A rapid evidence review of the Psychology of Food Choice

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Executive summary

Scope of the report

This report provides a rapid review of the evidence of the psychology of food choice, to address the brief set out by the FSA requesting a report to consolidate current knowledge and direction of development of research in relation to the psychology of food choice. It aimed to provide insight into the situational, social, emotional and psychological roles of food and how variation among them influence buying and eating decisions.

For ease of interpretation, we categorised the key fields within psychology that can aid our understanding of food choice and food consumption into three groups: (1) when people are in a position to think consciously about their choices (deliberate processes); (2) when people act 'on automatic pilot' (non-conscious processes); and (3) when choices are affected by other factors such as culture or society (indirect effects). Across these areas, we sought to answer the following questions set out in the FSA brief:

1) What are the key psychological processes that we should consider when thinking about our food choices?
2) What characteristics of a person, place or product can influence these processes?
3) What approaches to influence food choice have been tried and found effective – and what is the psychology behind them?
4) Which approaches to promoting positive food choices show the greatest promise? ‘Positive choices’ in this case infer those leading to better health or sustainability.
5) How have inequalities been incorporated into research, and where is greater consideration needed?

Methods

To enable us to manage the scope of the review, we conducted a scoping review of systematic reviews using the Web of Science database (see Appendix 1) in the last 5 years (2016-2021). Where recent high-quality systematic reviews were not available in areas either flagged by the FSA brief, or known to be very current by the project team, we searched the literature for individual studies. The absence of systematic reviews is usually indicative of more recent, or less well studied lines of research. Articles were screened by (i) title, (ii) abstract, and finally (iii) full text to check whether they met our inclusion criteria, addressing the focus of the review. In addition to extracting information from the studies on the association between the factors reported and food choice/consumption, we recorded the quality of the data to enable us to judge the confidence with which we could report the findings and recorded the outcomes of tests to assess whether the associations studied differed according to group (for example, gender, socio-economic position).

1926 systematic reviews were initially retrieved, and after removal of duplicates and studies not meeting our inclusion criteria, 39 systematic reviews were retrieved and used as the primary evidence on which this report is based (Appendix 2). Additional studies are referred to for illustration.

What works?

People usually only make conscious, or deliberate, choices when they have the opportunity to do so, a positive attitude towards the outcome (for example, health or sustainability) and are motivated to put effort into acting in line with these attitudes. We can help people who are already motivated to turn their intentions into action through providing them with simple tools aimed at helping them to achieve their goals and track their progress. Evidence is available as to which are the more effective ways providing this support and which can be delivered in person or online. In particular, the use of "*if-then*" plans (i.e., "*if* I am tempted to snack while watching TV, *then* I will make a cup of tea instead") may help to cement new behaviours into established habits.

Approaches that operate at a less conscious level, for example through habit or 'nudging', do not rely on attitudes or motivation to influence behaviour. The most extensive and robust evidence we found for strategies that influence food choice in this way related to *choice architecture*, such as altering where products are placed or providing easy-reference labelling, like traffic light systems, to influence purchasing patterns. While the evidence supporting *choice architecture* shows a consistently positive effect, the amount of change brought about is modest. Thus, these approaches can be part of a solution, but need to be used in conjunction with other strategies. Working with the gatekeepers (i.e., shops, cafes, restaurants) of the places where food is accessed will be pivotal to greater implementation of choice architecture.

Increasing the visibility of people making positive (healthy or sustainable) food choices will help others to do the same. This works through a number of mechanisms. For example, *social modelling* (i.e., seeing others make a certain food choice) can help to increase people's sense of capability by showing *how* they could incorporate healthy choices, *why* they should consider making more positive choices (i.e., through seeing the effects that others consider to be beneficial) and increasing their *confidence* to try. Increased visibility may also help to shift what people consider to be normal (influencing *social norms*), which can have a strong influence on their behaviour. This relates both to what we think others 'normally' do and what we feel others think we should do; people like to feel their behaviour is in line with others who they respect and value. While *marketing* has been shown to change such social norms to some extent, there is no strong evidence that any other specific strategies are effective in accomplishing this. However, any approach to normalise positive choices – or help people recognise that making a change is meaningful to them - works best if the case studies and examples are achievable (i.e., 'people like me') rather than aspirational. Modelling how positive choices fit into the lives of people across different sociodemographic groups is important to ensure an inclusive approach.

What works for whom?

Psychological approaches to promoting positive food choices are important but do not work equally across all social groups. People with more resources (social and financial) typically have greater opportunity to change what they eat, so will typically benefit more from policies that rely on individual's choosing to make a change. It is therefore important to investigate and attempt to prevent the unintended consequences of policies influencing food choice, such as endorsing stigma and widening inequalities.

One way to assess potential gaps in either who is supported by a given set of approaches or how we are supporting positive choices, is to map provision against theoretical frameworks of behaviour change and across different segments of the population. Table 1 shows how this may relate to the strategies summarised above. A more comprehensive map of approaches, according to known psychological predictors of behaviour and population segments, is provided within the report.

Table 1: Summary of evidence of strategies for promoting positive food choice

Strategies targeting primarily deliberate processes

What works?	Who for?	Impact on inequalities
"If-then" plans to cement repeated behaviours into daily routines	People already motivated to make healthy/sustainable choices. May help people learn to override impulsivity	May widen inequalities by focusing on individual change
Support for self-regulation (for example, goal setting, self-monitoring)	People already motivated to make healthy/sustainable choices	May widen inequalities by focusing on individual change

Strategies targeting non-conscious processes

What works?	Who for?	Impact on inequalities
Choice Architecture (for example, product placement in store, online landing pages)	Everyone, does not require motivation. May help to redirect impulsive choices towards more positive options	May be limited by cost for people in lower socio-economic positions (SEPs)
Easy-reference food labelling (for example, traffic light labelling)	Everyone, does not require motivation. May help to redirect impulsive choices towards more positive options	May be limited by cost for people in lower SEPs
Front of pack labelling (also targets deliberate processes)	People already motivated to make healthy/sustainable choices	May widen inequalities by focusing on individual change.

Strategies targeting indirect processes

What works?	Who for?	Impact on inequalities
Social modelling of positive food choices	Everyone, through influencing social practices. Strong effect in children and adolescents (from parents, from peers)	Could particularly help to support change in people with lower health literacy

What next?

Most of the existing research is on individual level processes (for example, putting the responsibility for change with the individual) and exploring relatively localised and minor environmental restructuring effects. More research is needed that draws on our understanding of how broad social and cultural effects on behaviour work. More research is also needed to explore how we can shift social practices, within the context of the systems wide approach, to promote health and sustainability. This could include research to better understand and harness naturally occurring large-scale shifts in social practices (for example, the movement to reduce plastic waste), or explore processes of social change that have emerged from our experience of

COVID-19 (for example, in relation to how we can build and maintain informal virtual social networks to provide support within communities).

Ultimately, conditions in which people feel that positive food choices are normal and supported by both others and their environment, rather than something requiring vigilance and hard work, will help positive choices to become less effortful and more sustainable.

Contents

1. Introduction

The choice and consumption of food is driven by a whole system of influencing factors. While this report focuses on the psychology of food choice, we emphasise that these psychological factors operate within the system rather than in isolation. To impact food consumption at a population level means considering all aspects of this system. As other parts of the system change (for example, environmental, fiscal, structural, cultural, educational factors etc), the relative impact and importance of the psychological and behavioural drivers of food choice may also change (Chen & Antonelli, 2020). Consideration of psychology is important in understanding how people are likely to respond to different approaches, but over-emphasis of the role of personal choice in food consumption could have unintended negative effects and increase health inequalities (Coggon & Adams, 2021).

1.1 The Psychology of food choice

In this report we make a distinction between three mechanisms that drive food choice and food consumption: 1) **deliberate processes** dominated by attitudes and motivation, where we may make plans to eat in a certain way and put these into action; 2) **non-conscious processes** where we may make choices quickly, without consideration; and 3) through the **indirect effects** of background factors which may reflect the influence of the culture or society that we inhabit (Figure 1).

In Sections 2-4 we introduce the mechanisms of each of these processes before presenting the evidence available as to how we might positively influence food choice through these mechanisms. While we have summarised the evidence on what works best for whom where possible, greater in-depth investigation of this is beyond the scope of this report. We have highlighted how different approaches impact lower socio-economic groups where possible.

Our recommendations are based on an evidence review following a search of publications of “what works” in theory as well as what works in practice. Where there are gaps in the evidence we draw on evidence of what works in other domains (i.e., approaches that work for other health behaviours, such as smoking or physical

activity) which could be translated to food choice. Ideas for future research are flagged.

We also consider some of the opportunities that may have been created as a result of our shared experience of living through the COVID-19 pandemic.

1.1.1 Key definitions:

1) **Food choice:**

In line with the brief set out by the FSA, we use the term ‘food choice’ throughout this report. However, the food that a person buys or eats is not always as a result of the sort of conscious process that we typically understand when using the word *choice*. What people eat may result from unconscious decisions (for example, through habit or impulse), as a result of having no alternative, or through other external factors. Therefore, while we use the term *food choice* for the sake of simplicity, we use it to encompass the broad set of influences that result in us eating the food that we eat.

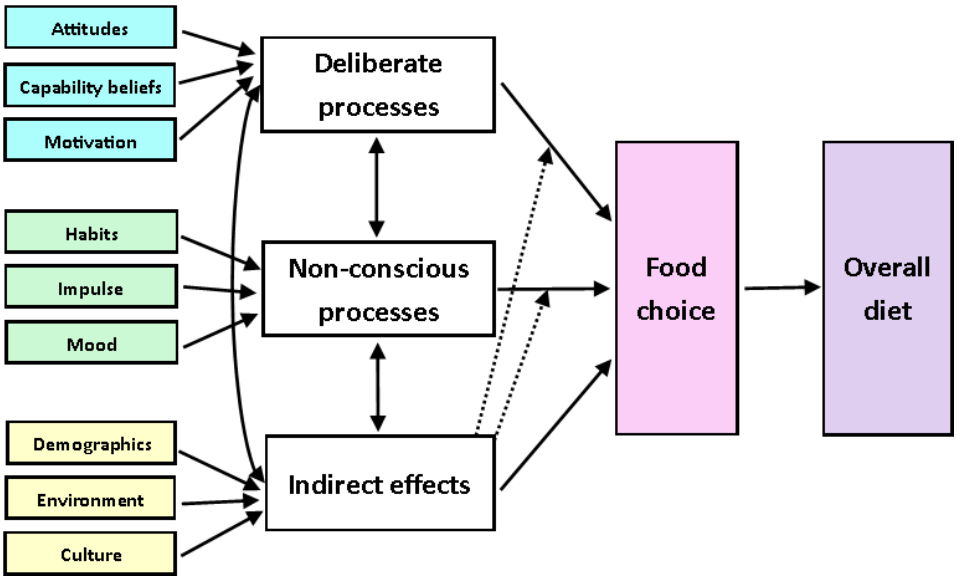
2) **Positive food choice:**

There was a wide variety of types of behaviour reported across studies, making it difficult to make direct comparisons or provide an overview by combining multiple studies. However, it was possible to group outcomes according to the behaviours that make a positive contribution towards either health or sustainability, as set out by the FSA as the agenda for the present report (noting that the two often overlap). Thus, where appropriate (i.e., where the results did not differ according to the type of outcome reported), we grouped findings into ‘positive food choices’ to incorporate any behaviour that would be expected to be beneficial. In relation to ‘health’ this included any changes linked to a reduction in health risk, including weight control, such as increasing fruit and vegetable consumption, reducing sugar intake or purchases of fast food, reducing portion size, reducing consumption of red and processed meat. Few studies reported on sustainability as an outcome under the current search strategy, but positive choices could relate to environmental or animal welfare benefits.

1.2 Behaviours involved in food choice

One of the challenges of compiling this review is the breadth of what is encompassed within the term “food choice”. This incorporates a range of different behaviours and settings, each of which may have very different determinants, influences and impacts. Our search strategy did not limit the type of behaviour that is reported to influence food choice, nor did we restrict the setting in which research studies took place. The settings for changing food consumption studied in the research we reviewed included grocery shopping, eating out at restaurants, at work or in school. Within these settings, target behaviours included increasing fruit and vegetable consumption, reducing purchase and consumption of calorie-dense snacks, and reducing how much is eaten overall. As these are rarely separated within the literature, we present them together under the banner of more positive food choices.

Figure 1: Model of food choice underpinning the structure of the report



Notes: dotted arrows indicate a moderating effect on the relationships between psychological factors and food choice. The term ‘food choice’ is used here to describe all aspects leading an individual to eat a certain food, including intentional and unintentional elements of arriving at a given option.

2. Methods and Evidence base

2.1 Design

A hybrid approach of pragmatism alongside a standard scoping review protocol was used to identify and select recent research evidence for this review. We searched primarily for systematic review articles that had already synthesised multiple studies in the same area. Further searches were conducted to explore the current state of knowledge in key areas, including both the determinants of food choice/food behaviour, and the efficacy of interventions attempting to influence food choice in order to change dietary characteristics (for example, for improved health, or sustainability). Details of search terms and hit rates are set out in Appendix 1.

The initial pool of studies retrieved were very similar and narrow in scope, and did not adequately address all of the questions posed by the FSA brief. Therefore, eight subsequent systematic searches were conducted to identify whether more data were available in the areas of; the effects of digital technology, online shopping, social media, marketing, and social influences and food choice, as well as searching for reviews that differentiated on the basis of age (older adult vs others) and socio-economic status.

A quality rating for all papers included in the review was obtained using standard approaches, and the outcomes of higher quality papers given greater weight in the reporting of findings.

2.2 Search outcomes

Following 1926 ‘hits’ following our initial search criteria, 39 systematic reviews met the search criteria and were used as the basis for this report (Appendix 2).

3. Deliberate processes underpinning food choice

3.1 How deliberate processes influence food choice

Theories that focus on attitudes and motivation infer that people usually act rationally in making food choices by thoughtfully weighing up our options, and that people's 'willpower' is an important driver of what they choose and eat. So, for example, we

may deliberate between priorities and make our choice on the basis of preferences for a certain taste or ingredients, relative to how the options fit with our other goals and values, such as managing our weight or money, fitting in with our peers, or consideration for the environment. Across various theories of behaviour change our **attitudes**, **motivation** and perceptions of **capability** emerge as key factors in driving behaviour.

Theories of behaviour change, such as the Theory of Planned Behaviour (Abeykoon, Engler-Stringer et al. 2017), the Health Belief Model (Janz and Becker 1984) or Self-Determination Theory (Deci and Ryan 1985), set out the sequence of effects that drive our behaviour. For example, the Theory of Planned Behaviour suggests that our intentions to act are driven by our assessment of whether the behaviour is 'normal', whether we think doing the behaviour is within our control, and our attitude towards it. The Health Belief Model also draws in our view of whether we are susceptible to any negative consequences from the behaviour and how bad they would be, what we think are the barriers to changing behaviour and how much we would benefit if we changed. By altering these underlying factors, we assume there will be knock on effects on our intentions and behaviour.

