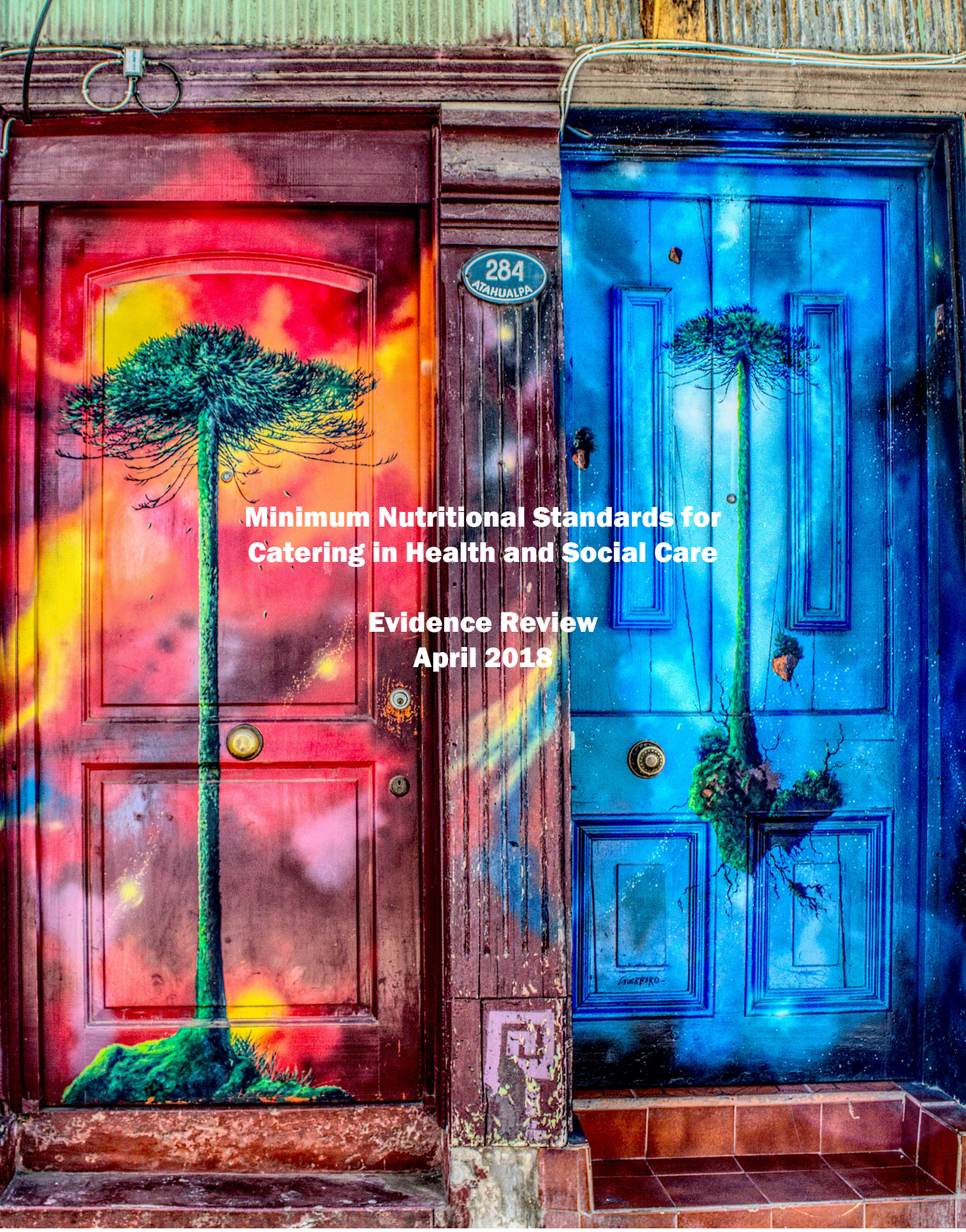

Minimum Nutritional Standards for Catering in Health and Social Care

Evidence Review
April 2018

Department of Finance
An Roinn Airgeadais
www.finance-ni.gov.uk

Innovation Lab

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Introduction

In June 2017 the Food Standards Agency, safefood and the Public Health Agency introduced the Minimum Nutritional Standards for Catering in Health and Social Care[1] for staff and visitors across all catering and retails outlets and vending.

This document is the first report from a project which was established to support the implementation of those standards by applying behavioural science techniques and evidence to the issue. It details the review of evidence conducted by the project partners.

The report is structured as follows:

- Overview of the project
- Methodology behind this stage of the project
- Results of the review of the evidence
- Next steps

The Project

The partners designed a project which would support the implementation of the Minimum Nutritional Standards for Catering in Health and Social Care. The project will examine how to change customer behaviour in relation to choosing healthier foods because this was identified as the biggest lever to ensure the successful implementation of the standards. A key part of the project is to look for solutions which ensure the profitability of catering outlets while providing healthier food choices. In addition, the project aims to generate knowledge and learning across the catering system as to how to successfully implement standards and to test assumptions about why customers choose specific types of food in order to generate learning for catering staff to promote healthier food and increase profitability.

The project has identified a number of activities to achieve these aims:

- A literature search on behavioural approaches to food choices: to provide stakeholders with a theoretical understanding of how to influence customer behaviour. This document is the outcome of this activity.
- Research to generate a behavioural analysis of customers in HSC catering outlets: knowledge of customer behaviours has been identified as a gap.
- Intervention design and evaluation: there appears to be little system wide knowledge about what works in this area so well designed interventions and evaluations of interventions will be crucial in order to drive system wide change.

We will produce a report detailing the activities and findings of each phase.

Project Partners

This project has six partners:

- Innovation Lab
- Food Standards Agency
- Public Health Agency
- Department of Health
- South Eastern Health and Social Care Trust
- safefood

[1]Minimum Nutritional Standards for Catering in Health and Social Care. http://www.publichealth.hscni.net/publications/minimum-nutritional-standards-catering-health-and-social-care-staff-and-visitors. Accessed 17.04.2018.

About this report

This report was researched and written by Sarah Allen, Christopher Farrington, and Rachael Singleton from the Innovation Lab and Joanne Casey, Emily Chan, Naomi Davidson from the Food Standards Agency.

We would like to thank the help and support of Richard Fallis from Queen's University Belfast's Medical Library.

The project steering group, which consists of representatives from the project partners has endorsed this document.

The Innovation Lab and its method

...connecting, collaborating, listening, failing fast, learning, disrupting, inventing, and enabling.

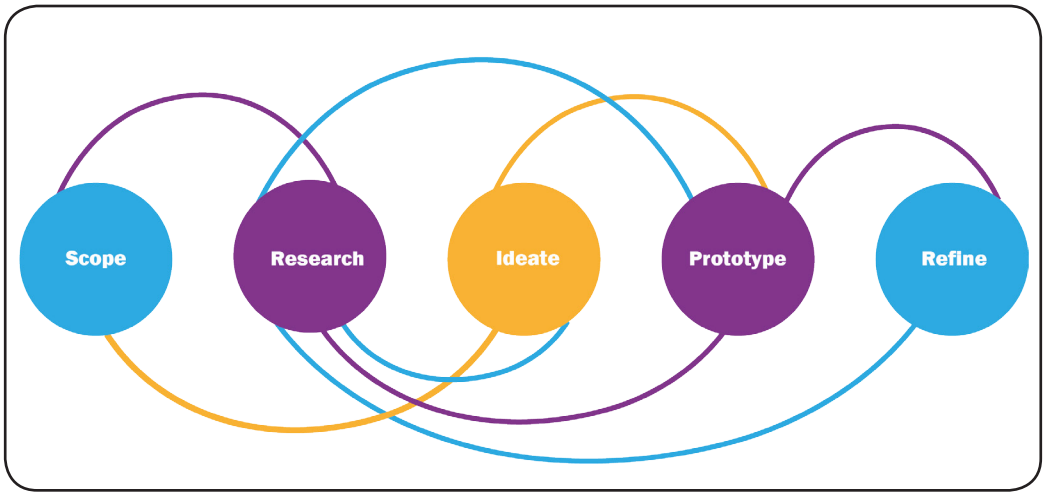
The Innovation Lab was established in 2014 and sits within the Department of Finance. The Lab has a role in Northern Ireland's Innovation Strategy for creating a culture of innovation by encouraging collaboration, openness to new ideas, innovation, and risk taking.

The Lab responds to challenges where effective service provision for the public has proved most difficult. It aims to improve public services by creating new and ground-breaking innovations through transformation and invention. We are committed to inspiring curiosity, empowering creativity, and bringing to life paradigm-shifting ideas. We believe in connecting, collaborating, listening, failing fast, learning, disrupting, inventing, and enabling. Our i-dec philosophy has been developed to address these challenges.

i-dec - innovation through design, experimentation and creativity

Our i-dec philosophy is built on design principles. Namely, putting users first, understanding relationships, developing prototypes, testing iteratively, and scaling up solutions which work. Our process is iterative and not stage-gate; projects will move backwards and forwards depending on what we learn and the ideas we can surface.

Figure 1: User-centred design process



Behavioural sciences and the Innovation Lab

The Lab has identified that behavioural science offers new ways of approaching problems and had delivered results in other contexts. It has been working to develop capacity and capability in behavioural science and has been developing behaviourally inspired solutions to business areas across the Northern Ireland public sector.

In essence, this stream of work applies psychological and social science insights to public sector problems with the specific aim of changing or influencing people's behaviour. This is a relatively young field with increasing applications across public policy problems. An important part of this work is using randomised control trials or experiments to test the effectiveness of interventions.

The Lab has been developing services using behavioural science which include the following:

- Assessment of the evidence base
- Design based research on behavioural journeys and existing choice architecture
- Intervention Design
- Intervention Re-design
- Experiment design
- Experiment implementation and analysis

The Evidence Base

Why is this important?

A review of existing evidence was necessary to further the knowledge of project partners in relation to the types of interventions which were effective. Therefore, the review aimed to:

- identify what works and what doesn't work;
- identify what has been tried and what hasn't been tried;
- identify how others have approached the design and study of interventions; and
- be aware of pitfalls or unintended consequences.

What were we looking for (our eligibility criteria)?

Before beginning the search, a set of criteria were constructed to allow studies of interest to be identified and which would form the basis of the evidence search. These criteria were developed using the PICOS framework.

Population: Studies which focused on adult populations, in other words, people who are aged 16 and over would be included. The project team were primarily interested in studies which prioritised or focused on habitual users of workplace restaurants but recognised that there were also studies that would not distinguish between habitual and occasional customers. In the particular case of studies conducted in hospitals, the project team were interested in including visitors and staff rather than patients.

Intervention: A decision was made to prioritise studies based on the experimental design if the search returned a set of unmanageable results. This would involve prioritising randomised controlled trials, followed by other types of controlled experiments including pre-post studies, and, finally, qualitative studies.

Comparison: The project team was interested in studies that made comparisons between options. This could be between a healthier and less healthy option or between choices of a particular food before and after an intervention. Studies which made comparisons across canteens were also of interest.

Outcome: The project team was looking for outcomes which changed behaviour and not outcomes which just looked at changing attitudes or beliefs towards food or food choices. This could be measured by sales of food, volume of food chosen or consumed, or some other measure of behaviour. It was decided that studies based on the length of time they were measuring an effect were not going to be excluded. Studies where the outcome only measured biomarkers, such as BMI, blood pressure, etc. were excluded.

Setting: The project team looked for studies which were set in a workplace restaurant / canteen / café, including university canteen settings. School canteens were excluded on the basis that the food choices of children in this setting was considered to be significantly different from adults. Studies that looked at any type of food choice were included because the project team was interested in behaviour associated with the main meal eaten outside of the home and also snacks. Studies were not excluded based on the country it was conducted in or on the basis of the food standards of a country. A few relevant articles set in fast food outlets, restaurant settings, or conducted in the lab were included where the intervention was of interest.

Information sources (where we searched)

Four databases were searched. Medline and Embase were searched as the two databases which focus on health and medical interventions because the subject matter was health related behaviour change. Psychinfo was also searched, which includes mainly psychology based research, because much of the behaviour change related research is psychology based. Finally, Scopus was searched because we were aware that there is a growing body of behaviour change research being conducted in disciplines such as economics.

Search Strategy and Terms (what we looked for)

The detailed search terms that were used can be found in Annex A. In general terms, the searches combined three topics:

"Behaviour change"
and
"Food preferences or food choice"
and
"Workplace restaurants or canteens"

Screening process (what we decided to read)

The search found 289 articles which matched the search criteria. Of those, 12 were duplicates, which gave us 277 articles to screen. After initial screening, 220 articles were excluded and 57 were taken through for further examination.

After reading the papers, 39 were subsequently excluded because they did not meet the criteria, leaving 18 papers from the original search. Another 13 papers were added which were identified through other sources or because the paper that was had found was part of a larger study or identified other studies which were relevant to the search. Overall, 31 papers were reviewed. Appendix B is a flow diagram of the process.

Results (What did we find?)

This section details the overall themes that emerged from the review. Details of each study have been provided in Appendices C to F to this report. The studies have been categorised and a synopsis is provided of each one.

