

Overview of existing knowledge concerning food behaviour interventions out-of-home, in the working environment and in health care settings – A literature review

Wageningen Economic Research, September 2020 | Machiel Reinders, Emily Bouwman and Danny Taufik



Preface

So-called 'closed settings', like restaurants, canteens, hospitals and other out-of-home locations, can play an important role in improving diet quality by offering healthier and more sustainable food choices (i.e., more vegetables, less meat) on their menus. This report aims to provide an overview of different real-life interventions focused on food choice behaviour of consumers in these closed settings.

This overview has been helpful for the partners in the PPP 'Food, Value and Impact' and the subsequent PPP 'Implementation of food interventions in health care and out of home' (in Dutch: 'Implementatie van voedingsinterventies in intramurale zorginstellingen en horeca'). In these PPPs we developed and tested interventions in real life based on the insights of this report in which former research has been studied.

Furthermore, the report can be helpful for other practitioners who want to stimulate healthy and sustainable food choices within closed settings, like caterers, restaurant owners, health care staff, employers or other providers of food. Additionally, this overview can be helpful for researchers who are interested in or want to develop an intervention in one of these settings.

The study has been performed within the PPP 'Food, Value and Impact' and the PPP 'Implementation of food interventions in health care and out of home' (in Dutch: 'Implementatie van voedingsinterventies in intramurale zorginstellingen en horeca'). We thank the Dutch government and the Topsectors Agri&Food and Tuinbouw&Uitgangsmaterialen (AF-16106 and KV-1605, KV-18012) for the financing of the PPPs.



Preface

Furthermore, we thank our colleagues in the PPP for their feed back and contribution: Monique Medema en Elena Cavagnaro (NHL Stenden Hogeschool), Michel Altan (Breda University of Applied Sciences), Lilou van Lieshout and Arzien Wels (Greendish), Marieke Battjes-Fries, Gerda Pot, Olga Patijn en Peter Voshol (Louis Bolk Instituut), Esmée Doets (Wageningen Food & Biobased Research).

Moreover, we would like to thank the partners in the PPPs for their contribution to a more healthy and sustainable society. First, we like to thank the partners of the PPP 'Food, Value and Impact': Clusius College, Compass Groep (Eurest), Gemeente Horst aan de Maas, Gemeente Venray, GreenCo, GreenPort Noord Holland Noord, HMS Hosting Koninklijke Horeca Nederland, Rabobank, The Greenery, Unilever, Van der Valk Vitaal, Van Gelder. Secondly, we are grateful for the contribution of the partners of the PPP 'Implementation of food interventions in health care and out of home' (in Dutch: 'Implementatie van voedingsinterventies in intramurale zorginstellingen en horeca'): Accor, Albron, Atlantis Handelshuis Azora, Bidfood, Bonduelle, CELTH, De Bakker, Drukkerij Lijnco, Dutch Cuisine, Friesland Campina, Fysiotherapiepraktijk Hokkeling&Huibers, Gemeente Meppel, Gemeente Rotterdam, Gemeente Steenwijkerland, Gemeente Westerveld, GGZ Noord-Holland-Noord, Greenco, HMSHost , JOGG, Kinderopvangorganisaties, Koppert Cress, Landal, Nederlandse Fruittelers Organisatie (NFO), Ondernemerspunt, Pennemes en Het Mennistenerf, Physique Preventiecentrum Epe, Sportcentrum Iedema, Stichting in Beweging, Tasty Basics, UMCG, Van de Kamp&Lolkema, Van Gelder groente&fruit, Van Kekem Fruit, IJsselland Ziekenhuis, Zorggroep Noordwest Veluwe, Zorgzaak.

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Summary

So-called 'closed settings', like restaurants, canteens, hospitals and other out-of-home locations, can play an important role in improving diet quality by offering healthier and more sustainable food choices (i.e., more vegetables, less meat) on their menus. This report aims to provide an overview of different real-life interventions focused on food choice behaviour of consumers in these closed settings. For this purpose, a review of the literature has been conducted with a main focus on interventions promoting healthy and sustainable food choices in three real-life closed settings, namely *out-of-home, the working environment* and *health care settings*. This deliverable provides insight into which type of behavioural interventions have been tested and are particularly effective in stimulating healthy and/or sustainable food choices in each of these settings. The overview is based on 79 studies in total (*out-of-home: 24; working environment: 33; health care: 22*), that were found by doing a literature search in the database Web of Science.

Results show that across the three settings, the large majority of the interventions were through an environmental intervention, for example a type of nudging, and fewer studies used and tested some form of education/information provision. More specifically, in the settings *out-of-home* and *working environment* most interventions tested a type of nudging strategy to stimulate healthy and/or sustainable food choices. In the *health care* setting, studies consisted mostly of a type of environmental intervention, where modifications were made in, for example, the way menus were offered or the type of offered products was altered.

Across settings, most studies were successful in influencing their outcome variable of interest. Overall, multi-component studies appear to be somewhat more successful than single-component interventions. In both *out-of-home* and *working environment* settings, studies that use priming nudges (i.e., by means of visibility, accessibility and availability) seem to be most successful, whereas mixed results were found for salience nudges (i.e., colour-coded labelling appeared to be more effective than calorie labelling). In the *health care* setting, environmental interventions were more successful than educational interventions. Specifically, the environmental studies using salience nudges, by means of labelling and verbal prompts, were effective. Priming nudges by means of accessibility (i.e., an alternative menu-ordering system) and visibility (enhancing ambiance) were also effective.



Summary

Note that, although the studies that are described in this deliverable are based on a thorough assessment of the literature, it cannot be labelled as a systematic review as it did not follow all necessary steps that are needed to qualify as a systematic review. The articles described depend on the search criteria that were set for the literature search. Therefore it is possible that some relevant studies might be missing. Nevertheless, this literature review gives an overview of which intervention components are particularly effective in stimulating healthy and/or sustainable food choices in each of the settings.

This overview can be helpful for practitioners who want to stimulate healthy and sustainable food choices within closed settings, like caterers, restaurant owners, health care staff, employers or other providers of food. Additionally, this overview can be helpful for researchers who are interested or want to develop an intervention in one of these settings.

This report is an update of the report 'Overview of existing knowledge concerning food behaviour interventions out-of-home, in the working environment and in online settings' from the PPP project *Food, Value, Impact* with input from the PPP project *Implementation of food interventions in health care and out of home* (in Dutch: *Implementatie van voedingsinterventies in intramurale zorginstellingen en horeca*).



Samenvatting

Zogenaamde 'gesloten settings', zoals restaurants, kantines, ziekenhuizen en andere locaties buitenshuis, kunnen een belangrijke rol spelen bij het verbeteren van de kwaliteit van de voeding door gezondere en duurzamere voedingskeuzes (dat wil zeggen meer groenten, minder vlees) op hun menu's aan te bieden. Dit rapport geeft een overzicht van verschillende praktijkinterventies die zijn gericht op voedselkeuzegedrag van consumenten in deze gesloten settings. Hiervoor is een literatuurstudie uitgevoerd waarbij de nadruk lag op interventies ter bevordering van gezonde en duurzame voedingskeuzes in drie reële gesloten settings, namelijk *buitenshuis, de werkomgeving en de gezondheidszorg*. Dit rapport geeft inzicht in de verschillende soorten gedragsinterventies die zijn getest en die met name effectief zijn in het stimuleren van gezonde en/of duurzame voedingskeuzes in de genoemde omgevingen. Het overzicht is gebaseerd op 79 studies (*buitenshuis:* 24: *werkomgeving:* 33: *gezondheidszorg:* 22), die werden gevonden door het uitvoeren van een literatuuronderzoek in de database Web of Science.

De resultaten laten zien dat in de drie settings de overgrote meerderheid van de interventies door middel van een omgevingsinterventie is uitgevoerd, bijvoorbeeld in de vorm van een soort duwtje in de rug (*nudge*), en dat er minder studies waren gericht op educatie/informatievoorziening. In de omgevingen *buitenshuis* en in de *werkomgeving* is bij de meeste interventies een soort *nudging* strategie getest om gezonde en/of duurzame voedingskeuzes te stimuleren. In de gezondheidszorg bestond het onderzoek meestal uit een soort omgevingsinterventie, waarbij bijvoorbeeld de manier waarop menu's werden aangeboden of het type aangeboden producten werd aangepast.

In alle settings zijn de meeste studies succesvol geweest in het beïnvloeden van de gewenste uitkomsten. Over het geheel genomen lijken studies met meerdere componenten iets succesvoller te zijn dan interventies met één component. In zowel de setting *buitenshuis* als in de *werkomgeving* lijken studies die gebruik maken van priming nudges (met behulp van zichtbaarheid, toegankelijkheid en beschikbaarheid) het meest succesvol, terwijl de resultaten voor salience nudges verdeeld waren (kleurgecodeerde labelling bleek effectiever te zijn dan calorie-labelling).



Samenvatting

In de *gezondheidszorg* waren omgevingsinterventies succesvoller dan educatieve interventies. Met name de omgevingsstudies waarbij gebruik werd gemaakt van *salience nudges*, door middel van etikettering en verbale aanwijzingen, waren effectief. *Priming nudges* door middel van toegankelijkheid (dat wil zeggen een alternatief menu-bestelsysteem) en zichtbaarheid (verbetering van de ambiance) waren ook effectief.

Let erop dat, hoewel de studies die in dit document worden beschreven gebaseerd zijn op een grondige bestudering van de literatuur, dit document niet kan worden bestempeld als een systematische review omdat niet alle noodzakelijke stappen zijn gevolgd die nodig zijn om het te kwalificeren als een systematische review. Voor de beschreven artikelen is gebruikgemaakt van de zoekcriteria die voor het literatuuronderzoek zijn vastgesteld. Daarom is het mogelijk dat enkele relevante studies ontbreken. Desalniettemin geeft dit literatuuroverzicht een overzicht van de interventiecomponenten die bijzonder effectief zijn in het stimuleren van gezonde en/of duurzame voedingskeuzes in elk van de settings.