The power of attitude-based processes in driving behaviour may vary in degree of 'elaboration' in thinking that a person gives to the choice they make. For instance, a person may consider products on all attributes deemed relevant for a choice, weigh the importance of these attributes before finally identifying the most preferred option. Equally, they may just make a quick choice according to simpler heuristics, such as choosing a product because a celebrity has recommended it. The characteristics of both the person, and the situation they are in when making a choice (for example, their mood, and whether they are with friends) may influence how much elaboration people give to each choice they make.

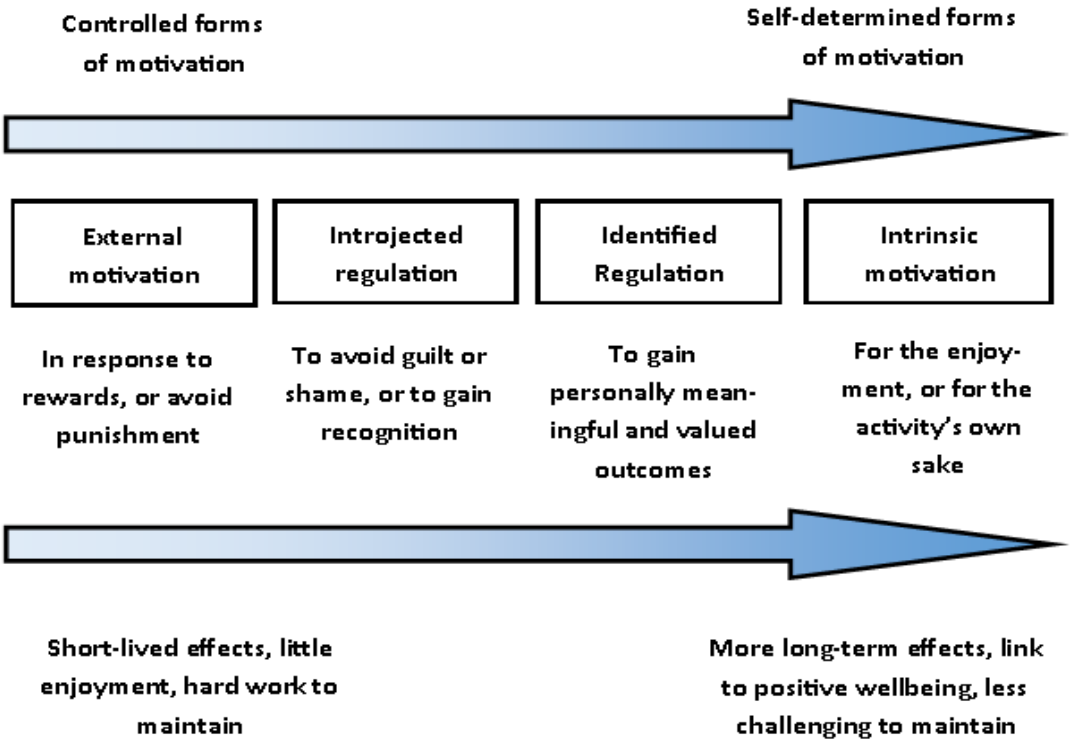
Attitudes refer to the degree to which people feel positive or negative (or agreement, disagreement) towards a given topic/action, as well to the specific views people may hold (for example, whether a certain food is 'healthy' or not).

Capability reflects perceptions like our sense of confidence that we are able to successfully complete a task we are faced with, and our sense of competence in a

given domain. People are more likely to take action when they feel they are likely to be successful.

Motivation refers to the reasons we have for acting, the origin of the reasons to act and strength of the drive. When we refer to motivation as part of deliberate processes, we are primarily concerned with the quality rather than quantity of motivation. Motivation can be seen to lie along a continuum from the poorest quality, which is the least self-determined, to the highest quality and most self-determined (Figure 2). People are more likely to make and sustain changes to their diet in order to control their weight when they do so through self-determined forms of motivation across age groups and clinical and non-clinical populations (e.g, Ng et al., 2012; Sheeran et al., 2020).

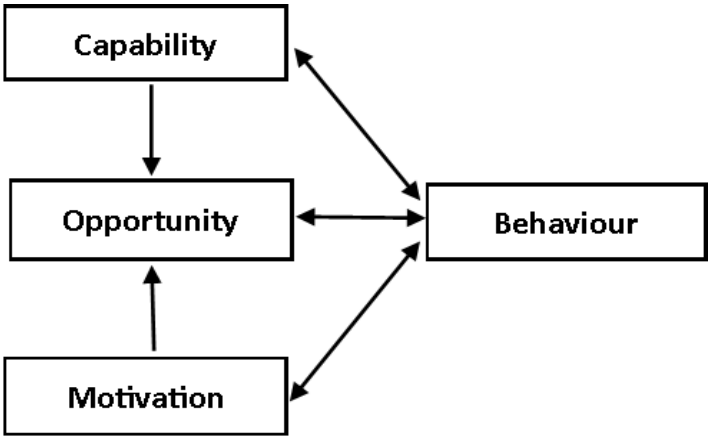
Figure 2: The motivation continuum



The COM-B framework of behaviour change has been created to help bring the determinants that influence our behaviour together to demonstrate the range of factors that need to be in place for sustained behaviour change (Michie, van Stralen & West, 2011). The framework makes explicit the need to ensure that across the environment as a whole, people need to experience **C**apability, **O**pportunity and

Motivation in order to effect **B**ehaviour change. The framework links these three behavioural determinants to intervention types and policy approaches, thus helping to assess how comprehensive are the range of approaches that are currently in place and where there may be gaps to assist in prioritising and choosing between potential policy approaches; we review the interventions discussed in this report relative to COM-B in Section 6.2.

Figure 3: The COM-B model



* Based on the diagram produced by Michie, van Stralen & West, 2011

3.2 Influencing deliberate processes underpinning food choice

3.2.1 Informing and educating

Food labelling is a well-used and well-studied approach to informing the public about food contents, aiming to both educate and provide brief information that helps people more easily categorise food as more/less healthy. Overall, food labelling has a small but meaningful positive effect on choosing healthier options and a positive association with a healthier diet overall (Cecchini and Warin 2016, Christoph and An 2018, Scapin, Fernandes et al. 2020). However, because they require more effort to read and understand, more information-dense food labels (i.e., front of package, FOP, nutrition labelling) are primarily only used by people who are already health conscious, motivated and taking steps to improve their diet (Anastasiou, Miller et al. 2019). Government consultation is currently underway as to the best way to present FOP information.

Other types of labelling that provide an immediate visual summary, such as **star ratings, logos and traffic light systems**, don't require so much effort to use, so are

more likely to influence people with weaker motivation. Evidence suggests that traffic light approaches in particular have a stronger effect than other types of labelling (Cecchini and Warin 2016, Christoph and An 2018, Scapin, Fernandes et al. 2020). These sorts of labelling may act as cues and nudges, as described in the later section on non-conscious responses. There can be drawbacks to appealing to such superficial processing, however, as this does not promote a full understanding and can lead to a "health halo" effect, that is, people consume more as they presume the product is healthier.

Not all evidence shows support for labels such as logos flagging a healthy choice or packaging making health-related claims (Anastasiou, Miller et al. 2019). This may be due to lack of trust (for example, if consumers do not trust a food corporation).

Food labelling requirements have also been found to **change the behaviour of food producers** resulting in reductions in fat and salt content of some foods (Shangguan, Afshin et al. 2019). Altering products removes some of the need to drive change through deliberate choice in order to achieve healthier diets.

3.2.2 Motivation

Self-determined motivation can be enhanced through: ensuring people have choice; respecting people's perspectives when introducing reasons for change (i.e., acknowledging that changing will be difficult); providing structure to make a change (for example, access to advice, an outline or graded steps towards change, information of when, where and how); and helping people to link proposed changes to reasons that are personally meaningful to them, rather than changing to please someone else (for example, Gillison et al., 2019).

Financial incentives can prompt people to try something new, adding an additional rationale or making an option more salient. However, while incentives may work in the short term, they lose their efficacy over time, even if the incentive continues, and can risk behaviour returning to below baseline levels when incentives are removed. Incentives also encourage 'cheating', as people are acting to obtain the incentive rather than to gain something from any intrinsic quality of the activity they are undertaking; so incentives do not support the same quality of behaviour or enable translation of what is learned from one behavioural domain to another if the behaviour is not underpinned by understanding.

This is in part as incentives are a controlling form of motivation and do not map to why we should change to meet our own goals and values. Incentives can be seen as particularly controlling if the source is not trusted (for example, doubting employers' motives in promoting healthier canteen options).

However, there may be occasions or means of using incentives that are not perceived as controlling, which could be a useful stimulus to behaviour change. For example, if incentives match public support, such that they are interpreted as the Government/workplace using incentives to encourage us to make changes that are important to us but difficult, they can be useful in bringing about quick changes if only a short-term change is needed (for example, changing diet during pregnancy).

Choosing healthy food may be more directly influenced by **goals and motivation** than choosing unhealthy foods (Chen & Antonelli, 2020). In part this is as our intentional goals usually relate to improving our choices, so cue us to notice opportunities to make a healthy choice and remember our rationale for doing so. Unhealthy choices may be driven more by non-conscious processes, for example related to the food environment (pricing deals, marketing) or characteristics of the food itself (for example, sensory elements related to pleasure).

Table 3.1: Influencing food choice through deliberate processes

Area	Mechanism of action	What works
Attitude	Attitudes reflect our emotions and beliefs about food choices. These include: • Beliefs about the attributes of a food choice – such as how healthy or sustainable. • Whether we feel positive or negative towards a food - this may be based on preferences (for example, taste, pleasure), and/or our values (for example, valuing health/sustainability). • Degree of 'elaboration' given to considering options, that is, how much effort is given to learning about and weighing up options. Interaction between the individual and the situation.	Provision of information/knowledge (about the attributes of food options) • Product labelling • Product endorsement (health professionals /celebrities) • Education (for example, schools, or from health professionals) Persuasion • Public health campaigns • Advice from health professionals • Product endorsement (for example, medical expert or celebrity)
Motivation	Motivation is the driving force behind engaging in behaviours that align with attitudes. • Motivation is longer lasting when we feel we are autonomous in our decisions, not controlled by others. • Autonomous motivation stems from feeling we have a choice, a personally meaningful reason to act, that we are competent to do what we need to do and that we	Provision of information/knowledge (to provide a meaningful rationale) • Product labelling • Product endorsement Behavioural support for self-regulation (for example, group support programmes) • Goal setting • Self-monitoring • Implementation intentions Gamification

Area	Mechanism of action	What works
	feel closer to other people when behaving in a certain way. • Making choices that override immediate pleasure to fit with longer term goals (for example, health) requires self-regulation. This takes effort - and therefore motivation - to maintain.	• A way to engage people who would not normally seek out information Social support
Capability	Perceptions of capability reflect our beliefs and confidence that we have the ability to successfully complete a task. • Our assessment of our capability draws on the size of the task, our past experience, seeing others similar to us attempt to do the same, and our assessment of the support we have to take the task on. • We are more likely to try when we are confident that we will succeed; that is, confidence and perceived capability increases motivation.	Provision of information/knowledge (about the size and scale of the task) • Product labelling • Self-monitoring to gain information on progress • Education (for example, schools or from health professionals) Demonstrating success • Using credible models in health promotion messaging Facilitating graded tasks • Breaking challenges down into component parts/ short term challenges (for example, 5 a day, Dry January) Persuasion • Advice from health professionals • Media/social media stories

3.2.3 Self-regulation

In order to make sustained intentional changes to our diets, whether changing to a more plant-based diet, reducing fat or sugar, or trying to achieve weight loss, people require **self-regulation**. That is, each time a person encounters a choice that requires them to override habit or preference, they will need to make a deliberate effort in order to act in line with their intentions. Self-regulation is driven by the motivation towards the longer term goal, but day to day can be supported through activities such as **self-monitoring, goal setting** and **implementation intentions.** Together these help to provide structure and feedback on our progress in a way that feels within our own control (i.e., self-determined) and not controlled by others.

Implementation intentions are specific plans of action explicitly stating *when*, *where* and *how* to act. For instance, an intention to lose weight may be furnished with an implementation intention to check the sugar/fat content of each product when doing the weekly shopping in the supermarket. Implementation intentions are thus filling in the gap between a relatively abstract goal (intention) to actual behaviour. Or in other words, implementation intentions shift the burden of control from internal 'willpower' to the external environment where specific actions are to be taken and prepare the individual mentally to engage in those actions when they find themselves in that environment. Implementation intentions can be utilised as a tool in behaviour change interventions to boost people's skills to self-regulate (Adriaanse, de Ridder, & de Wit, 2009; Riebl et al., 2015; Turton, Bruidegom, Cardi, Hirsch, & Treasure, 2016; Vinkers, Adriaanse, Kroese, & de Ridder, 2015).

Goal setting and self-monitoring can be facilitated easily through websites and apps that enable people to experiment with ways to reach a self-set goal without feeling observed or answerable to others should they not be immediately successful, and thereby explore the most acceptable and feasible changes in food choice for them.

Social media has been used effectively with adolescents to deliver support for adopting a healthier diet (eating more fruit and vegetables) including techniques such as providing social support, demonstration of how to eat a healthy diet, encouraging self-monitoring and providing individualised feedback (Hsu et al., 2018).

One way of encouraging people to learn ‘because they want to’ has been through **gamification**, usually through online games involving rewards and leader boards (Yoshida-Montezuma, et al., 2020). Positive short term benefits have been found in engaging and motivating children and adolescents, in particular, in healthy eating (usually increasing fruit and vegetable consumption) through this route.

3.2.3 Capability

Perceived capability, or our belief that we can act successfully in a given situation (also termed self-efficacy and perceived competence), is an important constituent of motivation. This can be supported through providing ‘**graded tasks’**, that is, starting with small challenges that are achievable to build confidence before progressing to increasingly difficult tasks to reach a larger goals. Initiatives such as Veganuary (committing to only eat plant-based food for just one month) are a good example of this: providing a more manageable challenge alongside an opportunity to experiment with making a change.

Providing **vicarious experiences or demonstrations** (a type of modelling) of other people succeeding can give us confidence. The more similar they are to us and our own level of skill, the more effective this can be. Seeing friends or neighbours adopt a healthier diet can work at a local level, and some TV adverts and documentaries can provide this at a wider population level (for example, story telling of a person’s weight loss success by following a certain diet).

Providing **informational feedback** rather than using praise when people achieve their goals/make a positive choice, helps people to identify how and why they have achieved something, which increases their confidence for next time they encounter the same situation. Self-monitoring can help to provide this in a non-controlling way.

Persuasion is most effective when done in a way that is supportive, and when it comes from someone we trust or value. Examples of persuasion in food choice are seen through celebrity endorsement, but can also come from peers, family and friends. Persuasion that is perceived as controlling, pressuring or coercive may work in the short term, but people are unlikely to continue to act in the desired way once the persuasive message (when perceived as a form of control) is removed.