Systematic reviews

The search identified a number of systematic reviews on associated topics, including vending machines, self-service settings, specific types of interventions, workplace interventions (rather than in the specific setting of a canteen or restaurant), and with interventions with college students (rather than just in the university canteen or restaurant).[2] The reviews covered many types of interventions including pricing strategies, increasing the availability of healthier food, environmental changes and a range of complex interventions. All of the reviews found that the studies were generally of weak quality. Moreover, they also all reported mixed or moderate evidence of the effects of interventions. In part this was a consequence of heterogeneous intervention designs which meant that comparing and aggregating evidence was, in general, not possible. These are themes which we also found in the search.

Study design

Almost all the studies were conducted in 'real world' settings rather than lab settings which meant that almost all of the studies had methodological limitations in terms of control groups and the measurement of effects. Some studies were able to track who had received an intervention and those who had not received one through identification cards. However, in the main, the studies that were found were generally either a pre / post study, a pre/post study with a control group, or a clustered randomised controlled trial.

There would seem to be general difficulties measuring the effect of interventions in this area. Many of the studies used pre and post intervention surveys as the method of measuring whether the intervention was successful. These surveys used self-reporting as the mechanism of measurement.

There were also a wide variety of measures which were used: some studies compares sales of specific food groups; some looked at overall calories consumed in the restaurant; some looked at overall calories consumed by individuals; and some looked at the volume of food sold or eaten. This also makes comparing across studies difficult.

It is also apparent that establishing a control group in this kind of setting is difficult. A common study design was to use one establishment and compare the effect of an intervention by using pre and post measurements. Others identified a comparable establishment (e.g. similar company or workplace) and compared effects pre/post across the sites. Some studies controlled the menus on offer during comparison periods and just compared the sales of particular items of food, while others introduced new food types and compared the sales of those foods across establishments.

Overall, it is difficult to judge whether the Hawthorne Effect is in play with these studies. The Hawthorne effect is the name which is given to the effect that is produced when research subjects modify their behaviour because they are aware of being observed. In this case, restaurant customers would be changing what they chose and what they eat because they are aware that they are participating in a study of eating behaviours. Some of the studies discussed whether they made participants aware that they were involved in a research study but many did not discuss this aspect.

[2]Grech, A, Allman-Farinelli M. (2015). A systematic literature review of nutrition interventions in vending machines that encourage consumers to make healthier choices, *Obesity Reviews, 16*, 1030-1041; Skov, L.R. et al. (2013). Choice architecture as a means to change eating behaviour in self-service settings: a systematic review. *Obesity Reviews, 14*, 187-196; Bucher, T et al. (2016). Nudging consumers towards healthier choices: A systematic review of positional influences on food choice. *British Journal of Nutrition, 115*, 2252-2263; Matson-Koffman, D.M., Brownstein, J.N., Neiner, J.A., and Greaney, M.L. (2005). A site-specific literature review of policy and environmental interventions that promote physical activity and nutrition for cardiovascular health: What works?, *American Journal of Health Promotion, 19(3)*, 167-92; Geaney, F, Kelly C., Greiner B., Harrington J., Perry I.J., Beirne, P. (2013). The effectiveness of workplace dietary modification interventions: A systematic review. *Preventative Medicine, 57*, 438-447; Maes, L. et al. (2012). Effectiveness of workplace interventions in Europe promoting healthy eating: A systematic review. *European Journal of Public Health, 22(5)*, 677-682.

Types of interventions

Abstracts were coded during the screening process with keywords and then sorted into four categories: labelling, pricing, education, and environmental and choice architecture interventions. On the basis of careful reading of the studies, a fifth category of complex interventions was added and the education category was removed because the studies used education in conjunction with environmental changes.

It should be noted that, in most studies, there was not enough information to code reliably the studies using behavioural change theory, such as the intervention functions in the Behaviour Change Wheel or using the Behaviour Change Technique taxonomy. In most instances the content of prompts, displays, or marketing materials was not available. Therefore, the categories presented below are not theoretically informed. In addition, while discrete categories of interventions have been identified, there is considerable overlap across the categories.

Labelling: These interventions provided point of choice information to the customer about the nutritional content or nutritional value of the food. There were several different types of labelling, including calorie information, traffic lights, branding labels, pictures of portion sizes, and exercise requirement labels. These labels use a number of different types of techniques ranging from simple information provision to reframing of information to affective norms (i.e. information about what we should do).

Pricing: These interventions changed the price of food items or created price based incentives to change consumer behaviour. These studies were the ones which looked most closely at the behaviour of interest: purchasing behaviour of healthier vs less healthy food.

Environmental and Choice architecture: This large category includes many different types of interventions which have been used to alter the environment in which choices are made. Four types of interventions were identified that had been used in this category:

- feedback, including awards and ‘micro-marketing’;
- prompts, including text messages, diet reminders at point of choice, and marketing;
- environmental changes, including plate sizes, portion sizes, and positioning and availability; and
- menu structuring and positioning.

Labelling could be considered a sub group of this category but generated enough studies to be considered by itself.

Complex interventions: These interventions combine a number of different types of interventions to address the complexity of the behaviours involved. Four different combinations of interventions were identified.

1. Labelling + Environmental Changes
2. Education + Environmental Changes
3. Education + Labelling
4. Environmental Changes + Labelling + Pricing

The most common intervention design in this category was to combine education and environmental changes.

Effectiveness of interventions

There are challenges with interpreting the evidence. The interventions either try different techniques or variations on the same technique which makes comparison difficult and aggregation impossible. This is a common challenge in this type of research.

Most studies reported effects which increased the consumption of healthier food, although many used self-reported surveys as a measurement device, which meant that the quality of the studies was low. However, there were also a minority which reported no effects or contradictory effects (where some measures indicated positive change and others indicated negative change).

Details of the results of the studies are given below and each study has been given a quality rating based on the following criteria.

* Low quality study
** Lab based study, i.e. not conducted in a 'live' environment*
*** Pre-post study with or without a control group
**** randomised control trial

Labelling (see Appendix C for details of the studies): There were not enough studies to be able to distinguish whether there is evidence to suggest that one type of label is more effective than another. However, studies were found that showed the following.

Quality Rating	Intervention	Effect
****	Logo label	No effect
***	Graph and nutrient information	Fewer calories
**	Exercise label	Fewer calories
***	'Lower calorie option'	More veg / salad but calories the same
***	Smaller portion picture	More smaller portions chosen
*	Traffic light on healthy option	More people chose healthy option

*Although lab-based studies reviewed had a high quality experimental design, they were considered to be of lower quality evidence because they were not set in a real world setting.

Pricing (see Appendix D for details of the studies): In general pricing manipulations, such as increasing the cost of less healthy food or decreasing the cost of healthier food, were effective at shifting consumer choices. Each study implemented a different strategy but it was found that changes of 10% and 20% could prompt behaviour change. There may be cost implications for implementing a pricing strategy which could increase or decrease revenue for the catering establishment. The studies showed the following.

Quality Rating	Intervention	Effect
**	Calorie labelling + value size pricing	No effect on calories ordered
***	Increase price of fries	Less purchases of fries
***	Reduce price of meal with fruit	Purchase of more fruit
***	More options + 50% price reduction	Threefold increase in fruit / salad
***	Branding+signs+35% price reduction	Increase in sale of turkey burger
**	Nutrition information	No effect
**	Changing price of food on menu	More choices from healthy menu

Choice Architecture (see Appendix E for details of the studies):
Feedback: awards showed positive changes but the quality of the study was poor. Micro-marketing was shown to affect positive changes.

Quality Rating	Intervention	Effect
*	Workplace awards	Increase consumption of 4 items
***	Feedback on purchases	More healthy choices made

Prompts: Evidence is not clear. One study showed positive effects of marketing but quality was low. Another study showed different effects of diet prompts on different categories of customer.

Quality Rating	Intervention	Effect
****	Nutrition course + daily texts	More healthy food selected
***	Logo and fliers to identify healthy food	Increase choices of 2 food items
****	Prompting diet goals on menus	Dieters made more healthy choices
***	Information about vegetable consumption	More self-reported vegetable consumption

Environmental changes: A study conducted in a lab setting found no effect from plate size. However, a study which gradually reduced the amount of fries in a portion size showed that this resulted in the sale of fewer fries.

Quality Rating	Intervention	Effect
**	Smaller plate	No effect on amount served or eaten
***	Making portion size of fries smaller	Consumption of less fries
***	75% of snacks supplied are 'healthy'	More healthy choices as snacks

Menu structuring and positioning: Two studies looked at the role of menus and both showed that choices could be shaped by how menus were presented.

Quality Rating	Intervention	Effect
**	Menu with meat free options	More meat free options chosen
***	Food items placed at top and bottom	More choices of those options

Complex interventions (see Appendix F for details of the studies):

Labelling + Environmental Changes: There was an increase in the purchase of healthier options and a decrease in the purchase of less healthy options as a result of the intervention which combined these elements.

Quality Rating	Intervention	Effect
***	Traffic light labels + food placement	Decrease sales of red items and increase sales of green items

Education + Environmental Changes: Evidence is generally positive. One study found some positive changes in certain body measurements and nutrition intake; another found an increase in the availability of fruits and vegetables; another found additional healthy choices and changes in choices; another study found an increase in fruit and vegetable consumption. The first three studies were of good quality, whereas the last study used self-reported measures.

Quality Rating	Intervention	Effect
***	Nutrition education + menu modification + increased availability of healthier food + price discounts for fruit + food placement + portion size control	Decrease of saturated fat intake and energy proportion from saturated fat and increase in nutrition knowledge
****	Education for catering staff + education for staff + posters and prompts	Increase in the availability of fruit and vegetables
***	Education material + point of sale prompts + demonstrations	Increase in fruit and vegetable consumption
***	Health messages / substitute pairings / affect based cues	Increase of healthy choices (N.B. study compared nine different interventions rather than combining)
***	Nutrition information + prompts + food placement + floorspace redesign	Increase in healthy food choices

Education + Labelling: One study tried this and found no impact.

Quality Rating	Intervention	Effect
***	Information on healthy eating + increase in availability of foods + 'new and healthy' labelling	No effect

Environmental changes + Labelling + Pricing: Although the study had limitations, there were effects from the combinations of techniques which were part of the intervention.

Quality Rating	Intervention	Effect
***	Calorie labelling (on one sign not individual items) + green traffic light labelling	No effect
***	Calorie labelling (on one sign not individual items) + green traffic light labelling + reward system for purchasing green labelled items	Increase in healthy options and decrease in less healthy options

What has not been tried?

While the studies were not coded using the intervention functions detailed in the Behaviour Change Wheel, it is useful to think about whether there is a predominance of particular functions. Studies found primarily used four intervention functions: environmental restructuring, education, incentivisation, and persuasion. That leaves four categories which are under explored:

- modelling, which is providing an example for people to aspire to or imitate;
- restrictions, which is using rules to reduce the opportunity to engage in the target behaviour;
- coercion, which is creating the expectation of punishment or cost; and
- training, which is imparting skills.

Even in terms of the intervention functions which have been used, there are some behavioural change techniques which could be explored further. Interventions which use the provision of information as the method of changing behaviour, such as labelling and marketing, could be classified as 'education' interventions. However, there are a range of other techniques which could be used, including information about health consequences, information about social consequences, activating anticipatory regret, using a credible source (otherwise known as the messenger effect), and comparing outcomes of people engaging the behaviour and those who do not engage in the behaviour.

What do we not know?

Does prompting 'healthier options' encourage contradictory behaviours such as 'treating yourself' to a dessert or snack? There is some evidence that this might be happening. Some studies looked at particular choices but measured the total calories consumed in the particular meal or in the restaurant overall; these studies found that the calories remained the same while there was an increase in healthier choices. This indicates the importance of measuring the right things and being clear on the goal of any intervention.

What are the long term effects of interventions? Some of the studies used long term follow up periods but the vast majority just looked at immediate effects in the immediate environment. Other research has found that people are drawn to novel and unusual things but that this dissipates over time. From the studies examined as part of this work it is not possible to conclude as to whether the interventions which have been developed have a 'shelf-life' and whether the choice behaviours that we are looking at will revert to the norm or previous patterns if the intervention is removed or even if it remains in place.

What are the effects of visual appeal / smells / descriptions of food or the overall ambiance of the canteen? None of the studies looked at or evaluated this aspect. It is possible that the success or failure of interventions could be driven by what people thought of the food on offer. There is some research which would indicate that this can be an effective strategy by itself.

Conclusion: How do we use this evidence to solve the challenge?

Undoubtedly the sheer heterogeneity of interventions, the limitations of study designs, and the variety of outcome measures means that making firm recommendations is difficult. Outlined below are some of the decisions which will need to be taken in order to design interventions.

Clear goals: From the current understanding of the challenge, it is recommended that goals are set around the sales of particular food items and the profitability from selling healthier food. However, it is appropriate to consider and review if this is correct in the light of new evidence or ideas. In this respect, multiple possible goals were found in the studies that we reviewed such as:

- improving the overall health of employees;
- change the proportion of healthier / less healthy food purchased in the restaurant;
- improve the profitability that comes from selling healthier food;
- improve the sales of particular items of healthier food;
- improve the knowledge of employees about nutrition;
- improve the knowledge within the system about behaviour change; or
- develop an evidence base for wider policy goals.

