Report on tailored toolboxes to promote healthier food choice

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Introduction

A report by the World Health Organization (2009) points out that nutrition is coming to the fore as a major modifiable determinant of chronic disease. Scientific evidence is increasingly supporting the view that alterations in diet can have strong effects, both positive and negative, on health over a lifetime. But how do we support people to make healthier dietary choices, particularly those who are at the lower end of the income distribution and educational ladder, and seem to be particularly vulnerable to obesity?

Over the last decades, a vast body of work was done to evaluate the effects of various policy instruments targeting dietary choices. Information provision is one of the key policy instruments with large public investments in public information campaigns (see Capacci et al., 2012, for a review). A subset of countries implemented or will implement nationwide taxes on certain macronutrients such as fat or sugar, or provide subsidies for comparatively healthy products such as fruits and vegetables. Also, there is growing interest into reformulation of food and drinks reducing sugar, salt, and some types of fats. More recently, the literature in behavioral economics has inspired new instruments such as so-called "nudges" (Thaler & Sunstein, 2008), self-commitment schemes (or "self-nudges"), and the choice architecture of canteens to facilitate healthier choices (see **Bauer & Reisch, 2018**, for a review).

One of the main goals of the Nudge-it consortium is *to develop tools to support the analysis and identification of biological, psychological, cognitive, and environmental mechanisms determining dietary choices*. The present report compiles the main results of our research on possible anchors for policy intervention that were identified by the partners of the consortium. These anchors are the basis for a toolbox of seven different candidate policies (see Box 1) to be applied, adapted, and optimized regarding the different behavioural targets as well as the different target groups.

It is important to stress that most of these policy proposals are deliberately general and have not been tested or evaluated to a significant degree to date. However, the policy anchors allow us to identify *targets* for policies (i.e., what should be the goal of the policy, what should it achieve?) but we do not necessarily specify which *instruments* are best to achieve it (e.g., should it be achieved through a nudge or a tax?). The latter is beyond the scope of the Nudge-it project. Despite some focused and ongoing research efforts to elevate the evidence level and test the application of specific mechanisms outside the laboratory, further work is necessary to evaluate real world interventions designed around these anchors.

The present report is work-in-progress and compiles the essence of the policy-relevant work done within the Nudge-it project until

June 2018. It is organized as follows: first, we discuss general approaches of early intervention and prevention, and highlight some of the challenges related to "curing" (suggesting that policy should concentrate on the former because the latter seems less promising), before each of the five policy anchors are sketched. For each anchor, key results of Nudge-it studies regarding these promising mechanisms are reported. Convinced of the fact that studies that have been designed within Nudge-it but have not been carried out (for various practical reasons) during the project are worth reporting, we also present plans of study designs and methodological suggestions. We believe that these designs and their obstacles can inform future research and policy testing. Thus, in presenting unimplemented designs, we also highlight major challenges associated with research on the determinants of dietary intake and food choice in general as well as experimental field work specifically.

Throughout, we chose a non-technical language and presentation style to make the key thoughts easily accessible also to non-experts. For details of methodology and study design, we refer readers to the papers published in scientific outlets as cited in the text. To mark the specific contributions of the Nudge-it consortium, we highlight studies that have been conducted by Nudge-it consortia members within the project in bold letters.

Prevention and Cure

With the large increase in obesity rates across many developed countries, public health policies can be categorized into two types: those that aim to reverse obesity (*cure*) and those that aim to prevent it (*prevention*). The view of the consortium is that policies focused on prevention are more promising than policies intended to cure obesity. The latter requires reducing calorie intake for a period of time, which necessitates the ability to counteract strong biological drives towards eating that have evolved over thousands of years. In practice, sustained calorie reduction is difficult to achieve, and this difficulty probably helps to explain why most diets don't work. The current evidence suggests that bariatric surgery is in fact one of the few options that shows some promise in the longer run (although not always) for reversing obesity. It appears to work because of changes in how much people can readily eat after the surgery and how full they feel.

