be confusing. They contain information on many different contents (e.g. sugar, salt, fat, calories, vitamins, and more), and using them well requires consumers to know what the effect of each of these is. Even those who understand this information, however, may often just be busy or tired after a long day, and to compare and contrast the alternatives for all the items in our weekly shop would take a lot of time.

This is reflected in the evidence. Providing comprehensive nutritional information appears to have a limited impact on purchasing behaviour. A systematic review that looked at consumer use and understanding of nutrition labels and their effect on dietary habits found that while nutrition labels help guide purchasing decisions and improve dietary habits for some people, this was less likely among children, adolescents, and older adults who are obese.^{lviii} In addition, poorer people and those with lower levels of education were less likely to understand and correctly interpret nutrition labels. These groups are more likely to be obese, which means the impact of the intervention is limited. This also means that providing information alone could end up exacerbating health inequalities. Using graphics, symbols, and minimal numerical content can mitigate these effects, as this makes the labels easier to understand.^{lix}

Numeric calorie labelling

One of the issues of providing nutritional information is that it still requires people to exert mental effort to compare and contrast (e.g. is it better to choose something with more salt but less fat?). Therefore more simplified approaches to labelling might increase comprehension and therefore behaviour change.

In many countries it is current practice for calorie information to be presented as numbers on food packages. Calories, however, are not intuitive to many consumers.^{lx} They represent an abstract number of which we need to keep a 'running total'. We should relate this to an overall target of 2,000 / 2,500 calories daily, but even when we know this target it requires mental effort to track against this. Furthermore, as noted above, we are poor at remembering

what we have eaten. One study found that men and women under-reported their energy intake by around a third compared to what they actually ate.^{lxi}

Another problem with simple numeric labelling is that people tend to judge the size of a difference relative to its size.^{lxii lxiii} The difference between 550kcal and 500kcal feels smaller than the difference between 70kcal and 20kcal, even though it is 50kcal in both cases. In practice, this means people are more likely to ignore a 50 calorie difference when the overall calorie content is high and on display. However, as we explain above small positive imbalances in energy intake (e.g. consuming just 50kcal more than we use each day) can over time lead to obesity.^{lxiv lxv lxvi lxvii} Calorie displays may be less effective when the proportional difference between two options is small as difference in calories is small - even though this difference will contribute to them becoming obese.

People with different levels of numeracy may approach numeric labels differently - a suggestion supported by the evidence.^{lxviii lxix} For example, the use of relative rather than absolute differences may be particularly pronounced in this group. A field experiment using online lunch orders tested the impact of providing numeric calorie labels, traffic light labels, or both labels combined.^{lxx} The authors found roughly a 10% reduction in calories ordered for lunch for each label type. Even without any numeric information the traffic light labels achieved meaningful reductions in calories ordered, and this condition was the only significant intervention for people with low numeracy. On the other hand, those with high numeracy saw significant reductions when numeric information was presented, but not if they only got traffic light labels. Finally, while there was directional reduction of calories for people of all weight groups, this reduction was only significant for those with a BMI above 30. Therefore, we think it is important to consider the target audience of any intervention, for example their expected levels of numeracy and BMI.

As found for nutritional guideline labels discussed above, the evidence suggests that calorie labelling is less effective for groups that are more likely to be obese such as poorer and less educated people, and those with lower self-control.^{lxxi lxxii lxxiii lxxiv} A study that looked at the impact of self-control on customers' response to calorie labelling in restaurants found that calorie labelling for food only resulted in healthier purchases among people with high self-control.^{lxxv} However, the authors did not detect this difference with beverages. This could be because people feel that they are 'missing out' when they eat lower calorie options for food, but diet versions for drinks feel more equivalent (especially since neither high nor low sugar drinks will make you feel full). This result suggests that interventions on beverage options would be more beneficial to the population as a whole, especially since lower self-control is correlated with undesirable eating behaviour.

There are labelling alternatives that address the same points as numeric calorie labelling points while trying to avoid some of its weaknesses. For example, one less well-known but possibly more valid measure would be nutrient density score, or energy density scores.^{lxxvi} Possible other labelling systems include the Food Standards Agency's Nutrient Profiling Model.^{lxxvii} The U.S. Food and Drug Administration has also considered approving nutrient claims based on the ratio of a beneficial nutrient to the food's energy content.^{lxxviii} These approaches would avoid some of the issues around numeric calorie labelling, such as the difficulty of comparing multiple different nutrients, the reliance on high-numeracy, and ambiguity due to unclear portion sizes.

In summary, nutritional information is helpful to those who engage with it, but it could be more impactful if it were made more salient and easier to understand at the point of purchase.

Behavioural barriers to fighting obesity

Despite the work that the government has done to inform consumers, the trend of rising obesity continues. Based on the evidence base from behavioural insights, there is a clear reason for this - a lot of our eating is more instinctive than it is the result of endless evaluation of nutrition and comparison of contents. In this section, we describe why eating often happens mindlessly, and what this means for designing successful initiatives to reduce obesity.