The decision on which one to choose should be aligned with the strategic goals of the project.

Careful measurement of outcomes: It is important to ensure that there is a strong link between goals and outcome measures and to align the two carefully. However, there is still a range of options and the studies found indicate that, while all are possible, some are more robust and easier to measure than others. Here are some possible measures:

- sales of particular food items;
- sales of combinations or groups of food items;
- nutritional value of items sold in the catering establishment;
- nutritional intake of customers in catering establishments;
- portion size;
- long term changes in eating behaviours; or
- profit / loss from sales of food items.

The decision on which one should be driven by the reliability and ease of the measurement, the link with the goal of the intervention, and should be a good measure of the theoretical logic of the intervention.

Risk appetite: In any experimental process, there is an element of risk. Risk can be thought about in several ways. It could be conceived of in terms of the investment of time and money against the possibility of not achieving goals. Another possibility is to think about risk in terms of complexity: a complex intervention is more likely to involve greater costs and will be more difficult to reliably implement. Finally, risk could be related to the evidence base: an intervention could be developed which seeks to test new theories or techniques rather than build on the evidence found in this review.

Here are some questions to answer to before beginning the design phase:

- Should the best evidence available be used to design an intervention?
- What is the financial risk appetite?
- Will a simple intervention achieve the project goals or will the challenge involve complexity?
- What size of effect justifies the cost or effort of developing and trialling an intervention?

Some of this risk can be mitigated by the research and design phase of the project as interventions will be tested before going 'live'. The trial phase is also a mitigation against risk, because interventions can be tested for a short period of time to limit financial impact. However, the answers to these questions will shape the project going forward.

Appendices

Appendix A: Search terms

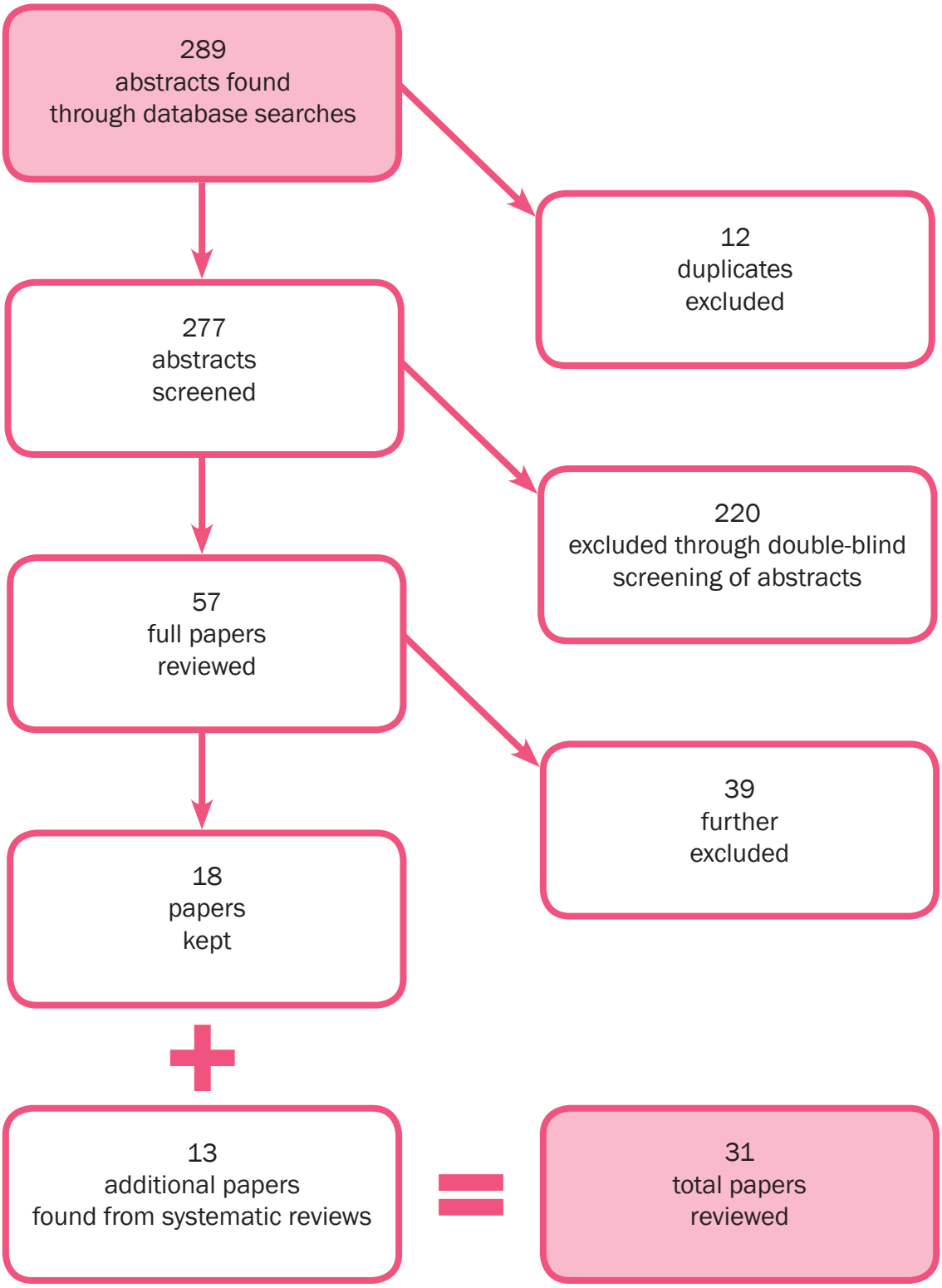
Medline and Embase searches

1. (chang* adj5 behavio?r*).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word]
2. Food Preferences/
3. “food choice*”.mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word]
4. ((purchas* or buy* or bought) adj5 (food* or meal* or lunch* or snack* or dinner* or supper* or tea* or break*)).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word]
5. 2 or 3 or 4
6. 1 and 5
7. Workplace/
8. food services/ or food service, hospital/ or menu planning/ or restaurants/
9. (canteen* or cafe* or dining).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word]
10. university/
11. 7 or 8 or 9 or 10
12. 6 and 11
13. limit 12 to embase

PsychInfo search

1. behavior change/ or behavior/ or behavior modification/ or change strategies/ or lifestyle changes/ or motivational interviewing/ or personality change/ or readiness to change/ or “stages of change”/ or transtheoretical model/
2. (chang* adj5 behavio?r*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]
3. 1 or 2
4. food preferences/ or diets/ or eating attitudes/ or fast food/ or food/
5. exp Choice Behavior/ and exp Food/
6. “food choice*”.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]
7. ((purchas* or buy* or bought) adj5 (food* or meal* or lunch* or snack* or dinner* or supper* or tea* or break*)).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]
8. 4 or 5 or 6 or 7
9. 3 and 8
10. workplace intervention/
11. workplace*.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]
12. “food service*”.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]
13. “menu plan*”.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]
14. (restaurant* or canteen* or cafe* or dining).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]
15. colleges/ or college environment/ or higher education/
16. universit*.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]
17. 10 or 11 or 12 or 13 or 14 or 15 or 16
18. 9 and 17

Appendix B: Flow diagram of search and screening process



Appendix C: Labelling Interventions

6 studies were identified which explicitly looked at labelling. In general, labelling seems to be an effective strategy for changing behaviour. However, various types of labels were used and it was not possible to find a series of studies which replicated the same type of labelling. Types of labels included information provision, traffic lights, and reframing labels. It is not possible from this review to determine the best labels to use. A summary of the studies are in Table 1. The remainder of this chapter details the studies, including their intervention components, their study design, a quality assessment, and their results.

Table 1: Labelling Interventions – high level summary

Year	Title	Intervention Results
2016	Improvements in recall and food choices using a graphical method to deliver information of select nutrients	Graphical signposting (in the form of plotting food items on a fibre (x-axis) and protein (y-axis) graph) improved nutrient content of purchases, with 16% fewer total calories purchased per patron compared with sales with no labelling present. Nutrition Facts Panel labelling (NFP) had no effect compared with the baseline. Calories ordered from total meals, entrées, and sides were significantly less during graphical signposting than no-label and NFP periods.
2011	Influence of placement of a nutrition logo on cafeteria menu items on lunchtime food choices at Dutch work sites	Placing a 'Choices' logo beside healthy options did not have a significant effect on employees' lunchtime food choices in a robust 25 worksite cafeteria RCT
2015	Menu labels displaying the kilocalorie content or the exercise equivalent: effects on energy ordered and consumed in young adults	Providing a menu with an exercise label (the minutes of brisk walking required to burn the food energy) resulted in less energy ordered and consumed compared to a menu with no-labels, but no differences were found between the exercise-label and the nutrition label and no differences were found between the nutrition label and no-label.
1984	The influence of caloric information on cafeteria food choices	Adding a label with the message "Lower calorie selection" significantly ($p<0.001$) increased the numbers of vegetable choices in the vegetable, vegetable/salad, and vegetable/salad/main course labelling conditions. There was a significant increase ($p<0.001$) in salad choices in both the salad and salad/vegetable labelling conditions. No effect of labelling was seen on main course selection. Vegetable and salad choices decreased back to baseline once labels were removed. Labelling did not affect the total calories of the meals purchased.
2011	Point-of-selection nutrition information influences choice of portion size in an all-you-can-eat university dining hall	Signs with images of 'small' and 'large' portions of fries placed beside the self-serve fries resulted in a significant reduction ($p<.05$) of students choosing a 'large' portion of fries

Year	Title	Intervention Results
2011	The Effectiveness and acceptability of a traffic light labelled menu with energy information to signpost customers towards healthier alternatives in a table service restaurant	When a healthier main course was added to a menu, 46% choose the healthy main course. Choosing a healthy main course significantly predicted choosing a dessert ($p<0.01$).

Improvements in recall and food choices using a graphical method to deliver information of select nutrients (2016).[3]

Aim: Determine the efficacy of graphically presenting nutrient information to improve healthfulness of consumer food decisions in a cafeteria on a university campus.

Methods: Intervention consisted of signposting nutrition information at the point of purchase in the cafeteria using either a Nutrition Facts Panel (NFP) or graphical format (in the form of plotting food items on a fibre (x-axis) and protein (y-axis) graph) in the cafeteria. The 12-week experiment was divided into four 3-week phases; baseline, NFP, washout and graphical data. Data was collected to measure change in purchasing behaviour during the third week of each stage in the form of meal receipts and completion of a survey.

Results: The nutrient content of 362 meals was compared between signposting phases: graphical, NFP, or no nutrition label. Graphical signposting improved nutrient content of purchases, with 16% fewer total calories purchased per patron compared with sales with no labelling present. NFP had no effect compared with the baseline. Calories ordered from total meals, entrées, and sides were significantly less during graphical signposting than no-label and NFP periods. For total meal and entrées, protein per calorie purchased was significantly higher and saturated fat significantly lower during graphical signposting than the other phases.

Influence of placement of a nutrition logo on cafeteria menu items on lunchtime food choices at Dutch work sites (2011).[4]

Aim: To determine the effectiveness on menu selections of labelling foods with the 'Choices' nutrition logo in work site cafeterias in the Netherlands.

Methods: Intervention consisted of displaying the 'Choices' logo on specific food groups. This logo has been developed internationally and is a recognised logo in other settings in the Netherlands.

The experiment design was a clustered randomised controlled trial. 13 cafeterias received the intervention and 12 served as a control. Sales data was collected for 9 weeks. In addition two sites completed questionnaires at baseline and after the intervention.

Results: No effects were found in the sales of sandwiches, soups, snacks, fruit, and salads.

[3]Pratt, N.S., Ellison, B.D., Benjamin, A.S., Nakamura, M.T. (2016). Improvements in recall and food choices using a graphical method to deliver information of select nutrients. *Nutrition Research, 36(1)*, 44-56.

[4]Vyth, E.L., et al. (2011). Influence of placement of a nutrition logo on cafeteria menu items on lunchtime food choices at Dutch work sites. *Journal of American Dietetic Association, 111*, 131-136.

Menu labels displaying the kilocalorie content or the exercise equivalent: effects on energy ordered and consumed in young adults (2015).[5]

Aim: To determine the effect of labels displaying the energy content of food or its equivalent in exercise requirement on energy intake in young adults.

Methods: The intervention consisted of three conditions: a menu with no labels; a menu displaying energy content of food in calories (calorie labels); and a menu displaying the minutes of brisk walking required to burn off the food energy (exercise labels).

300 students were recruited and randomised to one of the three menus and the study was conducted in student dining areas. All menus contained the same choices. Researchers measured the energy of the food by the weight of the food and the calorific values from the restaurant website. They also measured energy consumed after lunch by a survey using recall.

Results: Less energy was ordered and consumed by those seeing exercise labels than those seeing no labels. There was no difference between those seeing no labels and those seeing calorie labels. There was no difference between the calorie label and the exercise label. There was no difference in post lunch energy consumption.