Dit overzicht kan nuttig zijn voor mensen die gezonde en duurzame voedingskeuzes willen stimuleren binnen een gesloten omgeving, zoals cateraars, restauranthouders, gezondheidspersoneel, werkgevers of andere leveranciers van voedingsmiddelen. Daarnaast kan dit overzicht nuttig zijn voor onderzoekers die geïnteresseerd zijn of een interventie willen ontwikkelen in een van deze settings.

Dit rapport is een update van het rapport 'Overzicht van bestaande kennis omtrent eetgedrag-interventies buitenshuis, in de werkomgeving en in online omgevingen' uit het PPP-project *Food, Value, Impact* met input van het PPP-project *Implementation of food interventions in health care and out of home* (in het Nederlands: *Implementatie van voedingsinterventies in intramurale zorginstellingen en horeca*).



Introduction



Introduction

The aim of this report is to provide a review of the literature of real life interventions focused on the food choice behaviour of consumers. Over the past decades a lot of behavioural interventions to stimulate healthy and/or sustainable food choices and consumption among consumers have been developed and conducted. Skov and colleagues (2013) note that many of these studies to promote healthy eating have not (yet) been conducted in natural environments, i.e. real-life settings, such as restaurants. Most of these studies have been conducted under conditioned circumstances (e.g., food laboratories or online experiments). The added value of conducting studies in real-life settings is becoming more clear, as it is increasingly being acknowledged that the environment plays an important role in stimulating and inhibiting food choices (Wansink, 2015). Additionally, it could be argued that dietary change interventions can have the greatest impact when they are conducted in so-called 'closed settings', i.e., restaurants and canteens, as it is easier in these settings to sway customers towards making healthier choices (Bianchi et al., 2018). Therefore, restaurants, canteens, hospitals and other out-of-home locations can play an important role in improving diet quality by offering healthier and more sustainable food choices (i.e., more vegetables, less meat) on their menus (for an overview see Kraak et al., 2017 and Lorenz & Langen, 2018).

For this purpose, a review of the literature has been conducted with a main focus on interventions promoting healthy and sustainable food choices in each of the closed settings (i.e., *out-of-home, working environment* and *health care*). In this research, a literature review is a review of the literature without strictly applying the systematic methodology that is needed in a systematic literature review. The results can be found in this deliverable, which aims to provide an overview of which type of behavioural interventions have been tested and are particularly effective in stimulating healthy and/or sustainable food choices in each of the closed settings.



Introduction

This report is based on two PPP projects. First, the PPP project *Food, Value, Impact* (Reinders, Bouwman, & Taufik, 2019) provided insight into existing knowledge about the effects of environmental interventions that lead to healthy and sustainable consumer behaviour in three real-life settings: out-of-home (e.g., restaurants and cafeterias), working environment (e.g., onsite restaurants and canteens) and online (e.g., websites).

The subsequent PPP project, *Implementation of food interventions in health care and out of home* (in Dutch: *Implementatie van voedingsinterventies in intramurale zorginstellingen en horeca*), added health care as a new setting where food behaviour interventions are conducted. Health care as a setting for food behaviour interventions is relevant, since there is an increasing awareness of the relationship between food and health among health care professionals and other stakeholders that are involved in providing food in health care settings. Furthermore, health care professionals show a need for evidence-based knowledge on how healthy food choice behaviour can be stimulated (see for example Actieplan Taskforce Gezond Eten met Ouderen, Chapter 4).



Introduction – Type of intervention

Interventions can be arranged according to a 'ladder'; interventions that are higher up the ladder are more intrusive and therefore require a stronger justification (Nuffield Council on Bioethics, 2007). In that respect, Rothschild (1999) distinguishes three classes of behavioural intervention tools, namely education, marketing, and law. Education (or providing information) can be seen as one end of the intervention spectrum, as it is completely voluntary and seeks to empower consumers to make their own choices once they are equipped with accurate information (Nuffield Council on Bioethics, 2007). Regulation can be considered the other end, as the intervention is coercive, choice is restricted or eliminated and punishment is imposed for noncompliance. Marketing falls in between these two: behaviour is reinforced, induced by environmental changes (i.e., choice architectures or nudges) or (financial) (dis)incentives, but consumers keep free choice.

In the current literature review, we structure the type of intervention according to this tripartite classification, with an emphasis on education (or information provision) and nudging/environmental interventions (as part of what Rothschild refers to as 'marketing tools'), since we found only one study that focused on regulation/law.

To further disentangle the interventions that apply some type of environmental intervention by means of nudging, we use an existing framework developed by Wilson et al. (2016, Table 1, p. 49):

- Priming nudges: altering the visibility, availability and/or accessibility of food and beverages in the environment to nudge a particular choice.
- Salience nudges: increasing the salience of healthier or sustainable options, for example by different types of labelling, but also by tastings or altered portion sizes.
- *Default nudges*: a particular choice is pre-set, which makes it the easiest option.
- Incentive nudges: incentives are used to either reinforce a positive choice, or to punish a negative choice.
- Commitments and ego nudges: consumers make a commitment or promise, and their desire to feel good about themselves will nudge them to make choices consistent with their commitment or promise.
- Norms and messenger nudges: other people (of status) are used to establish a norm, as consumers are influenced by comparing themselves to others or by whom they receive information from.



Methodology

- Search terms
- Screening process
 - Round 1
 - Round 2
 - Round 3
- Screening process of health care setting
- Paper selection flow chart for inclusion into review of the literature



Methodology: Search terms

Criteria that were used to initiate the literature search were: (1) the study should involve some kind of field experiment, (2) the outcome variable of the study should be some kind of behavioural measure, (3) the study should concern the food domain and (4) the study should be applied in one of the relevant settings (i.e., *out-of-home, working environment* and *health care*). Based on these criteria, an initial list of search terms for the literature review for electronic searching of appropriate databases (i.e., 'Web of Science') was developed. The search covered studies in the period from 2000 to 2017 for *out-of-home* and *working environment* and 2000 to 2019 for *health care setting*. The search terms were included in the topic section of the database, and in the keywords, title, or abstract of the article being searched. Only articles published in English were included. The search terms were tested and refined through several rounds of paper identification, running the full search term in 'Web of Science', until the resulting database was manageable, while simultaneously demonstrating face validity (i.e. important key papers in the area of interest were picked up by the search string used). Appendix 4 provides the final search strings for each of the settings.

The search for *out-of-home* and *working environment* was conducted on 31 March 2017 in Web of Science, which yielded 3,440 papers for the setting *out-of-home* and 2,464 papers for the setting *working environment*. The search for *health care setting* was conducted on 22 May 2019 in Web of Science, which yielded 1,903 papers.



Methodology: Screening process

Round 1

The retrieved papers were screened based on their title. Although not all necessary information can be deducted from the titles, they provided a first indication whether a paper is relevant or not. For example, papers that were clearly outside the behavioural domain (e.g., medical articles, microbiological articles, etcetera) as well as papers targeted at specific diseases or specific groups that were outside the scope of this project (e.g., children) were excluded. Furthermore, if the title provided that information, we excluded studies that evaluated specific health campaigns in specific countries/regions. With regard to the review of literature of interventions in health care settings, titles that indicated that the studies were targeted at specific eating problems in hospitalisation (e.g., dysphagia; eating certain products after abdominal surgery) or nutritional interventions/ supplementation after surgery or hospitalisation, were excluded. Furthermore, interventions for specific patient groups (e.g., cancer, diabetes, etc), but that were not in relation to hospitalisation, were excluded. Also studies focusing on home care or community-dwelling groups (i.e., elderly or individuals with developmental disabilities) were excluded.

Based on this screening 101 papers for the setting *out-of-home* and 157 papers for the setting *working environment*, and 127 papers for the setting *health care* were selected. The selected papers were stored in EndNote.



Methodology: Screening process

Round 2

The remaining papers were further screened for inclusion/exclusion in the literature review based on the paper abstracts. If doubting whether a paper should be included, the full paper was retrieved to obtain the relevant information. The following *exclusion criteria* were used to identify papers that were relevant to the literature review:

- 1. Study not in English
- Interventions executed among specific 'niche' target groups (e.g., people with certain diseases or syndromes, specific ethnic minority groups). This also includes interventions focused on children (e.g., on schools, kindergartens, etcetera). More general target groups, like low socio-economic status families were included.
- 3. Interventions aimed at specific diseases (e.g., cancer, coronary heart diseases, nutritional deficiencies) or specific health aspects (e.g., dental health, obesity).
- 4. Interventions executed in developing countries, since these countries have their own dynamics that do not allow to 'translate' the results to a western context.
- 5. Interventions that do not focus on food (e.g., focused on alcohol, smoking, physical activity, gardening).
- 6. Interventions that focused on other aspects of food instead of food consumption (e.g., food safety, contamination).
- 7. Interventions that focused on evaluations of specific programmes or campaigns (e.g., national school programmes on fruit and vegetables or specific nutrition education programmes).
- 8. Papers that contain no interventions (i.e., qualitative studies, correlational studies, cross-sectional studies or trend analyses). If these papers appeared to be relevant for the project (e.g., systematic reviews or literature overviews that contain relevant information), they were separately stored in a group in EndNote (labelled Non-experimental papers).



Methodology: Screening process

Round 3

The papers with relevant field experiments were retrieved and the abstracts were screened for incorporation in the literature review. Although the dropout rate was significantly smaller than in the previous rounds, also in this round some papers were dropped from further analysis. Reasons for exclusion were:

- 1. The full paper was not retrievable.
- 2. The paper presents no empirical results but merely a protocol/description of the empirical study.
- 3. It appears from screening the paper that the paper still met one of the exclusion criteria as formulated in the previous (second) round.