Eating mindlessly

The great majority of our weight gain is a result of relatively small but repeated overconsumption. Several estimates have suggested that a positive energy imbalance of 100 calories or less per day, meaning that people consume only 100 calories more than they use each day, can explain the US increase in obesity over the last thirty years.^{lxxix lxxx lxxxi lxxxii lxxxiii} This is much less than a can of many high sugar drinks or other SSBs contains. As a small but repeated imbalance in energy intake has resulted in rising obesity over time, reversing this imbalance can play a major role in reducing obesity.

Behavioural research into consumption of food has found that when we eat it is often not a conscious and wilful act, but rather an almost ‘mindless’ response to our environment.^{lxxxiv} People often eat food they are exposed to without thinking about it, as if on auto-pilot. Exposure drives consumption, and we have been exposed to much more food over the last thirty years. Since the early 1980s, the amount of food available to us has increased significantly. There are now an additional 500–700 calories available to each person in the US every day.^{lxxxv lxxxvi lxxxvii} For example, there are many more food products to choose from nowadays, and new products are launched faster than ever before.^{lxxxviii} This increased variety matters: experiments have shown that seeing a wider range of food leads to more calories being consumed. It does not seem to matter whether this exposure happens at once^{lxxxix} or over subsequent days.^{xc} This may help to explain the rise in obesity over this time period.^{xcii}

Our mindless response to eating suggests that we are less aware and in control of what we eat than we think, and that we tend to be strongly influenced by our environment. Humans have a limited amount of working memory, and the more things we have to keep in mind at the same time the more we experience ‘cognitive load’.^{xcii} When we experience cognitive load we are using most of our mental capacity, which can be thought of as cognitive ‘bandwidth’, and we have less available for the decisions at hand.^{xciii} People who are experiencing cognitive load make poorer decisions as a result.^{xciv} One study found that people occupied by a cognitively demanding task were much more strongly influenced by food advertising, for example.^{xcv}

As our instinctive response to being confronted with food is to eat,^{xcvi} exerting control over calorie intake is hard. Unfortunately, some studies show that those who are trying to control what they eat (e.g. dieters) actually end up eating more as a result.^{xcvii} This happens because making choices is more difficult when we are experiencing cognitive load, and when we diet (and track our calorie intake) we add cognitive load to our day-to-day. Expending a lot of our cognitive bandwidth on calorie counting actually makes people more likely to over-eat, as we are “taken unaware” when we are presented with something we consider to be healthy or “guilt-free”.^{xcviii} That way, we may consume *more* calories even though we are eating healthier foods (just more of it).

Overweight individuals, and those who feel hungry, seem to respond even more strongly to food cues (such as exposure to food, but also advertisements and food packaging).^{xcix} Highlighting these mindless responses to our environment, previous studies have shown that how food is positioned and displayed can affect consumers’ choices. For instance, one study found that customers selected a disproportionate amount of food from the first three choices presented to them in a canteen, whether this was healthy or unhealthy food.^c Simply placing items in less convenient places can influence what people choose,^{ci} and moving unhealthy items from direct eyesight can result in consumers selecting healthier alternatives. For example, removing high sugar drinks from sight in a hospital in Australia led to substitution behaviour towards diet drinks with no loss of total sales.^{cii}

In addition to shaping what types of, and how much, food we purchase, the way food is presented to us affects how much we eat (and whether we actually feel full after eating or not). For example, several studies suggest that all else being equal we eat more when we use larger plates, bowls or serving implements.^{ciii civ cv} This happens because we ignore signals that we are full, and some research suggests we implicitly use the size of the plate or package as a ‘rule of thumb’ for when to stop eating.^{cvi} Several studies suggest that people who have been served more food do not notice this, they do not feel fuller as a result, and they do not adequately compensate by eating less later (for example for dessert).^{cvii cviii cix cx cxi cxii cxiii}

People use such rules of thumb, also called heuristics, regularly in their day-to-day lives. When we take a heuristic, for example that a full plate is the right amount of food for one meal, and this leads to systematic bias, for example because we buy larger plates but keep the same heuristic, this can lead to regular overeating and, eventually, obesity. Because people use many different heuristics throughout the day, especially in settings like supermarkets where we have to make a large number of decisions,^{cxiv} our use of unhelpful heuristics can have significant implications.

It is rarely the case that people eat more because the original portion was not enough to satisfy them – we see the increase in consumption even when portions are far too large to

eat in one sitting.^{cxv} The effects are particularly strong for energy–dense foods that lead to obesity (e.g. crisps and confectionary).^{cxvi} The effects seem to occur even if we serve ourselves: larger packages increase consumption.^{cxvii cxviii cxix} These results hold true for people of different ages, gender, BMI, and socioeconomic status.^{cxx cxxi cxxii}

Our ‘mindlessness’ regarding food consumption is a natural behavioural trait, as carefully considering each decision around food requires considerable effort. We face a vast number of tasks and choices every day - one study found that people made more than 200 food decisions daily, but they only reported making around 25.^{cxxiii} We can only focus on a small fraction of these decisions, so most of the time we are on “auto–pilot,” behaving using established routines and rules of thumb, guided by our instinctive responses. For example, an experiment showed that it took just half a second on average to make a food buying decision.^{cxxiv} Half a second is not enough to compare between 5 different brands of cereal and to consider the calories, fat, and sugar contents of each. If we did conduct such comparisons we would spend all of our time in supermarkets, and using helpful shortcuts and cues (like choosing brands we know) can save time and simplify the decision–making process.