Perceived capability to eat a healthy diet typically increases with age, suggesting that more support for this needs to be provided for younger people if encouraging

them towards deliberate dietary change (Davison et al., 2015; McCarthy, Collins, Flaherty, & McCarthy, 2017).

3.3 Disadvantages to intervening on attitudinal pathways

Attitudes and motivation are important in determining if we will attempt to make certain food choices. In order to fully understand whether these attempts will translate into the intended positive food choice, however, we need to view these in the context of external limitations, competing motives, and daily fluctuations in mood and self-control.

What we choose to eat is also not determined by any single factor or rationale. People hold multiple attitudes, intentions and sources of motivation towards their food choices, which operate at the same time, sometimes pulling in different directions; for example, to eat a healthy diet *and* not upset family or friends who cook for you, or eat sustainably *and* feed a family on a small budget). Sometimes our core values pose limitations beyond our control, which means that even if we are motivated, we are unable to turn that motivation into action (for example, being motivated to eat a sustainable diet but not able to afford many options).

Motivation is also dynamic, varying as a function of mood, time of day or social context. For example, people may consciously choose to ‘use’ food for functions such as providing comfort, stress relief or as a reward, as reported in a recent FSA survey (Lasko-Skinner & Sweetland, 2021). In these cases, mood or other factors may lead to people prioritising immediate above longer-term desires when making food choices, or emotional goals may undermine self-control to act according to longer term intentions (e.g, McCarthy et al., 2017). These more immediate drivers of mood, social influence and impulse may be more powerful than background values in the moment of making a decision about what to eat.

Further, good intentions may not materialise because people may not know *how* to implement them. Intentions may not be formulated sufficiently specifically. For instance, an intention "to lose weight" is not easy to execute unless one has specific plans of action (for example, if-then plans). In addition, it may be difficult to decide *when* to start implementing an intention. Lastly, although this may seem trivial, many intentions remain unaccomplished because people simply forget them.

Overall, while attitudes and motivation are fundamental to driving intentional behaviour (i.e., we are unlikely to maintain positive change without them), they do not bring certainty that there will be an effect. An “intention-behaviour gap” exists that reflects the disruption of intentions through internal factors (mood, memory, emotion, experience), external factors (who we’re with, marketing, environmental cues), as well as the interaction between our different motives and attitudes in any given situation.

4 Non-conscious processes underpinning food choice

4.1 How non-conscious processes influence food choice

Many of the decisions we make in day to day life are not planned and deliberate, but operate at a much more instinctive and non-conscious level. We have evolved these automatic responses to enable us to minimise the demands on our ‘working memory’ when carrying out relatively simple or frequently encountered tasks, conserving our effort for novel or complex activities. Non-conscious processes relate to instinct, habit and emotionally driven decisions; they tend to be quick, requiring little effort, and are decisions we are often not aware of having made.

4.1.1 Habit

Habits can be considered as blueprints for actions that we repeat and which are stored in memory to allow us to respond automatically to specific cues in situations that we meet repeatedly. Examples of habits that relate to food choice include shopping habits (for example, always putting the same food in a basket), cooking habits, consumption habits (for example, always eating a biscuit with a cup of tea or buying something from the vending machine after swimming), habitual responses to mood states (for example, a glass of wine after a bad day), and social habits (for example, always taking food offered regardless of whether hungry).

Habits form when behaviour is frequently repeated, particularly if this happens under the same circumstances, and is rewarded in some way, leading us to perform a behaviour mindlessly and automatically. Rewards from food come first and foremost from sensory satisfaction such as aroma and taste. While experiencing these sensations may be conscious, recent research has also established reward

mechanisms that occur completely outside awareness, namely via subcortical neural pathways directly from the gut to brain circuits that deal with rewards (de Araujo et al., 2020). In other words, some food choice habits may form completely without any conscious awareness of reinforcement.

People acting through habit are less interested in and attentive to information about their habitual behaviour and are less likely to respond to changes in the value or outcomes of choice options. That is, **habits are fairly impervious to change.**

Habit mechanisms may underpin both 'bad' habits (for example, unhealthy snacking) as well as 'good' habits (for example, eating vegetables and fruit) (Wethington, Finnie et al. 2020). Those habits linking to healthy or sustainable eating are therefore very desirable, as they allow us to meet this goal without too much thought or effort, and will be relatively robust to situations that try to disrupt them. However, habits for less healthy or sustainable choices can be very hard to reverse.

The **pleasure** we derive from food has many dimensions (22 have been reported through one extensive systematic review of 119 studies), with the most commonly reported being sensory experience (for example, taste, appearance, texture), social experiences, food characteristics, preparation, novelty and variety (Bedard, Lamarche et al. 2020). The relationship between pleasure and dietary outcomes appears to be mixed; in Bedard et al.'s 2020 comprehensive review (Bedard, Lamarche et al. 2020), 20 of 35 studies (57%) exploring the association between dietary outcomes and pleasure found favourable associations (i.e., a mental link between consumption of a particular food, and a pleasurable outcome), although this was stronger for making favourable (i.e., more healthy) food choices than for overall dietary quality.

4.1.2 Mood

Mood may influence food choice at both a very immediate level, influencing food choice without our knowledge, or be a conscious goal we may have for what we choose to eat.

Most studies show that **being in a positive mood has a positive effect on diet quality (healthy eating) and being in a negative mood predicts poorer diet and food choice** (Zorbas, Palermo et al. 2018, Clohessy, Walasek et al. 2019, Devonport, Nicholls et al. 2019, Khaled, Tsofliou et al. 2020). These effects may

reflect that we are better able to exert self-control and self-regulation to act in line with intentions when feeling positive, such as a sense of wellbeing or positive self-perceptions (Zorbas, Palermo et al. 2018). Conversely, people are more likely to resort to habits when stressed, including when under time pressure or multi-tasking.

Stress in particular has been widely studied and found to have a negative effect on healthy eating in general (Zorbas, Palermo et al. 2018), poorer diet in the workplace (Clohessy, Walasek et al. 2019) and a trend towards increased choices of high-fat, sweet and fast food intake in women (Khaled, Tsofliou et al. 2020)). Stress has also been associated with binge eating in adolescents (Campbell, Frank et al. 2019). Other mood states associated with less healthy eating included mental ill health, boredom and comfort eating (Zorbas, Palermo et al. 2018).

Some of the ways in which people try to manage their mood using food are set out in the recent FSA report on food during the COVID-19 pandemic report, including **food as comfort, as a treat or to relieve stress** (Food Standards Agency, 2021). These may be more deliberate processes through attitudinal and motivational pathways.

4.1.3 Impulse purchases/eating

Consumers experience impulsive urges during shopping trips and restaurant visits, prompted by the many ways that food appeals through our senses. In general impulse buying is related to factors associated with a person's disposition (i.e., the degree to which a person has a trait-like disposition towards responding impulsively), the situation in which a choice is made (for example, presence of cues to buy and an individual's mood) and sociodemographic variables such as age, gender and income. The interaction between a person's disposition and the situation is particularly important in predicting when impulse buying will take place (Amos, Holmes, & Keneson, 2014).

In restaurant settings, impulse buys are greater when mood is poor, when people's attitude to food is that it is a means of indulgence (compared with say, a route to health), and when they believe that food will improve their mood (Miao & Mattila, 2013). However, there are generally mixed findings between mood and impulsive food purchases, suggesting there may be unrelated effects through several different mechanisms. For example, negative moods influence impulsive purchases by lowering self-regulation and creating motives for self-indulgence to feel better,

whereas positive mood states may stimulate impulse buying as a result of an increased state of arousal (Amos et al., 2014).

Situational/environmental effects that influence impulse buying include discounts and bonus packs, store layout and ambience. More pleasant environments, for example with music and appropriate lighting, encourage us to stay and browse, encountering more triggers for impulsive buying (Mohan, Sivakumaran, & Sharma, 2013). Evidence on how to reduce unhealthy food choices bought through impulse is inconclusive (van Beuren et al., 2016).

4.2 Influencing non-conscious processes

4.2.1 Nudges and choice architecture

A popular trend in harnessing non-conscious processes is summarised under the label of 'nudging'. Nudging comprises (re)arranging the performance environment such that certain choices become more likely, without forbidding options. Nudge interventions can take many forms and can be effective in changing specific behaviours in specific situations. Choice architecture is the mechanism used to facilitate positive choices and the two terms are used interchangeably in the literature (Hollands et al., 2013). Across different domains, interventions based on nudging and choice architecture include influencing: ambience, functional design, labelling, presentation, sizing, availability, proximity, prompting and priming (Hollands et al., 2013).

Proximity: There is a consistent, moderate size of effect on increasing purchasing as a result of positioning food closer to the consumer and more prominently in supermarkets (Harbers, Beulens et al. 2020) as well as restaurants and cafeterias (Broers, De Breucker et al. 2017, Bucher, Murawski et al. 2018, Harbers, Beulens et al. 2020).

Labelling: As set out in section 2.2.1, labelling (i.e., nutrition information and signs) (Harbers, Beulens et al. 2020), particularly traffic light systems (Torris and Mobekk 2019), increases positive food choices.

Functional design: There is little evidence that manipulating properties of products (for example, colour, design) makes a difference to healthy choices.

Choice architecture works across population groups, regardless of age, -economic position (Harbers, Beulens et al. 2020), and body weight (Bucher, Murawski et al. 2018). Choice architecture also works in **online settings**, with the items displayed on the first, or landing screen being most powerfully linked to product choice (Pitts, Ng et al. 2018). These initial landing sites often showcase unhealthy items.

4.2.2 Making and breaking habits

Interventions aimed at breaking or changing food choice habits should typically focus on supporting people to receive consistent reinforcement (which can be any kind of positive feedback) when making healthy choices in a specific situation or context where habitual behaviour occurs. Places where similar cues are encountered each day, such as a work or school canteens, or regular shopping trips, are useful settings for establishing positive habits.

Interventions to influence habits often draw on **implementation intentions** (i.e., helping people to set specific “if-then” plans, for example, if I am tempted to eat biscuits while watching television, I will make a cup of tea instead). The mechanism of if-then plans is related to making positive responses more available to memory and providing a means of making a less effortful decision, in the same way that habits evolve naturally. Implementation intentions are more effective in promoting the inclusion of healthy items in a person’s diet (for example, eating more fruit and vegetables) than they are at reducing unhealthy items, which may already be established habits (Adriaanse, Vinkers, De Ridder, Hox, & De Wit, 2011).

Table 4.1 Influencing food choice through non-conscious processes

Area	Mechanism	What works

Habit	Habits are a learned sequence of behaviours that are automatic, unconscious responses to cues or triggers:
	
	• Habits form when experiencing "rewards" (for example, pleasurable tastes) to repeated behaviours in similar contexts.
	• Habits require little or no deliberation but are automatic responses to environmental cues.
	• Habits are stable behavioural patterns that are hard to break and can help to sustain positive behaviours over the long term.
	• Harder to override unwanted habits when stressed.
		• Disrupting environmental cues
		  • Changing the environment to disrupt current negative habitual behaviours (for example, removing confectionary from till/POS areas, reducing prevalence of fast food outlets)
		  • Product labelling
		• Fostering new habits
		  • Implementation intentions – "if-then" plans to build the relationship between a cue and a desired response
		  • Targeting interventions at times when the environment changes naturally (habit discontinuity), for example, moving house, school, workplace, life stage

Impulse	Impulse or "impulsive buying" refers to an acute urge to make a choice or buy a product that you didn't previously intend to eat or purchase.
	
	• Impulse buying is predicted by the interaction between a person's disposition (trait level impulsiveness), the situation (time spent in store, intensity of temptation etc.) and demographic characteristics.
		Limited research but promising directions include:
		• Behavioural support for self-regulation
		  • Implementation intentions
		  • Goal setting/planning (for example, setting the goal of only purchasing
		  • pre-planned items on a list)
		• Awareness
		  • Mindfulness-based interventions

Area	Mechanism	What works

Mood	Mood refers to the valence of emotion (for example, positive or negative), as well as intensity and degree of arousal.
	
	• Negative mood states (such as high stress) are associated with poor eating behaviours/food choice.
	• Positive mood states are associated with better diet quality and greater capacity for self-control.
	• More energy dense food choice is associated with negative mood and expectations that the food will alter mood.
	• Mood has a stronger effect on younger people.
	• Social influences may moderate the impact of mood on food choice.
		• Behavioural support for self-regulation
		  • Goal setting/planning
		  • Self-monitoring
		  • Implementation intentions

The use of “if-then” plans have also shown promise in helping adolescents to plan for how they will respond in situations where they feel likely to make impulse buys (Thürmer, Bieleke, Wieber, & Gollwitzer, 2020).

As habits are so hard to break, points in life when old habits are disrupted present a real opportunity for establishing new habits that are purposefully more positive. Such life transitions include starting or leaving school, moving to a new house, changing jobs, starting a family or retirement (Baer, Deutschbein et al. 2020). Under those circumstances ('habit discontinuities') the operation of habits may (temporarily) be replaced by the operation of attitudes and motivation. This opens the door for interventions based on education and attitude change, to which individuals may be more sensitive during these transitions. In other words, this approach focuses on *when* to intervene.

5. Indirect effects

5.1 How indirect effects influence food choice

Many types of indirect influence operate on food choices, including environmental, social and cultural influences, and how these interact.

5.1.1 Social norms and practices

Food choice and consumption may be part of a person’s social practices. Social practices are bundles of attitudes and behaviours which in a society at a given time are considered as meaningful and culturally accepted, if not promoted (for example, standards of hygiene, safety practices or indeed food choice). Although social practices are longstanding and move only slowly, they are nevertheless malleable in the long term. For example, they can be influenced by marketing, which in turn shifts social norms and social learning, leading to so called ‘ripple effects’ that can influence population level diets (Cairns 2019).

The social environment may relate to food choice and consumption by determining beliefs and attitudes (whose impact we cover in Section 2) and also social norms. **Social norms** relate to both the perceived approval of others (termed ‘injunctive norms’, i.e., “*what I think other people think I should do*”), and what a person thinks most people actually do (termed ‘descriptive norms’). These social norms can operate at a number of levels, so we may need to navigate the norms of our close

social network (including family, peers and colleagues) as well as at a societal level (such as nationality or ethnic group). Different reference groups may be more salient in different settings. Different reference groups may be more salient in different settings. Feeling related to those around us is an important factor in motivation, which results in people eating in line with the norms they perceive.

In people of all ages, there are strong effects on how much we eat according to the person we are with as a result of **modelling**. People eat more or less energy-dense snack foods when the person they are with eats more or less of these too (Cruwys et al., 2015). The impact of eating with other people can increase food intake sometimes by large margins (estimates range from 12-48%, depending on how this is measured (Ruddock, Brunstrom et al. 2019)). The effect is only apparent when eating with friends and family, not with strangers, and is suggested to be prompted by modelling and social norms for eating more.

However, there is less social influence on what we choose to eat. This may in part relate to being more certain about our own preferences than we are about appropriate portion sizes. Some types of food choices/meals may also be more subject to social influences than others; meals for which people have a stronger habit (for example, breakfast, lunch at a work canteen) may be relatively stable, but snacks or meals eaten out may be more subject to social modelling effects (Cruwys, et al., 2015).