Methodology: Screening process of health care setting

The screening process of the papers related to the search for the *health care setting* was slightly different compared to the other settings after the title screening in the first round. In contrast to the other settings, only one additional second round of screening was applied based on the paper abstracts (so round 2 and 3 were combined). Furthermore, the eligibility criteria differed a bit from the other literature search concerning the other settings. The following *exclusion criteria* were used to identify papers that were relevant to the literature review:

- 1. Study is not in English
- 2. No empirical results are presented (e.g., only a study protocol is described)
- 3. Interventions executed in developing countries, since these countries have their own dynamics that do not allow to 'translate' the results to a western context
- 4. Interventions executed among specific 'niche' target groups (e.g., specific ethnic minority groups). More general target groups, like low socio-economic status families were included
- 5. Interventions aimed at specific diseases (e.g., cancer, coronary heart diseases, nutritional deficiencies) or specific health aspects (e.g., dental health, obesity) are *not* excluded, unless it does not take place in a health care setting (e.g., home care)
- 6. Papers that contain no interventions or field experiments (i.e., qualitative studies, correlational studies, cross-sectional studies or trend analyses)
- 7. Interventions that do not focus on food (e.g., focused on alcohol, smoking, physical activity, gardening)
- 8. Interventions that focused on other aspects of food instead of food consumption (e.g., food safety, contamination)
- 9. Studies that were not executed in a real-life context are excluded (i.e., lab or online studies)
- 10. Specific nutrition studies were excluded (supplements or meal-enriched interventions).



Paper selection flow chart for inclusion into review of the literature

The following figure provides an overview of the number of papers in each of the rounds of the literature review process. The final number of articles was relatively equally distributed over the settings: 24 articles for *out-of-home*, 33 for *working environment* and 22 for *health care*.



Overall results (across the three settings)



Results: Overall synthesis

The literature revealed a number of similarities concerning the interventions conducted in the settings *out-of-home and working environment* show, but also some differences.

Outcome variables

In the settings *working environment* and *health care* most studies focused on a form of food intake/consumption as a main outcome variable, respectively 22 of the 33 studies for the setting *working environment* and 11 of the 22 studies in *heath care* setting. For the setting *out-of-home*, most studies used purchases/sales of healthy food items as main outcome variable: 18 of the 24 studies. For *working environment* 10 of the 33 studies also included purchases/sales as a main outcome variable. In addition, in the *health care* setting a lot of studies focused on energy and macro nutrient intake and non-invasive phenotypical measures (e.g., body weight) as outcome variables. Often a combination of both outcome variables was used. Finally, most of the studies focus on stimulating healthy food choices.



Results: Overall synthesis

Type of interventions

In the settings *out-of-home, working environment* and *health care*, the large majority of the interventions were through an environmental intervention, for example a type of nudging, and fewer studies used and tested some form of education/information provision. Across settings, most studies were successful in influencing their outcome variable of interest.

Out-of-home – Most studies tested a priming nudge (either by means of increased visibility, accessibility or availability) or a salience nudge (by means of calorie labelling, descriptive labels, colour labelling, taste testing or reducing plate size). A smaller number of studies (also) tested information or education tools as part of the intervention (e.g. factsheets, guides and education programmes). Only one intervention captured regulation.

Working environment – Most studies tested a priming nudge (either by means of visibility, accessibility or availability) or a salience nudge (by means of calorie labelling or colour labelling). A smaller number of studies (also) tested information or education tools as part of the intervention (e.g. nutrition information and workshops).

Health care - Studies consisted mostly of a type of environmental intervention, where modifications were made in, for example, the way menus were offered or the type of offered products was altered.



Single vs multi-component

Particularly in the setting *working environment*, there were relatively many multiple-component studies, in which multiple intervention mechanisms were tested simultaneously. Overall, multi-component studies appear to be somewhat more successful than single-component interventions. Thus, using multiple intervention mechanisms simultaneously in a single intervention might be more effective than using a single intervention mechanism. However, testing multiple intervention mechanisms simultaneously also has certain disadvantages: costs are often (but not always) higher for multi-component interventions. Moreover, when multiple mechanisms are tested at the same time it is not possible to pinpoint where an effect comes from.

Non-behavioural measures

In the setting *out-of-home* about half of the papers also discuss non-behavioural outcome measures in the abstract. For the setting *health care* about two thirds of the papers discuss non-behavioural measures. In the setting *working environment*, only a quarter discuss non-behavioural measures most used in the *out-of-home* setting are attitudes, awareness and intentions. In the setting *working environment*, self-efficacy, food satisfaction and intentions are mentioned most. The non-behavioural measures most used in the *health care* setting were measures on satisfaction, mental state or quality of life.

In the settings *out-of-home* and *health care*, in most cases an increase in one of the non-behavioural measures led to a change in one of the behavioural outcomes. In the setting *working environment*, this was the case for half of the studies. However, all settings also included studies that only found an effect of their intervention on the non-behavioural measures, and no effect on the behavioural measures. The setting *working-environment* was the only setting with studies that found no effects on non-behavioural measures, but did find effects on the behavioural measures.



Results: Out-of-home setting

Summary

- Type of interventions
- Outcome variables
- Effectiveness of single interventions
- Effectiveness of combined interventions
- Non-behavioural measures

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Summary



Appendix 1 presents an overview of the relevant articles for the setting out-of-home. The following paragraphs describe point-by-point the main results of the literature review for interventions in this setting.

The studies conducted in an out-of-home setting did not necessarily focus on actual sit-down restaurants; most studies focused on fast-food environments or some kind of self-service restaurant. The main outcome-variable studies focused on is the purchase (sales) of healthy menu items. The non-behavioural measures most used were attitudes, awareness and intentions. The majority of studies were single-component, thus manipulating and testing a single variable. Manipulations consisted mostly of a type of nudge (mainly a salience or a priming nudge; Wilson et al., 2016). Calorie labelling was most often used as a technique to influence the purchase of healthy menu items. Overall, most studies were effective. Specifically, all the studies using **priming nudges** by means of **visibility**, **accessibility** and **availability** were successful. **Salience nudges** by means of **calorie labelling** were mostly ineffective and **salience nudges** by means of **descriptive labels** were mostly effective. **Financial incentives** did not elicit an additional effect compared to using only labels.

Descriptives (number of articles, setting specifications, target group)

- In total 24 articles are incorporated.
- Not many interventions focused on actual sit-down restaurants (merely 5 studies). The rest of the interventions focused on either fast-food restaurants (5 studies), self-service cafeterias (11 studies), take-away (1 study), a train station snack shop (1 study) or private dining areas (1 study).
- In total 7 interventions took place at a university, 3 interventions in a hospital cafeteria, 1 in a sporting canteen, 1 in a hotel and 1 in a swimming pool.
- The target groups of the interventions were mainly customers of the mentioned locations.



Type of interventions¹



- Only 4 out of 24 studies are intervention programmes focusing on multiple components in their interventions. Therefore, most studies focused on a single component in their intervention or used different experimental groups to test different components separately.
- Used intervention mechanisms:
 - Priming nudge by means of visibility (6 studies)
 - Priming nudge by means of accessibility (4 study)
 - Priming nudge by means of availability (4 studies)
 - Salience nudge by means of calorie labelling (10 studies)
 - Salience nudge by means of descriptive labels (5 studies)
 - Salience nudge by means of colour coded traffic light (3 studies)
 - Salience nudge by means of taste testing (3 studies)
 - Salience nudge by means of reducing plate size/invitation to downsize meal (2 studies)
 - Point-of-decision/point-of-purchase prompts (4 studies)
 - Norms and messenger nudge (3 studies)
 - Default nudge (1 study)
 - Providing education & information (e.g. table tents, signs, posters, media, advertising, promotional materials, education programmes, group sessions, digital menu boards, guides, factsheets (8 studies)
 - Financial incentive (5 studies)
 - Regulation (1 study)

¹ It is possible that the amount of studies assigned to the different intervention types is bigger than the amount of studies that are included in the overview. This is because in some cases a study can have multiple types of interventions. Alternatively, a single intervention in a study can test multiple different intervention mechanism simultaneously (i.e., multi-component interventions).



Outcome variables



- Main behavioural outcome variables: purchase (sales) of healthy menu items (total calories ordered) (18 studies), (self-reported) food consumption (4 studies), and fruit and vegetable intake (2 studies).
- Non-behavioural outcome variables that are reported, are: awareness of the campaign/implementation of intervention activities (6 studies) and attitudes towards healthy food (3 studies).
- Other interesting (behavioural and non-behavioural) outcome variables that were only considered in a single study were: food waste, intentions towards repatronage, willingness to pay, acceptance of smaller portions, weight and waist circumference, emotional eating, diet related self-efficacy, and barriers to weight management when eating out.



Effectiveness of single interventions



- All the studies on priming nudges by means of visibility, accessibility and availability were effective in increasing healthy purchases and fruit and vegetable consumption. One study found that adding extra disclosure information, had no extra effect.
- Salience nudges by means of calorie labelling was mostly ineffective. Only three studies found an effect on calorie consumption/purchasing. In one study, adding traffic lights elicited an effect on selecting low-calorie items. But in another study, which did find an effect of calorie labels, adding traffic lights had no additional effect. One study solely studying traffic lights, found an effect, but only under certain conditions.
- Salience nudges by means of reducing plate size/or invitation to downsize meals were effective in reducing food waste and reducing calories eaten.
- Salience nudges by means of **descriptive labels**, were effective in reducing food waste and increasing sales of certain food products. One study with salience nudging by means of **descriptive labels** and **taste testing** only found an effect on sales of healthy items in a subsample. **Financial incentives** had less impact than labels when it comes to influencing nutrition behaviour.
- Point-of-decision/purchase prompts were mostly effective in influencing purchase/intake behaviour. In one case it was only effective with sufficient motivation to change one's diet and sufficient objective nutrition knowledge.
- The default nudge was used only in one study, and it was successful. The ratio between the purchase of margarine and butter was changed sevenfold by reversing the positions.
- One study that focused on education through group sessions was effective. Participants in the intervention group lost significantly more weight, had lower average daily caloric and fat intake and had increased diet-related self-efficacy.