Overall, we propose that prevention appears more promising than cure, particularly interventions early on in life. The limited public health policy funds should hence primarily be invested into *prevention* efforts.

Anchors for Designing Policy Tools

In a natural world, one could expect biological mechanisms and impulses to translate into relatively optimal food choices and consumption decisions. Powerful biological mechanisms regulate hunger, appetite and satiety, and one could expect that these instinctively guide us towards the foods that we need and translate into relatively stable calorie intake.

However, in the current world of wide availability of various foods, some of them being "engineered" by a market industry, these biological processes may not necessarily lead to optimal choices. Biological processes are obviously very useful and hard to "switch off" anyway, and we know that dietary choices are mostly habitual and do not involve much thinking. We believe that policies will only be effective if they are designed within these constraints. As a consequence, existing policies that either aim to go against these fundamental biological processes or assume that food decisions are heavily thought through, are unlikely to be successful.

We argue that policies should work in concert *with* biological processes rather than against them; and should not require substantial cognitive effort, such as processing complex information. In the following, we discuss *five key anchors* for policies that fit into this remit. Some of these anchors directly tap into the challenges to the biology of eating in the modern world, others relate to facilitating informed food choice in simple ways. These five anchors are the base for *seven policy tools* (Box 1).

Box 1: Policy Toolbox

1. **Encourage the consumption of solid foods over liquids** (other than water or breast milk) – especially within the same food group (i.e., eating an apple is preferable to drinking the juice from the same apple).
2. **Avoid drinks with added sugar** because such drinks generally have little or no nutritional value while contributing significantly to caloric intake.
3. **Decrease exposure to non-obesogenic foods early on in life** in order to foster the development of non-obesogenic tastes, which possibly plays a key role in the establishment of unhealthy dietary habits.
4. **Increase the regularity of eating and limit snacking to small amounts**, which should facilitate stable calorie intake over time.
5. **Reduce stress** or, perhaps more feasibly, **increase the ability to cope with stress** with stress management methods.
6. **Facilitate healthy decision-making overall, and in stressful situations in particular**. This suggestion reiterates the importance of establishing good habits early on life to which one can fall back on during stressful situations (this relates to Anchor 3), as well as encouraging pre-planning of future consumption while in low-stress situations (this relates to Anchor 4).
7. **Facilitate access to information on individual needs and foods.** Work within Nudge-it emphasizes that this information should be both highly salient and easily processed. The goal should be to reduce the effort required to incorporate health concerns into the choice process.

Anchor 1*: Calories versus nutrients*

Theoretically, the trajectory to become obese involves energy imbalance: Calorie intake exceeds calorie expenditure for a period, and that leads to weight gain. However, as hinted earlier, the idea of "eating too much" is not a natural one from a biological perspective. In fact, one would expect that higher calorie intake at one point in time leads to lower calorie intake later on. This hypothesis is echoed by the popular wisdom that eating something before dinner spoils the appetite. In biology, this phenomenon is referred to as *compensatory behavior.*

A promising hypothesis to explain the limits to compensatory behavior is that we eat not just to ingest calories but also to ensure an adequate supply of nutrients. For example, it is well known that rodents and herbivores develop an intense salt-craving in conditions of sodium deficiency. It is plausible that the brain is able to signal an imbalance in certain food nutrients and that leads to more food intake. The hormones guiding appetite and satiety appear to play a role in determining which types of food we choose to eat and alter the reward value of food meaning that all foods or calories are not treated equally.