The influence of caloric information on cafeteria food choices (1984).[6]

Aim: To assess the effect of identifying the lower calorie items on customer food purchasing in a cafeteria.

Methods: Green cards with a red dot in the corner with the message “Lower calorie selection” were placed next to the three lowest calorie items in each food group: main course; vegetable; salad. Actual number of calories were not posted. A larger sign nearby drew attention to the new labels. Food service was dinner only. The multiple baseline design was as follows: Baseline 1; label vegetables only; label vegetables and salads; label vegetables, salads, and main courses; Baseline 2. Data from the cash register was collected over an 18-week period at the end of each Tuesday evening for each session of the experiment and research assistants approached 50 customers each Tuesday and asked them what food they chose and whether they saw the labels. Desserts were included in the computation of total meal calories, but were not labelled.

Results: Adding labels significantly ($p<0.001$) increased the numbers of vegetable choices in the vegetable, vegetable/salad, and vegetable/salad/main course labelling conditions. There was a significant increase ($p<0.001$) in salad choices in both the salad and salad/vegetable labelling conditions. No effect of labelling was seen on main course selection. Vegetable and salad choices decreased back to baseline once labels were removed. There were no significant main effects of labelling on total calories of the meals. The number of customers averaged 450 for both the baseline and intervention periods.

[5]James, A., Adams-Huet, B., Shah, M. (2015). Menu labels displaying the kilocalorie content or the exercise equivalent: effects on energy ordered and consumed in young adults. *American Journal of Health Promotion, 29(5)*, 294-302.

[6]Dubbert, P.M., Johnson, W.G., Schlundt, D.G., Montague, N.W. (1984). The influence of caloric information on cafeteria food choices. *Journal of Applied Behavior Analysis, 17(1)*, 85-92.

Limitations: There is likely bias in the way customers were sampled by researchers – which may bias the data on calorie consumption. The calorie content of the main dishes increased over each phase of the study and authors don't know why. The calorie content of the labelled low calorie salad or vegetable was often only 50 calories less than the unlabelled salad or vegetable, and choosing a low calorie item seems to have been compensated for by selecting a higher calorie main dish, which may explain why the overall calorie content of the meal didn't change with the labelled item.

Point-of-selection nutrition information influences choice of portion size in an all-you-can-eat university dining hall (2011).[7]

Aim: To assess the impact of providing images of small and large portion sizes of fries on portion size of fries chosen in a university canteen.

Methods: During week 1 baseline phase, an observer discreetly recorded all self-served portions of fries as either "small" (<18 fries) or "large" (>18 fries) for three lunchtime sessions. Researchers also recorded which salad dressing students chose. For four weeks, signs with images of large and small food portions (along with nutrition information for each size) of each food item were placed at eye level on the sneeze-guard above the food item at the point-of-selection. The salad dressing sign showed all dressings in 2 oz. cups arranged from most to least caloric. Each sign also should one or two slogans ("Portion Size Matters" and "A Small Change Makes a BIG Difference") above the photograph. Small laminated signs with these slogans were also placed around the dining hall.

Results: During baseline, 60% of students chose the "large" portion of fries and 40% chose "small". During the intervention, the pattern was reversed: 43.3% of students chose the "large" portion of fries and 56.7% chose the "small" portion, representing a significant reduction in chose of "large" size from baseline ($p<0.05$). However, there were no differences in the numbers of students choosing fries (any size) during baseline and intervention. The percentage of students who chose Thousand Island and honey mustard dressings (mid-range health options) also significantly increased.

Limitations: Robust pre/post study with observational data collection rather than self-reported measures. It's not possible to determine if the photograph or the nutrition information alone changed food selection. The classification of 'large' and 'small' portions of fries is not clear cut: for example, some students may have reduced their portion size from more than 18 fries to just over 18 fries, but their portion would still be considered "large" by researchers. The study was short in duration and researchers did not have control over the menu items. Students may have felt they were being observed. No information was collected on other items students may have chosen to replace the reduction in fries.

[7] Freedman, M.R. (2011). Point-of-selection nutrition information influences choice of portion size in an all-you-can-eat university dining hall. *Journal of Foodservice Business Research, 14*, 86-98.

The effectiveness and acceptability of a traffic light labelled menu with energy information to signpost customers towards healthier alternatives in a table service restaurant (2011).[8]

Aim: to assess the impact of traffic light labelling dishes on a menu at a table service restaurant on customer food choice.

Methods: A menu was developed for one independent restaurant which included two new 'healthier' alternative menu items for two main courses. All main dishes were coded with traffic light labels according to standard (no more detail given in paper). Over a 2-week period, customers were offered a survey to complete after their meal which asked about their choice and their views of the healthier options.

Results: 70 surveys were returned. Almost half (46%) chose the healthier main course option. Choosing a healthy main course significantly predicted choosing a dessert ($p<0.001$).

Limitations: This is not a randomized study and you can only conclude that putting healthier options on menus means that some people will buy them – in this case 46% of people who completed the survey. No conclusions can be drawn about the traffic light system.

[8]Heathcote, F., Baic, S. (2011). The Effectiveness and acceptability of a traffic light labelled menu with energy information to signpost customers towards healthier alternatives in a table service restaurant. *Journal of Human Nutrition and Dietetics, 24*, 390.

Appendix D: Pricing Interventions

5 studies were identified which explicitly looked at pricing strategies and 1 systematic review that included discussion of pricing in vending machines. In general, pricing seems to be an effective strategy for changing behaviour, although some of the studies combined pricing changes with other strategies and this makes it slightly difficult to separate the effect of the pricing from the other factors. A summary of the studies that we found are in Table 2. The remainder of this chapter details the studies, including their intervention components, their study design, a quality assessment, and their results.

Table 2: Pricing Interventions – high level summary

Year	Title	Intervention Results
2008	Effects of calorie labelling and value size pricing on fast food meal choices: Results from an experimental trial	No significant differences were found in the energy content of meals ordered, the selection of food groups, or portion sizes between participants who ordered from a menu with calorie labelling, value size pricing, or a combination of the two.
2016	Effectiveness of Pricing Strategies on French Fries and Fruit Purchases among University Students: Results from an On-Campus Restaurant Experiment	Increasing the meal price by 10% when choosing French fries was associated with a 10.9% reduction and the 20% increase was associated with a 21.8% reduction in French fries purchases. This was also associated with an increase of profits of €490.50 and €721. Reducing the meal price by 10% and 20% when choosing fruit increased the purchase of fruit by 25.1% and 42.4%. This was associated with losses of €1178 and €2958.
1994	An environmental intervention to increase fruit and salad purchases in a cafeteria	Increasing the selection of fruits from 3 to 6 and adding three vegetable options to the salad bar and reducing the price of fruit and salad by 50% resulted in a threefold increase in the purchase of fruit and salad during the three week intervention period. Purchases dropped to slightly above baseline after the intervention was over.
2016	Improving Healthy Eating and the Bottom Line: Impact of a price incentive program in 2 hospital cafeterias (The 'Better Bites' Programme)	Introducing branding, marketing signage, and a 35% price reduction on a new healthy turkey burger and a healthy salad resulted in a 13-fold increase of sales of the turkey burger in one location and 4-fold increase in another. Sales of healthy salad increased in one location but not the other. Analysis of the financials show that profits during the intervention were significantly higher than the baseline for all burgers at both locations.
2018	Effect of price and information on the food choices of women university students in Saudi Arabia: An experimental study	Providing a one-page sheet of nutrition information did not influence food choice from a menu. Healthy food selection (from a menu in a university setting) increased from 49.5% to 58% when the price of unhealthy food increased or the price of healthy food reduced.

Effects of calorie labelling and value size pricing on fast food meal choices: Results from an experimental trial (2008).[9]

Aim: To evaluate whether there was a difference between calorie labelling or value size pricing on the calorific value of meals ordered by habitual customers of fast food restaurants.

- Calorie labelling was defined as the provision of nutrition information.
- Value Size Pricing is defined as structuring product prices so that the unit cost decreases as portion size increases.

Methods: This research was an experimental study, where participants were asked to order off one of four menus that varied as to whether calorie labelling or value size pricing was used. Researchers measured the calorific value of the meals chosen by participants and also collected data on beliefs about nutrition, demographics, and the weight of leftovers.

The study had 594 participants of adults and adolescents who regularly ate at fast food restaurants. Participants were randomly allocated to one of the four conditions. The experiment was powered to detect effect small sizes.

Results: No significant differences were found in the energy content of meals ordered, the selection of food groups, or portion sizes between experimental conditions.

Effectiveness of pricing strategies on French fries and fruit purchases among University students: Results from an on-campus restaurant experiment (2016).[10]

Aim: To examine the effect of price changes on the consumption of French fries and fruit among university students in a university canteen.

Methods: The researchers conducted their experiment in a university canteen with approximately 1200 to 1300 student visitors per day. They collected data during a control week and then during intervention weeks.

In one intervention a control week was identified as week one and data was collected (2930 purchases). The price of the meal was increased by 10% in week three (2344 purchases) and 20% in week five (2325 purchases) when the student chose French fries.

In the other intervention (five weeks after the French fries experiment), a control was measured at week one (3235 purchases) and then the price of the meal decreased by 10% in week three (3802 purchases) and 20% in week five (3728 purchases) when the student chose fruit for dessert.

Menus were the same on weeks where the intervention was delivered. Researchers also conducted interviews with subsamples of students.

[9]Harnack et al. (2008). Effects of calorie labelling and value size pricing on fast food meal choices: Results from an experimental trial. I*nternational Journal of Behavioural Nutrition and Physical Activity, 5(63).*

[10]Deliens, T. et al. (2016). Effectiveness of Pricing Strategies on French Fries and Fruit Purchases among University Students: Results from an On-Campus Restaurant Experiment. *PLoS ONE, 11(11)*: e0165298.

Results: Increasing the meal price by 10% when choosing French fries was associated with a 10.9% reduction and the 20% increase was associated with a 21.8% reduction in French fries purchases. This was also associated with an increase of profits of €490.50 and €721.

Reducing the meal price by 10% and 20% when choosing fruit increased the purchase of fruit by 25.1% and 42.4%. This was associated with losses of €1178 and €2958.

An environmental intervention to increase fruit and salad purchases in a cafeteria (1994).[11]

Aim: This study aimed to test the hypothesis that increasing the variety of fruit and salad in a canteen and reducing its price would increase the consumption of fruit and salad.

Methods: The study was conducted in a cafeteria setting at a university office building. The design consisted of three weeks of baseline observation, three weeks of intervention, and three weeks of return to baseline conditions.

In the intervention condition, researchers increased the selection of fruits from three to six and added three vegetable options to the salad bar (about a 30% increase). They also reduced the price by 50%. The intervention was advertised by signs in the cafeteria and a flyer in each employee's mailbox. Researchers measured (1) the total number of customers each day (2) the total number of fruit purchases each day and (3) the total pounds of salad purchased each day. They also collected questionnaire data from customers on one day during each time interval.

Results: The number of customers remained steady throughout the period and were not influenced by the intervention.

The purchase of fruit and salad increased by approximately threefold during the intervention. When the intervention was removed, fruit and salad purchase dropped significantly but remained slightly above baseline (no change for fruit but salad remained significantly higher).

Improving healthy eating and the bottom line: Impact of a price incentive program in 2 hospital cafeterias (The 'Better Bites' Programme) (2016).[12]

Aim: to increase the purchase of healthy foods while maintaining the gross sales of two hospital cafeterias.

Methods: 3 month baseline phase where new healthy items were added to menus but without marketing and pricing components. 9 month intervention phase where marketing and pricing components were introduced.

The measure was the change in food sales. The secondary outcome was change in proportion of food sales (healthy vs traditional). Financial data was also collected and analysed, including gross sales and weekly profit from the burger.

[11]Jeffery, RW., French, SA., Raether, C., Baxter, JE. (1994). An environmental intervention to increase fruit and salad purchases in a cafeteria. *Preventative Medicine, 23(6)*, 788-792.

[12]Patsch, A.J., Smith, JH., Liebert, M.L., Behrens, T.K., Charles, T. (2016). Improving Healthy Eating and the Bottom Line: Impact of a price incentive program in 2 hospital cafeterias. *American Journal of Health Promotion, 30(6)*, 425-432.

Results: 3 items at each hospital were selected and paired with new healthier options. The intervention developed a new turkey burger that was paired with the traditional burger, a new healthy salad that was paired with the traditional salad, and two other options which were not reported because they could not be compared across sites. The new options were branded, marketing signage used, and a 35% price differential introduced.

There were 16215 burger and salad sales (52.7% of which were healthy options) at one site and 2868 (22.3% of which were healthy options) sales at the other during the intervention.

Sales of the healthy burger increased 13-fold in one location and 4-fold in the other when the intervention (marketing and price changes) was introduced. The proportion of healthy vs traditional burger sales changed in favour of the healthy burger.

Sales of the healthy salad increased at one site but not the other. Researchers suggest that this is because the healthy salad was already outselling the traditional one during the control phase and before the intervention.