Effectiveness of combined interventions



- The 'Treat Yourself Well' intervention included a combination of providing information, taste testing and norms and messenger nudging, and was an effective intervention, influencing purchasing behaviour of healthy menu items.
- The 'Waupaca Eating Smart' intervention included a combination of providing information, taste testing, norms and messenger nudging, priming nudging (availability, accessibility, visibility), point-of-purchase prompts and financial incentives. The intervention found no, or minimal, changes in customer behaviour.
- A combined intervention, including providing information, priming nudging (availability) and salience nudging (calorie labels), had no effect on behaviour. It did affect respondents noticing and using nutrition information to select their food items.
- A combined intervention, including providing information, norms and messenger nudging, priming nudging (availability, accessibility, visibility) and financial incentives, was effective in influencing members of intervention clubs to purchase fruit and vegetable and non-sugar-sweetened products.





About half of the papers also discuss non-behavioural measures in the abstract. The non-behavioural measures most used are attitudes, awareness and intentions.

In most cases an increase in any of the non-behavioural measures leads to a change in the behavioural outcome. For example, in a study by Sonnenberg et al. (2003) respondents who noticed labels during the intervention and reported that labels influenced their purchases were more likely to purchase healthier items than respondents who did not notice labels. However, two studies only found an effect of their intervention on the non-behavioural measures, which was thus not translated into behaviour. Loureiro and Rahmani (2016) found that calorie information did reduce the probability of selecting high calorie meals in the questionnaire but did not have significant impact on actual purchasing behaviour in the field. Martinez-Donatel et al. (2015) found that restaurant food environment scores improved in the intervention community, however no or minimal changes in customer behaviours were observed.



Results: Working environment setting

Summary

- Type of interventions
- Outcome variables
- Effectiveness of interventions
- Non-behavioural measures



Summary



Appendix 2 presents an overview of the relevant articles for the setting 'Working environment'. The following paragraphs describe point-bypoint the main results of the literature review for this setting.

In sum, most studies focused on intake/consumption and about one-third of the studies focused on purchases/sales as main outcome variable. The non-behavioural measures most used are self-efficacy, food satisfaction and intentions. About two-third of the studies were multi-component studies, in which several intervention mechanisms were tested simultaneously. The interventions that were conducted in these studies consisted mostly of a type of nudge. Priming nudges (availability and accessibility) were most often used. Overall, most studies were effective. Specifically, all the studies using availability nudges were successful. Mixed results were found for labelling nudges: colour-coded labelling appeared to be more effective than calorie labelling. Knowledge gaps for this specific setting lay in exploring other nudging mechanisms (i.e., default options, social norms, commitment nudges, incentive nudges). In half of the cases, a change in the non-behavioural outcome measures, but this did not translate into changes in the behavioural outcome, and there were three studies that found no effects on the non-behavioural measures, but did find an effect on the behavioural measure.

Descriptives (number of articles, setting specifications)

- In total 33 articles are incorporated. Notice that 6 out of these 33 articles are written by Lassen et al.
- Most studies were published since 2010 (26 out of 33 articles).
- Hospital cafeteria/restaurant with hospital staff was most often used as a specific setting (7 times).



Type of interventions



20 out of 33 studies are intervention studies that focus on multiple components in their interventions.

Out of the total amount of 33 articles, 19 articles were incorporated that purely focused on interventions with nudges, like increased availability of healthy foods, labelling of food items, but also price incentives:	7 articles purely focused on interventions based on information and education:	7 articles focused on interventions that contain both environmental changes as well as information provision:
 Salience nudge by means of (colour-coded or calorie) labelling: 10 studies Priming nudge by means of increasing the availability: 6 studies Priming nudge by means of accessibility (making choices easier): 2 studies Priming nudge by means of visibility (rearranging menu items): 2 studies Use of financial incentives (i.e., discount or reduced price): 2 studies Commitment nudge (i.e., by means of pre-ordering): 1 study Social norm nudge: 1 study Combination of financial incentive and availability nudge: 2 studies 	 Providing information: either general nutrition information (folders), specific product information or tailored to the person (6 studies) Offering concrete activities: tastings, workshop, participatory strategies, mindfulness training (4 studies) Providing some form of feedback: either socially or personally (2 studies) Supporting the canteen owner in stimulating fruit and vegetable intake (1 study) Offering free fruit (1 study) 	 Providing information messages: for example '5-a-day' message or about the benefits of fruits and vegetables (4 studies) Promotions, e.g., use of POP displays, posters, stickers) (4 studies) Increased availability of healthy food items like fruits and vegetables (4 studies) Use of price incentives (i.e., price reductions) (3 studies) Use of labelling (2 studies) Other (i.e., social norms, organisational support, emphasise ways to adapt (new) skills in everyday life, increase in physical activity facilities) (4 studies)

Behavioural outcome variables

Most studies focused on intake/consumption as main outcome variable (22 studies, with no less than 17 studies focusing on fruit and/or vegetables intake, 6 studies reported fat
intake and also 6 studies focused on energy intake).

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• Additionally, 10 studies reported food purchases or sales data as outcome variable.

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Effectiveness of interventions



- From the 13 single component studies, 4 studies were not effective in influencing the outcome measures of interest. From the 20 multiple component studies, also 4 studies were not effective in influencing the outcome measures. However, when comparing both studies, the multiple component studies seem to be somewhat more successful (especially multicomponent studies with single interventions).
- Most of the 19 studies with nudging interventions were effective in influencing the outcome measure. In total, 16 out of the 19 articles were (partially) successful:
 - All availability nudges were successful.
 - Mixed results for accessibility nudges: changing choice architecture was not always successful.
 - Mixed results for labelling nudges: colour-coded labelling appeared to be more effective than calorie labelling.
 - Social norm and incentive nudges can enhance the effect of other nudges (i.e., colour-coded labelling) (see Thorndike, Riis & Levy, 2016).
 - In the study by Stites et al. (2015), both a commitment nudge (pre-ordering) and an incentive nudge (i.e. offering a discount) were employed. Although an effect was found, it is not possible to assign the effect to one of the nudges. Additionally, in the study by Thunström et al. (2016) a combination of visibility nudge (i.e., rearranging menu) and salience nudge (labelling) was applied.
- In total, 5 out of the 7 interventions that focused on information were successful:
 - Intervention designs with multiple components seem to be more successful than single interventions (all multi-component studies were effective, whereas no significant effects were reported for interventions with single components).
 - However, in interventions with multiple components it was difficult to disentangle what interventions exactly evoked the desired effects.
- In total, 4 out of the 7 studies that used a combination of environmental and informational interventions were successful.



Non-behavioural measures



About a quarter of the papers also discuss non-behavioural measures in the abstract. The non-behavioural measures mostly used are selfefficacy, food satisfaction and intentions.

In half of the cases, a change in the non-behavioural measures led to a change in the behavioural outcome. For example, in a study by Backman et al. (2011) an increase in self-efficacy towards eating 2 servings of fruit each day was found as well as a significant increase in fruit and vegetable consumption. However, a study by Engbers et al. (2006) did find a change in the non-behavioural outcome measures, namely an increase in social support, self-efficacy and attitudes, but this did not translate into changes in fruit, vegetable and fat intake. There were also three studies that found no effects on non-behavioural measures, but that did find an effect on the behavioural measure. For example, in a study by Lassen et al. (2014) healthy labelled meals did not lead to an increase in food satisfaction, but did show a mean decrease in energy density in the consumed meals.


Results: Health care setting

- Summary
- Descriptives
- Type of interventions
- Behavioural and non-behavioural outcome measures
- Effectiveness of single interventions
- Effectiveness of combined interventions
- Non-behavioural measures





Summary

Appendix 3 presents an overview of the relevant articles found for food interventions in health care settings. The following paragraphs describe point-by-point the main results of the literature review for interventions in this setting.

Most studies in health care settings focused on hospitals or nursing homes. The main behavioural outcome-variable studies focused on is food intake and non-invasive phenotypical measures (e.g., body weight). Often a combination of both outcome variables was used. Other behavioural outcome variables that were often used, was intake of macro-nutrients and/or energy. In 15 studies also non-behavioural outcome measures were used. The non-behavioural measures most used were measures on satisfaction or quality of life.

The majority of studies were single-component, thus manipulating and testing a single variable or using different experimental groups to test different components separately. Only 7 out of 22 studies are intervention programmes focusing on multiple components in their interventions. Manipulations consisted mostly of a type of environmental intervention, where modifications were made in, for example, the way menus were offered or the type of offered products was altered.

Overall, most studies were effective. Environmental interventions were more successful than educational interventions. Specifically, the environmental studies using **salience nudges**, by means of labelling and verbal prompts, were effective. **Priming nudges** by means of **accessibility** (i.e., an alternative menu-ordering system) and **visibility** (enhancing ambiance) were effective. However, **priming nudges** by means of **availability** of snacks to increase energy intake, was not as effective. A **social norm nudge** was partly effective.



Descriptives

Descriptives (number of articles, setting specifications)

- In total 22 articles are incorporated. Notice that quite a number of authors published more than 1 article (i.e., Holst et al., Mathey et al., McCray et al., Munk et al., Simmons et al.)
- Most studies were published since 2010 (14 out of 22 articles).
- 13 studies were conducted in hospitals, 9 studies were conducted in nursing homes and 1 study was conducted in group homes.

Some developments were observed within the included researches. The studies before 2010 mostly focused on ambiance, increased staff contact with patient, flavour of the meals, verbal prompts and dining together (one of them in cafeteria style).