Even when we are trying to exert control over our food consumption, we find it very difficult to know what the right food choices are. We usually do not know how many calories are in meals and when we have to guess, we usually considerably under–estimate.^{cxxv} And sometimes, good intentions are simply overridden by impulses and desires at the time of decision making for an unhealthy alternative.^{cxxvi} If we want to reduce calorie consumption, this would therefore need to involve changing food environments (to alter what we are exposed to, and how) and helping individuals make the right instinctive responses (for example by making it easier to find healthier options). Supermarkets acknowledge this, and it is one of the reasons some are removing unhealthy sweets from the checkout area – to encourage people to eat more healthily.^{cxxvii}

Shops and cafes

Because so much of our eating behaviour happens mindlessly, it is crucial to reduce the excessive availability and exposure to food on a day-to-day basis. When we have something in the house, or we have ordered something in a restaurant and it is sitting on a plate in front of us, we are much more likely to eat it - even when we are not hungry. Because of this, what we eat depends in large part on what we purchase in supermarkets or restaurants. Research has shown that many unconscious cues influence our purchasing decisions in store environments.^{cxxviii} If we can change how much food people buy, or the types they buy, this will inevitably shape our consumption patterns.

Being exposed to food prompts triggers our desire to purchase and consume food, even when we are not hungry,^{cxxix} and in supermarkets and cafes such food prompts are everywhere. Even though many people want to choose healthy items we often do not have enough knowledge about which items are healthy or unhealthy.^{cxxx} For example, an online survey study in Ireland found that almost two thirds of participants were unaware of World Health Organization's guidelines for sugar intake, and that comprehension of whether different ingredients were added sugars was low.^{cxxxi}

In order to help people understand what they are buying and eating, many food items provide nutritional information labels on the packaging. Focus groups find that labels containing a large amount of information are confusing.^{cxxxii} Labels are useful because they can replace other heuristics, or mental shortcuts, that we use on a daily basis. For example, people underestimate the number of calories in foods that are described as 'low fat', even though this phrase only indicates that it is *lower* fat than the regular version and it may still be relatively fatty.^{cxxxiii} This effect is stronger in overweight individuals: labelling chocolates as low fat led to a much larger increase in consumption in overweight individuals than in normal weight individuals.^{cxxxiv} Therefore, for labels to address obesity and to minimise reliance on health claims such a "low fat", it is particularly important that they use a simple system.

For the purposes of this review we primarily consider evidence from supermarket and cafe contexts, as these are the places where many of our food decisions are made. In addition, as we will explain further below we believe the effect of making small changes to these parts of our food environment can have powerful effects. A meta-analysis of interventions that manipulate environmental factors found that on average, interventions such as physical changes to the environment, changes to perceptions, availability of food, and knowledge-based changes resulted in an average 15% increase in healthier choices.^{cxxxv} We will discuss different approaches to this in our section on choice architecture, below.

Behavioural approaches to reducing obesity

Because of the mindless nature of eating, public health information campaigns and other attempts to inform consumers (most notably through adding nutritional information on food packages) have not managed to stop the rise in obesity. Incentives, on the other hand, may be able to do this but have not been applied widely (the introduction of the Government's Soft Drinks Industry Levy will change this). However, financial incentives to encourage healthy eating at scale are costly or involve a significant burden on businesses and consumers. Even if they prove effective we should investigate lower cost interventions that may bring about similar impacts. In this section, we address two behavioural approaches to helping people mindlessly eat healthier - changing the choice architecture and using heuristic labelling.

Changing the choice architecture

Choice architecture refers to the way a choice is presented to us, and how this presentation influences what we choose.^{cxxxvi} As we discuss above, the way food is positioned and displayed affects consumers' choices. Over the past decades, our exposure to food and food cues has risen tremendously, which contributes to our increased consumption. Supermarkets, cafes, and restaurants are public places where many people are exposed to these cues, and an intervention in these locations would affect more people than, say, interventions in individual kitchens. As there is abundant choice in supermarkets, restaurants, and cafes, changing the choice architecture in these places can shift consumption to healthier alternatives. In this section, we discuss three factors that relate to the choice architecture of food choices in restaurants, cafes, and supermarkets: (1) ease and convenience, (2) shelf position and (3) amount of shelf space.