While there are few studies to confirm this (so our certainty in the finding is provisional), there is some evidence that social modelling is more powerful a predictor of food intake than hunger in social situations (Hermans, Herman, Larsen, & Engels, 2010). Modelling effects appear consistent across body weights and are seen whether or not people are trying to restrict their eating (i.e., are on a diet).

5.1.2 Marketing and advertising

Marketing has been studied extensively in relation to the impact of **advertising** on children and adolescents. Children's exposure to food adverts is high, and even short periods of exposure are associated with increased food intake (particularly snacking) while watching television (Russell, Croker, & Viner, 2019) as well as other media such as film, video games and advergaming (Villegas-Navas, Montero-Simo, & Araque-Padilla, 2020).

Less data is available on the influence of marketing on adult food choices beyond studies already discussed as they relate to choice architecture (for example, in relation to product design and placement), and on brand loyalty. **Brand loyalty** is less easy to interpret from a food choice perspective, as we are more interested in food group/type, than the specific brand. However, it is of note that coercive types of marketing persuasion (for example, appealing to status, or through incentives) are less effective at supporting repeat business, so may be less associated with influencing long term change (Gilal, Zhang, Paul, & Gilal, 2019).

Marketing does however contribute to perceptions of social norms, through both increasing the salience of certain choices (i.e., influencing descriptive norms) and communicating what other people think we should do (for example, celebrity endorsement) (Cairns, 2019).

5.1.3 Environmental influences

Environmental factors may moderate both deliberate and non-conscious pathways on food choice.

Access to food is strongly associated to food intake, regardless of individual differences (Lake, 2018). For example, obesity is one and a half times greater in areas where there is the highest density of fast-food outlets (Burgoine, Sarkar, Webster, & Monsivais, 2018). This effect is particularly strong for those on the lowest incomes (Burgoine et al., 2018), which is of particular concern for health inequalities given that there is clustering of fast-food outlets in more deprived areas (Lake, 2018).

Good evidence exists to support the importance of **workplaces** in food choice and overall diet quality (Clohessy et al., 2019; Zorbas et al., 2018). Access to healthy food, facilities for storing and heating food brought from home and food labelling within the workplace are all associated with healthy eating, whereas experiencing pressure at work, high proximity to snacks, and a culture of eating out after work (which leads to less healthy consumption than meals eaten at home) are associated with less healthy diets. The work environment also links to social effects, as the social acceptability of healthy eating at work is considered to be low, and unhealthy foods such as alcohol and sweets considered sociable. Snack consumption increases later in the working day.

The COVID-19 pandemic has accelerated increases in online shopping, which has brought about a shift in some shopping environments. Research into online shopping choices indicates that online purchases are less likely to be subject to impulse purchases than shopping carried out in person (Pitt, Gallegos et al. 2017), but people are less likely to buy fresh produce when shopping online (Pitt, Gallegos et al. 2017).

5.2 Influencing indirect effects

5.2.1 Shifting social norms

Social norm interventions often focus on **providing information about what others do and eat**. There is mixed evidence for the efficacy of this approach and it may be more effective in promoting increases in healthy food choice (for example, fruit and vegetables) than reducing unhealthy food choices (Robinson, Fleming, & Higgs, 2014). However, one study found that providing information on what others eat (i.e., suggesting that other people eat less junk food that you might think) had a similar positive impact on reducing junk food intake in young adults as providing information about health benefits of not eating junk food (Robinson, Harris, Thomas, Aveyard, & Higgs, 2013). There have been unintended negative consequences of this approach: for example, if the person receiving the message on what is 'normal' typically consumes less unhealthy food or more healthy food than 'normal', bringing their behaviour in line with the norm would result in them having a poorer diet.

Social modelling effects are stronger when people are similar or when people are trying to fit in with or gain approval from the person they are eating with (Cruwys et al., 2015). Modelling works both consciously and non-consciously and is influenced by self-control (i.e., it takes effort to override the modelling effects that suggest we should overeat).

Parental modelling can be particularly important for children (Chen & Antonelli, 2020), with even factors such as **pleasure from certain foods** being something children can learn (Marty, Chambaron, Nicklaus, & Monnery-Patris, 2018). Learning to like particular foods provides a strong advantage by linking to unconscious processes as well as self-determined motivation towards choosing healthy or sustainable options.

Table 5.1 Influencing food choice through indirect effects

Mechanism	What works

Social norms are collective representations of widely accepted actions and behaviours. We may be influenced by the norms of immediate social networks (friends, family, colleagues) as well as broader cultural groups (ethnic group, nationality).
 	
• Encompasses perceived approval of others ('injunctive norms'), and what a person thinks most people do ('descriptive norms').
• More impactful when eating with others, particularly in relation to how much we eat.
• May be particularly salient in adolescents and young people (for example, choosing a specific food to fit in or match a peers likes/dislikes).
	• Providing information on what others do
	  • education (for example, schools, or from health professionals)
	  • Public health campaigns (for example, 5-a-day)
	  • Product endorsement (for example, medical expert, or celebrity)
	• Social modelling
	• Marketing
	  • Cautious use of social media could be a persuasive means to altering perceptions of social norms (especially in young people)
	  • Explore potential to influence through peer-to-peer interventions and social networks

Social media is an increasingly pervasive means of transmitting social norms, particularly among young people. Exposure to images which are perceived to be idyllic, for example, in relation to a desired body image or food choices, can have a positive influence on food choice and eating behaviour, but this is not always the case. Social media use has been associated with disordered eating in young people when it is used for social/self-comparisons (Rounsefell et al., 2020).

A means of altering other health behaviours is **influencing social networks**, for example, enhancing peer-to-peer information sharing or targeting health education at people within a network with the most social capital or influence. While these show promise for other health behaviours (for example, sexual health and substance

abuse) (Hunter et al., 2019), few robust studies were identified in relation to food choice and eating behaviours.

6. Differential effects across groups

A range of background factors may indirectly influence food choice and consumption. Demographic characteristics such as age, sex, education, household composition and geographic location can have strong influences in moderating the psychological mechanisms described in earlier sections. These characteristics come with a range of potential moderators of food choice and food consumption, for instance financial resources, access to different foods and media use.

6.1 Socio-economic position

Many studies conclude that socio-economic position (SEP) is the biggest predictor of food choice, or of a poor diet (Campbell, Frank et al., 2019), with people in lower SEPs having poorer diets than those in higher SEPs. Reasons for this have been investigated through exploring environmental differences (for example, access and availability of affordable healthy food), psychological differences (for example, motivation), differences in skills and education, as well as financial limitations.

In the UK, people living in areas with poorer **access to healthy food** (for example, further from supermarkets, more reliant on convenience stores) are typically from lower SEPs. The density of fast-food outlets is also higher in these areas. Nonetheless, there is no strong evidence for a causal link between access to healthy food and food choices according to SEP (Mackenbach, Nelissen et al., 2019) suggesting the relationship is more complex than access alone.

While **cooking at home** is associated with having a healthier diet, people from both lower and higher SEPs are as likely to cook from scratch at home (Mills, White et al. 2017).

Price is an important differentiator of food choice between people of different SEPs. The majority of studies show that people from lower SEPs are more responsive to price changes (Mackenbach, Nelissen et al., 2019). Some studies suggest that pricing changes only have an effect on the purchases of those in lower SEPs (Mackenbach, Nelissen et al., 2019).

In exploring whether SEP moderates the **psychological pathways** that affect food choice, a review combining 106 studies found that SEP had no influence on the link between psychological predictors (attitudes, perceived social norms and perceived behavioural control) and healthy food choice (Li, Figg et al., 2019). That is, people with similar attitudes and beliefs were just as likely to make healthy choices regardless of SEP. However, there may still be differences according to SEP on the average levels of some of these factors; for example, differences in what the perceived norms for food choices are or the strength of beliefs of the importance of healthy eating. There is some evidence that there are lower levels of trust in nutritional information among people from lower SEP groups (Zorbas et al., 2018). Eating more unhealthy foods when eating out is also more common in lower SEP groups (Zorbas et al., 2018), and emotional eating is more prevalent in lower SEP groups (Zorbas et al., 2018).

A review on the impact of different types of policies on **social inequalities** concluded that pricing approaches, including those that combined taxes and subsidies, have the greatest impact on the diets of people in lower SEPs and therefore reduce inequalities. Whereas policies that target deliberate processes (for example, educational, cooking skills, tailored counselling) have a greater impact on people in higher SEPs and therefore increase inequalities (McGill et al., 2015).

6.2 Age

Children and adolescents

While the influences on food choices among children and adolescents are similar to those influencing adults, although children tend to have a biological preference for sweet foods (Mennella and Bobowski, 2015) and children and adolescents are more strongly influenced by factors within the **home environment** (Chen & Antonelli, 2020). This includes both what and how much a parent eats (i.e., modelling) (Chen & Antonelli, 2020), in addition to **food availability** in the home (Yee et al., 2017; Perez-Cueto., 2019).

Guidance and education appear more effective in promoting healthy eating in children and adolescents, whereas rules and restrictions may be more effective for preventing unhealthy eating. Implementation of rules and regulations are effective when provided in a negotiated and informative fashion, rather than didactic and authoritarian; that is explaining why rules are being set and listening to children's

views when flexibility may be reasonable, rather than enforcing inflexible and unexplained restrictions. While children under the age of seven tend to respond better to praise, rules and limiting availability has greater influence on older children (Yee et al., 2017).

Pressuring children to eat (for example, to finish everything on a plate) and using **food as a reward** are associated with children eating more unhealthy food (Yee et al., 2017). The issue of parents using food as a reward has been challenged (Fedewa and Davies., 2015), especially as parents usually use unhealthy foods (for example, high salt, fat, sugar) as rewards.

Social norms and **wanting to fit in with a peer group**, may be particularly salient in adolescents and young people. For example, studies with children and adolescents almost uniformly show increased interaction with peers to be associated with more unhealthy food choice, particularly when in shared environments outside the home (Rageliene and Gronhoj, 2020). Most studies looking at the mechanism for this find that children think that eating healthily will be negatively judged by their peers, for example that it will be interpreted as them trying to appear better than others, and they fear it might expose them to being mocked. While children and adolescents, particularly girls, may try to support each other to eat a healthier diet, in most research this does not translate into positive effects in practice (Rageliene and Gronhoj 2020). This is not to suggest it is never the case; in a large international study, albeit cross sectional which does not infer causality, peer support of healthy eating is associated with a healthier diet (Stok et al., 2015). No association was found with peer support to discourage unhealthy eating).

While marketing and advertising can influence both adult and child food choices, advertising can also lead to pestering from children to encourage parents to purchase less healthy food (McDermott et al., 2006), a phenonium commonly referred to as **'pester power'**. The Government's Obesity Strategy (2020) shows the intention implement restrictions on the promotion of foods high in fat, salt of sugar (HFSS) on TV before 9pm and online by 2023 in recognition of this.

Older adults

Older adults are no different to the general adult population in many ways, but some differences in food choice are observed in relation to the **limitations of ageing** (i.e.,

changes in taste, dentition and appetite, as well as functional limitations affecting ability to shop far from home), as well as social effects of changing life stages (Host et al., 2016).

In older adulthood, **self-perceived health** is positively associated with eating a healthy diet, as is having an interest in healthy eating (i.e., motivation). Differences in older adults' actual health state and resources are much weaker predictors of their motivation towards eating, and maintaining a healthy and sufficient diet, than are their own perceptions of their health and resources (Host et al., 2016).

Bereavement, particularly of a spouse or life partner, can have a negative impact on nutrition and be a risk factor for decline in older adult health. This may be through social isolation, which is highlighted as a key predictor of food choice among older adults living alone, linked to a reduced motivation for shopping, preparing and eating meals when doing so just for one (Host, McMahon, Walton, & Charlton, 2016; Whitelock & Ensaff, 2018). Some older adults may have never learned to cook, instead relying on a spouse for this, so the death of a spouse can confound social barriers to healthy eating through lack of cooking skills within the home; single men are particularly vulnerable to under-nutrition in later life. Having good social support in older age is largely predictive of a better diet and older adults eat more when they eat outside the home with other people.

6.3 Weight status

Evidence is mixed as to whether a person's body weight or weight status influences the pathways that predict food choice. In part this is because few studies have directly compared the mechanisms of effect across people with different body weights. For example, Colhessy et al. (2017) reported that people with obesity were more influenced by social pressure to eat unhealthy foods than those of a healthy body weight, but this was only tested in 1 of 22 studies included in their systematic review and is not consistently reported in other reviews (for example, Cruwys et al., 2015). Similarly, Devonport et al. (2019) found only 1 of 29 studies reported differences according to body weight on the degree to which people use food to regulate their mood. However, this single study provided some indication that people who are overweight are more likely to seek out high carbohydrate foods when stressed.

Greater certainty is provided around the importance of self-determined motivation for making healthy food choices, which is stronger for people with higher BMI or who are overweight (Sheeran et al., 2020). That is, eating healthily for personally endorsed reasons rather than through feelings of guilt or obligation are particularly important for those who are overweight.

Consistent results were found for the differential effects of TV advertising on children; in a review of 39 studies, children who are overweight or have obesity are more likely to be influenced towards consuming more calorie-dense foods by TV adverts than healthy weight children (Russell et al., 2018).

We note however that some of these effects may reflect factors that are independent of weight, for example, being in a state of restrained eating which is known to make people more susceptible to environmental cues to eat whatever their body weight. As such, differences between people within different weight categories should not be inferred to be causal but may be indicative of increased frequency of factors such as restrained eating or experience of weight-related stigma.

7. Who will respond, when and how?

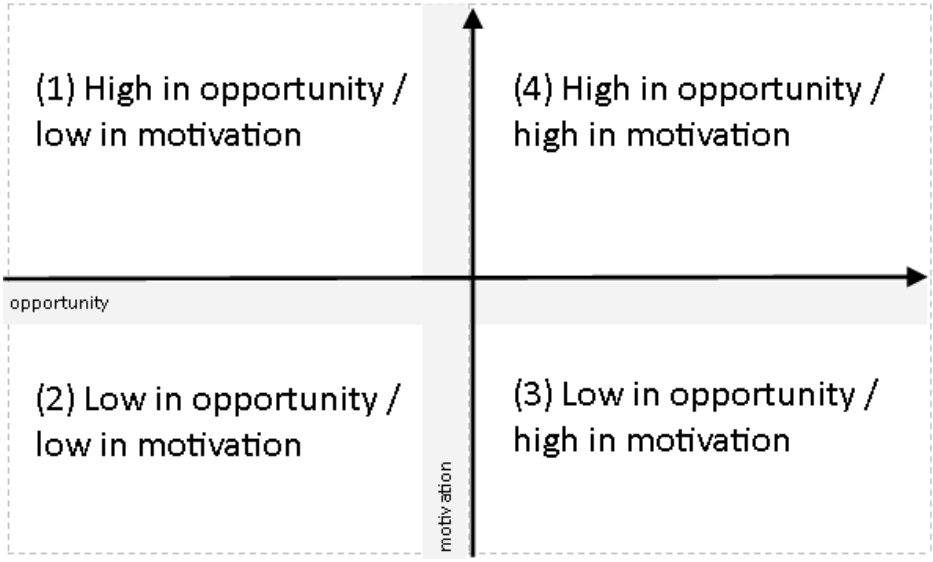
Two frameworks can be useful in bringing together the evidence presented in this report and designing ways forwards; population segmentation and COM-B.