In the studies from 2010 more focus on individualised counselling and offering of food is observed. With regard to the latter, especially interventions related to the food delivery system got attention: delivering food within a shorter time span. Multiple studies after 2010 imply that food used to be ordered 24h before the meal and on paper menus. These studies tried to change these circumstances. An example is that patients can order their food through an initiative called 'Meals on Wheels', so a patient can meet his or her current appetite (Goeminne et al., 2012). Technology was sometimes used to facilitate individualised counselling. One study showed nutrition assistants discussed meal options with the patients that suited their diet intake and personal preferences, which the assistant could send directly to the kitchen with a wireless mobile device (McCray, Maunder, Norris et al., 2018).



Type of interventions

8 out of 22 studies are intervention studies that focus on multiple components in their interventions.

Out of the total amount of 22 articles, 14 articles were incorporated that purely focused on environmental interventions

- Salience nudge by means of labelling (i.e., in a menu, altering taste, verbal prompts):
 5 studies
- Priming nudge by means of accessibility (timing, meal ordering system, new menu): 4 studies
- Priming nudge by means of increasing the availability: 3 studies
- Priming nudge by means of visibility (improving ambiance): 1 study
- Social norm nudge (attend a supervised dining room): 1 study

2 articles purely focused on interventions based on information and education:

- Staff received an integrity-promoting care training: 1 study
- Nutritional therapy: 1 study

6 articles focused on interventions that contain both environmental changes as well as information provision:

- Conversation about the meal and elements of social behaviour (smiling): 1 study
- Feedback & nudging by new dining program: 1 study
- Education, plans, improved menus and eating environment, and awareness: 1 study
- Improved eating environment and education on individual preferences and challenges for eating: 1 study
- Protein-enriched menu in conjunction with individualised dietary counseling: 1 study
- Protected Mealtimes, where mealtimes are protected from unnecessary and avoidable interruptions, providing an environment conducive to eating with multidisciplinary education: 1 study



Behavioural and non-behavioural outcome measures

All interventions have a behavioural outcome measure (since this was one of the selection criteria), but 15 papers also discuss nonbehavioural outcome measures.

Behavioural outcome measures that are reported in the studies

- food intake (on product level) (11 studies)
- body weight (10 studies)
- macronutrient intake (i.e., often focusing on proteins) (8 studies)
- energy/calorie intake (6 studies)
- biochemical indicators (e.g., blood tests) (3 studies)
- food orders (2 studies)
- food waste (2 studies)
- costs (2 studies)
- other body measures (e.g., height) (2 studies)
- nutritional practices (2 studies)
- other (i.e., outcome variable only once mentioned) (6 studies).

Non-behavioural outcome measures that are reported in the studies

- satisfaction (6 studies)
- psychological/mental state or depression (4 studies)
- quality of life (3 studies)
- appetite (2 studies)
- staff perceptions (2 studies)
- other (i.e., outcome variable only once mentioned) (7 studies).



- Most interventions were successful
- Environmental interventions (14 studies)
 - **Salience nudging** is effective in **4 out of 5 studies**. A *labelled menu*, led children in a hospital choosing more 'green-light' healthy choices and fewer 'red-light' items. *Verbal prompts* are also an effective intervention, increasing fluid intake in a nursing home and protein intake in a hospital. *Enhancing the taste* of a cooked meal with flavour and/or MSG in nursing homes, had no effect in one study, but did have a significant effect in another study.
 - **Priming nudge** by means of **accessibility** was effective in **3 out of 4 studies**. All four studies took place in hospitals. Three studies implemented a *new menu ordering system following the idea of room service*, which increased daily food intake, energy and protein intake and intake of oral nutritional supplements and decreased waste and patient food costs. Patients also appreciated the new system. One study tested a *new menu*, but was not effective in increasing energy and protein intake.
 - **Priming nudge** by means of increasing the **availability** was effective in **1 out of 3 studies**. The studies, one hospital study and two nursing home studies, *increased availability of food/ snacks* to increase weight. In the hospital, availability of snacks was not more effective than giving supplements, however it resulted in higher satisfaction. In the nursing home one study was effective and the other was not.
 - **Priming nudge** by means of **visibility** was effective (**1 study**). *Improving the ambiance* increased body weight and dietary intake in a nursing home.
 - **Social norm nudge** was partly effective (**1 study**). Attending a *supervised dining room* increased energy intake, but did not influence protein intake or weight.





Educational interventions (2 studies)

- An *integrity-promoting care training* in a nursing home, increased weight of patients with dementia. According to the staff, the program increased contact with the patients and promoted a more pleasant atmosphere.
- *Nutritional therapy* in a hospital, overall did not have an added value above providing patients with an oral nutritional supplement regarding energy and protein intake and quality of life.



Effectiveness of combined interventions

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- Most multi-component interventions successful, though it was not possible to differentiate which intervention had the most impact.

Interventions in nursing homes (2 studies):

- A study with two *communication strategies* (i.e. 1) focused conversation about the meal and the mealtime experience, and 2) specific elements of social behaviour (smiling, eye contact)), led to residents being able to sit at the table longer and eat more food, while body weight remained stable. There were no changes in proportion of fluids consumed.
- The 'Eat Right' intervention is a 2-component delivery system, including systematically changing and updating menus to include residents' food ratings, and a select menu and a buffet-style dining program, supporting resident food choice. It led to residents enjoying the food (service) more and also to an increased body weight and improved serum prealbumin levels.

Interventions in hospitals (4 studies):

- A combined intervention targeting action plans, education, diagnose-specific nutrition plans, improved menus and eating environment, and awareness, improved patient experienced communication, intake of energy and protein.
- A combined intervention, including improving the eating environment and serving and targeting individual preferences and eating challenges in the nurse-patient welcome interview, was effective in influencing overall energy intake in two of the three departments and in the overall group, however no improvements to protein intake were observed.
- A protein-enriched menu in conjunction with individualised dietary counselling, led to higher energy and protein intake. No difference between readmission rates was found.
- Protected Mealtimes with multidisciplinary education, and additional assistant-in-nursing, overall increased mealtime assistance levels and adequate energy intake.



Non-behavioural measures

All interventions have a behavioural measure (since this was one of the selection criteria), but 15 papers also discuss non-behavioural outcome measures. The non-behavioural measures most used are satisfaction (6x), mental state or depression (4x) and quality of life (3x).

In most cases an increase in any of the non-behavioural measures leads to a change in the behavioural outcome. For example, in a study by Crogan et al. (2015) the intervention group residents enjoyed the food and the service more in comparison to control group residents and also improved their body weight. Additionally, Goeminne et al. (2012) found that patients appreciated Meals on Wheels more than the old system and Meals on Wheels also increased the total daily food intake and decreased waste.

However, four studies only found an effect of their intervention on the non-behavioural measures, which was thus not translated into behaviour. For example, Campbell et al. (2013) did find that patients in the mid-meal trolley group reported higher satisfaction and quality of life, however it did not affect their food intake. Similarly, Holst et al. (2017) found that an aesthetically pleasing presentation of the meals was very much welcomed, however, it did not effect energy intake.



Conclusion and discussion

- General discussion of the results of the literature review
- Knowledge gaps
- Knowledge gaps per setting

WAGENINGEN

General discussion of the results of the literature review

In the settings *out-of-home* and *working environment* most interventions tested a type of nudging strategy to stimulate healthy and/or sustainable food choices. Testing the effectiveness of information and education tools is relatively underexplored. Salience nudges (calorie labelling) were most often used as a technique in the *out-of-home* setting to influence the purchase of healthy menu items, while priming nudges (availability and accessibility) were most often used in the *working environment* setting to encourage employees to make healthy choices in the worksite cafeteria. In both settings, studies that use priming nudges (i.e., by means of visibility, accessibility and availability) seem to be most successful, whereas mixed results were found for salience nudges (i.e., colour-coded labelling appeared to be more effective than calorie labelling). These findings are in line with Wilson et al. (2016), who also found that priming nudges are more effective than salience nudges.

In the setting *health care*, interventions were implemented in either a hospital or nursing home and most interventions tested environmental interventions, with only a few focusing on educational interventions. The majority of the studies included in this review focuses on stimulating energy and protein intake in patients. Most of the studies were single-component, in which one intervention mechanism is tested at a time. Overall, most of the studies in this review were effective, with the environmental interventions being more effective than the education interventions. More specifically, salience nudges (labelling and verbal prompts) were effective in most of the studies, as well as priming nudges by means of accessibility (alternative menu-ordering system) and visibility (enhancing ambiance). However, priming nudges by means of availability of snacks to increase energy intake, were not as effective. Note that these findings are not in line with what was found for the other settings (e.g., out-of-home and working environment), where priming nudges by means of increased availability were one of the most successful type of interventions. These findings are also not entirely in line with the review study of Wilson et al. (2016), who found that priming nudges are more effective than salience nudges. However, Wilson et al. mainly focused on out-of-home settings as well.



General discussion of the results of the literature review

The majority of the interventions that were included in the literature review were successful in stimulating the 'right' food choices. It should be addressed, however, that the overall success of interventions might also be inflated due to publication bias. Publication bias causes effective studies to be published more than ineffective studies.

The majority of the studies included in this review were multi-component (especially in the settings *working environment* and *out-of-home*), in which several intervention mechanisms are tested simultaneously. Overall, intervention designs with multiple components seem to be more effective than single-component interventions. This aligns with Wilson et al. (2016), who also found that the studies where 'priming' and 'salience' nudges were combined were most effective in influencing healthier choices.



Knowledge gaps

Based on the overview of which type of behavioural interventions have been tested in each of the settings, we can also make an indication of what possible **knowledge gaps** are.