Ease and convenience

Ease and convenience are usually associated with unhealthy food options such as take-away food or ready-made meals. One study found that making chocolates less convenient to eat by placing a wrapper on them significantly reduced the number of chocolates eaten.^{cxxxvii} Similarly, changing the serving utensils at a salad bar from tongs to spoons, making the salad easier to obtain, increased the amount of salad taken.^{cxxxviii}

Making healthy food easier to reach in an environment by simply bringing it closer has also found similar effects. Moving items back towards the middle of a salad bar, making them harder to reach, reduced the number of these items being chosen, whereas placing items on an easier-to-reach edge increased the likelihood they were chosen. Similar effects were found for drink choices. Moving bottled water from hard-to-reach areas in a canteen to

easier-to-reach areas such as refrigerators in the centre of the canteen and at food stations increased its consumption by 26%.^{cxxxix}

To test whether the degree of effort required to reach an item correlated with the likelihood of an item being chosen, authors of one study manipulated the distance of an unhealthy snack and measured the number of people who made the effort to obtain it.^{cxli} They found that moving an unhealthy snack from 20cm, where a participant could easily reach it while sitting down, to a more distant position (70 or 140cm away) reduced the number of people obtaining the snack. These findings suggest that a small change in convenience, through placing snacks further away, may be an effective strategy to decrease intake.

The evidence on the effect of increasing ease and convenience on consumption is somewhat mixed, however. Within a supermarket setting, some scholars placed healthy whole grain bread either in a convenient or inconvenient location for the shopper, and found no difference in purchases (possibly due to preference and habitual factors).^{cxlii} The effect of small changes in convenience might be less effective in supermarkets, in which many people are regular customers who repeatedly buy the same brands or items, than in restaurants (where people may make less habitual and more infrequent food decisions).

Shelf position

The position of a food item on a shelf also has an impact on whether consumers will choose it or not. As we are more likely to choose items we first see, regardless of whether they are healthy or unhealthy, food positioned at the ends of an aisle is more likely to be chosen than food in the middle.^{cxliii} According to one estimate, approximately 30% of overall supermarket sales come from the end of the aisles.^{cxliiii} An analysis of beverage sales found a large increase in sales for all products, both alcoholic (beer and spirits - increases of 23% and 46% respectively) and non-alcoholic (soft drinks, coffee and tea - increases of 52%, 73%, and 114%) when they were moved from the middle to the end of an aisle in a supermarket setting.^{cxliiv} The effect was particularly strong for soft drinks, with weekly sales doubling once these drinks moved location.

As we are more likely to choose items that are easier and more convenient to obtain, it is not surprising that food placed at eye-level is more likely to be chosen than items placed on harder-to-reach shelves.^{cxliv cxlvi} One scholar has suggested that a disproportionate amount of what we buy comes from within one foot of our eye-level,^{cxlvii} mostly because we are more likely to purchase items which attract our attention.^{cxlviii} Products at eye-level do not only influence adult purchasing behaviours. Children request more products at their eye-level than products located above their eye-level, a finding many marketers exploit.^{cxlix}

In supermarkets, one study found that cereals aimed at children are placed on average 28 inches below cereals aimed at adults.^{ci}

Another finding in the literature on shelf position is that within a set of options, food placed between other options is more likely to be chosen. In one study that illustrates this, three similar cereal bars were placed on a shelf.^{cii} The researchers were interested in whether moving the healthy option to the middle would increase the likelihood it would be chosen. In the control condition the three boxes of snack bars were positioned from left to right in ascending order of calorie content with apple flavoured (the lowest calorie content) on the left, chocolate flavoured (middle calorie content) in the middle and chocolate and apple flavour (highest calorie content) on the right. In this condition people chose the healthy apple choice 13% of the time. In the experimental condition when this option was moved to the middle, it was chosen 36% of the time. Scholars investigating this finding propose that the reason that people tend to choose the middle option is because they believe, whether consciously or subconsciously, that retailers place the most popular items in the middle.^{ciii} Consumers are strongly influenced by what they believe other people purchase, which may explain why placing products in the middle influences purchasing behaviour.^{ciii}

Amount of shelf space

In addition to an item's location on the shelf, the amount of shelf space allocated also influences purchasing behaviour. An early field experiment conducted in a supermarket found that doubling the shelf space given to fruit in a supermarket increased sales by 44%.^{civ} This finding has remained consistent in the literature. Across two studies, a group of scholars manipulated the amount of shelf space given to healthy or unhealthy products.^{civ} They found when 75% of the shelf space was given to healthy and 25% given to unhealthy products, the likelihood that consumers chose healthy products increased. When 75% of shelf space was given to unhealthy and 25% given to healthy products, people chose more unhealthy options instead. The researchers hypothesised that the amount of space given to an item signals a consumption norm (for example, we may think that if something is given more space it must be because more people choose it). A study investigating shelf space in the US found that supermarkets and convenience stores assign a disproportionate amount of shelf space to unhealthy food compared to healthy food.^{cvi} Changing these proportions could be a simple and effective way to shift consumption patterns from unhealthy to healthy items.

If we are serious about encouraging people to eat healthier, it is crucial that we consider the physical choice architecture of food environments where this is feasible.

Heuristic labelling

Most people know that they should eat healthily. One of the most intuitive approaches to getting people, at least those who want to eat healthily, to do so is simply to inform them about what is healthy. Food items such as snacks and drinks are legally required to contain labels with nutritional information to help people make informed decisions about how healthy food is.