Analysis of the financials show that profits during the intervention were significantly higher than the baseline for all burgers at both locations. Cafeteria gross sales increased by 5% in one location and 8% in the other.

Effect of price and information on the food choices of women university students in Saudi Arabia: An experimental study (2018).[13]

Aim: To assess the impact of providing information about healthy food and changing the price of healthy/unhealthy food choices on selection of food from a menu.

Methods: 99 women students at a Saudi Arabian university were recruited to the study which was held in a lab setting. Half of the students were given a one-page sheet about healthy food choices and the impact of poor dietary behaviours of future health, while the other half received information about agriculture in Saudi Arabia. Students were then given 5 menus one-at-a-time and asked to select a main course, dessert, and drink from the menu. There were two healthy and two less-healthy options for each element of the menu. Menus differed systematically in terms of price of the healthy and unhealthy options. Students were given paper money and were told that they could exchange their change for real snacks at the end of the study. This was to encourage a focus on price.

Results: There were no differences in food choice between the information groups. When the prices for healthy and less-healthy options were the same, 49.5% of choices were healthy. Healthy food selection increased to 58% when the price of unhealthy food increased or the price of healthy food reduced. When the price of unhealthy food was lowered and the price of healthy food increased, healthy food choices went down, but only slightly, to about 47%.

Limitations: Although this is a robust RCT, the menu selections were artificial and limited. Students were not making choices in real-time with real food. The experiment was also only done with women in a setting that may not generalise.

[13]Halimic, A., Gage, H., Raats, M., Williams, P. (2018). Effect of price and information on the food choices of women university students in Saudi Arabia: An experimental study. *Appetite,123*, 175-182.

Appendix E: Nudges and Environmental changes

11 studies were identified which fell into this category. This was a complex category, which included a variety of different strategies. Four distinct strategies were identified: feedback, prompts, environmental changes, and menu positioning and structure. In general, the studies had methodological limitations but provide evidence that these interventions can produce effects. However, the heterogeneity in the studies and the way in which interventions have been implemented means that it is difficult to generalise learning. A summary of the studies that are in Table 3. The remainder of this chapter details the studies, including their intervention components, their study design, a quality assessment, and their results.

Table 3: Nudges and Environmental Changes – high level summary

Year	Title	Intervention Results
2004	Does the Heartbeat Award scheme in England result in change in dietary behaviour in the workplace?	Staff of workplaces who received a Heartbeat Award reported positive change in consumption for 4 food items (increase fruit, reduction in fried foods and sweet puddings, change to using lower fat milk) compared to staff in workplaces without the award as measured by self-reported frequency of consumption pre/post the award being given.
2015	Micro-marketing healthier choices: effects of personalised ordering suggestions on restaurant purchases	Small but non-significant percent changes were observed in calories, total fat, saturated fat and cholesterol in food items ordered in a fast-food restaurant who gave customers tailored receipts indicating the food's calories and fat as well as suggested healthier substitute foods as compared to control restaurants. The receipt also shifted the mix of items purchased towards healthier alternatives. Changes were observed over a three-year period.
2016	Efficacy of a brief web-based intervention with and without SMS to enhance healthy eating behaviours among university students	Students who took a web-based healthy-eating course and received a daily text message to prompt healthy choices (text included elements of planning and monitoring; anticipation of barriers to goals; peer-modelling and social support; implementation intentions; encouragement and affirmation; and educational information) were more likely to achieve Centre for Disease Control (CDC) guidelines of vegetable consumption and increased number of university sponsored healthy food options selected as measured on a pre/post self-reported recall of consumption compared to students who did not received the course or texts.

Year	Title	Intervention Results
2010	Positive changes in perceptions and selections of healthful foods by college students after a short-term point-of-selection intervention at a dining hall	Students self-reported a significant increase in cottage cheese and low fat dressing use based on self-reported measures of food consumption pre and post intervention. No change found in other food groups. 42% reported an increase in the belief that healthy food choices are easily identified and 22% said their eating habits changed because they were more aware of healthy food options. The intervention consisted of signs with humour and benefit-based messages both above and in front of 10 healthy food items labelled with the logo "The Right Stuff!, along with flyers and 'table tents' in a university canteen.
2012	Healthy Dining. Subtle diet reminders at the point of purchase increase low-calorie food choices among both chronic and current dieters	When prompted with diet goal primes, chronic and current dieters choose more healthy options from a menu than non-dieters. In the control condition, the choices of both chronic dieters and current dieters did not differ from the choices of non-dieters.
2014	Effects of environmental intervention in workplace cafeterias on vegetable consumption by male workers	Providing information (via table tent) for 24 weeks about increasing vegetable consumption based on the transtheoretical model and process of change led to increased vegetable consumption per day (+0.32 servings; $p = 0.01$; as assessed by self-report) compared to cafeterias that did not receive the intervention.
2007	Using a smaller plate did not reduce energy intake at meals	Participants served themselves similar amounts of food, and ate similar amounts of food, no matter what size of plate they were given (lab-based study).
2010	Reducing portion size reduces food intake and plate waste	A reduction in portion size of fries in one portion resulted in less fries consumed by the average person in a university canteen – even when participants could have selected as many portions as they wanted.
2014	Motivating sustainable food choices: The role of nudges, value orientation, and information provision	Students were significantly more likely to select meat-free food options if the options were given as a separate menu from the traditional menu, even if the traditional menu was on the wall 3 metres away and students could have selected from it too. Presenting environmental benefit information did not affect menu selection in any category.
2011	Nudge to nobesity II: Menu positions influence food orders	Food items that appear on a menu at the very top or very bottom of their list of similar items were chosen more often than when they appeared in the middle of the list ($p<0.01$). Their popularity increased by about 20%.
2012	Healthy snacks at the checkout counter: A lab and field study on the impact of shelf arrangement and assortment structure on consumer choices	Significantly more snacks were chosen from a virtual 'shelf' and from a real-life shelf in a hospital canteen when the proportion of the availability of healthy snacks to unhealthy snacks was 75% to 25% than when the proportion was the reverse. There was no effect of shelf arrangement (items placed at the top or bottom of the shelf) or interaction between availability and arrangement.

Feedback

Does the Heartbeat Award scheme in England result in change in dietary behaviour in the workplace? (2004).[14]

Aim: To test the impact of a workplace intervention on frequency of consumptions of key food items.

Methods: Pre-Intervention questionnaire given to staff (n=453) in 4 workplaces 6 months before the workplace was awarded a Heartbeat Award (HBA) and again 6 months after the scheme. Pre and post questionnaires (one year apart) were also given to staff in 2 workplaces who did not receive the award. Respondents were asked how frequently they 16 food items and 4 food types on a scale from 'Never' to 'More than once a day'. HBA were given if (1) at least one-third of the dishes on the menu were 'healthy choices' (2) at least one-third of the eating area was non-smoking (3) at least 30% of staff had received training on hygiene and (4) the premises complied with food hygiene regulation.

Results: Positive changes in consumption were reported for 4 food items tested in the workplaces that had received the award. No change occurred for the workplaces who did not receive an award. The food items were: increase in fruit; reduction in fried foods and sweet puddings; and a change to using lower fat milks.

Quality Assessment: Not great. No link to theory. Unclear about the exact intervention components – the control group simply did not meet the standard to receive the award. The components of the intervention are also not relevant anymore (i.e., non-smoking and not everyone having correct hygiene certificates). It's a pre-post study with a long gap in between the measures. Weak outcomes used (i.e., self-reported frequency of consumption of individual food items).

Micro-marketing healthier choices: Effects of personalized ordering suggestions on restaurant purchases (2015).[15]

Aim: To study the effects on future purchasing of providing current fast food customers with a Nutricate receipt, which makes personalised recommendations for healthier choices as targeted suggestions based on current choices. To identify any impact the Nutricate receipt will have on sales. To report on the total nutritional content of transactions.

Methods: Store-level weekly purchase data was recorded over a consecutive 125 week period between 2007 and 2010 for the 39 restaurants in the US located Burgerville fast food chain. One of the 39 stores, the 'treatment' store, was responsible for providing an intervention, in the form of a Nutricate receipts process. This entailed amending standard receipts to include tabular information regarding the food's calories and fat, and personalised purchase suggestions promoting healthier products that are close substitutes to an item the customer has just purchased – with five items defined as discouraged and nine as encouraged. Calories, total fat, saturated fat and cholesterol per transaction were measured and recorded as aggregate data.

[14]Holdsworth, M., Raymond, N., Haslam, C. (2004). Does the Heartbeat Award scheme in England result in change in dietary behaviour in the workplace? *Health Promotion International, 19 (2)*, 197-204.

[15]Bedard, K. and Kuhn, P. (2015). Micro-Marketing Healthier Choices: Effects of Personalized Ordering Suggestions on Restaurant Purchases. *Journal of Health Economics, 39*, 106-122.

Results: Raw difference in difference estimates (category shares) were used to evaluate the relative percent change in the treated store for item substitution, and these consistently revealed a positive impact ranging from 0.98 to 8.41. While the findings regarding item substitutions were strong, the overall effects on nutrition and calories were relatively muted, albeit that each did fall, with the relative percent change in the treated store being: -0.56 for calories, -0/82 total fat, -1.02 saturated fat and -2.67 cholesterol. There was no negative change to the treated store's sales.

The study supports the benefits of using information technologies to enable retailers to tailor product marketing to individual consumers in order to generate healthier choices.

Quality assessment: Aggregate data was used to evaluate results, meaning that there was no way of identifying which particular customers made the changes. Further to this, the findings are limited by the absence of information regarding customers' food choices outside of this particular environment. The improvements that were seen could potentially be enhanced if the intervention was to be rolled out in outlets with the capacity to change menu offerings.

Prompts

Efficacy of a brief web-based intervention with and without SMS to enhance healthy eating behaviours among university students (2016).[16]

Aim: To increase numbers of students meeting CDC guidelines for fruit and veg consumption and to increase selection of university-sponsored healthy food items during their lunch or dinner.

Methods: 154 Undergraduate students randomly split into three groups: baseline assessment only, baseline plus web-based intervention, baseline plus web-based intervention plus daily SMS. Baseline measurements were self-reported recall of fruit and veg portions consumed in past 7 days along with self-reported measure of how often they selected university sponsored healthy food options (identified with a "Sargent Choice" logo in the canteen). Web-based intervention was a one-off online 'course' that integrated personalized feedback, motivational enhancement, education, and self-regulation strategies. The text message was sent every day at 4:30pm and included planning and monitoring; anticipation of barriers to goals; peer-modelling and social support; implementation intentions; encouragement and affirmation; and educational information. All participants repeated the baseline assessment 32 days later.

Results: Web-based assessments plus texts were sig. more likely to achieve CDC guidelines of vegetable consumption (not fruit) than Assessment only. Web-based plus texts did not differ from web-based only and web-based only did not differ from assessment only. Web-based plus texts also increased choice of university-sponsored healthy food items, whereas web-based only intervention did not. Daily texts can support a nutrition programme.

Quality assessment: Good experimental trial with limits: there was no condition to test the text only; no long-term follow up; and there was a reliance on self-reported data.

[16] O'Brien, L., Palfai, T. (2016). Efficacy of a brief web-based intervention with and without SMS to enhance healthy eating behaviours among university students. *Eating Behaviors, 23*, 104-109.

Positive changes in perceptions and selections of healthful foods by college students after a short-term point-of-selection intervention at a dining hall (2010).[17]

Aim: To determine the effect of marketing 10 selected healthy foods on selection of those food items.

Methods: Students were approached in the dining hall and asked to complete a pre and post intervention survey asking about their dining habits in the canteen, their perception of how easily healthy choices are identified in the canteen, and their self-reported frequency of choosing each of 10 items in the canteen. The intervention consisted of signs with humour and benefit-based messages both above and in front of the 10 food items with the logo "The Right Stuff!" on the sign. Flyers and 'table tents' were throughout the dining hall. Post-Intervention surveys were completed after three weeks of the intervention.

Results: 104 students completed both pre and post questionnaires. 42% reported an increase in the belief that healthy food choices are easily identified in the dining hall. 22% said their eating habits changed because they became more aware of healthy food choices in the dining hall. Self-reported changes in 7 out of 10 eating habits also sig. improved. Self-reported use of cottage cheese and low fat dressing increased significantly but no change was found in self-reported consumption of steamed veg, chicken breast, salad, fruit, deli sandwiches, or skim milk.

Quality Assessment: Pre-post design with self-reported measures of food consumption. Low evidence that point-of-choice signage improved healthy food consumption and outcomes were based on self-reported recall in the weeks after the intervention and not at the time of intervention.

Healthy dining. Subtle diet reminders at the point of purchase increase low-calorie food choices among both chronic and current dieters (2012).[18]

Aim: To investigate whether diet goal reminders would facilitate healthy choices in a restaurant setting among both chronic and current dieters.