- First, there is a need for more single-component studies in a real-life setting. Information on which mechanisms work in which context and in combination with which other techniques is lacking and therefore future studies cannot build onto that.
- In the settings out-of-home, working environment and health care, we observed that testing the effectiveness of information and education tools is relatively underexplored, compared to the number of studies testing an environmental intervention or a nudging strategy.
- Moreover, as noted, most studies focus on interventions related to healthy food choices, and less focus lies on sustainable food choices. Using environmental interventions to steer sustainable choice behaviour can offer new research opportunities. Furthermore, in the *health care* setting most studies focus on interventions related to stimulating energy and protein intake, and less focus lies on stimulating healthy food choices, like fruit and vegetables. In this setting, using environmental interventions to steer healthy food choice can offer new research opportunities.



Knowledge gaps per setting



Out of home:

we noticed that the majority of studies focus on fast-food environments or some kind of self-service restaurant, as compared actual sit-down restaurants. More insights can be gained by studying opportunities for health gains in sit-down restaurant.



Working environment:

some types of nudges are underexplored, for example default options, social norms, commitment nudges and incentive nudges.



Health care:

we observed that testing the effectiveness of information and education tools is relatively underexplored, compared to the number of studies testing an environmental intervention. Moreover, most studies focus on interventions related to stimulating energy and protein intake, and less focus lies on stimulating healthy food choices, like fruit and vegetables. Finally, in line with the trends in studies, future studies may focus on more personalised approaches of food interventions in health care settings.



Appendix 1: *Out-of-home* table

Appendix 2: Working environment table

Appendix 3: *Health care* table

Appendix 4: Final search strings used to retrieve articles





the positions

Author(s)	Year	Setting	Target group	Type of intervention(s)	Outcome variables	Effectiveness
Acharya, Patterson, Hill, Schmitz, Bohm	2006	Different restaurant chains: 1 fine-dining restaurant and three family-style restaurants (Mexican, upscale pizza, and 40s-style diner)	Consumers (general population)	 'TrEAT Yourself Well' (TYW) campaign Various promotional activities: In-restaurant promotions Table tents, posters, etc. Community events Seminars, food tasting, educational programmes Information distributed by health professionals Dietitians, physicians, health educators Paid media advertising Television and magazine advertisements 	 Non-behavioural Awareness of 5-A-Day and the TrEAT Yourself Well campaign Beliefs, attitudes of healthy menu items Behavioural Purchase behaviour of healthy menu items 	 Non-behavioural Consumers who (a) were aware of the 5-A-Day campaign, (b) notice specially marked healthy menu items, or (c) dine in the region were more likely to be aware of the TYW campaign. Awareness of TYW Campaign had positive effects on their beliefs and attitudes toward healthy dining. Behavioural TYW campaign directly increased the probability of a consumer purchasing a healthy menu item by 3.7% By improving consumer attitudes toward healthy menu items, TYW campaign indirectly increased purchases of these items by 4.4%.
Dorresteijn, van der Graaf, Zheng, Spiering, Visseren	2013	Hospital self-service restaurant	Hospital staff & visitors	 Point-of-decision prompts on hospital elevator doors promoting stair use Point-of-purchase prompts in the hospital restaurant promoting reduced-salt soup Point-of-purchase prompts in the hospital restaurant promoting lean croissants Reversal of the availability of diet margarine and butter 	Non-behavioural / Behavioural 24-h number of stair passages Purchase of low-salt soup and lean croissants Purchase of butter Purchase of margarine	 Non-behavioural / Behavioural Elevator signs increased the mean 24-h number of stair passages by 11.2% and maintained at least for 2 weeks after removal of the prompts Point-of-purchase prompts promoting low-salt soup and lean croissants did not result in altered purchase behaviour The ratio between the purchase of margarine and butter was changed sevenfold by reversing





Author(s)	Year	Setting	Target group	Type of intervention(s)	Outcome variables	Effectiveness
Ellison, Lusk, Davies	2014	Full-service, sit-down restaurant. \$14 for lunch incl. drinks and desserts. At Oklahoma State University but is open to everyone	Restaurant guests	 Three menu treatments: Control: restaurant's conventional menu (without caloric information) Calorie-only menu Calorie + traffic light menu Prices were manipulated on all 3 menus: 'fat tax' for high caloric items and 'thin subsidy' on lower caloric items 	Non-behavioural / Behavioural • Total calories ordered (based on sales data from daily lunch receipts)	Non-behavioural / Behavioural • Numeric labels did not influence food choice, but symbolic traffic light labels caused restaurant patrons to select lower-calorie menu items; • Labels can both reduce intake more than a 10% tax on high-calorie items and a 10% subsidy on low-calorie items
Feldman, Hartwell, Brusca, Su, Zhao	2015	Student cafeteria	Students	 Menu comprising 7 healthy and 7 unhealthy meal options: Unlabelled as control Labelled with healthy and non-healthy nutrient icons as an intervention test menu 	Non-behavioural / Behavioural • Consumers' first 3 choices of meals	 Non-behavioural / Behavioural Findings demonstrate that despite a positive observed trend, there were no significant differences between healthy selection of labelled and unlabelled dishes (p=0.16).
Finkelstein, Strombotne, Chan, Krieger	2011	Mexican fast-food chain	Consumers (general population)	 Mandatory menu labelling (calories) Drive-through postings 	Non-behavioural / Behavioural • Purchasing behaviour of healthy menu items (based on average calories per transaction)	Non-behavioural / Behavioural • No significant impact of mandatory menu labelling on monthly transactions and calories sold per transaction
Hammond, Goodman, Hanning, Daniel	2013	Experiment conducted in lab setting, but with real sandwiches ordered from Subway	Adults	 Participants ordered a free meal from one of four experimental menus: 1) no nutritional information shown, 2) calorie amounts only, 3) calorie amounts in 'traffic lights', and 4) calorie, fat, sodium, and sugar shown in 'traffic lights' 	Non-behavioural • Recall of nutrition • Use of nutrition information Behavioural • Calorie consumption	 Non-behavioural Participants in the calorie conditions were more likely to recall the calorie content of meals and to report using nutrition information when ordering. Behavioural The calorie content of meals was not significantly different across conditions; however, calorie consumption was significantly lower among participants in the Calorie only condition compared to the No information condition.





Author(s)	Year	Setting	Target group	Type of intervention(s)	Outcome variables	Effectiveness
Hoefkens, Pieniak, Van Camp, Verbeke	2012	University canteens	University canteen customers (students)	 Point-of-purchase (POP) nutrition information nutrition information on the best meal combinations 	Non-behavioural Liking and use of the information Attitude towards healthy canteen meals Motivation to change diet Nutrition knowledge	 Non-behavioural Significant relations between liking of the information and its use A positive effect in attitude towards healthy canteen meals
					 Behavioural Energy intake from canteen meals Number of chosen meals that complied with all recommendations 	 Behavioural Motivation to change diet and objective nutrition knowledge were required to maintain a recommended energy intake or to decrease in energy intake from canteen meals
James, Adams- Huet, Shah	2015	Two private dining areas at a university and a residence occupied by graduate students	Young adults, of which 77.3% college students	 Subjects were randomised to: menu with no labels (no-labels) menu with kilocalorie labels (kcal-labels) menu with exercise labels displaying the minutes of brisk walking needed to burn the food energy (exercise-labels). 	Non-behavioural / Behavioural • Energy ordered and consumed • weight of the food • Energy content of the same foods on the restaurant Website. • Post-lunch energy intake was assessed by food recall.	 Non-behavioural / Behavioural The exercise-labels group consumed significantly less energy at lunch, compared to the no-labels group (not compared to the kcallabels group) Energy ordered and consumed were not different between kcal-labels and no-labels groups. There was no difference in post-lunch energy intake by menu type.
Kallbekken, Sælen	2013	Hotel buffet	Hotel guests	 Reducing plate size Providing social cues 'Welcome back! Again! And again! Visit our buffet many times. That's better than taking a lot once" 	Non-behavioural / Behavioural • Food waste	Non-behavioural / Behavioural • Plate size reduces food waste by 19.5% • The social cue reduces food waste by 20.5%



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Author(s)	Year	Setting	Target group	Type of intervention(s)	Outcome variables	Effectiveness
Van Kleef, van den Broek, van Trijp	2015	Self-service restaurant located in a store	Customers of a self-service restaurant located in a store	 'Verbal prompting' as a nudge Four different prompts suggesting a side dish (i.e. orange juice, fruit salad, pancakes) given by cashiers 	Non-behavioural / Behavioural • Sales	 Non-behavioural / Behavioural Sales of orange juice increased (35-42% of all breakfasts sold) compared to baseline (20%) Sales of fruit salad (9%) and pancakes (3%) rose to a small but significant extent compared to baseline sales (3% and 1%, respectively).
Krieger, Chan, Saelens, Ta, Solet, Fleming	2013	Fast-food chain restaurants in Washington	General population (> 14 years)	 A regulation requiring chain restaurants to post calorie information on menus or menu boards was implemented 	Non-behavioural / Behavioural • Mean number of calories purchased	Non-behavioural / Behavioural • Mean calories per purchase decreased 18 months after menu labelling in some restaurant chains and among women but not men
Kroese, Machiori, de Ridder	2016	Train station snack shops	Customers of train station snack shops	 Repositioning of food products: healthy foods were placed at the cash register desk, while keeping unhealthy products available elsewhere in the shop 	Non-behavioural • Attitudes Behavioural • Sales	 Non-behavioural A majority of customers reported positive attitudes toward the nudge. Behavioural A nudge led to more sales of healthy (but not fewer unhealthy) products. No difference between the nudge and the nudge + disclosure condition (the same nudge together with an explanatory sign)
Lachat, Verstraeten, De Meulenaer, Menten, Huybregts, Camp, Roberfroid, Kolsteren	2009	University canteens	Canteen customers	 In the intervention group, canteen customers were given 2 portions of fruit and 1 portion of vegetables for free at lunchtime. 	Non-behavioural / Behavioural • Fruit and vegetable intake	Non-behavioural / Behavioural • Canteen customers in the intervention group ate 80 grams more fruit and 108 grams more vegetables than the control group.