Informing people about the contents of what they eat and drink can have a real effect. A systematic review of studies that tested interventions to promote healthy choices in supermarkets found that the majority of high-quality studies resulted in healthier purchases.^{clvii} We have discussed the evidence behind providing factual nutritional information above. However, an alternative approach to informing beyond providing purely factual information (such as the number of calories) is to provide guidance for people to interpret this factual information.

When we make decisions we often use informal rules of thumb, or ‘heuristics’. For example, we are recommended to consume ‘five a day’ of vegetables and fruit, and when we see the word ‘light’ or ‘diet’ we think of items as healthy (even if the calorie content is still high). In this section, we investigate different approaches to informing consumers about which items are healthier in stores and restaurants, in particular by leveraging the heuristics we use.

Location of labels

Adding information on healthiness to foods can influence whether people buy them. Interventions in a canteen showed that simple traffic light food labels, using red labels for unhealthy foods, green labels for healthy foods and amber for those in between, prompted individuals to consider their health and to make healthier choices.^{clviii} Respondents in this study who noticed the labels during the intervention and reported that labels influenced their purchases were more likely to purchase healthier items than respondents who did not notice labels.^{clix} When we add information to products, it is important to make this information easy to see.

Front-of-Package (FOP) labelling is more effective in influencing purchasing and consumption behaviour than such labels on the side or back of products.^{clx} FOP labelling means that labels (for example with nutritional content) are printed on the front, rather than the back or side, of a package). An eye tracking study from the U.S. found that using coloured FOP labels increased attention to nutritional information.^{clxi} For certain products the use of coloured FOP labels resulted in less attention being paid to the more

comprehensive Nutrition Facts Panel (NFP), which suggests that consumers simply use the FOP label as a shortcut.

The alternative to on-pack labelling is point of purchase labelling (which adds labels to the store or restaurant environment itself, for example on the shelves). Although there is currently no direct comparison between on pack labelling and point of purchase labelling, there are many reasons to think the latter will be effective.^{clxii} Several studies have considered the effect of on-shelf labels in stores. These are reportedly used by consumers to inform their decision-making, with minority groups being significantly more likely to be aware of them.^{clxiii} Two separate studies have found positive effects of on-shelf labelling for health outcomes.^{clxiv clxv} Previous choice experiments have found that consumers appreciate seeing nutritional information on grocery store shelf labels.^{clxvi}

In restaurants and cafes, many items are not packaged or displayed on shelves and labels cannot be used in these places. Research suggests that providing calorie labelling on menus might help reduce the amount of calories ordered and consumed in these contexts, although there is significant heterogeneity across studies on how pronounced this effect is.^{clxvii clxviii} A study that analysed fast food purchases in low-income neighbourhoods before and after the introduction of the mandatory calorie posting - adding the calorie content of items on menus - in fast food restaurants in New York City found calorie posting had no statistically significant impact on calories per transaction.^{clxix} The clientele of fast food restaurants is more likely to have lower levels of numeracy, which may help explain why numeric information seems less impactful there.

However, calorie labelling did have an effect in the cafe-chain Starbucks (the clientele of which is more likely to have higher numeracy). A study found the introduction of calorie labelling next to beverage options decreased average calories per transaction by 6% in Starbucks, without negatively impacting Starbucks' profit.^{clxx} A small randomised controlled trial (RCT) in a different coffee shop tested the effect of a sign that ordered the options from least to most calorific, above a scale that transitioned from green to red with increasing calorie count (see Figure 1).^{clxxi} The authors found that people ordered, on average, 66 fewer calories when they saw this sign before ordering.



Figure 1: Sign used in a cafe to decrease the amount of calories purchased.^{clxxii}

Content of labels

A number of different means of conveying this information have been tried. Some of them, which we describe above in the section on government responses, focus on numeric information. However, due to the cognitive capacity required to keep track of your daily calorie intake or to compare and contrast all the alternatives for items you buy, these approaches to informing consumers may not be the most effective. Instead, behavioural science suggests making interventions as salient and as easy to understand as possible.^{clxxiii} Here, we describe several behaviourally informed approaches to helping inform consumers - often using heuristics.

Contextual or interpretive cues

The use of numeric information on labels may be difficult for people to understand, because it requires us to constantly calculate and track the number of calories we consume. We often buy and eat mindlessly, so it is important to make the information we convey stand out as much as possible - to make it salient.^{clxxiv} One approach to this is to include contextual or interpretive information. An example of this is using exercise equivalence labels, which show how much exercise (e.g. 30 minutes of jogging) one would need to do to burn the calories contained in the item. Exercise equivalents have not yet been studied extensively, but some research suggests that they may be marginally more impactful than calorie labels alone.^{clxxv}

^{clxxvi}

A systematic review and meta-analysis found that adding contextual or interpretive nutrition information specifically, instead of providing calorie contents alone, helps consumers to

select and consume fewer calories (−67 kcal and −81 kcal respectively).^{clxxvii} Women choosing and consuming fewer calories drove this effect, while there was no noticeable change among men.