Two other factors that are often mentioned as possibly driving up calorie intake are: (1) an increase in average portion sizes and (2) erratic eating and snacking. We know that default portion sizes have historically been increasing, and they are often mentioned as a possible culprit for excessive food intake. Similarly, snacks appear to represent a large portion of daily calorie intake. For children, a US-based study by Piemas and Popkin (2010) shows that children get 27% of their daily calorie intake through snacks, which are often nutrient-poor, and high in sugar and saturated fats. The evidence on the effects of portion sizes and irregular eating on overall calorie intake is, however, scarce. It is also not clear that portion sizes have contributed to the rise in obesity (Benton, 2015; English et al., 2015; Herman et al., 2016). Similarly, there is mixed evidence on the effects of snacking on BMI (Larson & Story, 2013). Hence, it could very well be that we eat more snacks than we used to, but that could have translated to eating less calories at regular meal times.

Within Nudge-it, studies were conducted both with animals and with humans to test the extent to which we are able to regulate overall calorie intake and maintain body weight. First, a study by **Hume et al. (2016)** in rodents provides evidence for the ability to regulate calorie intake: Rodents who were given sweet treats (sweetened condensed

milk) reduced their *voluntary* food intake by the equivalent amount of calories. However, this compensatory behavior appears to have limits. If rats were provided with more than half of their calories in the form of sweet treats, they did not fully compensate and increased their overall calorie intake. Thus, "overeating" appears to be a biologically plausible path to obesity when caloric and nutrient intake are out of balance.

Another Nudge-it study, by **Belot, Berlin et al. (2017)** evaluated a randomized controlled trial where adults and children were asked to stick to a regular eating pattern and avoid snacking between meals (children were allowed two specific snacks in between at regular times). The protocol also included a "day off" where participants could eat whenever they wanted. No significant effects were found on overall calorie intake, neither for children or for adults, but the study found that regular eating does translate into lower weight gain for children. Possibly, the protocol was too difficult for adults to stick to, which may make it difficult to identify significant effects of changes in eating. Overall, the potential for regular eating patterns to limit weight gain without caloric reduction is a promising avenue for future research and policy development.

While it has been established that obesity is generally associated with higher levels of nutrient deficiency, the causal pathways are not yet fully understood (Astrup & Bügel, 2010, García et al., 2009). This observed association is likely to be multifactorial and despite some experimental evidence that suggest a causal link between micronutrient deficiency and appetite regulation (e.g. Major et al., 2009), evidence for alternative explanations exists. The observed nutrient deficiency in obese individuals might be a mere byproduct of low-cost, calorie-high, but nutrient-poor diets that promote obestiy. Further explanations relate to metabolic alterations as a consequence of being obese such as higher nutrient demands or lower absorbtion (Damms-Machado et al., 2012, Gebler et al., 2015). Further research into mechanisms of these causal relationships is needed before we can assess the importance of nutrient-poor foods and "empty calories" on obesity. Even though the mechanics are conceptually plausible, current evidence suggest a complex interplay between obesity, micro-nutrient deficinciey and the biological regulatory systems that requires further investigation (Astrup & Bügel, 2010; Gebler et al., 2015).

If overeating is caused by deficiency in certain nutrients, avoiding high calorie foods that are poor in nutrients could be a promising way of tackling and preventing obesity. Interventions aiming at reducing snacking behavior may therefore be promising. The results of the RCT conducted in **Belot, Berlin et al. (2017)** show that merely instructing parents to feed children at regular times and only offer a healthy snack mid-morning and mid-afternoon is effective in reducing gain weight in children. The results also show that parents, on the other hand, do not respond. It appeared much easier for children to follow the new protocol than for adults, confirming that

habits are more malleable early on in life than later. These results also emphasize the important role that parents, and potentially schools, play in guiding children's nutrition and health.

Anchor 2*: Liquid versus solid foods*

Solids and liquids are assimilated differently, and liquid consumption appears particularly problematic for overall calorie intake. We are capable of consuming a lot more calories in liquid than in solid form. Consequently, drinks that are high in energy (because of added sugar, for example) could lead to an increase in overall calorie intake and contribute to energy imbalance.