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Author(s)	Year	Setting	Target group	Type of intervention(s)	Outcome variables	Effectiveness
Lee-Kwan, Bleich, Kim, Colantuoni, Gittelsohn	2015	Carryout (take-home) Restaurants	Low-income neighborhoods of Baltimore	 Phase 1: menu board revision and healthy menu labeling Phase 2: increase of healthy sides and beverages Phase 3: promotion of cheaper and healthier combination meals. 	Non-behavioural / Behavioural • Weekly handwritten menu orders collected to assess changes in the proportion of units sold and revenue of healthy items (entrée, sides and beverages, and combined)	 Non-behavioural Behavioural Odds for healthy entrée revenue significantly increased in phase 1, phase 2, and phase 3 Odds for healthy side and beverage revenues increased significantly in phase 2 and phase 3 compared to baseline. Total revenue in the intervention group was significantly higher in all phases than in the comparison
Loureiro, Rahmani	2016	Fast-food restaurant	Mainly students	 Calorie information on fast food choices Food vouchers to be used in a fast-food restaurant 	 Non-behavioural Reported probability of selecting high calorie meals Behavioural Actual purchasing behaviour in fast-food restaurant. 	 Non-behavioural Calorie information only reduces the probability of selecting high calorie meals in the questionnaire Behavioural Calorie information did not have significant impact on actual purchasing behaviour in the field.
Martinez- Donatel, Riggall, Meinen, Malecki, Escaron, Hall, Menzies, Garske, Nieto, Nitzke	2015	Two Midwestern U.S. communities (7 restaurants and 2 supermarkets)	Inhabitants of 2 Midwestern US communities	 'Waupaca Eating Smart' programme: <u>Restaurants</u> included healthy bundled meals, training wait staff to promote the programme, and promotional materials around the restaurant. <u>Supermarkets</u> included recipes and shopping lists for healthy bundled meals, in-store displays with healthy samples, promotional materials around the store, providing bag stuffers with healthy tips, and point-of-purchase signs for fruits and vegetables 	Non-behavioural • Food environment scores Behavioural • Change in customer behaviour	 Non-behavioural Restaurant food environment scores improved from 13.4 to 24.1 in the intervention community and did not change significantly in the control community. Behavioural No or minimal changes in customer behaviours were observed after a 10-month implementation period.





Author(s)	Year	Setting	Target group	Type of intervention(s)	Outcome variables	Effectiveness
Olstad, Goonewardene, McCargar, Raine	2014	Recreational swimming pool	Visitors of the swimming pool	 3 types of interventions were tested: Signs in supporting healthy food purchases Signs + taste testing in supporting healthy food purchases Signs + taste testing + economic incentive (30% price reduction) in supporting healthy food purchases 	Non-behavioural / Behavioural • Change in the proportion of healthy items sold in the intervention periods relative to pre- and post-intervention in the full sample	 Non-behavioural Behavioural Healthy items represented 41% of sales and were significantly lower than sales of unhealthy items In the full sample, sales of healthy items did not differ due to the interventions In a subsample, sales of healthy items increased by 30% when a signage + taste testing intervention was implemented. This increase was maintained when prices of healthy items were reduced by 30% and when all interventions were removed
Papies, Veling	2013	Café-style restaurant	Restaurant customers	 Subtle environmental diet reminders Integrating diet-related words into the menu 	Non-behavioural / Behavioural • Low-calorie food choices	Non-behavioural / Behavioural • Diet reminders increased choices for low-calorie foods, among both chronic and current dieters
Schwartz, Riis, Elbel, Ariely	2012	Chinese fast-food restaurant (on a university campus)	Mix of college students, staff, and visitors	 Servers ask customers if they wanted to downsize portions of three starchy side dishes. Participants were invited to take a half portion of their side dish. 	 Non-behavioural Acceptance of the downsizing offer Behavioural Average calories served per customer 	 Non-behavioural 14-33% of customers accepted the downsizing offer, and they did so whether or not they were given a nominal twenty-five-cent discount. Behavioural Those who accepted smaller portions did not compensate by ordering more calories in their entrées, and the total calories served to them were, on average, reduced by more than 200. Accepting the downsizing offer did not change the amount of uneaten food left at the end of the

meal.





Author(s)	Year	Setting	Target group	Type of intervention(s)	Outcome variables	Effectiveness
Sonnenberg, Gelsomin, Levy, Riis, Barraclough, Thorndike	2013	Hospital cafeteria	Visitors of the hospital cafetaria	Traffic light food labelling Red (unhealthy) Yellow (less healthy) Green (healthy).	Non-behavioural Awareness of healthy foods Behavioural Purchase of healthy foods	 Non-behavioural More respondents identified health / nutrition as an important factor in their purchase and reported looking at nutrition information
						 Respondents who noticed labels during the intervention and reported that labels influenced their purchases were more likely to purchase healthier items than respondents who did not notice labels
Timmerman, Brown	2012	The intervention is the group sessions. Measurements focus on eating out in general	Women 40-59 years old who eat out at least 3 times per week	 6 weekly 2-hour small group sessions that focused on reducing calorie and fat intake when eating out through education, behavior change strategies, and mindful eating meditations. 	Non-behavioural Diet related self-efficacy Barriers to weight management when eating out Behavioural • Weight, Waist circumference • Self-reported calorie and fat intake	 Non-behavioural The intervention group increased diet-related self-efficacy and had fewer barriers to weight management when eating out. Behavioural The intervention group lost more weight and
						had lower average daily caloric and fat intake
Vanderlee, Hammond	2014	Hospital cafetarias	Cafetaria patrons	 The 'intervention' site featured energy (calorie), sodium and fat content on digital menu boards, as well as a health logo for 'healthier' items. The intervention site had also revised its menu items to improve the nutrient profiles. 	 Non-behavioural Self-reported measures on noticing and using nutrition information Behavioural 	 Non-behavioural More respondents at the intervention site reported noticing nutrition information and using it to select their food items.
				 The 'control' site provided limited nutrition information at the point of sale. 	 Self-reported measures on food choice & consumption 	 Behavioural Respondents at the intervention site consumed significantly less energy, sodium, saturated fat and total fat.



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Author(s)	Year	Setting	Target group	Type of intervention(s)	Outcome variables	Effectiveness
Wansink, Painter, van Ittersum	2002	A faculty cafeteria at a major Midwestern university	Customers of faculty cafeteria	 During the Tuesday and Friday lunch of each of the six test weeks: Two of the items were presented with a basic label (e.g., grilled chicken) Two items were presented with a descriptive label A mix of geographic labels, nostalgia labels, or sensory labels 'Grandma's zucchini cookies' 'Succulent Italian seafood filet' Two items were not offered 	 Non-behavioural Attitudes Intentions towards repatronage Willingness to pay Behavioural Sales 	 Non-behavioural Attitudes towards the food and the restaurant improved Intentions towards repatronage improved Willingness to pay was not directly increased Behavioural Sales increased by 27%
Wolfenden, Kingsland, Rowland, Dodds, Gillham, Yoong, Sidey, Wiggers	2015	Community sporting club canteens	Members of the sporting club canteen	 Availability of fruit, vegetables and non-sugar sweetened beverages Used promotional strategies Meal deals Signs and posters Displaying products within view of consumers and at eye level Coaches recommending all players to drink water and consume fruit at half time Handing out healthy food and drink guides/factsheets to parents/players 	 Non-behavioural / Behavioural Purchase of fruit, vegetable and non-sugar sweetened drinks 	 Non-behavioural Behavioural Clubs allocated to the intervention were significantly more likely to: report purchase of fruit, vegetables and non-sugar sweetened drinks



Appendix 1: *Out-of-home* table

Appendix 2: Working environment table

Appendix 3: *Health care* table

Appendix 4: Final search strings used to retrieve articles





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Author(s)	Year	Setting	Target group	Type of intervention(s)	Outcome variables	Effectiveness
Backman, Gonzaga, Sugerman, Francis, Cook	2011	Worksite	Low-wage employees	 Fresh fruit deliveries with enough for 1 serving per employee, 3 days a week 	Non-behavioural • Self-efficacy Behavioural	 Non-behavioural Significant increase in self-efficacy toward eating 2 servings of fruit each day
					Fruit and vegetable intakePurchasing of vegetables	 Behavioural Significant increase in fruit and vegetable consumption, in fruit purchases and in family vegetable purchases.
Beresford, Shannon, McLerran, Thompson	2000	Work sites (13 in total)	Employees	 Different types of interventions combined into 1 intervention programme: '5-a-day' message (5 servings a day) was continually posted at work site, social norms, increased availability of fruits and vegetables at work sites, organisational support. 	Non-behavioural / Behavioural • Change in fruit and vegetable intake between baseline and follow-up (measured via Food Frequency Questionnaire (FFQ))	Non-behavioural / Behavioural • Greater changes in fruit and vegetable intake occurred in the work sites compared with medium average baseline intake
Beresford, Thompson, Ziding Feng, Christianson, McLerran, Patrick	2001	Work sites with food-serving cafetarias (14 intervention, 14 control)	Employees	 Different intervention messages following (transtheoretical) stages of change model. Start with '5 a day' message (1. precomtemplation), message benefits fruits and vegetables (2. preparation), use of POP displays and incentives (phase 3), emphasise ways to adapt (new) skills in everyday life (phase 4) 	Non-behavioural / Behavioural • Change in fruit and vegetable intake between baseline and 2-year follow-up (FFQ)	 Non-behavioural / Behavioural Self-reported intervention effect of +0.3 servings fruits and vegetables (intervention group vs control group) Objective intervention effect of +0.16 servings fruit and vegetables (via plate observations at checkout)
Engbers, Van Poppel, A Paw, Van Mechelen	2006	Governmental companies (1 intervention, 1 control)	Employees	 Intervention consists of product information (kcal in products translated into number of minutes needed to burn those calories via physical activity) 	 Non-behavioural Social support, self-efficacy and attitudes Behavioural Intake of fruit, vegetables and fat 	 Non-behavioural Social support, self-efficacy and attitudes positively changed Behavioural Intervention was ineffective in changing intake of fruit, vegetables and fat