Similarly, it may be beneficial to include information to help interpret numeric calorie labelling. While factual numeric labelling of calorie contents allows people to count the calories they consume, it does not automatically put those calories into perspective. A 2010 study tested the impact of providing numeric calorie contents alone as opposed to providing this information paired with a guideline for total daily recommended calorie intake.^{clxxviii} This information helps people interpret the numeric calorie information. While people ordered about 15% fewer calories per meal in each condition (from about 2,200 to about 1,850 kcal), people who saw the calorie contents as well as the recommended daily intake ate less after the meal. The people who only saw numeric information, on the other hand, compensated for their reduced calorie intake by eating more after the meal. On the whole, the numeric information alone did not significantly reduce calorie consumption, whereas this information paired with the interpretive clue reduced calorie consumption overall by about 15%.

Traffic light labelling

On the whole, the literature suggests that for labelling to be effective it needs to be simple and heuristic based.^{clxxix} Commonly used symbols such as traffic light colour-coding have been found to be more beneficial than other systems, in large part because they reduce the difficulty of comparing products. Another recent meta-analysis supports these findings.^{clxxx} Consumers spend an average of 6 seconds looking at food before deciding which option (e.g. brand) to purchase,^{clxxxi} and simple labels require significantly less time for consumers to evaluate.^{clxxxii}

Traffic lights represent a simple heuristic that is effective regardless of levels of numeracy. Research investigating what type of labelling leads to consumers correctly identifying food as healthy or unhealthy consistently finds that traffic light labelling is more effective than any alternatives such as Guideline Daily Amounts,^{clxxxiii} ^{clxxxiv} ^{clxxxv} ^{clxxxvi} a “healthy choice” tick,^{clxxxvii} nutrition information packs,^{clxxxviii} or percentage based labels.^{clxxxix} Traffic light labelling conveys information without relying on numeracy and literacy skills and is therefore an effective strategy to convey health information to those with both high and low levels of education.^{cxc}

A systematic review on consumer response to front-of-package nutrition labelling found that using symbols and colour coding helped consumers interpret nutritional information and select healthier options more easily than only providing numeric information.^{cxc} Research on providing nutrition information found that using a traffic light system (green for healthy,

amber for moderately healthy and red for unhealthy) instead of calorie information is more successful in promoting healthier choices.^{cxcii cxciiii} Some approaches, discussed in more detail later, use multiple traffic lights (e.g. one for sugar, one for salt, etc.), while others pool the different nutritional factors into a single ‘overall’ health indicator.

Interventions in a canteen showed that traffic light food labels prompted individuals to consider their health and to make healthier choices. Traffic light labelling in this study decreased sales of ‘red’ beverages by 16.5% and increased sales of ‘green’ beverages by 9.5%.^{cxciiv} In a study by the U.S. Farm Service Agency, including ‘high’, ‘medium’ and ‘low’ with traffic lights (for example about sugar or calorie content) was beneficial to people’s understanding.^{cxci v}

BIT has tested different formats of traffic light labelling based on calorie contents in an online Amazon Mechanical Turk^{cxci vi} (‘MTurk’) study (see Figure 2). We found that the intervention was particularly effective for drinks. The most effective intervention used four different colours - green, yellow, amber, and red. The fourth colour (yellow) was introduced to counter licensing – overconsumption of ‘green’ items because they are seen to be healthy. This approach used a hypothetical choice (which would have corresponded to reducing calorie intake by 1/3, from 119kcal to 79kcal), by either increasing the range of the amber label or by introducing a fourth yellow label. While traffic light labelling seems useful in helping people to choose healthier options, evidence suggests that this does not harm sales.^{cxci vii cxci viii} This makes it more feasible to implement broadly.

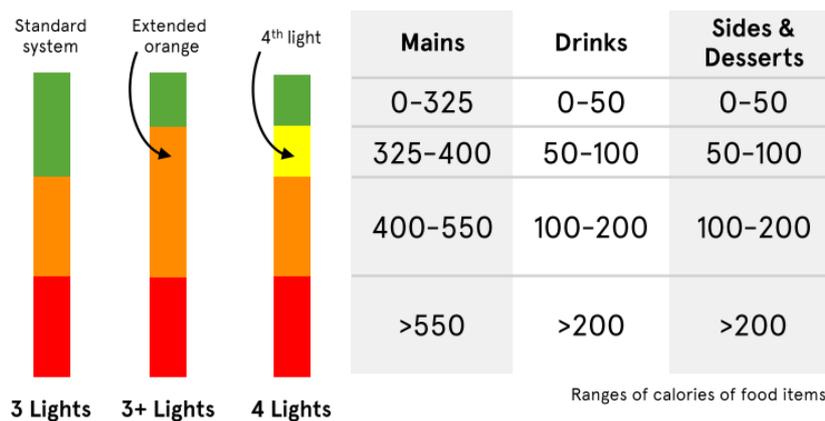


Figure 2: Traffic light versions used by BIT’s online study

Our finding is supported by the results of a longitudinal study looking at the impact of introducing traffic light labelling in a hospital cafeteria.^{cxci x} This field experiment found that the sale of ‘red’ items decreased from 24% at baseline to 20% after two years. In this same

period, the sale of 'green' items increased from 40% to 46%. Interestingly, the shift from 'red' to 'green' was particularly pronounced among beverages (with a decrease of 'red' beverage sales from 26% to 17% and an increase of 'green' beverage sales from 52% to 60%). As we seem more malleable in our choice of drink than we do in our choice of food, there may be larger gains from targeting drinks.