The mechanisms behind this difference between liquid and solid foods are not yet well understood. A priori, solids take longer to eat than liquids. It could be that in nature foods that require more effort to consume (e.g. those that involve more chewing) tend to be associated with higher calorie content. Also, in the natural world, foods are almost universally solids, while the only natural liquid available for consumption is water, which is calorie free. For most of human history, the only calorie-dense liquid consumption was human breast milk and was limited to the first few years of life.

There is evidence that even with equal calorie content, solids and liquids are not equal. In particular, eating the same amount of calories in liquid or solid form may result in different senses of fullness (Wooley et al., 1972). It has been proposed that the mastication of solids could trigger a satiety signal that is not triggered by swallowing liquids (Haber et al., 1977). Liquids have also been documented to have a more rapid gastro-intestinal transit time than solids (Phillips & Powley, 1996), which can result in a different time course of nutrient exposure in the gut with possible implications for appetite and meal initiation.

Within Nudge-it, the work by **Camps et al. (2016)** showed that people experience different senses of fullness when consuming foods that differ in viscosity but are equivalent in calories; foods that are thicker make people feel fuller for a longer time. However, this work also showed that the stomach empties more rapidly when the food has a lower calorie content, and that calorie content is more important than viscosity in determining the speed at which the stomach empties.

As outlined in **Bauer and Reisch (2018),** foods designed to be consumed fast and with low oral processing are likely to yield lower immediate satiation and long-term satiety – despite equal caloric density. As a number of nudge-it studies suggest, the psychological and behavioural experience, especially subjective (mis)perceptions of meal size and content are important determinants of food choice and caloric intake (e.g. **Camps et al., 2016, Ferriday et al., 2016, Wilkinson et al., 2016**). However, these findings are mostly limited to laboratory studies and require further testing in large-scale longitudinal studies to see whether the effects hold up outside the lab and can be used to inform future regulation. Future studies of this mechanism might be tested by the reformulation of food products in increasing oral exposure or inform interventions that alter the consumption environment to increase the vividness of the eating experience – an approach closely linked to Anchor 4 below.

In a nutshell, several lines of evidence created in Nudge-it suggest a potential "solid versus liquid foods" approach to reduce obesity. Relating the problem of overconsumption not only to the nutritional quality of different food items, but also their presentation and characteristics that determine how the food is consumed (i.e., viscosity, oro-sensoric exposure, bit sizes), provides many promising avenues for policy.

Anchor 3*: Formation of tastes and habits*

There is a widespread hypothesis that tastes play a key role in dietary choices, and that tastes are formed early in life (Steptoe et al., 1995). Consequently, targeting the *formation of food preferences* in childhood seems a promising route to establish healthy dietary habits later in life. There is a large literature in nutrition science showing that food tastes develop early on and are shaped by exposure (see Birch, 1999, for a review).

One question is whether exposure to obesogenic foods early on in life has a significant impact on food preferences later on and whether one could manipulate the exposure to reduce the attractiveness of obesogenic foods later on.

Forming healthy food preferences in young age has potentially multiple health benefits and successful interventions in this area could have long-lasting effects that prevent the onset of obesity. In a recent review, Olsen et al. (2013, p. 162) highlight that it is "never too late" to target food preferences, but emphasize the importance of starting

early with promoting healthy food preferences among children and the responsibility of parents and caretaker alike.

Different ways to foster the formation of healthier food preferences among children and adults have been explored within Nudge-it. **Belot, Berlin et al. (2017)** conducted a randomized controlled trial with families with a child between the age of 2 and 6 years old, where treated families received food ingredients and recipes at home for preparing five healthy meals a week for 3 months. Preliminary evidence suggests that children in treated families gained less weight than children in the control group, while no effects were identified for parents. These results, once again, highlight the potentially limited malleability of food preferences and dietary habits later on in life.

Rabasa et al. (2016) studied the formation of food preferences among rodents and showed that early-life diet matters in rodents, but significant effects are found only if the healthy diet is maintained over time and into adulthood.