7.1 Population segmentation

No single approach to promoting healthier or more sustainable food choice will work for everyone. Segmentation could help us to predict what types of intervention will work for whom, allowing us to assess whether we are providing support to different groups of the population. We propose a segmentation approach considering where people lie along two continuums: opportunity and motivation. Although capability (the third contributory factor as set out in COM-B in section 6.2) is undeniably also important, we prioritise the other two axes for simplicity; for most food behaviours capability can be incorporated within either opportunity (for example, Can I afford to make this choice? Do I have a vegetable shop near my home?) or motivation (for example, Do I have the confidence to attempt to increase my children's intake of vegetables?).

Therefore we present the evidence review of “what works” across four quadrants, or segments, formed by considering where a person lies on the continuum of **motivation** (in this case, not at all motivated to highly motivated) and **opportunity** (in this case considered to be anything that moderates a person’s ability to act on that motivation, including food availability, living conditions, skills, and so on) (Verplanken, 2018). These segments are set out in Figure 4.

Figure 4: Segmentation Quadrants



Segment 1

High in opportunity/low in motivation. People in this segment are unlikely to engage with interventions targeting deliberate processes such as education, the provision of behavioural support for self-regulation. Improving their health through their diet, or eating more sustainably may be things they do not believe in, or they may be considered positive outcomes but not a priority at a given point in time. Interventions aimed at non-conscious and indirect processes may be more impactful, such as nudges, incentives, or other prompts that are easy to use without requiring too much allocation of mental resources. Having high opportunity suggests they are likely to have sufficient social or financial, or even just easy access to places selling healthy foods so may use these if the choice is made easy for them.

Segment 2

Low in opportunity/low in motivation. People in this segment are unlikely to engage with interventions targeting deliberate processes, and may lack the resources to respond as other groups may do to nudge type activities if these are not available in

their geographic area, or too costly for them to afford. To help this segment pricing approaches, and legislation that regulates food content (for example, regulating sugar content) and portion sizes may be the most effective, as they remove the requirement for people to make a positive choice in order to benefit, given they do not have the opportunity to make that choice.

Segment 3

Low in opportunity/high in motivation. People in this segment are keen to make healthy choices so interventions that increase availability and access to healthy or sustainable foods will have a positive benefit. While support for deliberate processes may be helpful in sustaining that motivation, they are unlikely to provide sufficient assistance to overcome lack of opportunity on their own. Interventions that increase opportunity, such as environmental or community-based interventions (for example, that could foster social support or social change driving increased availability) and financial supports, may help this group. People in this group will likely respond positively to nudging and choice architecture where they come across it, and benefit from health messaging and information (for example, through labelling, celebrity endorsement) in sustaining motivation. They may also represent a group who could capitalise on habit discontinuities/moments of change to enable them to act on their intentions if their situation changes.

Segment 4

High in opportunity/high in motivation. This group will benefit from interventions that provide support for self-regulation and provide assistance in translating intentions into action (for example, guidance towards using implementation intentions). These are the most likely to make more challenging dietary changes such as moving to a more environmentally sustainable diet (for example, eating less meat) for which there may be less community level support in place. They will of course still benefit from interventions acting through non-conscious and indirect processes, like people in the other segments. They are still an important segment to support as they often form the ‘early adopters’ that are valuable in increasing the visibility of positive food choices, shifting social norms and driving consumer demand which could influence opportunities for

all.

Table 7.1 details the relationships between the types of interventions included in this report, how they link to psychological processes and which population segment they would be most expected to influence.

Table 7.1: Relationship between psychological processes, intervention approaches and population segments

Psychological processes	Targets to change	Choice Architecture	Disrupting habitual cues	Education /information	Endorsement (celeb / expert)	Gamification	Incentives / pricing	Labelling (traffic light)	Labelling (info-dense)	Legislation (for example,	Social support	Social modelling	Supporting self-regulation±
Deliberate processes: Attitudes	• Knowledge • Values	-	Yes	Yes	Yes	-	-	Yes	Yes	-	-	Yes	Yes
Deliberate processes: Motivation	• Reason to try • Self-regulation • Autonomy	-	Yes	Yes	-	Yes	-	Yes	Yes	-	Yes	Yes	Yes
Deliberate processes: Capability	• Seeing success • Difficulty • Control	-	Yes	Yes	-	-	-	Yes	Yes	-	Yes	Yes	Yes
Non-conscious	• Repetition • 'Cues'	Yes	Yes	-	-	-	Yes	-	-	-	-	-	Yes

Psychological processes	Targets to change	Choice Architecture	Disrupting habitual cues	Education /information	Endorsement (celeb / expert)	Gamification	Incentives / pricing	Labelling (traffic light)	Labelling (info-dense)	Legislation (for example,	Social support	Social modelling	Supporting self-regulation±
process: Habit	• Rewards												
Non-conscious process: Impulse	• Rewards or pleasure	Yes	-	-	Yes	Yes	Yes	Yes	-	-	-	-	-
Non-conscious process: Mood±	• Affect • Stress	-	-	-	-	Yes	-	-	-	-	Yes	-	-
Indirect effects: Social norms	• Modelling • Approval • Convention	-	-	-	Yes	-	-	-	-	-	Yes	Yes	-

Psychological processes	Targets to change	Choice Architecture	Disrupting habitual cues	Education /information	Endorsement (celeb / expert)	Gamification	Incentives / pricing	Labelling (traffic light)	Labelling (info-dense)	Legislation (for example,	Social support	Social modelling	Supporting self-regulation±
Indirect effects: Marketing /influencing	• Persuasion • Association	Yes	-	-	Yes	-	Yes	Yes	-	-	Yes	Yes	-
Indirect effects: Environmental factors	• Cost • Availability	-	-	-	-	-	Yes	-	-	Yes	-	-	-
Population segment*1	high opportunity low motivation	Positive	No effect	No effect	Positive	No effect	Positive	Positive	No effect	Positive	No effect	No effect	No effect
Population segment*2	low opportunity low motivation	Positive	No effect	No effect	Positive	No effect	Positive	No effect	No effect	Positive	No effect	No effect	No effect

Psychological processes	Targets to change	Choice Architecture	Disrupting habitual cues	Education /information	Endorsement (celeb / expert)	Gamification	Incentives / pricing	Labelling (traffic light)	Labelling (info-dense)	Legislation (for example,	Social support	Social modelling	Supporting self-regulation±
Population segment*3	low opportunity high motivation	Positive	Positive	Positive	Positive	Positive	Positive	Positive	No effect	Positive	Positive	Positive	Positive
Population segment*4	high opportunity high motivation	Positive	No effect	Positive	No effect	Positive	Unknown	Positive	Positive	Positive	Positive	Positive	Positive

Key: *All segments will be influenced by non-conscious and indirect effects to some degree, but those with higher motivation may be more likely to override barriers posed to intentional (healthy, sustainable) choices. Positive symbolises a likely positive effect, and no effect indicates that no effect is likely. ± Includes goal setting, implementation intentions, graded tasks, self-monitoring

7.2 Using COM-B to assess the breadth of support for positive food choice

Rather than segmenting the population, COM-B indicates the direction in which we would like to move all of the population in order for them to benefit from knowledge about the importance of and benefits from positive food choices. We should not assume that because someone is not primarily motivated to make healthy choices now, or does not feel capable of making a change now, that they never will be. While there may be little point in providing individual supports to those who will not use them, implementing supports for motivation and capability at a population level (for example, in health messaging, in providing relatable case studies of what difference making changes has made to people) remains important. At various stages of life, our motivation and sense of capability may change. For example, for people experiencing food insecurity, health may not be an immediate priority, but if and when they step out of that place and their priorities, time and finances increase their choices, these supports towards forming intentions for positive change will be important.

Table 7.2 provides an outline of the types of support at different levels of influence that could be provided within a system.

Table 7.2: Mapping intervention types to COM-B

Psychological processes	Choice Architecture	Disrupting habitual cues	Education /information	Endorsement (celeb / expert)	Gamification	Incentives / pricing	Labelling (traffic light)	Labelling (info-dense)	Legislation (for example, sugar	Social support	Social modelling	Supporting self-regulation[±]
Capability	Yes	Yes	Yes	-	-	-	Yes	Yes	-	Yes	Yes	Yes
Opportunity	Yes	Yes	Yes	-	-	Yes	Yes	Yes	Yes	-	-	-
Motivation*	-	-	Yes	Yes	Yes	Yes	-	-	-	Yes	Yes	Yes

*While the COM-B framework considers automatic processes within motivation, for consistency with the report we relate to social-psychological models of motivation in this table

8. Unintended consequences

Intervening in people's choices can have unintended negative effects. Understanding and predicting what these may be can help in the design and delivery of policies to protect those groups who may be adversely affected or help them to choose between options. While it is beyond the scope of this report to provide a comprehensive review of the literature on unintended consequences, we provide some examples which have prompted recent discussion. These discussions also emphasise the importance of aiming to develop food environments which support opportunity and accessibility to healthy dietary choices for all.

8.1 Impact of interventions on people with, or at risk of, eating disorders

While overweight and obesity are at the forefront of public health agenda and are often the primary context used when discussing the promotion of healthier food choices to support health, there is also evidence to show an increasing prevalence of eating disorders (Health Survey for England, 2019). This has also been exacerbated through the COVID-19 lockdown; between February 2020 and January 2021, the eating disorder charity BEAT saw a 173% increase in demand for support (BBC, 2021). Some approaches to promoting healthy food choice, particularly in relation to calorie labelling on menus and PACE (Physical Activity Calorie Equivalent) labelling, have generated push back from charities representing people with eating disorders, concerned that these could exacerbate disordered eating (BEAT, 2018). While calorie labelling on menus can support consumers to select foods lower in calories, and PACE labelling may lead to a reduction in the number of calories selected and consumed (Daley et al, 2020), the long-term impacts are unknown (Sinclair et al, 2014).

Robust research evidence looking at the impact of both types of menu calorie labelling on people with eating disorders is limited, although there is initial evidence looking at hypothetical scenarios that suggests people with eating disorders order fewer calories, which may contradict their medical advice (Haynos & Roberto, 2017). Our search did not result in strong peer-reviewed research articles investigating the impact of labelling on health and wellbeing, but concern has been raised by charities

and in informal feedback on twitter and in response to BBC articles indicating a swell of public opinion against such approaches. Further research using longitudinal study designs and assessing the impact in real world settings is called for.

8.2 Health Literacy

Any proposal made to encourage healthier food choices should also consider health literacy, that is an individual's ability to access and understand health information. Low health literacy, which is highest amongst the most deprived communities, has been linked to a range of unhealthy lifestyle behaviours, including poor diet, and increased risk of mortality and morbidity (Public Health England [PHE], 2015). Nutrition information can often be used to help guide food choice; however, it has been shown that in England 42% of adults cannot understand health information and this rises to 61% if the information is numerical (PHE, 2015), which nutrition information often is.

8.3 Endorsing obesity stigma

The way in which the factors influencing food choice are presented to us, whether through public health campaigns, advertising or other media (for example, TV and radio, social media, etc.), can influence our shared mental models of why people eat in the way that they do. We typically like to think of ourselves as rational, intelligent and thoughtful beings, which makes us very ready to believe that this is how our decision-making works. We rarely acknowledge quite how much of an impact environmental, demographic and non-conscious factors have on us.

When public health approaches endorse the role of deliberate processes in food choice (for example, through promoting interventions that put the responsibility for healthy eating, managing portion sizes and choosing sustainable options etc. onto individuals) they endorse the shared mental model that everyone should be able to achieve these if they put in sufficient effort and willpower. The flip side of this is that they also endorse the belief that anyone who does not achieve this fails as a result of ignorance or laziness or other morally undesirable personal attributes – that is, it creates a feeling of stigma among those who fail. This is particularly problematic given the visibility of body size and obesity. People experiencing stigma and shame

tend to avoid situations where they feel more likely to be judged negatively; for people living with obesity this may be avoiding eating in public or avoiding exercising. People living with obesity are also likely to be considered less deserving of help and support, and less likely to experience the optimism and positive mood states that support positive behaviour change (Elwell-Sutton et al., 2019).

Public policy approaches and the media have a leading role to play in reframing how people understand the determinants of health and health behaviours. Public understanding of the impact of external factors on food choice could help to shift stigma and the exacerbating effect this has on people's health (Elwell-Sutton et al., 2019). **Reframing the determinants of health** could be done by ensuring that when we provide or talk about policies that target individuals to change their own behaviour, it is made clear that this is one of a range of policies and that other influences on food choice, such as the environment, industry and social practices, are also important. This necessity is increasingly recognised, for example, the Royal Society for Public Health released a statement in January 2020 in relation to PACE labelling in which they recognised the need to move away from a focus on individual responsibility. We need to find workable ways to translate this recognition into action.

8.4 Compromising perceptions of autonomy

Policies that are felt to be coercive or controlling by the public are rarely effective as people push back when they feel that their right to choose and sense of autonomy are undermined (Moller, Ryan, & Deci, 2006). This effect of psychological reactance, or boomerang effect, occurs when people consciously act to defy controlling policy approaches, doing the opposite to what is advocated. Famously, an attempt by TV chef Jamie Oliver to improve school meals in 2005 resulted in media images of parents feeding beef burgers to their children through the school fence in defiance of the new healthy meals on offer. In exploring why this was, parents were reported to be angry at having not been consulted and concerned that the replacement meals on offer would leave their children hungry. Thus, even though both Jamie Oliver and parents might be expected to have the same aim of improving children's health, through undermining parents' sense of autonomy the initial impact on children's diets was likely to be (The Guardian, 2006).

Public policy that is autonomy supportive, and thus avoids reactance, can be created when information is provided that does not frighten or threaten people, or pressure them into acting for reasons clearly removed from their own interests and values. Such policies should be communicated as a choice, with a meaningful rationale for the benefits to the individual rather than society (for example, cost saving), and when it is made easier to do (i.e., structure is provided) (Gilal et al., 2019; Moller et al., 2006).

9. Recommendations

9.1 Caveats to the evidence review and conclusions

9.1.1 Quality

The volume and quality of the evidence supporting this review was very variable across different approaches. The highest volume relates to *Choice Architecture*, including product placement, pricing and presentation, in addition to an extensive literature around food labelling. The research quality is good, as the approach lends itself to testing in well controlled settings with comparison groups (i.e., comparing sales before and after making changes), and includes research conducted in research laboratories as well as 'real-world' applications, such as schools and workplaces.

While there is a large body of evidence around how we support healthy eating through individual level interventions targeting self-regulation, beyond interventions with children and adolescents, much of this research relates to weight management interventions. The factors that drive motivation for weight control may not be generalisable to the wider population but can still provide context an indication of likely tools to support changes in diet.