Example: Massachusetts General Hospital

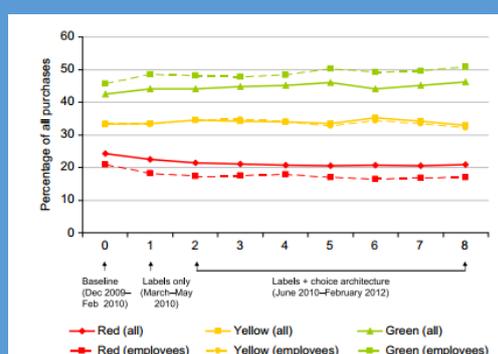
An intervention at Massachusetts General Hospital's cafeteria^{cc} developed a traffic-light labelling system based on the 2005 U.S. Department of Agriculture 'My Pyramid'¹ recommendations.

Every item in the cafeteria was labelled as green (healthy), yellow (medium), or red (unhealthy). The study used a simple method to decide what colour label each item would receive. There were three positive criteria (fruit/vegetable, whole grain, and lean protein/low-fat dairy as the main ingredient) and two negative criteria (saturated fat and calorie content). Items with more positive than negative criteria were labelled green, items with equal positive and negative criteria were yellow, and items with more negative than positive criteria were red. The only exceptions were bottled water and diet beverages with 0 calories; they were labelled green despite having no positive criteria according to the above list.

This system had the advantages of being easy, providing a simple system of product assessment as well as clear and salient information for consumers. The drawback was that the measure was rather simplistic.

The new labelling system in the cafeteria was promoted to hospital employees and visitors, and permanent signage and menu board changes accompanied the labels. Signage highlighted that green meant "consume often," yellow meant "consume less often," and red meant "there is a better choice in green or yellow." The study found that after two years, purchases of **red** food items fell by 20%, yellow fell by 4%, and green rose by 12%.

Figure 3. Purchases by (1) all customers and (2) a cohort of regular employee customers, from baseline to 24 months following implementation of the cafeteria intervention. Note: Each number 0–8 on the X axis represents a 3-month period of time.



¹ 'My Pyramid' has since been replaced by 'My Plate' (<http://www.choosemyplate.gov/>). The information about what and how much to eat has not changed—both MyPyramid and MyPlate are illustrations that are based on the same food groups and recommendations about what and how much to eat. <http://www.choosemyplate.gov/food-groups/downloads/MyPlate/UsingMyPlateAlongWithMyPyramid.pdf>

Aggregate traffic light labelling

Traffic light labelling may also have drawbacks. Ratings or labels for individual items could backfire: people may choose several ‘green’ items without realising the overall calorie impact of purchasing more green items than they would usually purchase otherwise (and, perhaps, more than they would consume if they had bought any item in the absence of labels).^{cc1}

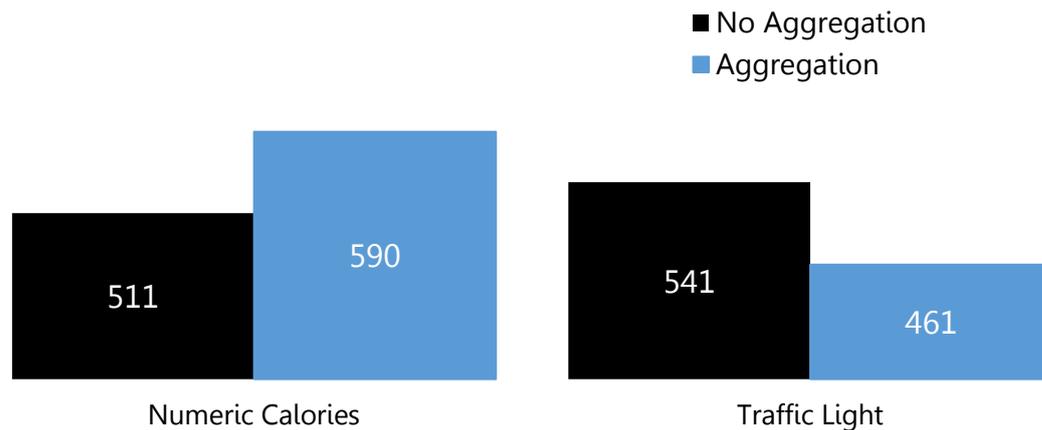


Figure 4. The aggregated number of calories is decreased when traffic lights are used at the aggregation. This is not the case for numeric calorie aggregation.^{ccii}

Where possible, we believe it is important to aggregate traffic light labels when people are choosing multiple items. In practice, this could be implemented at check-outs or even during the food shopping experience on top of a shopping trolley. As shopping becomes more interactive and provides faster real-time information about purchases, an aggregate food labelling system will also become easier to implement. However, it does not seem feasible to implement such a system at this time.