EUI and **CBS are** conducting a randomized field trial to assess the effects rewarding practices with food on the preference of the food reward of children. The study is still ongoing. The identification of such mechanism could potentially inform parental education regarding the use of food reward. Alternatively, future studies could try to leverage this mechanism to increase preference for healthy foods among children by using them as a reward.

Future studies

On top of the above, CBS had designed two additional, larger studies that can be conducted to test potential Anchor 3 interventions. Both studies were originally planned to take place within the Nudge-it project, but were – for practical reasons - moved to a later date. We also invite other researchers to use the two fully developed study designs that we are happy to share on demand.

(1) The first study aims to assess the long-term effects of small incentives for healthy food choices within elementary schools. It is based on **Gwozdz et al. (2018)**, Belot et al. (2016) and Loewenstein et al. (2016) who tested similar approaches over a few weeks in elementary schools. They found promising yet mostly non-persistent effects of small monetary rewards or stickers on food choice and children's habit formation. Our study design would test the effectiveness of repeated use of non-monetary incentives on food choice over a longer time period. It might help to provide insights into how to foster healthier food choices and good eating habits among children. The practical challenge is to convince a sufficiently large number of schools to participate. Engaging with local governments, health insurances or similar institutions might help.

(2) The second study cooperates with supermarkets as practice partners. In cooperation with a tech start-up company (Germany based *SO1 GmbH*) that uses consumer data to predict individual willingness-to-pay for different food products, the study tests the provision of

individual discounts or subsidies for healthy foods. Using predictive modelling to determine consumers' reservation prices has great potential to maximize the efficiency of public funds to encourage healthier diets. Harnessing the full potential of big consumer data could provide individually targeted discounts in online and brick and mortal supermarkets that account for individual dietary needs and preferences, while creating the most dietary health benefits for a given budget. The practical challenge will again be to find a cooperating supermarket and to have the necessary means to buy the software. Additionally, strict data protection laws can sometimes be major barriers. However, the study approach holds greats promise for future research.

Anchor 4: *Reduce stress*

The idea of "stress eating" and turning to comfort foods to increase one's mood is pervasive in both the scientific literature and popular culture. There are many theories about the biological and psychological drivers of this phenomenon, including (1) stress causes a shift towards habitual behavior or simplifying heuristics, (2) stress promotes reward-seeking behavior, and comfort eating is an adaptive response, and (3) stress is a signal of a possible period of food scarcity (to name but a few potential drivers). Work within Nudge-it provides support for some of these hypotheses yet also makes clear that the response to stress is quite heterogeneous. For example, many people actually consume fewer calories when stressed (Sproesser et al., 2011). Thus, we cannot simply look at stress in isolation but need to consider individual and situational factors.

A Nudge-it study by **Maier et al. (2015)** showed that, on average, acute stress leads people to choose energy-dense, highly palatable foods over healthier alternatives. In other words, stress decreased dietary self-control. These effects of stress are particularly noteworthy given the socio-economic gradient of obesity. It is well known that states of poverty contain numerous stressors (Evans & English, 2002; Haushofer & Fehr, 2014). The high levels of stress on low-SES individuals could be one reason for the socio-economic gradient in obesity.

Although **Maier et al. (2015)** found that stress decreases dietary self-control on average, they also identified substantial individual differences in the psychological, autonomic, and brain responses to stress that were in turn associated with differential patterns of food choice. Some of the variation in stress responses may relate to differences in the habits and heuristics people fall back on in times of stress, which is another reason why it is important to establish healthy eating (and coping) habits, and to do so as early in life as possible.

Alem et al. (2016) found that a four-week stress-reduction program (based on

mindfulness practice organized via an online platform) leads to lower levels of self-reported stress and a reduction in self-reported stress-related eating. These findings are encouraging and suggest that stress-reduction measures can improve dietary health if we can find the means and time to incorporate them into our daily lives.