Most research on marketing that extends beyond product design and placement (i.e., marketing not captured by Choice Architecture), and studies evaluating the effect of gamification, has taken place with children and adolescents. Similarly, most research looking at the impact of social media is related to adolescents and young adults.

Beyond research exploring how we might change perceived social norms through the provision of normative information, research into how we bring about a cultural shift in social practices and norms is lacking.

9.1.2 Measures included within interventions targeting "food choice"

Research included in this review, retrieved through searching for studies of food choice, food behaviour and diet, can be difficult to compare as studies target a wide range of outcomes within this. For example, very different factors may drive our behaviour when buying food in a supermarket to prepare and eat at home, to the factors that drive our behaviour when buying food to eat immediately. Similarly, choosing to eat something healthy, commonly assessed through fruit and vegetable intake, requires different psychological processes than restraining ourselves from eating something unhealthy so may respond to different interventions. We have grouped together outcomes described as positive as those that reflect a healthier or more sustainable diet, as specified by study authors (see Appendix 1 for a table summary). But studying these in finer detail may help to understand why interventions and policy approaches do not always transfer across settings.

9.2 Specific suggestions and recommendations

Public sector understanding of the pervasive effects of disadvantage on people's ability to make healthy choices is increasing, as demonstrated by recent shifts towards systems approaches throughout public health (Allender et al., 2019; Stansfield et al., 2020)). Our ability to know how to implement systems approaches remains in its early days. The suggestions below reflect approaches that could form part of a system designed to create an environment that is more supportive of intentional changes in food choice, that nudges people towards positive choices by default, and normalises the selection of healthy and sustainable choices within social groups.

We split our recommendations into things we suggest should continue, those which should be extended, and those which could be started anew.

9.2.1 Continue: Policies currently in place

1) Implement choice architecture approaches

Promoting the placement of healthier /more sustainable items at the front of shelves/landing pages of online retailers, and reducing the accessibility of less

healthy /sustainable options nudges people from all segments. Encouraging the regulation or guidance of portion sizes can cue how much people eat, especially when eating out in groups (i.e., where social expectations currently lead people to eat more).

This approach of course relies on cooperation of the gatekeepers of the places where food choice is enacted, such as shops (Houghtaling et al., 2019) and restaurants (Kraak, Englund, Misyak, & Serrano, 2017). Persuading people with commercial interests to make changes to the environment that are not of commercial benefit, and may be to their financial detriment, is beyond the scope of this report but an important area of research in itself.

Improve this by: Working with vendors to promote the purchasing of healthier/more sustainable choices through ways that will also result in commercial benefit. For example, promotions that cluster all the ingredients for a meal together to make creating a meal easier are currently largely aimed at customers from higher SEPs (i.e., in higher costs supermarkets such as M&S and Waitrose). Those on lower incomes often have less time, so would benefit more from similar shortcuts if more every day, low budget healthy options can also be marketed in this way (for example, at Asda).

2) **Food labelling**

Quick reference indicators of food quality such as star ratings and traffic light signals appear most effective, particularly for people with less motivation. FOP labels are useful to help the population segment that is high in both motivation and opportunity to make positive food choices.

Improve this by: More rigorous monitoring of the unintended consequences of the evolution of labelling (for example, PACE labelling), especially in terms of extending diet culture and risks of harm to people with, or at risk of, eating disorders.

3) **Provision of support for self-regulation for people who are motivated to change**

Helping those to change who are already motivated to do so will benefit their own health and wellbeing, but also help to shift social norms and provide models of successful behaviour change to their social networks. Advice works better if it is consistent, clear, framed on what to do rather than what not to do (i.e., increase fruit

and vegetable intake, rather than cut particular foods), and is provided by trusted sources such as health service personnel and NHS-endorsed websites (for example, Change for Life). Advice should not only focus on what to eat as part of a healthy or sustainable diet, but how to achieve this – for example, advice and tools to facilitate SMART goal setting, implementation intentions, emphasis of the importance of getting social support and scaffold up from initially small, manageable goals.

Improve this by: Increasing awareness of the immediate benefits people may experience from healthy and sustainable eating (for example, mood, energy, feelings of having 'done one positive thing today' for the environment etc), rather than long term health gains.

9.2.2 Extend: Policies currently in place to some degree

4) **Increase the visibility of positive food choices and the modelling of healthy eating by 'regular people'**

Modelling is a powerful means of both (a) increasing people's confidence that they can achieve something and (b) shifting our perceptions of what is normal. Modelling works best if we see "people like us" achieving desirable outcomes; very often advertising shows only aspirational models in positive scenarios (for example, famous people, beautiful and young models, white models, cooking in middle-class homes and settings) which is less likely to effect change in confidence and norms. Unrelatable models may even be counter-productive in implying these food choices are not for people like us. Visibility could be at a local, national or global level. As people move away from consuming information through standard, regulated news channels, innovation in how to present positive modelling in the places that people get their information is needed (for example, social media, youtube, TV programming and streaming services, including initiatives such as *Soap Operas for Social Change* and Together TV).

9.2.3 Start: New policy areas to explore

5) **Build on our shared experience and messaging during COVID-19**

   i) Many people talk about experiencing weight gain during the COVID pandemic as a result of taking less exercise and eating more or more energy dense 'comfort' foods. While typically weight gain is morally fraught and associated with stigma, this may be an opportunity to help us

all to understand that weight can follow changes to our environment that are beyond our control, reducing stigma and creating a social movement that encourages healthier food choices and appropriate intake. That is, we have an opportunity for messaging about “post COVID” health kicks that will be perceived as relevant to all.

ii) The COVID-19 response has resulted in the establishment of lines of provision for vulnerable people. Many of these people were already less able to leave the home and gain access to healthy food prior to the pandemic and will remain more vulnerable going forwards. We have an opportunity to explore how we can continue to use these lines of provision not to provide emergency support, but as a route to enhance access to nutritious food and the social support and encouragement that motivates those with poorer health to eat well.

iii) Digital literacy and access to equipment has dramatically improved across all age groups, and within most SEPs during the COVID-19 pandemic. We have an opportunity and perhaps responsibility to explore what this means for the quality of people’s food choices (for example, the impact of online food shopping for access, purchasing patterns, access to food delivery schemes, increased reliance on cashless payment systems), as well as understand the impact of digital exclusion as systems continue to evolve as we come out of the initial phase of the pandemic.

Take care to avoid: With point (i) and other approaches targeted at reducing food intake rather than improving diet quality, we need to engage with eating disorder charities and those experiencing disordered eating to ensure that messaging does not negatively impact people with eating disorders. This is likely to rely on messaging about what nutritious foods to increase, rather than focusing on restraint and reducing consumption.

6) Horizon scanning for societal behavioural shifts that could impact food and diet quality

A number of shifts in social practices have been observed in recent years that can impact on food choice or diet quality. These provide opportunities while habits are still forming and less established to embed healthier or more sustainable choices. Two examples spring to mind; the shift in public consciousness and willingness to

act to reduce plastic use, partly ignited by the David Attenborough Blue Planet series, and the (pre-COVID) shift to a carry-about coffee culture in which people increasingly move about public and work spaces with coffee constantly in hand. The first may have had a positive impact on sustainability, for example prompting cafes and restaurants to provide tap water more freely, and of course reducing food-related plastic use. The second may have undermined health as people drink more frequently, including drinks that are high in calories and sugar, and are exposed to increasing prompts and cues to purchase more attractive (usually sweet or creamy) products and accompaniments.

Identifying early indicators of social movements such as these, treating them as potential occasions of habit discontinuity at a population or community scale to harness the social shift for health and sustainability benefit, may effectively be pushing on an open door.

7) **Explore how to shift social practices through on- and offline social networks**

A person's social network influences their food choice and/or consumption (Zhang, De La Haye, Ji, & An, 2018) and subsequently weight and health. Individuals within social networks are remarkably similar in their choices and health states. As people increasingly struggle to work out what information to trust, research to implement what has been found in other settings with regards to disseminating ideas through social networks (for example through peer-to-peer approaches, identifying and supporting 'early adopters or use of knowledgeable and trusted influencers; Latkin & Knowlton, 2015) would be valuable when applied to food. Misinformation is widespread in the food domain, particularly among people or groups whose health literacy is low, so means of disseminating reliable information (such as sharing stories of potential immediate benefits of making more sustainable and healthy choices, how to do it and where to do it) could be useful.

People of all ages are increasingly comfortable and familiar with online environments, and health tracking tools have shown excellent success in enabling people to find social support from a ready pool of like-minded people (Chung et al., 2017), indicating that social networks are relevant both on and offline.

9.2.4 Recognising the importance of factors beyond the scope of this review

In reducing health and social inequalities as they relate to food and health, approaches to promoting positive food choice that have the greatest potential for population-wide effects are necessary, which may then enable psychological approaches to benefit more of society. With this in mind we flag the following approaches that may be pivotal to reducing health inequalities over the next few years:

- Fiscal measures
- Regulatory measures (for example, limiting the use of 'direct to the public' financial incentives at food outlets [for example, buy one get one free] to more nutritious and less calorie dense foods)
- Legislating to require the reformulation or sizing of products
- Restricting the density of fast-food outlets, particularly in more deprived neighbourhoods, and increasing access to affordable fresh fruit and vegetables and other nutritious food
- Improving the nutritional quality of food provided by food banks in times of crisis

A combination of these sorts of approaches will help to create environments that support positive choices rather than work against them. Changing the legislative and physical environment benefits everyone, and also communicates to the population that the government is taking food and nutrition seriously; this in turn helps to shift social norms as is often seen in the way that public attitudes follow, rather than precede, changes in policy.

Appendix 1: Detail of review methodology

A hybrid approach of pragmatism alongside a standard scoping review protocol was used to identify and select recent research evidence for this review. We searched primarily for systematic review articles that had already synthesised multiple studies in the same area. Further searches were conducted to explore the current state of knowledge in key areas, including both the determinants of food choice/food behaviour, and the efficacy of interventions attempting to influence food choice in order to change dietary characteristics (for example, for improved health, or sustainability). In areas where recent high-quality systematic reviews were not available, individual studies were retrieved to supplement findings. A quality rating for all papers included in the review was obtained using standard approaches, and the outcomes of higher quality papers given greater weight in the reporting of findings.

Search strategy

Piloting of search terms generated many reliable systematic reviews investigating most determinants of food choice and behaviour. Therefore, only reviews published within the last 5 years (since 2016) were included. Searches were conducted using Web of Science. Initially generic search terms were utilised to capture the broadest possible search results (for example, (psychology AND food choice). Following these searches, titles were screened and reasons for removal noted. The results of this initial screening were then subjected to a second, more rigorous screening of abstracts. At this stage researchers independently assessed the suitability of the reviews within the remit of the current report. Where relevant topics were not evident within search outcomes (as judged by reference to theoretical literature, and author expertise), additional searches were conducted.

At the search stage, we did not discriminate between studies investigating the association between psychological factors and food choice/behaviour (for example, reporting research on the strength of association between attitudes and food choice), and investigating the impact of interventions to influence food choice through these mechanisms (for example, reviews of the efficacy of food labelling to increase knowledge, or media initiatives to influence attitudes). The latter were more common.

Search terms

A range of searches were conducted to provide insight into the breadth of research related to the psychology of food choice. Initial piloting of search terms was conducted to identify the range of concepts that have been studied, and those for which there is a larger body of literature. Subsequent searches were conducted to both provide greater depth in areas found to be important in studies reporting of barriers and facilitators to positive food choices, and to extract evidence to illustrate key theoretical approaches to understanding healthy eating behaviour.

Table 1: Search terms used[a]

Search terms	**Hits**	**Initial screening**	**Final sample ±**
Psychology AND food choice	97	49	22
Digital technology AND food choice	87	18	0
Marketing AND food choice	108	10	6
Older adult AND food choice	481	-	1
Online shopping OR Online grocery shopping AND food choice	80	4	1
Social media AND food choice	429	36	2
Social AND food choice	493	25	2
Socioeconomic AND food choice	75	9	5
Sustainability AND food choice	76	10	0*

Notes: [a] additional reviews that are cited in the report were found through more purposeful searches, as these search terms did not generate all papers of which we were already aware – a wider set of search terms was needed. However the 3-week period allowed for the review did not allow for revision of the initial strategy, so later papers were included based on a structured but not exhaustive process. *indicates some exclusions related to reviews being on very specialised area (for example, meat consumption, organic purchases), ± this column excludes repeats, such that only 'new' sources from each additional search (beyond the broadest search, listed first) are listed. Hence, the number does not reflect the total on each topic.

Inclusion and exclusion criteria:

Inclusion: Systematic reviews, written in the English language, published within the last 5 years (2016-present).

Exclusion: Reviews referring to small sub-groups of the population (for example, pregnant women), reviews with clinical populations (including people with eating disorders), reviews focusing on changing diet for weight loss/ weight loss maintenance or sport performance, conference abstracts/papers.

Data extraction

Data were extracted using a standardised template by an individual researcher (LB and FG).

Review quality:

Systematic review quality was judged based on (i) adherence to standard review methodology (for example, PRISMA guidelines) (Moher, Liberati et al. 2009), (ii) scope of the review (for example, size, scale, range of research designs included, adherence to PRISMA guidelines), and (ii) study author quality ratings of included original research papers.

Assessment of moderating factors:

We sought information about the impact of psychological mechanisms, or outcomes of intervention studies on different sectors of the population through (a) extracting information from systematic reviews on differential effects relative to participant age, gender, ethnicity or socio-economic position, where this was available, and (b) through supplementary searches for studies that has explicitly assessed these differential effects.

Final review inclusion

Where multiple reviews were found in similar time frames on similar topics, only the strongest were selected for data extraction and as the basis for the sections below.

Data synthesis

The key findings of identified systematic reviews were extracted, and summarised in Appendix 1. Within each group, greater weight is given to the reviews with data quality. Data are presented as a narrative account under relevant subject headings.

Areas highlighted for further research, whether as research is in its early stages or to establish the efficacy of new hypotheses are set out on Section 6.

Appendix 2: Summary table of primary review aims and outcomes

Information provision (knowledge and understanding)

Author /title	Review characteristics	Findings
Deliens et al., 2016 Dietary interventions among university students: A systematic review	20 studies involving over 13,000 participants, all experimental trials. Study designs were fairly heterogenous, including interventions to promote education, self-regulation and point of purchase messaging (nudges) Overall weak	Studies showed a positive impact on improving dietary intake among university students, and while the type of approach was very varied, positive outcomes were found for modifying self-regulation (through education and BCT deliver; often online, and Point-Of Purchase (POP) messaging. Only 1 intervention looked at long-term outcomes.
Hsu et al., 2018 Effectiveness and Behavioral Mechanisms of Social Media	7 studies representing 3554 participants, experimental or cohort study designs. While the review focused on social media, the mechanisms of effect were through targeting knowledge and understanding of healthy eating.	Most studies reported on interventions aiming to drive behaviour change towards healthy eating through attitudinal processes (for example, social support, demonstration of behaviours, self-monitoring and feedback) delivered online.