Methods: Eighty nine participants were recruited in a restaurant during five nights (three Thursdays and two Fridays) over a three week period. They were randomly separated into two groups: one that received menus tailored to include diet goal primes and one, the control, which received the standard, existing menu. Pricing was deliberately similar for all items and everyone at a given table received the same kind of menu. The orders taken by waiting staff were intercepted on their way to the kitchen by the experimenter, who noted the detail. After the customers had paid their bills they were asked if they would participate in the study. The eighty nine who agreed were then presented with a questionnaire that incorporated the 'Concern for dieting scale of the Restraint Scale', in order to identify chronic dieting, along with questions about height, weight, current dieting and age and gender. They were then asked not to talk about the survey and were offered the chance to participate in a lottery to win a gift, as a token of appreciation. Meal choices were coded as rather healthy (1) or rather unhealthy (0).

[17]Peterson, S., Duncan, D., Null, D., Roth, S., Gill, L. (2010). Positive changes in perceptions and selections of healthful foods by college students after a short-term point-of-selection intervention at a dining hall. *Journal of American College Health, 58(5)*, 425-431.

[18]Papies, Esther K., Veling, Harm (2012). Healthy Dining. Subtle diet reminders at the point of purchase increase low-calorie food choices among both chronic and current dieters. *Appetite 61* (2013), 1-7.

Results: Logistic regression analysis revealed that diet reminders affected dieters and non-dieters differently. In the control condition there was no effect of dieting status, as the choices of both chronic dieters and current dieters did not differ from the choices of non-dieters. In the diet reminders condition both chronic dieters and current dieters made more healthy choices than non-dieters. Chronic dieters and current dieters did not differ from each other in either the control or the diet reminders conditions.

Quality assessment: The study benefited from being conducted in a field rather than lab environment. One consideration is that since all subjects at a table received the same menu type, this may have led to a social norm influence that has not been taken into consideration. The study does not consider the quantity of food consumed in terms of actual calorie intake.

Effects of environmental intervention in workplace cafeterias on vegetable consumption by male workers (2014).[19]

Aim: To assess the effects of an environmental intervention which increased access to nutritional information on vegetable consumption in workplace cafeterias.

Methods: The intervention consisted of table tents (a total of 12 types overall) placed once every 2 weeks on all tables in each cafeteria. The table tents were designed to match the progression through stages of a model of behaviour change (pre-contemplation to contemplation to preparation to action). Posters and personalised feedback were also used.

The study design was a controlled trial. 8 workplaces received the intervention and 8 were designated as a comparison group. The population was limited to males and participants were approached and agreed to be part of the study. 349 workers participated in the study.

Results: There was no difference in vegetable consumption based on the stage of the intervention. There was an increase in vegetable consumption in the intervention group compared to the control group overall and per day.

Environmental Changes

Using a smaller plate did not reduce energy intake at meals (2007).[20]

Aim: Does giving people a different plate size affect how much food they eat?

Study 1: Methods: Participants ate lunch in the laboratory every day for 3 weeks and served themselves mac and cheese from a standard-sized dish at their desk. Each day they were given either a small, medium, or large plate to eat off of. Participants served as their own control (repeated-measures design).

Results: Plate size was not related to the amount of food they ate. The only thing that predicted food consumption was 1) estimated daily energy expenditure and 2) score for tendency towards hunger.

[19]Kushida, O., Murayama, N. (2014). Effects of environmental intervention in workplace cafeterias on vegetable consumption by male workers. *Journal of Nutrition Education and Behaviour, 46(5)*, 350-358.

[20]Rolls, B. et al. (2007). Using a smaller plate did not reduce energy intake at meals. *Appetite, 49*, 652-660.

Study 2: Methods: Participants ate lunch in the laboratory every day for 2 weeks. Each day they were offered 700g of mac and cheese on a plate that was either 22cm or 26cm with a standard spoon with the medium plate or a soup spoon with the large plate. They were told to eat however much they wanted. Participants served as their own control (repeated-measures design).

Results: Plate size was not related to the amount of food they ate. 80% of participants also correctly guessed that the food was the same amount on both plates (i.e., they did not perceive there being more food on the large plate).

Study 3: Methods: Participants ate lunch in the laboratory every day for 3 weeks. Participants were given either a small, medium, or large plate and were told to serve themselves from a buffet of large quantities of 4 different hot foods and one salad located 6m away from their desk. They could eat as much as they wanted and return to the buffet as often as they wanted.

Results: Participants ate a consistent amount no matter what the size of the plate. Participants made almost 3 trips to the buffet with the small plate compared to 2 trips to the buffet with the medium and large plates, but plate size did not affect the total amount consumed. About 1/3rd of participants guessed the true purpose of the study, but this knowledge did not affect the results of the experiment.

Conclusion: Plate size is not related to the amount of food that people eat. In previous studies, serving size, however, has been shown to affect amount consumed with bigger portions related to higher intake. Strategies to reduce portion size should be focused on rather than plate size.

Quality: High quality laboratory study using repeated measures (participants serving as their own control) and different groups of participants were used for each of the three studies. Study was powered to 80%.

Reducing portion size to reduce food intake and food waste (2010).[21]

Aim: To determine if decreasing the portion size of French fries on offer in a university canteen decreased the amount of French fries selected and consumed.

Methods: Fries were initially packaged in 88g portions for students to select as part of the buffet in the university canteen. Over 5 weeks, the number of fries in each portion was reduced by about 4 fries per week. Total fry production was measured and waste was measured by canteen staff who separated waste into different buckets depending on how many portions of fries (as indicated by the remaining wrappers) the student selected. Numbers of students who took one, two and three+ bags were discreetly counted by a volunteer. Approximately 703 diners ate in the dining hall each week.

Results: As the portion size decreased, there was a significant reduction in consumption per diner and in portion waste. On average, all diners consumed about 80% of the fries, no matter the portion size. During week 1, 87% of diners took one bag and by week 3 77% still only took one bag – this indicates that around 84% of diners who took one bag (also diners who started by taking two bags and continued to take two bags) benefited from reduced portion size and ate less fries because they were getting smaller portions. Only those few diners (n=31) who chose more than three bags rather than one bag would have increased their French fry intake over baseline.

[21]Freedman, M., Brochado, C. (2010). Reducing portion size reduces food intake and plate waste. *Obesity, 18*, 1864-1866.

Conclusion: A reduction in portion size of fries appears to results in less fries consumed on average per person, even when people can choose however many portions they want.

Limitations: Study design is before-and-after with no control group or element of randomisation. The study could not measure those who came back through the line for more fries. It could not determine if students bought other types of foods to compensate for fewer fries or to control the menu that may have influenced when/if students wanted to purchase fries. There is no way to know the effect of research assistants on students' food choices.

Healthy snacks at the checkout counter: A lab and field study on the impact of shelf arrangement and assortment structure on consumer choices (2012).[22]

Aim: To examine the effect of snack placement and assortment on consumer purchase of snacks in a lab setting and a real-world hospital canteen.

Study 1: Methods: Students were asked to choose a snack from a photograph of 16 different single-portion snacks arranged on a virtual shelf on the computer. 158 students were randomly assigned to one of four conditions which differed by placement of the healthy snacks (top or bottom row) and the proportion of healthy snacks available (25% or 75% of snacks were healthy). Healthy snacks were defined as having less than 110 calories.

Results: When there were 75% healthy snacks, 44.3% of people chose a healthy snack compared to only 13.9% of people who chose a healthy snack when 25% of the snacks available were healthy. When 75% of snacks were healthy, participants were 2.9 times more likely to select a healthy snack than when 25% of snacks available were healthy. No differences were found in choice when healthy snacks were at the top or bottom of the virtual shelf. Participants rated the shelves with 75% healthy snacks as less realistic than shelves with 25%.

Study 2: Methods: The procedure was the same as the lab experiment but replicated in real-life on a real shelf in a hospital canteen setting. Each condition ran for one week (excluding weekends) over a 4-week period. 500 people purchased items each day and all items were priced at 0.85 except for fresh fruit sold at 0.50. The shelf was put on display one week before the experiment started to get customers used to the new items for sale. During the intervention, sales data were collected by staff by counting the number of items left at the end of the day. Staff restocked the shelf during the day.

Results: 291 snacks were sold over the 4-week period. There was no effect of assortment or shelf arrangement on sales of unhealthy snacks. Significantly ($p=0.01$) more healthy snacks were sold when the assortment was 75% healthy vs. 25% healthy snacks available. There was no effect of shelf placement (top vs. bottom) although there was a trend in the hypothesized direction. There was no interaction of shelf arrangement and assortment structure. A survey also found that more visibility (on the top shelf) and availability of healthy snacks led to higher ratings of attractiveness of the display; and 71% selected the shelf display with 75% healthy options on top as being their preferred display out of the 4.

Limitations: Study 1 was conducted in an artificial setting where shelf position (top/bottom of a shelf on the screen) could be deemed irrelevant. There was also a relatively small number of total snacks sold over 4-weeks in the real-world condition. It's also unclear if the manipulations would result in sustained behaviour change.

[22]Van Kleef, E., Otten, K., van Trijp, H.C.M. (2012). Healthy snacks at the checkout counter: A lab and field study on the impact of shelf arrangement and assortment structure on consumer choices. *BMC Public Health, 12*.

Menu positioning and structure

Motivating sustainable food choices: The role of nudges, value orientation, and information provision (2014).[23]

Aim: To see how presenting meat-free options on menus affects menu choices.

Methods: Students were interrupted at the point where they entered the cafeteria and asked to participate in the study. They were then randomized into one of 8 menu conditions and asked to choose something off of the menu. They did not purchase nor eat the menu item selected. The conditions were (1) 'appealing' meat-free options only with standard options also available on a menu located 3.5m away from the table; (2) 'appealing' meat-free options with additional information below about the environmental benefits of eating meat-free food; the standard menu was also available on the wall 3.5m away; (3) 'appealing' meat-free options were presented with information about the environmental impact but these options were presented on the same menu as the traditional options; (4) 'appealing' meat-free options were presented alongside the traditional options but with no additional environmental information. Those 4 conditions were repeated but with 'unappealing' meat-free options instead. Appeal of meat-free options was rated by students in a previous experiment.

Results: 320 students took part with 40 students in each category. Students were sig. more likely to select both 'appealing' and 'unappealing' meat-free options when the options were presented in a separate menu from the traditional menu (with the traditional options still available on a menu 3.5m away from the student). Presenting additional environmental information did not affect menu selection in any category.

Quality Assessment: Study might have been underpowered with only 40 students per condition. Experimental design with fully randomized conditions. Good quality. Not sure about generalizability but interesting to consider how presenting meat-free options or healthy options as a default meant that more students choose one of those items, even though the other items were available on another menu on the wall. Might students have not felt they could or should choose from the other menu option on the wall? Social desirability bias might be at play.

Nudge to nobesity II: Menu positions influence food orders (2011).[24]

Aim: To assess the influence of menu position on food choice in the lab and in a café setting.

Study 1: Methods: 240 Hebrew University students were randomly assigned to one of 4 menu conditions. Each menu had the same selection of appetizers, main courses, soft drinks, and desserts but items appeared in different orders. There were no prices listed and students were told to choose one items per category. The menus conditions were organized such that most (but not all) items appeared at the very top or very bottom of their group but at least all appeared in the top or bottom half of their group.

Results: Items appearing at the top or bottom of their list were chosen more often than when they appears in the middle of the list ($p<.01$). Their popularity increased by about 20%.

[23]Arvai-Campbell, V., Arvai, J., Kalof, L. (2014). Motivating sustainable food choices: The role of nudges, value orientation, and information provision. *Environmental Behaviour, 46(4)*, 453-475.

[24]Dayan, E., Bar-Hillel, M. (2011). Nudge to nobesity II: menu positions influence food orders. *Judgement and Decision Making, 6(4)*, 333-342.

Study 2: Methods: Two different menus appeared in a town-centre coffee shop serving coffees and desserts. The menus were presented on alternating days with one being the café's standard menu and the other menu exchanged the items in the middle of the categories with items on the outside edges of the categories. Wait staff recorded the numbers of items selected by patrons for 15 days. Patrons who ordered by habit rather than off the menu were excluded.

Results: Items appearing at the outside edges of their category were chosen more often than items appearing in the middle of the category list. Their popularity also increased by about 20%.

Conclusions and limitations: Robust randomized studies that showed the same effect in a lab as in a real-world setting: placing a food item at either the top or bottom of its category on a menu increases the population of that items by about 20%. The setting was not a hospital or habitual work canteen where patrons serve themselves, however, and there are questions about the generalizability of the results.

Appendix F: Complex Interventions

9 studies were identified which could be classified as 'complex interventions'. These were defined as ones which have several interacting components; specifically, an intervention had to use two or more distinct techniques to attempt to change behaviour. Combining education interventions with environmental changes was the most common complex intervention. However, researchers also used labelling in conjunction with environmental changes and, separately, with education, and one study used environmental changes with labelling and pricing. In general, the studies were able to show that their interventions had a positive effect on food choices. A summary of the studies that were found are in Table 4. The remainder of this chapter details the studies, including their intervention components, their study design, a quality assessment, and their results.