In one Nudge-it study, **Belot, James et al. (2017)** set up a choice experiment so assess the impact of time stress on food choice. The first hypothesis tested is whether exposure to acute stress has an impact on immediate and on planned food choice. The second hypothesis tested is whether in-utero exposure to stress is correlated with food preferences of children. The hypotheses will be tested with a randomized controlled experiment with low income mothers, in Italy and in the UK. The goal is to better understand how stress may affect food choices, and focus particularly on a possible biological mechanism (in utero exposure to stress).

Time pressure is one of the most common sources of stress in modern life, and it may have additional direct effects on eating behavior as well. Work from Nudge-it shows that eating more slowly, with longer pauses and more oro-sensoric exposure, is related to higher and more lasting satiation (**Ferriday et al., 2016**). People eating more slowly reduced food intake and showed little compensation when offered a dessert after their meal. Eating in a rush or on-the-go mode precludes experiencing these benefits. The fact that solid foods take longer to eat and provide more oro-sensoric exposure is another reason to favor them over liquid foods. We have already noted the benefits of eating at regularly planned intervals in terms of the types and amount of food consumed. An additional benefit of planning meal times could be the length of those times themselves and the higher level of satiation they induce.

Similarly, the benefits of reducing children's stress levels with targeted and combined interventions – mainly reducing TV use, correcting unhealthy sleep patterns and increasing physical activity – were one of the major findings from an earlier EU FP7 project "I.Family" (Intemann et al., 2017; Kovács et al., 2015) in which Nudge-it researchers were involved. In line with the literature on stress and childhood well-being, these results echo the implications drawn from the Nudge-it project.

Stress reduces dietary self-control and, mediated by faster eating rates, can also reduce the satiation of the foods consumed **(Maier et al., 2016; Ferriday et al., 2016).** More studies are needed to investigate the long-term effect of stress reduction during meal selection and consumption on overall calorie intake. Such interventions could focus on different aspects: *first*, one can try to improve individual resilience against stress by targeting the individuals themselves. Advising or training people how to better cope with stress has shown promising results (see Alem et al., 2016, Katterman et al. 2014), and poses a promising target for future interventions. However, such approaches should be supplemented with a *second* approach to

further investigate the causes of stress, with a particular focus on work and eating environments. Long-term evidence regarding different stress factors and their impact on food choice and satiations are still limited. A *third* way to reduce stress, at least during decision-making process, could be through alterations in the choice architecture. There is a growing body of literature regarding the effectiveness of shifting meal-selection to moments of low stress and low hunger. Such methods are closely related to the use of self-commitment devices that help to shield decisions in line with long-term goals against short-term, situationally triggered temptations.

Anchor 5: *Cognitive mechanisms, attention, and salience*

In a natural environment, one could expect that following biological signals of hunger and satiety would translate into relatively optimal food selection and consumption decisions. However, in the current world, there appears to be a role for cognitive mechanisms and self-control to achieve healthy choices.

The difficulty is that making healthy choices is not simple. Optimizing dietary choices requires processing information about one's own needs and health status in combination with information on the various foods available. Making such computations is effortful and time-consuming. We know that, in fact, most of us do not spend a lot of mental energy on thinking about food choices. Recent work in behavioral economics (see, for example, Sunstein, 2013) shows that facilitating information acquisition - for example, by providing information on calorie and macronutrient content in a way that is easy to comprehend – may be helpful in encouraging healthier choices.

Within Nudge-it, **Belot, James et al. (2017)** tested the effects of providing generic or tailored information about one's health status and recommendations to reduce the chances of getting diabetes or coronary heart diseases. One group received information based on their own profile (including family history, lifestyle habits and anthropometric measurements), indicating whether they were at lower or higher risk than an average person of their age group and gender. The probability assessment was associated with tailored (dietary) recommendations on how to reduce their risks. A second group received only information on average risks and was exposed to all recommendations. A third group served as a control group and received irrelevant information (not related to health or diet). All groups were then asked to pick a basket of foods worth £30. It appeared that the generic group responded most and reduced purchases of foods rich in fat. The tailored group did not respond much, possibly because they were in fact too pessimistic about their health and most received good news. These results advocate

caution regarding providing tailored information. On the other hand, generic information that is provided in a low cost and salient way appears to have immediate effects on purchasing behavior.