Author /title	Review characteristics	Findings
Interventions for Positive Nutrition Behaviors in Adolescents: A Systematic Review	Participants are 13-18 year-old social media users. Quality was mixed with only 1 study judged high quality; overall quality was judged weak. Further, most social media sources/ platforms reported on were judged relatively out of date by the time of the review.	Most (5 of 7) studies reported a positive impact on at least one nutrition behaviour, primarily fruit and vegetable intake. Evidence for reducing sugar sweetened beverages was weaker. Outcomes were typically short lived.

Labelling

Author /title	Review characteristics	Findings
Anastasiou et al., 2019 The relationship between food label use and dietary intake in adults: A systematic review	26 studies, with the aim of summarizing the current observational and experimental evidence for an association between the use of food labels and dietary intake. Quality of studies; 20 cross-sectional, 5 RCT, 1 cohort. Many considered weak through convenience sampling. Overall considered to have moderate confidence in findings due to large sample sizes.	Results were inconsistent in relation to dietary intake and use of food labels. Some evidence that the nutrition facts panel is associated with a healthier diet, but insufficient evidence on the association between food intake and reading an ingredients list, serving size or front of pack labels. Authors suggest some bias, as individuals looking to engage with product labels are more likely to be

Author /title	Review characteristics	Findings
		"health-seeking" or looking to use the information for weight management purposes
Cecchini et al (2016) Impact of food labelling systems on food choices and eating behaviours.	Meta-analysis of 9 studies (11,144 participants). Includes lab studies, online and real-life experimental studies.	Food labelling increased the number of people selecting a healthier option by about 17.95% (CI: 11.24% to 24.66%). Traffic light labelling is the most effective labelling scheme. Food labelling didn't significantly reduce calorie intake.
Christoph & An (2018) Effect of nutrition labels on dietary quality among college students: a systematic review and meta-analysis	19 studies conducted with college age students in real world settings (cafeteria or vending machines), and 3 in lab settings. Quality of studies; 9 rated higher, 6 lower, but both showed similar findings	Nutrition labels at the point of purchase were associated with decreased calorie purchase, (reduced in 8 or 13 trials), and a positive effect on diet quality (9 of 12 studies) were found to have a moderate but significant positive effect on dietary choices in college students. Studies in cafeterias and laboratories generally produced more positive effects than those in quick-service restaurants or vending machines. Contextual labels listing daily recommended intake or

Author /title	Review characteristics	Findings
		including traffic lights or exercise equivalents displayed higher efficacy in this population
Daley et al, 2020 Effects of physical activity calorie equivalent food labelling to reduce food selection and consumption: systematic review and meta-analysis of randomised controlled studies.	15 studies identified exploring the effects of physical activity calorie equivalent (PACE) food labelling on the selection, purchase or consumption of food/drinks. Risk of bias was not well reported within studies, so confidence in the quality of studies was not strong.	PACE labelling led to significantly fewer calories being selected and consumed, relative to comparator labelling. There was no significant effect on purchasing.
Scapin, et al., 2020 Influence of sugar label formats on	23 studies extracted, informing on the association between l (Traffic light, warning sign, health warning, GDA, graphical depiction, alternative nutrition facts panel, health star rating) and consumer understanding of sugar content.	More quickly/easily interpretable formats such as traffic lights (with high in sugar text), warning signs, health warning messages and graphical designs have the most potential for influencing sugar content of consumer choices.

Author /title	Review characteristics	Findings
consumer understanding and amount of sugar in food choices: a systematic review and meta-analyses	Quality of extracted studies assessed using a standardised tool; 4 strong, 12 moderate, 7 weak.	There is a large degree of variance in effect depending on the label format and content.
Shangguan, Afshin et al. 2019 A meta-analysis of food labelling effects on consumer diet behaviors and industry practices.	60 studies assessed to explore the influence of food and beverage labelling (food labelling) on consumer behaviours, industry responses, and health outcomes. Evidence for publication bias was not identified.	Labelling was found to impact consumers and industry. Estimates of the size of effect for consumers were; energy intake down by 6.6% total fat down by 10.6% other unhealthy dietary options down by 13.0% vegetable consumption up by 13.5% Estimates of the size of effect for industry were; decreased sodium by 8.9% decreased artificial trans fat by 64.3%

Author /title	Review characteristics	Findings
		No consistent differences were found according to the type of label, duration, product, region, population, voluntary or legislative approaches.
Sinclair et al, 2014 The influence of menu labeling on calories selected or consumed: a systematic review and meta-analysis.	17 studies were retrieved from searches designed to determine whether (1) the provision of menu-based nutrition information affects the selection and consumption of calories in restaurants and other foodservice establishments, (2) the format of the nutrition information (informative vs contextual or interpretive) influences calorie selection or consumption. Studies included those rated of high quality, but were mixed overall.	No effect of calorie labelling found on calories selected or consumed. Adding contextual or interpretive nutrition information on menus (for example, additional information, such as the recommended daily calories for an average adult, to help put the number of calories into context) did result in a reduction in calories Women were more likely to use information to select and consume fewer calories.

Mood, Emotion and pleasure

Author /title	Review characteristics	Findings
Bedard et al., 2020 Can eating pleasure be a lever for healthy eating? A systematic scoping review of eating pleasure and its links with dietary behaviours and health	119 studies were reviewed, based in lab, online or real-world settings. All study designs were included, from participants aged 5 to older adulthood. Quality ratings not reported, in part as there was such a wide range of designs and outcomes.	22 dimensions of pleasure were identified from the literature with the most commonly reported being sensory experience (for example, taste, appearance, texture), social experiences, food characteristics, preparation, novelty and variety. 20 of 35 studies (57%) exploring the association between dietary outcomes and pleasure found favourable associations, although this was stronger for making favourable (i.e., more healthy) food choices than for overall dietary quality. Specifically considering food choice, 6 of 8 studies found a significant positive association between pleasure and positive food choice.
Clohessy et al, 2019 Factors influencing employees' eating	22 studies (all designs accepted) investigating the impact of social support (at work) on healthy eating. Quality of studies was moderate to high.	Healthy eating was influenced negatively by; pressure at work, a culture of eating out, proximity to snacks (snacking increased later in the working day)

Author /title	Review characteristics	Findings
behaviours in the office- based workplace: A systematic review		Positively influenced by: access to healthy food, facilities for storing and heating lunch that is brought in to work, food labelling. Social influences could work in both directions; colleagues can provide social support for healthy eating, or provide pressure to join in shared unhealthy eating (for example, cakes, pizza etc). People with obesity were more influenced by social pressure to eat unhealthy foods than those of a healthy body weight (1 study).
Devonport et al., 2019 A systematic review of the association between emotions	29 studies, conducted with adults, including qualitative and quantitative data. Included both lab studies and ecological (real-world) analyses Judged weak quality	Positive mood was consistently associated with healthier food choices. Feeling stressed was associated with choosing less healthy food (i.e., typically high fat and sugar food, such as desert and snacks) and having an unhealthier eating pattern overall.

Author /title	Review characteristics	Findings
and eating behaviour in normal and overweight adult populations		Looking cross-sectionally, studies indicated that positive moods resulted in greater ability to act in line with intentions (i.e., use self-regulation strategies). No significant effect on food choice from studies testing the effect of training to supress emotions, or studies that tried to induce positive or negative mood and monitor food choice in response (though the trend was in the expected direction). People of all body weights use food to regulate their mood, but people who are overweight are more likely to seek out high carbohydrate foods when stressed (n=1).
Khaled et al., 2020 Perceived stress and diet quality in women of reproductive age: a systematic review and meta-analysis	24 studies were reported, on 31,033 female adult participants in workplaces and university campuses. Quality was rated moderate overall, with poor quality papers removed.	Half of studies reported a negative relationship between stress and diet, predicting increases in high fat, fast-food, sweets and other high calorie food intake. Similarly, consumption of fruit and vegetables was lower when stress was high.

Author /title	Review characteristics	Findings
Zorbas et al., 2018 Factors perceived to influence healthy eating: a systematic review and meta-ethnographic synthesis of the literature	39 studies involving 1746 adults, conducted in ecological settings aiming to increase healthy eating. 33% focussed on lower SEP participants. CASP tool was cross checked for each study; many studies were found to be unclear or insufficient in the information provided about recruitment and data collection.	Positive emotions, good mental wellbeing and positive self-perceptions (including self-control, self-regulation and motivation) were found to increase healthy eating. Emotional states such as cravings, comfort eating, stress eating and boredom were linked to poorer diets, and mental health issues and lack of mental wellbeing found to be barriers to healthy eating. Social support, food availability when eating in social settings and in workplaces, and social transfer of food values affected choices. Overall, the social acceptability of healthy eating was considered low, whereas unhealthy foods such as alcohol and sweets considered sociable. Emotional determinants of eating were found to be more prevalent in lower SEP groups. Similarly, believing the need to overeat during pregnancy, lack of trust in nutritional information, and eating more

Author /title	Review characteristics	Findings
		unhealthy foods when eating out were more common in lower SEP groups

Motivation

Author /title	Review characteristics	Findings
Sheeran et al, 2020 Self-Determination Theory Interventions for Health Behavior Change: Meta-Analysis and Meta-Analytic Structural Equation Modeling of Randomized Controlled Trials	Within the broader review of 65 papers reporting on health behaviours, 8 studies reported on diet specifically (n=1534 participants). All studies were randomised controlled trials, but inclusive of all ages. Quality was rated, most studies included some risk of bias, but no overall rating provided.	Overall, for all health outcomes, studies that provide autonomy support predicted better health behaviours (more healthy diets), mediated by autonomous (self-determined) motivation and higher perceived competence. The effect size of autonomous motivation on health outcomes of a moderate size. Age and gender did not moderate the size of effects. SES was not assessed. Larger effect sizes were found for people with higher BMI or who were overweight.

Social media exposure

Author /title	Review characteristics	Findings
Rounsefell et al., 2020 Social media, body image and food choices in healthy young adults: A mixed methods systematic review.	30 studies, involving 11,125 participants exploring the impact of social media engagement on food choices. Participants were young adults, aged 18-30 Mixed design studies were included, no clear indication of final quality rating.	Greater negative engagement in social media (for example, seeking reassurance) use was associated with more disordered food choices (i.e., greater eating restraint). However, greater exposure to idyllic images was associated with healthy eating, unless young adults engaged in social comparisons, which again predicted disordered eating.

Gamification

Author /title	Review characteristics	Findings
Yoshida-Montezuma, et al., 2020 Does gamification improve fruit and vegetable intake in adolescents? a systematic review	7 studies investigating the impact of gamification (5 online, 2 board games) with adolescents. Quality assessed using a risk of bias tool, overall considered moderate.	Six of seven studies reported improvements to fruit and vegetable intake in participants that received the gamified intervention, primarily fruit and/or vegetable intake following the use rewards. Studies also indicated that the majority of studies using leader-boards and challenges were also effective.

Choice architecture

Author /title	Review characteristics	Findings
Bucher et al., 2016 Nudging consumers towards healthier choices	Reported on 18 studies incorporating 13065 participants evaluating the impact of nudge techniques. Included studies in the field (cafeterias) and the lab, manipulating the proximity and order of products	16 of 18 studies showed that changing food position (increasing proximity/reducing distance to the consumer, or the order in which items are presented) nudged people towards a healthier food choice.

Author /title	Review characteristics	Findings
	Most studies rated of neutral quality (with 1 stronger study, and 3 weak).	2 studies compared effects between overweight and healthy weight participants, finding no difference in effects.
Harbers et al., 2020 The effects of nudges on purchases, food choice, and energy intake or content of purchases in real-life food purchasing environment	75 studies included to review evidence of the effectiveness of the different types of microenvironment set out in the TIPPME typology; i.e., any study manipulating the availability, position, functionality, presentation, size, and/or information of products (for example, foods), related objects (for example, shelfs), or the wider environment (for example, supermarket) was altered. Majority were of moderate or higher quality.	There was evidence for a modest effect of both 'informational nudges' (for example, nutrition information and signs), and 'positional nudges' (i.e., moving products to closer and more salient positions in shop or restaurant). Nudges using symbols were considered to have no effect, and there was too little data to make strong conclusions on other types of nudge (for example, sizing, and floor layouts). Evidence investigating the moderating role of SEP was limited, although some studies reported greater effects in low SEP subgroups.

Author /title	Review characteristics	Findings
Broers et al., 2017 A systematic review and meta-analysis of the effectiveness of nudging to increase fruit and vegetable choice.	14 studies, including those conducted in the field (cafeterias) and the lab. Examined impact of proximity, properties, placement & availability of products. Quality and risk of bias assessed, articles (n=8) removed if insufficient quality. Judged moderate quality.	Medium effect size for the placement of healthy products to influence healthy choices (positive effect in 4 of 7 studies). No consistent effect demonstrated for manipulating product properties (only 2 studies conducted).
Torris & Mobekk, 2019 Improving Cardiovascular Health through Nudging Healthier Food Choices: A	21 studies looking at differences between types of nudge, inclusive of interventions in all settings and with people of all ages. Nudges considered: (Ambience, Functional design, Labeling, Presentation, Sizing, Price, Availability, Proximity, Priming, Promoting).	Overall, these interventions showed a positive effect, with traffic light labelling common to most of those reporting a small but positive effect on healthy food choice. Most used a combined approach, so it is hard to separate out individual factors. Sizing to reduce portion size showed mixed effects, while labelling and pricing approaches were associated with more positive (healthy) food

Author /title	Review characteristics	Findings
Systematic Review.	Studies of poor quality were excluded. Most were conducted without people being aware of the trial, which increases validity and reduces the chance of social desirability effects.	choices. Prompting and priming were not associated with positive effects but were researched less often and usually in addition to other measures.
Allan et al., 2016 Environmental interventions for altering eating behaviours of employees in the workplace: a systematic review	22 studies conducted to explore the efficacy of nudges (labeling, presentation, sizing, availability, proximity, priming, prompting) in workplaces. Overall quality was weak.	Most interventions used a range of strategies, most commonly labelling at point of sale, changing portion sizes and changing proximity. Half of interventions resulted in more healthy food choices.
Pitts Online grocery shopping: promise and pitfalls for	24 studies exploring qualitative and quantitative findings of studies looking at the online shopping environment.	The landing screen may be important from a choice architecture perspective (i.e., online, positional nudge) – as products shown on the first screen seen predict product choice. Self-regulation may feel less effortful online than shopping in person. Shoppers

Author /title	Review characteristics	Findings
healthier food and beverage purchases	Assessment of quality of the incorporated studies was not available.	buy fewer perishable items online than when shopping in person. A (single) innovative study offered lower-calorie within-category 'swaps' for higher calorie options - there was some evidence of the lower-calorie 'swaps' improving the healthfulness of purchases

Socio-cultural impacts

Author /title	Review characteristics	Findings
Cairns, 2019 A critical review of evidence on the sociocultural impacts of food marketing and policy implications	10 umbrella reviews, and 31 individual studies exploring the impact of marketing on social norms and learning, in a model of impact on population level healthy diets. This review was conducted as a review of reviews search, with snowballing to look at other reviews.	Marketing and advertising were found to increase the salience of high fat, salt and/or sugar foods, along with price promotions, which prompt bulk buying and indirectly increase consumption. Similarly, food marketing contributes to the shifting of new behavioural norms; marketing weakens injunctive norms (i.e., norms that discourage over-consumption) and can make us believe certain products and practices (for example, snacking) are

Author /title	Review characteristics	Findings
		more regular and typical in an 'average' diet than they are.
Ruddock et al, 2019 A systematic review and meta-analysis of the social facilitation of eating	42 studies explored the effect of 'co-eating', through a range of study designs in people of all ages. Quality was not reported of individual trials.	Food intake was increased through social facilitation, i.e., in the presence of others. This was stronger when eating with friends and family than strangers. This increase could be considerable, estimated at around 29-48% in diary studies, and 12% in studies in which the researcher observes eating behaviour. Compared with eating alone. Hypothesised mechanisms include social norms (but only 1 study reported on this), modelling, but not distraction or changes in subjective mood.
Cruwys et al., 2015 Social modeling of eating: A review of when and why	69 studies were reported exploring the impact of social modelling on food intake (k=58) or choice between food stuffs (k=11). While the studies included people of all ages (children upwards), most were conducted with children and young adults.	Strong evidence that people eat more or less of high fat, sugar and salty foods when the person they are with eats more or less of the same. This has not been studied to the same extent with healthy foods, but that evidence which exists suggests the

Author /title	Review characteristics	Findings
social influence affects food intake and choice	No formal quality rating was conducted or study quality commented on.	modelling effect is weaker/non-existent with less hedonic food types. Less evidence that modelling effects what people eat, more evidence to suggest it influences how much. Effects were similar regardless of weight status, but stronger in those who are more impulsive/display less self-control.