Table 4: Complex Interventions – high level summary

Year	Title	Intervention Results
2012 and 2014	Traffic light labelling and choice architecture in a hospital canteen	Labelling cafeteria food item with red (unhealthy), yellow (less healthy) or green (healthy) dots, along with putting 'green-dot' drinks, chips, and sandwiches at eye level resulted in a decrease ($p<0.001$) of red items from 24% at baseline to 20% at 24 months and an increase of green items from 41% to 46% ($p<0.001$). Making bottled water the default option (eye level, in all refrigerators, in baskets near the food) increased sales by 25%.
2016	The effect of complex workplace dietary interventions on employees' dietary intakes, nutrition knowledge and health status: a cluster controlled trial	A nutrition education programme (monthly group nutrition presentations, detailed group nutrition information, and individual nutrition consultations) resulted in a decrease in dietary saturated fat intake (24hr dietary recall). An environmental modification intervention (menu modification; increase in fibre, fruit and vegetables; price discounts for whole fresh fruit; strategic positioning of healthier alternatives; and portion size control) resulted in a decrease in energy proportion from saturated fat, increase in total sugars, and a decrease in nutrition knowledge. A combined education and environmental restructuring intervention resulted in a decrease in dietary intake of saturated fat, a decrease in energy proportion from saturated fat, and an increase in nutrition knowledge.
2011	Impact of an intervention on the availability and consumption of fruits and vegetables in the workplace	Providing educational material, a manual, and culinary workshops for food production managers along with nutritional educational materials for workers purchasing meals resulted in the intervention canteens offering 49g more fruits and vegetables in their food offering than the control groups.

Year	Title	Intervention Results
2001	Seattle 5 a Day worksite program to increase fruit and vegetable consumption	An intervention campaign consisting primarily of educational material and point-of-purchase signs about healthy eating (all intended to increase awareness of healthy eating) led to a significant increase in fruit and veg consumption (0.3 servings) as measured by a self-report measure of food-frequency recall conducted pre and post intervention.
2013	Encouraging healthful dietary behaviour in a hospital cafeteria: A field study using theories from social psychology and behavioural economics	Information, in the form of reinforcing health messages, had the most consistently beneficial effect on the healthfulness of purchases. Environmental changes (healthy substitute pairings and grouping by healthfulness) and affect-based cues also increased healthy choices. Cues about social norms had no effect on the target items but may have affected the purchases of healthier, substitute goods (fruit).
2017	Delivering Healthy Food Choice: A Dual-Process Model Enquiry	A “GO FOOD” labelling intervention aimed at reminding military personnel of health-eating intentions and to draw attention towards items that help them eat well was combined with modifications to the dining room layout to ensure diners encountered healthy items first. The pre-post intervention led to more selections of items in the ‘most healthful’ categories (e.g. green vegetables and lean meat selection).
2004	The impact of education and environmental interventions in Dutch worksite cafeterias	No significant differences were found between cafeterias who received an educational programme; an increase in availability of low fat products, fruits and vegetables plus the education programme; labelling programme plus the education programme; or no programme.
1984	Changing food selections in a public cafeteria: an applied behaviour analysis	Weak evidence that placing two large signs at the entrance with the caloric value of all available menu items results in a reduction of carbs chosen in a cafeteria. No change in numbers of healthy items selected when healthy items were marked by a green triangle. When healthy items were marked with the green triangle AND students were offered a stamp on a small card for each green triangle food selected in order to get a $1 rebate after 10 stamps, there was a significant rise in the numbers of several different healthy food selections.

Labelling + Environmental Changes

Traffic light labelling and choice architecture in a hospital canteen (2014)[25], (2012).[26]

Aim: Pre-post study to determine the outcome of using red/yellow/green labelling on foods in a hospital canteen affects purchasing patterns over two years.

Methods: Baseline sales were monitored for three months. Only staff who used a debit card linked to direct payroll deduction and who made a purchase at least three times during each three month period (baseline, 12 months, 24 months) were included in the analysis. After baseline, the first intervention was traffic light labelling: every item in the cafeteria was labelled as red, yellow, or green based on three positive criteria (fruit/ vegetable, whole grain, and lean protein/low-fat dairy as the main ingredient) and two negative criteria (saturated fat and caloric content). Items with more positive than negative criteria were green, items with equal positive and negative criteria were yellow, and items with more negative than positive criteria were red. Posters and signage were located in the cafeteria.

Three months later, the choice architecture was added: green beverages were arranged at eye level; bottled water was placed in all refrigerators and in additional baskets around the canteen; Green pre-packed sandwiches were arranged at eye level; 'green' chips were placed at eye level, 'yellow' lower down, and 'red' at the bottom.

Results: Weekends and holidays were excluded. Beverages analysed separately. Anonymous shoppers made purchases over 9 weeks for data validation (that the cashiers were entering the foods in correctly). The 3-month baseline was compared to 3-month follow-up periods at 12 and 24 months. The outcome was the proportion (out of all items purchased) of red and green items and beverages purchased. The proportion of red items decreased from 24% at baseline to 21% at 12 and stayed the same at 24 months. Green items increased from 41% to 45% at 12 months and 46% at 24. Red beverages decreased from 27% to 17% at 12 months and 18% at 24. Green beverages increase from 52% to 59% and 60% at 24. All changes from baseline were statistically significant.

When looking at changes from baseline to labelling (Phase 1) to choice architecture (Phase 2): from baseline to labelling, all red items decreased by 9.2% and decreased a further 4.9% after Phase 2; red beverages decreased 16.5% in Phase 1 and a further 11.4% in phase 2; green items increased by 4.2% in Phase 1 but decreased by 0.8% in Phase 2. Bottled water sales decreased by 2.4% in Phase 1 but increased by 25.8% in Phase 2.

Summary: Traffic light labelling and choice architecture increased sales of items labelled 'green' while decreasing sales of 'red' food and beverage items. Making bottled water the default option (eye level, in all refrigerators, in baskets near the food) increased sales by 25%.

Limitations: No control site, but overall patterns of consumption were stable in the two years. No new items were added to the offering.

[25]Thorndike, A., et al (2014). Traffic-light labels and choice architecture promoting healthy food choices. *American Journal of Preventative Medicine, 46(2)*, 143-149.

[26]Thorndike, A. et al. (2012). A 2-Phase labelling and choice architecture intervention to improve healthy food and beverage choices. *American Journal of Public Health, 102(3)*, 527-533.

Education + Environmental Changes

The effect of complex workplace dietary interventions on employees' dietary intakes, nutrition knowledge and health status (2016).[27]

Aim: The Food Choice at Work (FCW) study aimed to assess the effectiveness of a workplace environmental modification, a nutrition education intervention, and a combined environmental and education intervention compared to a control group.

Methods: The study was conducted through a controlled trial in four large manufacturing workplaces. Participants were informed that they were involved in a university study to observe workplace dietary behaviours. The intervention conditions were as follows:

- Control – no intervention.
- Nutrition education, which included 3 elements: monthly group nutrition presentations, detailed group nutrition information, and individual nutrition consultations. Each participant attended three individual consultations (at baseline, 3-4 months, and 7-9 months).
- Environmental dietary modification, which included five elements: menu modification; increase in fibre, fruit and vegetables; price discounts for whole fresh fruit; strategic positioning of healthier alternatives; and portion size control.
- Combined nutrition education and environmental modification, which included both interventions with one modification to the individual consultations as part of the nutrition education, which, in this condition, also provided employees with personalised knowledge that enabled them to make healthy food choices within a modified environment

Results: The study measured changes in employee's dietary intakes of salt and their body mass index at 7-9 months follow. Secondary outcomes included changes in dietary intakes of total fat, saturated fat, total sugars and fibre, nutrition knowledge, mid-way waist circumference, and resting blood pressure at 7-9 months follow up. These were measure by a combination of 24hour dietary recall and physical measurements.

850 participants were recruited at baseline; data was collected from 678 participants at 3-4 months follow up, 541 participants at 7-9 month follow up, and 517 participants for complete follow up.
The study found significant changes between the control condition and the intervention conditions between baseline and 7-9 months follow up as follows:

- Education: a decrease in dietary saturated fat intake
- Environment: a decrease in energy proportion from saturated fat, increase in total sugars, and a decrease in nutrition knowledge
- Combined: a decrease in dietary intake of saturated fat, a decrease in energy proportion from saturated fat, and an increase in nutrition knowledge

The study also detailed the costs associated with the start-up and maintenance of the intervention. The combined intervention cost €31108 (€62 per employee), the education intervention cost €28529 (€57 per employee), the environmental intervention cost €3689 (€7 per employee) and the control cost €0.

[27] Geaney, F. et al. (2016). The effect of complex workplace dietary interventions on employees' dietary intakes, nutrition knowledge and health status: a cluster controlled trial. *Preventative Medicine, 89*, 76-83.

Impact of an intervention on the availability and consumption of fruits and vegetables in the workplace (2011).[28]

Aim: The study aimed to implement and evaluate an education and environmental intervention on the availability and consumption of fruit and vegetables in workplace cafeterias.

Methods: The study was a randomised controlled trial which implemented an intervention in a number workplaces and compared those to control workplaces. The intervention had four phases, which were implemented sequentially over a six month period:

- production of a manual for managers including nutritional guidelines and education information;
- culinary workshops for workers responsible for preparing meals;
- educational materials for workers purchasing meals were distributed in the cafeteria; and
- an educational approach which used posters to summarise the intervention and promote fruit and vegetable consumption.

Results: availability of fruit and vegetables was measured using a combination of menu plans and consumption data. The intervention group offered 49g more fruits and vegetables than the control group following the intervention than the control group. There were also a decrease in the availability of fat and an increase in the availability of fibre.

Seattle 5-a-Day educational nutrition intervention on self-recalled food consumption (2001).[29]

Aim: To evaluate the impact of a 5-a-day campaign on fruit and veg consumption of staff in worksite canteens.

Methods: 14 worksites were randomly assigned to the intervention and 14 to a control condition. A random sample of employees from each work site completed a self-reported measure of Food Frequency about their usual frequency of consuming veg and fruit and juices over the past months. They also completed a Fat and Fibre Questionnaire which asks questions about how likely they are to replace high fat with lower fat items etc. Another random sample of employees completed the same scale 2 years later. The intervention was a campaign consisting primarily of educational material and point-of-purchase signs about healthy eating, all intended to increase awareness of healthy eating. There were also on-site food prep and cooking demonstrations. Researchers also spent one hour pre and post intervention observing staff and manually marking the items staff selected for lunch in order to calculate the number of fruit and veg bought per person.

Results: Staff in the intervention group (about 1,200) had a sig. increase in fruit and veg consumption (as assessed by the self-report measure of food-frequency recall) and a sig improvement in the Fat and Fibre questionnaire. The effect of the intervention was 0.3 serving increase in fruit and veg reported. There were no changes to the numbers of fruit/veg selected in the plate observation outcome.

Quality assessment: An increase of 0.3 servings is small, but perhaps not insignificant.

[28]Bandoni, DH., Sarno, F., Jaime, PC. (2011). Impact of an intervention on the availability and consumption of fruits and vegetables in the workplace. *Public Health Nutrition, 14(6)*, 975-981.

[29]Beresford, S., et al. (2001). Seattle 5 a Day worksite program to increase fruit and vegetable consumption. *Preventive Medicine, 32*, 230-238.

Limitation: self-report measures with no change in directly observed measures; statistical procedure not clear. Intervention was primarily educational/information-giving and, although there was a checklist of certain things that had to be included in the intervention, worksites could modify or add elements as desired.

Encouraging healthful dietary behaviour in a hospital cafeteria: A field study using theories from social psychology and behavioural economics (2013).[30]

Aim: To assess the effectiveness of a variety of interventions—each of which is associated with a different psychological mechanism that has been shown to influence decision making—in influencing dietary decisions and encouraging healthy food purchases.

Methods: Over a 21-month period, 9 interventions were tested in a point-of-purchase field study at a hospital cafeteria, focusing on the healthfulness of beverage purchases and chip purchases. The interventions include price changes (economic), coloured-nutrition labelling (cognitive), novel framing of caloric health messages (cognitive), pairings of unhealthful and healthful substitutable items (environmental), grouping of items by healthfulness (environmental), normative messages about the purchases of cafeteria patrons (social), and smiley- and frowny-face labelling on food items (affective). After each intervention a 'washout' phase returned the cafeteria to the baseline condition to remove the effects of the previous intervention. For data analysis the study analyses register receipts, focusing on sales of beverages, chips, and fruit and specifically on the percentage of healthful items sold.

Results: Detailed findings are presented in the paper but overall, the study found that information, in the form of reinforcing health messages, had the most consistently beneficial effect on the healthfulness of purchases. Environmental changes (healthy substitute pairings and grouping by healthfulness) and affect-based cues also increased healthy choices. Cues about social norms had no effect on the target items but may have affected the purchases of healthier, substitute goods (fruit).

Delivering healthy food choice: A dual-process model enquiry (2017).[31]

Aim: To assess and compare the effects of two programs designed to improve the healthfulness of food selections in military dining facilities.

Methods: Two program were implemented which consisted of 1) consumer-focused communications and 2) broader social marketing program including communication and environmental changes.