Related Nudge-it work shows that providing *additional* information may not be necessary in all cases, and simple cues prompting individuals to pay more attention to the health information they already possess can facilitate healthier choices. In a lab experiment mimicking an online supermarket shopping experience, **van der Laan et al. (2017)** showed that a subtle health cue (i.e., an unrelated advertisement for a healthy recipe) presented during the shopping task could increase the number of choices for low over high energy-dense food by approximately 10%. Similarly, **van Meer et al. (2017)** and **Hege et al. (2018)** found that simple instructions to consider healthiness with no additional information about healthiness increased the proportion of healthy foods selected and reduced meal portion sizes.

Computational modeling of choice dynamics by **Maier and colleagues (in prep)** indicates that drawing attention to health factors in the absence of new information helps people make healthier food choices, in part by speeding up the cognitive processing of healthiness relative to other attributes such as palatability or satiety during decision making. One important caveat is that the effects of uninformative health cues on food choices have, so far, been tested only in populations composed mostly of high education and SES individuals. Obviously, these cues require a basic understanding of what makes food (un)healthy.

Ongoing studies

As described in the **Bauer and Reisch (2018)**, several studies have tried to assess the impact of health priming and prompting on food choice. However, evidence is yet inconclusive regarding suitable areas for intervention and long-term effects. Ongoing research is trying to enrich the evidence base for this anchor in particular:

One project led by **CBS** aims to follow up on the promising results from the eye tracking study by **van der Laan (2017)** – a study based on a mostly female student population that showed positive effects of health priming on low caloric food choices. The novel study, currently under pre-test, aims to translate the choice task from a lab setting to an online experiment elicit the effectiveness on a population representative sample. Additionally, treatment conditions aim to study the effect of competing hedonic priming cues presented with the dietary related cue and thereby simulate the idea of counter-nudging (Sunstein, 2017). Counter-nudging can occur when local stakeholders aim to reduce the intervention effect if perceived as detrimental to business. We hope this study provides novel insights into the effectiveness and robustness of potential health priming interventions.

A field experiment by **CBS**, data collection completed, tested the use of prompts to consume more fruit and vegetables in Danish supermarkets. This conceptual replication of Payne et al. (2015)

manipulates shopping baskets and trollies with encouraging food advertisement using social norm messaging. As grocery shopping determines a large share of daily caloric intake, this easy-to-implement intervention could lead to meaningful changes in people shopping baskets if found to be effective. Data collection took place over several months and might therefore provide potential insights into long-term effects of such types of nudges.

Challenges in Evidence Gathering

Gathering evidence on what may work to reduce and limit obesity requires a good understanding of candidate mechanisms that determine dietary choice. As it is now, we see three major challenges in collecting evidence **(Bauer & Reisch, 2018):**

(1) Diet is a difficult outcome to measure. All measures currently available have strong limitations. Either they rely on self-reports or they capture limited episodes of consumption (such as one specific choice during the day, for example).

(2) It is difficult to conduct experiments among human populations. Ideally, one would like to collect data on a representative sample of the population of interest, expose them to different interventions in a randomized way and collect a range of measures from dietary outcomes to anthropometric measures such as Body Mass Index. Such data collection is difficult to do. Specifically, recruiting participants from certain subgroups, such as from disadvantaged backgrounds or pregnant women, is extremely challenging. Gathering evidence with high external validity requires access to situations where real-life food choices are made. These situations are often controlled by private actors, which limits researchers' ability to study them easily and independently.

(3) The mechanisms driving dietary choices are hardly understood and are likely to differ across individuals. The idea of "one policy fits all" seems misplaced, and more evidence needs to be gathered on how individuals differ in the way they process food.

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