Social factors and their influence on children and adolescents

Author /title	Review characteristics	Findings
Yee et 2017 The influence of parental practices on child promotive and preventive food consumption behaviors: a	78 studies of parental influences were reported, the majority of which were cross-sectional. Studies were considered that explored associations from the age from 2-18. No formal quality rating was conducted or study quality commented on.	Healthy and unhealthy consumption associated most strongly with availability and parental modelling. Effects appear to be small to moderate in size. Guidance and education appear more supportive for healthy eating, whereas rules and restrictions may be more effective for prevention unhealthy eating. The availability of unhealthy food, plus modelling of eating by parents, pressure to eat

Author /title	Review characteristics	Findings
systematic review and meta-analysis		and food as a reward were all associated with unhealthy food consumption. For sugar sweetened beverage consumption, 8 of 38 studies showed some backlash to restrictions and rules, in that consumption increased. However most showed a reduction. Food as a reward did increase the consumption of the foods tried, but these are typically more unhealthy foods. There is little evidence as to whether healthy food could work equally well. Age of children showed a moderating effect, with rewards and praise showing better promise for younger children (7 and under), and rules and restricting availability more effective in children over 7.

Author /title	Review characteristics	Findings
Rageliene et al., 2020 The influence of peers′ and siblings′ on children's and adolescents′ healthy eating behavior. A systematic literature review	29 studies were reported, looking at peer and sibling impacts on healthy eating in children up to the age of 18 (categorised into 3 groups). Studies were assessed for quality, and poor quality studies not included.	Most studies looked at peer, rather than sibling effects, or both together. In most cases the impact on healthy diet was negative, although not exclusively. 28% of studies showed a positive direction of effect. Mechanisms of a negative effect were explored through indirect social interactions, and included; following peers' eating patterns, adhering to social norms and peer approval, and modelling. Children think that eating healthily will be negatively judged as trying to appear better than others, or proud, and might expose them to being mocked. No significant links were found between peer support, or healthy injunctive norms for healthy eating and healthy choices. However, adolescents eat more 'junk food' when eating out with peers.

Older adults

Author /title	Review characteristics	Findings
Baer, Deutschbein et al. 2020 Potential for, and readiness to, dietary-style changes during the retirement status passage: a systematic mixed-studies review	10 studies (5 qualitative, 5 quantitative) identified of studies exploring change in diet following retirement. 7/10 studies rated high quality.	Findings were inconsistent, as common changes incorporated both improved diet (i.e., increased vegetable consumption [k = 4]), but also increased snacking [k=2]. This was mediated through changes in available time, mealtime structure and finances.
Host et al, 2016 Factors Influencing Food Choice for Independently Living Older People—A	24 studies of all designs, exploring factors influencing food choice in people aged over 50 years. Quality graded as moderate.	Food choice can be dictated increasingly by physiological and biomechanical changes of older age (i.e., changes in taste, poor dentition), as well as consequences of functional limitation in relation to access to food and ability to cook. Appetite effects of grief, bereavement and depression result in reduced nutrition, as can social

Author /title	Review characteristics	Findings
Systematic Literature Review		isolation for those for whom eating is a social activity (for example, reduced motivation for shopping, preparing and eating meals when alone). Food intake may therefore be greater when eating out, and/or when simulating company through the radio or TV. Efforts to maintain independence can have contrasting effects; getting out more and maintaining access to shops and amenities associated with a better diet, but failing to accept help predicts a poorer diet. Social support is largely predictive of a better diet. Self-perceived health and resources (rather than objective status) is positively associated with eating a healthy diet, as is an interest in healthy eating.

Socio-economic position

Author /title	Review characteristics	Findings
Li et al., 2019	106 studies reporting on what aspects of socio-economic status (SES) may influence food choice,	The set of studies included have some limited facility to answer the question as the majority (75%) of studies were with UG students (i.e., young, well

Author /title	Review characteristics	Findings
Socioeconomic Status and the Prediction of Health Promoting Dietary Behaviours: A Systematic Review and Meta-Analysis Based on the Theory of Planned Behaviour	incorporating a range of study designs with adult populations. Overall, quality was deemed medium to low.	educated) and were from a very disparate range of countries and therefore cultures. Nonetheless, the review assessed whether the positive association between variables as set out in the theory of planned behaviour (i.e., attitude, subjective norm, and perceived behaviour control (PBC)) and food choice (which was found to be significant across all studies) were moderated by indicators of SES. No moderation by any SES variable was detected.
Mackenbach et al., 2019 A Systematic Review on Socioeconomic Differences in the Association	43 trials investigating the role of the food environment (price, proximity, accessibility) on adolescents and adults. Most studies good to moderate quality.	People from lower socio-economic groups are more responsive to price changes in their purchasing of unhealthy, vs healthy foods. Specifically, people with higher SEP may not be responsive to changes in fruit and vegetable pricing, only those form lower SE groups.

Author /title	Review characteristics	Findings
between the Food Environment and Dietary Behaviors		The moderating effect of SES on other aspects of the food environment shows mixed findings; while most studies SEP does not moderate the impact of access on food choice, there are still some high-quality papers that report stronger associations in low SEP populations than in high SEP populations.
McGill et al., 2015 Are interventions to promote healthy eating equally effective for all? Systematic review of socioeconomic inequalities in impact	Review of 36 studies to compare the impact according to SEP, reporting on the categories of; Price (18), Place (6), Product (1), Promotion (4), and Person (18). The majority of price studies relied on modelling, so were considered of weak quality. Higher quality was observed in studies relating to place and person.	Better outcomes (and thus a reduction in inequalities) were found for people with lower SEP for price, as well as interventions that combined tax and subsidies. Interventions categorised as (i.e., promoting individual behaviour change through motivational routes, counselling) had a greater impact with increasing SEP Most studies identified in the initial screening did not explore differential effects by SEP, limiting the representativeness of these findings.

Skills

Author /title	Review characteristics	Findings
Mills et al. 2017 Health and social determinants and outcomes of home cooking: A systematic review of observational studies	38 studies, incorporating >230,000 participants. All studies were observational or cross-sectional. All ages considered. Quality was judged got be strong for quantitative research but weak for qualitative.	Greater levels of home cooking related to having a healthier diet, although there was less evidence of this over the longer term. Self-efficacy (measured by self-assessed cooking skills) had a strong impact on motivation to cook at home, as well as sense of perceived responsibility (I.e., role of wife and mother etc), and personal goals. Past experience did not show a consistent relationship. Social factors, including household type (i.e., having dependents) and having strong role models were also strong indicators of the likelihood to cook at home. There was no consistent outcome for SES. Time and cost moderated the relationship between self-efficacy and motivation and cooking at home,

Author /title	Review characteristics	Findings
		and the relationship between cooking at home and healthy diet was stronger in men than women.

Marketing

Author /title	Review characteristics	Findings
Russell et al., 2018 The effect of screen advertising on children's dietary intake: A systematic review and meta-analysis	39 articles were reported, including lab based, real life settings and online survey data. Participants were children from age 2-18 years, conducted in a range of settings from labs, childcare facilities, schools and community settings. Quality of studies was assessed, but not used to exclude studies.	Exposure to food adverts was seen in shows ranging from cartoons, nature shows and children's programming, with most studies testing children's ad lib consumption of snacks made available while viewing footage. Even relatively short exposure to unhealthy food advertising on TV was associated with an increase in calorie intake of around 60 calories, though prompting an increase in consumption of unhealthy food. In observational studies, a moderate association was found between advert exposure and dietary intake. Children who are overweight or with obesity were more likely to be influenced by TV adverts than

Author /title	Review characteristics	Findings
		healthy weight children. No consistent gender difference.
Villegas- Navas et al., 2020 The effects of foods embedded in entertainment media on children's food choices and food intake: A systematic review and meta-analysis	26 articles were identified, reporting on studies with children aged up to 18 years. Risk of bias was assessed as moderate.	Seeing foods embedded in entertainment media was linked to increased consumption of those foods; as most foods embedded have low nutritional value, this contributes to an overall poor diet. Children from 6-12 years significantly increased risk of choosing embedded foods compared with those younger.

Implementation intentions and impulse management

Author /title	Review characteristics	Findings
Adriaanse, Vinkers, De	23 studies investigating the effect of implementation intentions on eating behaviour, either by i) increase	Stronger findings for implementation intentions on promoting intake of healthy food, than reducing

Author /title	Review characteristics	Findings
Ridder, Hox, & De Wit, 2011 Do implementation intentions help to eat a healthy diet? A systematic review and meta-analysis of the empirical evidence	healthy eating (i.e., eating more fruits) or ii) diminishing unhealthy eating (i.e., eating fewer unhealthy snacks). No assessment of overall study quality was provided. The association of outcomes with study quality was mixed; higher quality outcome measures but lower quality control comparisons yielded stronger effects.	consumption of unhealthy food. Effects are of a moderate size.
Turton, Bruidegom, Cardi, Hirsch, & Treasure, 2016 Novel methods to help develop healthier eating habits for eating	44 RCTs were identified, with a dependent variable of eating behaviour or weight (39 looking at the effect of implementation intentions, 5 on inhibition training, and 3 on attention bias modification). No explicit quality criteria were used, but all trials were RCTs, but the majority in lab conditions with only short-term follow up.	Implementation intentions had a small, positive effect on healthy food intake, and unhealthy food intake (i.e, reducing intake), but negligible impact on body weight. Inhibition training had a small to moderate effect on reducing unhealthy food intake Fewer studies were available on attention bias modification, but show a trend towards increasing

Author /title	Review characteristics	Findings
and weight disorders: A systematic review and meta-analysis.		healthy food intake and reducing unhealthy food intake. The authors suggest these approaches are used in conjunction with other methods.
van Beurden et al., 2016 Techniques for modifying impulsive processes associated with unhealthy eating: A systematic review.	92 studies met review criteria, reporting on the techniques used to modify or manage impulsive processes related to eating. No formal quality assessment conducted due to wide range of study designs, but studies were assessed for risk of bias (for example, randomisation, sampling bias, sample size). Quality was judged overall to be weak.	The poor quality of the evidence limits the conclusions; presented more as a preliminary paper categorising types of technique that can be used, rather than definitive source of efficacy evidence. Suggests provisional evidence that visuospatial loading, physical activity, if-then planning can help to reduce food consumption (through reducing craving); mixed evidence of the efficacy of mindfulness. More research is needed for firm conclusions.

Notes: SEP/SES - socio-economic position/status; RCT - randomised controlled trial; GDA - Guidance daily allowance; CASP - Critical Appraisal Skills programme; k indicates number of studies within a systematic review, n indicates number of participants in a study.

Appendix 3: Types of food choice behaviour incorporated in the evidence retrieved from the rapid review

Food-related behaviour (and setting)	**Approaches reported**	**Evidence quality and availability / areas for further study**
Shopping	Choice architecture - Labelling - Product placement - Portion size* Price manipulations	Extensive evidence, consistent positive effects reported. Implementation: Challenge is to implement the findings within commercial organisations.
Eating out (school or work cafeteria setting)	Choice architecture - Labelling - Product placement Price manipulations Social/peer interventions	Good volume of evidence, but limited generalisability (adult research primarily in student populations). Implementation: Some challenges to implement vs financial interests of organisations. Areas for further research: How to harness social support and peer influences to create more positive norms in canteens used by consistent social groups such as colleagues or students.
Eating out (restaurant setting)	Choice architecture - Labelling - Portion control	Good volume of evidence, much in simulated situations. Implementation: Likely differential public health impact of focusing on fast food vs other restaurants. Risk of unintended

Food-related behaviour (and setting)	**Approaches reported**	**Evidence quality and availability / areas for further study**
		consequences for labelling at point of consumption. Areas for further research: Not clear how much impact eating out has on diet overall (i.e., importance on targeting eating out).
Increasing fruit and vegetable intake	Educational interventions Choice architecture - Product placement - Cues and prompts Price manipulations	Gamification Good volume of evidence, pervasive messaging, albeit focussed primarily on health benefits. Implementation: Key challenge is providing access to good quality fruit and vegetables at affordable prices to people from lower SEPs/living in in more deprived areas, and those using food banks (i.e., increasing opportunity). Gamification tends to show short-term effects in children, but potential to boost familiarity and influence preferences. Long term effects less well understood.
Snacking	Educational interventions Choice architecture - Product placement - Cues and prompts	Good evidence on determinants of snacking, less on how to influence snacking behaviour. Implementation: Competing with significant marketing promoting snack consumption and pervasive availability.

Food-related behaviour (and setting)	**Approaches reported**	**Evidence quality and availability / areas for further study**
	Behavioural support - for example, “if then” plans	Areas for further research: How to change social practices (including norms) to reduce snacking/grazing habits of typically energy dense products.

Notes: The behaviours reported above relate to motives or outcomes relevant to health or sustainability agendas (for example, purchasing choices may be made to fulfil either agenda) so are not differentiated here, but elaborated on where relevant in the text. * In a review of an earlier draft of this report it was noted that there are surprisingly few references to portion size. No specific search was made for portion size, however interventions aimed at reducing portion size were included in the review where they reported impact on fat, salt or sugar intake specifically, in line with the research question. Portion control studies that reported on overall dietary outcome, calorie intake etc without reference to specific dietary components were not included as they did not meet the inclusion criteria.

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