Consumer focused communications program - The "GO FOOD" theme aimed to remind military personnel of their healthful eating intentions, connect with and intensify existing motivation, and draw attention toward items that help them to eat well. A combination of posters, placards, floor stickers, and food labels, in highly visible places in the dining room, was used to execute this program.

Broader social marketing program - The second program used the same "GO FOOD" communications but coupled them with environmental changes known to influence food choice. Modifications were made to the dining room layout to take advantage of the predictable traffic flow. To increase prominence, counters containing healthy choices were moved to ensure diners arrived at these counters first.

[30]Mazza, M.C. (2013). Encouraging Healthful Dietary Behavior in a Hospital Cafeteria: A Field Study Using Theories from Social Psychology and Behavioral Economics. Doctoral dissertation, Harvard University.

[31]Carins, J.E., Rundle-Thiele, S.R., Parkinson, J.E. (2017). Delivering Healthy Food Choice: *A Dual-Process Model Enquiry. Social Marketing Quarterly, 23(3),* 266-283.

A quasi-experimental pre–post design was used to test the programs over a 6-week period. During Weeks 1 and 2, measures were taken at each site to quantify food choice behavior prior to program implementation. In Weeks 3 and 4, program materials were installed and layout changes made. In Weeks 5 and 6, food choice behavior was again measured following full implementation of the programs.

Results: Diner numbers varied meal by meal, with a total of 4,400 diners (average 280 diners per meal) observed over the course of the experiment. Taken altogether, results indicate both programs increased the healthfulness of individual food selections. The communications-only program appears to have prompted an extra selection, which appears to have been from the moderately healthful category. A small reduction in availability of the most healthful dishes may have influenced which category the extra selection was chosen from. Food types that were chosen more were pasta/rice sides and green salad, potato salad, and Caesar salad. The broader social marketing program (communications and layout changes), with no change to total number of selections and no change to availability during the program, appears to have prompted a switching behaviour, from the least and moderately healthful categories to the most healthful category. Increased lean meat selections as well as vegetable selections (principally an increase in green vegetables) would have driven this increase in most healthful selections.

Education + Labelling

The impact of education and environmental interventions in Dutch worksite cafeterias (2004).[32]

Aim: To assess the separate effects of two environmental interventions (changes in food supply and labelling) aimed at reducing fat intake and increasing fruit and vegetable consumption in worksite cafeterias.

Methods: Cafeterias were randomly assigned to one of four experimental conditions:

- Educational programme: information provision to change attitudes and on increasing self-efficacy, teaching skills, and managing social influences.
- Food supply programme plus educational programme. Food supply programme comprised of an increase in availability of low fat products, fruits and vegetables, and attention was drawn to the new products by way of a sign which said ‘new and healthy’.
- Labelling programme plus education programme. Labelling programme comprised of a sign in front of the product which included a logo, the name of the item, and an indication that the item was low fat. Fruit and vegetables were also labelled.
- No programme.

Data was collected in the form of questionnaires which were completed 1 month before the intervention, 1 month after the start of the intervention, and 6 months after the intervention. Sales data was also collected for the 3 weeks before the intervention and during the first month of the intervention.

Results: No significant differences were found between the groups.

[32]Steenhuis, I. et al. (2004). The impact of educational and environmental interventions in Dutch worksite cafeterias. *Health Promotion International, 19(3)*, 335-343.

Environmental Changes + Labelling + Pricing

Changing food selections in a public cafeteria: an applied behaviour analysis (1984).[33]

Aim: To run three different interventions in the same university canteen to measure the impact on university student food choices.

Methods: Student food choices and body type of student ("lean", "obese", "normal") were recorded by researchers at the point of sale in a university cafeteria during each baseline and intervention phase. The dependent variable was the percentage of individuals who chose at least one food in a particular food group during a phase. Food groups were, for example: vegetable/soup/fruit/low-fat dairy; salad; red meat etc. The whole trial lasted approx. 2 years with each phase lasting 8-9 weeks. Phases were: Baseline 1, Caloric Feedback, Baseline 2, Labelling, Baseline 3, Token, Baseline 4.

- Caloric Feedback phase: two large signs were placed at the entrance listing all available menu items and corresponding caloric values.
- Labelling Phase: Sign at the front of canteen listed healthy food items qualifying for the 'green triangle'; the same healthy food items had a green triangle put beside them to ID them. Leaflets handed out encouraging people to choose 'green triangle' items.
- Token Phase: same as labelling phase but offered a stamp on a small card for each 'green triangle' food selected. After receiving 10 stamps, the student got a $1 rebate.

Results:
Caloric feedback: Resulted in reduction of carbohydrates for all subjects and carbs stayed low after the intervention ended. It appears that carb intake was particularly high during baseline one, however, so results are difficult to interpret. Also found an increase in salad and veg/soup/fruit categories and a decrease in high-fat dessert/sauces category for female 'obese' subjects.

Labelling Phase: Changes reported for some subgroups but no overall changes detected. Increase in veg/soup/fruit categories for both male/female obese groups. Decline in carb consumption for 'normal' female subjects.

Token Phase: Produced 'most uniform' change in behaviour: 88% of students participated in token system; produced a sig. rise in salad and chicken/fish/turkey and increases in veg/soup/fruit/low-fat dairy. Consumption of high fat/dessert/sauces dropped for all females and male 'leans'.

Limitations: Pre-post study, not RCT. The study relied on there being no long-term effects of each programme because they needed the baselines to return to 'normal' after each intervention.

[33]Cinciripini, P. (1984). Changing food selections in a public cafeteria: an applied behaviour analysis. *Behaviour Modification, 8(4)*, 520-539.

References

Arvai-Campbell, V., Arvai, J., Kalof, L. (2014). Motivating sustainable food choices: The role of nudges, value orientation, and information provision. *Environmental Behaviour, 46(4)*, 453-475.

Bandoni, DH., Sarno, F., Jaime, PC. (2011). Impact of an intervention on the availability and consumption of fruits and vegetables in the workplace. *Public Health Nutrition, 14(6)*, 975-981.

Bedard, K. and Kuhn, P. (2015). Micro-Marketing Healthier Choices: Effects of Personalized Ordering Suggestions on Restaurant Purchases. *Journal of Health Economics,39*, 106-122.

Beresford, S., et al. (2001). Seattle 5 a Day worksite program to increase fruit and vegetable consumption. *Preventive Medicine, 32*, 230-238.

Bucher, T et al. (2016). Nudging consumers towards healthier choices: A systematic review of positional influences on food choice. *British Journal of Nutrition, 115*, 2252-2263.

Carins, J.E., Rundle-Thiele, S.R., Parkinson, J.E. (2017). Delivering Healthy Food Choice: A Dual-Process Model Enquiry. *Social Marketing Quarterly, 23(3)*, 266-283.

Cinciripini, P. (1984). Changing food selections in a public cafeteria: an applied behaviour analysis. *Behaviour Modification, 8(4)*, 520-539.

Dayan, E., Bar-Hillel, M. (2011). Nudge to nobesity II: menu positions influence food orders. *Judgement and Decision Making, 6(4)*, 333-342.

Deliens, T. et al. (2016). Effectiveness of Pricing Strategies on French Fries and Fruit Purchases among University Students: Results from an On-Campus Restaurant Experiment. *PLoS ONE, 11(11)*: e0165298.

Dubbert, P.M., Johnson, W.G., Schlundt, D.G., Montague, N.W. (1984). The influence of caloric information on cafeteria food choices. *Journal of Applied Behavior Analysis, 17(1)*, 85-92.

Freedman, M.R. (2011). Point-of-selection nutrition information influences choice of portion size in an all-you-can-eat university dining hall. *Journal of Foodservice Business Research, 14*, 86-98.

Freedman, M., Brochado, C. (2010). Reducing portion size reduces food intake and plate waste. *Obesity, 18*, 1864-1866.

Geaney, F. et al. (2016). The effect of complex workplace dietary interventions on employees' dietary intakes, nutrition knowledge and health status: a cluster controlled trial. *Preventative Medicine, 89*, 76-83.

Geaney, F, Kelly C., Greiner B., Harrington J., Perry I.J., Beirne, P. (2013). The effectiveness of workplace dietary modification interventions: A systematic review. *Preventative Medicine, 57*, 438-447.

Grech, A, Allman-Farinelli M. (2015). A systematic literature review of nutrition interventions in vending machines that encourage consumers to make healthier choices. *Obesity Reviews, 16*, 1030-1041.

Halimic, A., Gage, H., Raats, M., Williams, P. (2018). Effect of price and information on the food choices of women university students in Saudi Arabia: An experimental study. *Appetite,123*, 175-182.

Harnack et al. (2008). Effects of calorie labelling and value size pricing on fast food meal choices: Results from an experimental trial. *International Journal of Behavioural Nutrition and Physical Activity, 5(63)*.

Heathcote, F., Baic, S. (2011). The Effectiveness and acceptability of a traffic light labelled menu with energy information to signpost customers towards healthier alternatives in a table service restaurant. *Journal of Human Nutrition and Dietetics, 24*, 390.

Holdsworth, M., Raymond, N., Haslam, C. (2004). Does the Heartbeat Award scheme in England result in change in dietary behaviour in the workplace? *Health Promotion International, 19 (2)*, 197-204.

James, A., Adams-Huet, B., Shah, M. (2015). Menu labels displaying the kilocalorie content or the exercise equivalent: effects on energy ordered and consumed in young adults. *American Journal of Health Promotion, 29(5)*, 294-302.

Jeffery, RW., French, SA., Raether, C., Baxter, JE. (1994). An environmental intervention to increase fruit and salad purchases in a cafeteria. *Preventative Medicine, 23(6)*, 788-792.

Kushida, O., Murayama, N. (2014). Effects of environmental intervention in workplace cafeterias on vegetable consumption by male workers. *Journal of Nutrition Education and Behaviour, 46(5)*, 350-358.

Maes, L. et al. (2012). Effectiveness of workplace interventions in Europe promoting healthy eating: A systematic review. *European Journal of Public Health, 22(5)*, 677-682.

Matson-Koffman, D.M., Brownstein, J.N., Neiner, J.A., and Greaney, M.L. (2005). A site-specific literature review of policy and environmental interventions that promote physical activity and nutrition for cardiovascular health: What works? *American Journal of Health Promotion, 19(3)*, 167-92.

Mazza, M.C. (2013). Encouraging Healthful Dietary Behavior in a Hospital Cafeteria: A Field Study Using Theories from Social Psychology and Behavioral Economics. Doctoral dissertation, Harvard University.

Minimum Nutritional Standards for Catering in Health and Social Care. http://www.publichealth.hscni.net/publications/minimum-nutritional-standards-catering-health-and-social-care-staff-and-visitors. Accessed 17.04.2018.

O'Brien, L., Palfai, T. (2016). Efficacy of a brief web-based intervention with and without SMS to enhance healthy eating behaviours among university students. *Eating Behaviors, 23*, 104-109.

Papies, Esther K., Veling, Harm (2012). Healthy Dining. Subtle diet reminders at the point of purchase increase low-calorie food choices among both chronic and current dieters. *Appetite 61* (2013), 1-7.

Patsch, A.J., Smith, JH., Liebert, M.L., Behrens, T.K., Charles, T. (2016). Improving Healthy Eating and the Bottom Line: Impact of a price incentive program in 2 hospital cafeterias. *American Journal of Health Promotion, 30(6)*, 425-432.

Peterson, S., Duncan, D., Null, D., Roth, S., Gill, L. (2010). Positive changes in perceptions and selections of healthful foods by college students after a short-term point-of-selection intervention at a dining hall. *Journal of American College Health, 58(5)*, 425-431.

Pratt, N.S., Ellison, B.D., Benjamin, A.S., Nakamura, M.T. (2016). Improvements in recall and food choices using a graphical method to deliver information of select nutrients. *Nutrition Research, 36(1)*, 44-56.

Rolls, B. et al. (2007). Using a smaller plate did not reduce energy intake at meals. *Appetite, 49*, 652-660.

Skov, L.R. et al. (2013). Choice architecture as a means to change eating behaviour in self-service settings: a systematic review. *Obesity Reviews, 14*, 187-196.

Steenhuis, I. et al. (2004). The impact of educational and environmental interventions in Dutch worksite cafeterias. *Health Promotion International, 19(3)*, 335-343.

Thorndike, A. et al. (2012). A 2-Phase labelling and choice architecture intervention to improve healthy food and beverage choices. *American Journal of Public Health, 102(3)*, 527-533.

Thorndike, A., et al (2014). Traffic-light labels and choice architecture promoting healthy food choices. *American Journal of Preventative Medicine, 46(2)*, 143-149.

Van Kleef, E., Otten, K., van Trijp, H.C.M. (2012). Healthy snacks at the checkout counter: A lab and field study on the impact of shelf arrangement and assortment structure on consumer choices. *BMC Public Health, 12*.

Vyth, E.L., et al. (2011). Influence of placement of a nutrition logo on cafeteria menu items on lunchtime food choices at Dutch work sites. *Journal of American Dietetic Association, 111*, 131-136.

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