Pooled traffic light labelling

People want to choose healthier options, and the less they have to think about it the more likely they are to do so. Having too many labelling systems reduces their effect - there is a need to keep the approach simple in content and volume of information.^{cciii} Traffic lights help people easily identify healthy and unhealthy products by indicating whether it is low or high in various categories (e.g. salt, sugar, saturated fat, and calories). This provides useful information, but relies on consumers to weigh how much they care about each of those categories. An online choice experiment (which asked people to choose from two hypothetical meals with comparable labels) found that foods with more ‘red’ categories in the traffic light label were much less likely to be thought of as healthy. Interestingly, the impact of having a red label for saturated fats or salt was significantly greater than for total

fat content or sugar - potentially because people see these as worse (or feel like they are sacrificing less by avoiding these).^{cciv} To avoid relying on consumers to weigh labels related to different categories, traffic light labels can be pooled to create a label reflecting the overall healthiness of the item.²

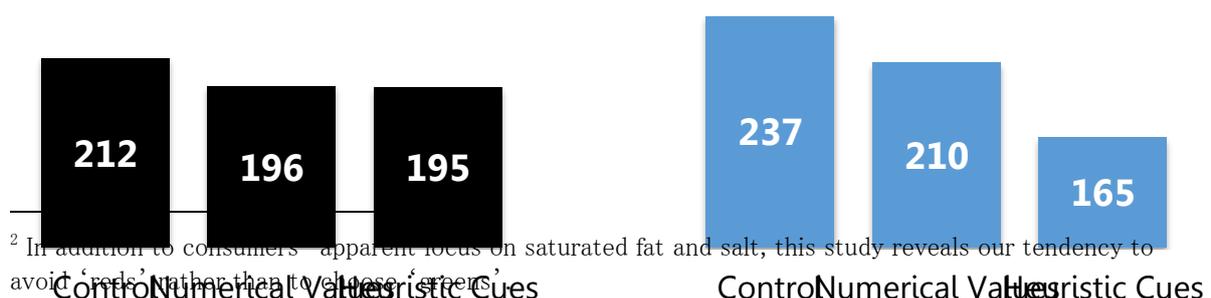
Traffic light labelling with an overall rating for a product appears to perform better than multiple traffic lights or daily intake recommendations when people were asked to identify healthier foods.^{ccv} Multiple traffic lights are helpful when people are engaged with choosing a healthier item but may have too much information to affect the behaviour of less engaged individuals.^{ccvi}

There is evidence to suggest that consumers focus on one or two elements of a multiple traffic light label, and use these to guide their choice.^{ccvii} Even when consumers are provided with information, many will impose their own heuristics. In addition to being more effective, a review on consumer perceptions of nutrition labelling found that shoppers appreciate the benefits of simplified information (such as traffic light labelling). However, they would like to know what this simplified information stands for (e.g. what determines whether something is green or amber).^{ccviii} The authors also note the potential for backfiring effects if consumers feel coerced or pushed to make certain choices they do not like. This suggests that any labelling should be clear and straightforward, ideally by tying it to a single objective figure (such as sugar content per 100 grams) rather than combining different scores.

The existing evidence favours pooled traffic light labelling (also called single traffic light labelling), which pools the different nutrition contents into one overall score.^{ccix} A recent systematic review, which found that shelf labelling shows promising results, highlighted the increased effect of adding nutrient summary scores (which assign a sort of unified 'score', rather than content information for different categories).^{ccx} Providing a single cue in this way, and adding it to the heuristic of the familiar traffic light colouring, seems particularly effective among obese people (Figure 5).

Normal Weight

Overweight



² In addition to consumers' apparent focus on saturated fat and salt, this study reveals our tendency to avoid 'reds' rather than to choose 'greens'.

Figure 5. Simple heuristics can be especially helpful in reducing calorie intake among obese people.^{ccxi}

There has been little work comparing the relative effect of a food or beverage tax to other types of interventions. However, one study sought to estimate the cost-effectiveness of interventions by comparing traffic light labelling to imposing a 10% ‘junk-food’ tax.^{ccxii} The authors, using rough assumptions, concluded that both interventions have the potential to reduce mean weight in a cost-effective way, although the tax was estimated to be more cost-effective. On the other hand, an analysis by McKinsey estimates that changes to food labelling could reduce the number of deaths due to obesity almost three times as much as a 10% tax on high-sugar and high-fat foods at a similar cost.^{ccxiii}

Heuristic labelling can help people understand and evaluate complex food decisions, and we should make this as easy as possible. We need to be aware of the risk of licensing people to consumer more ‘green’ items than they otherwise would, and for this reason we recommend a focus on highlighting ‘red’ options while not labelling the other options.

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