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Author(s)	Year	Setting	Target group	Type of intervention(s)	Outcome variables	Effectiveness
Fiske, Cullen	2004	Lounges of teachers	Employees (teachers)	 Promotional materials: 1. Labels with price stickers for low-fat items, 2. Labels + large (motivational) signs Increased availability of low-fat items in vending machines (3 new low-fat items in designated area, in addition to 5 low-fat items that were already present) 	Non-behavioural / Behavioural • Sales of low-fat items in vending machines	Non-behavioural / Behavioural • Most low-fat items sold in condition of increased availability + labels + large signs (3.2 per week vs. 2.6 in condition increased availability + labels vs. 2.5 control)
Franco, De Castro, Wolkoff	2013	Worksites	Employees	 Elements of the intervention (historical control group): 1. investment in making the concessionaire owner and the nutritionist more aware of the importance of promoting fruit and vegetable intake. Suggestions were provided on how to incorporate more fruit and vegetables in food items in the canteen. 2. Food tastings with fruit and vegetable dishes, folders containing information about the benefits of consuming fruits and vegetables. 	Non-behavioural / Behavioural • Fruit and vegetable intake	Non-behavioural / Behavioural Fruit and vegetable consumption increased among employees exposed to an intervention focused on the promotion of these foods with 53.6 g (38%), corresponding to an increase of 0.66% of a portion of FV.
French, Harnack, Hannan, Mitchell, Gerlach, Toomey	2010	Garages	Metropolitan transit workers	 Multiple components of intervention programme: increase in physical activity facilities, increase in healthy choices in vending machines, lower prices on healthy choices in vending machines, group behavioural programmes. 	Non-behavioural / Behavioural • BMI • Energy intake • Fruit and vegetable intake	Non-behavioural / Behavioural In the intervention group: No significant change in BMI Significant decrease in energy intake Significant decrease in fruit and vegetable intake No significant change in unhealthy choices

(e.g. sweets)



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Author(s)	Year	Setting	Target group	Type of intervention(s)	Outcome variables	Effectiveness
Gans, Markham Risica, Dulin- Keita, Mello, Dawood, Strolla, Harel	2015	Worksites	Employees	 3 intervention groups: 1. Non-Tailored written information (NT), which received three separate mailings of traditional nutrition education and other wellness brochures. 2. Tailored written information (TW), which received three separate mailings of written materials tailored for participants; 3. Tailored written information + tailored video (TW+ TV), which received three separate tailored videotapes (DVDs) plus the tailored written materials. 	Non-behavioural / Behavioural • Fat intake • Fruit and vegetable intake	 Non-behavioural / Behavioural The tailored interventions were more likely to decrease fat intake and increase F&V intake than the non-tailored intervention, and that for the most part, the TW+ TV group was the stronger of the two tailored interventions, especially at the longer term follow-up
Geaney, Harrington, Fitzgerald, Perry	2011	A public sector workplace setting (hospital)	Those who consumed at least one main meal in the hospital staff canteen daily	 Provide nutritious food while reducing sugar, fat and salt intakes 	Non-behavioural / Behavioural • Intakes of total sugars, (saturated) fat and salt	 Non-behavioural / Behavioural Reported mean intakes of sugar, (saturated) fat and salt were significantly lower in the intervention hospital, adjusted for age and gender 72% of respondents, compared with 42% in the non-intervention hospital, complied with the recommended under-3 daily servings of food high in fat and sugar 43% of respondents exceeded the recommended salt intake of 4–6 g/d, compared with 57% in the non-intervention hospital
Holdsworth, Raymond, Haslem	2004	Worksites	Employees	 Intervention is the implementation of the Heartbeat Award (HBA) scheme, a programme that provides information, reminders, guidelines and reinforcement to promote healthier food choices 	Non-behavioural / Behavioural Intake of 20 food items (e.g. fruit consumption, consumption low-fat milk), both at work and at home	Non-behavioural / Behavioural • Pre- vs. post-test, the intervention had a positive impact on 4 of the 20 food items studied: more fruit & low-fat milk products and reduction in sweet pudding and fried food





Author(s)	Year	Setting	Target group	Type of intervention(s)	Outcome variables	Effectiveness
Krogholm, Bredsholff, Alinia, Christensen, Rasmussen, Dragsted	2010	Worksites	Employees	 Intervention consists of provision of free fruit at worksites 	Non-behavioural / Behavioural - Fruit intake - Measurement 10 flavonoids (objective biomarkers of fruit intake)	Non-behavioural / Behavioural • Increase in self-reported fruit intake in intervention group, compared to control group • Measurements of flavonoids (objective biomarkers of fruit intake) are consistent with self-reported increases in fruit intake
Kushida, Murayama	2014	Worksite canteens	Employees	 Intervention based on Transtheoretical Model (TTM): based on stage of change participants read different types of information message in table tents + In the intervention group posters were placed in the canteen about locally grown vegetables and social support of local farmers. 	Non-behavioural • Stage of change Behavioural • Vegetable intake	 Non-behavioural The stage of change did not significantly differ Behavioural The environmental intervention caused an increase in vegetable consumption
Lassen, Hansen, Trolle	2007	Worksite canteens in Denmark	Employees having lunch at the worksite canteens	 Two meal serving systems Buffet style with a fixed price for a varied number of dishes A la carte style with a separate price for each item on the menu 	Non-behavioural / Behavioural - Energy intake - Macronutrient composition - Fruit and vegetable intake - Lower energy density of the food	Non-behavioural / / Behavioural / Eating at buffets was associated with an increased intake of fruit and vegetables and a lower energy density of the food for both genders
Lassen, Thorsen, Sommer, Fagt, Trolle, Biltoft- Jensen, Tetens	2011	Worksites	Employees	 Intervention measures differed per intervention worksite and control worksite (e.g. free fruit programme, food workshop), with the exception of informational material on nutrition which was provided at all intervention worksites. 	Non-behavioural / Behavioural • Fat intake • Fibre intake • Fruit and vegetable intake	Non-behavioural / Behavioural • Decrease of fat intake in the intervention group • Increase in fruit and vegetable intake in the intervention group; greater effect for fruit • Increase in fibre intake in the intervention group





Author(s)	Year	Setting	Target group	Type of intervention(s)	Outcome variables	Effectiveness
Lassen, Ernst, Poulsen, Andersen,	2012	Financial worksite	Employees of the worksite	 Canteen Take Away (CTA): providing employees with healthy ready-to-eat meals to bring home to their families 	Non-behavioural /	Non-behavioural /
Hansen, Biltoft- Jensen, Tetens					Behavioural Energy density Vegetable intake 	 Behavioural Overall dietary quality (energy density of the food; excluding beverages) was significantly lower on days consuming CTA meals Increased vegetable intake
Lassen, Beck, Leedo, Andersen	2013	Worksites	Employees	 Use of 'keyhole' label on food items which are identified as healthy 	Non-behavioural /	Non-behavioural /
Angersen, Christensen, Mejborn, Thorsen, Tetens					Behavioural • Fat intake • Fruit and vegetable intake • Energy intake	 Behavioural Mean decrease in lunch intake of fat from 40 E% to 21 E% Increase in mean fruit and vegetable content from 35 g/100 g to 45 g/100g. Mean energy intake decreased significantly from 2.5 MJ to 1.8 MJ per lunch meal eaten
Lassen et al.	2014	Worksite canteen	Employees	 Healthy labelled meals in the intervention worksite 	 Non-behavioural Food satisfaction Behavioural Nutrient composition of the consumed lunch meals and plate waste (based on a validated digital photographic method) 	 Non-behavioural No significant changes were seen with regard to food satisfaction and plate waste. Behavioural Intervention showed mean decrease in energy density in the consumed meals.





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Author(s)	Year	Setting	Target group	Type of intervention(s)	Outcome variables	Effectiveness
Lassen, Beck, Leedo, Andersen, Christensen, Mejborn, Thorsen, Tetens	2014	Worksite canteens	Employees	 Use of 'keyhole' label on food items which are identified as healthy 	Non-behavioural • Food satisfaction Behavioural • Energy intake • Plate waste	 Non-behavioural No significant effects of intervention on food satisfaction Behavioural Mean decrease in energy density in the consumed meals from 561 kJ/100 g at baseline to 368 and 407 kJ/100 g at end-point and follow-up, respectively (P < 0.001) No significant effects of intervention on plate waste Results of the half-year follow-up measurement found that the nutritional improvements of the lunch meals were sustained
Levy, Riis, Sonnenberg, Barraclough, Thorndike	2012	Cafeteria	Employees of a large hospital	 A traffic light-style color-coded labelling system Healthy items (labelled green) Unhealthy items (labelled red) 'Choice architecture' - physically rearranging certain cafeteria items Green-labelled items more accessible Red-labelled items less accessible 	Non-behavioural / Behavioural • Food purchases	Non-behavioural / Behavioural • Labelling decreased all employees' red item purchases and increased green purchases • Choice architecture further decreased red purchases after the labelling
Lowe, Tappe, Butryn, Annunziato, Coletta, Ochner, Rolls	2010	Worksite cafetarias	Employees	 2 conditions: 1. Intervention with only environmental changes (i.e. introduction of 10 new low-energy-density food items and provision of labels for all food items with information on kcal, nutritional content and energy density), 2. Intervention with environmental changes + pricing incentives (15- 25% discounts on low-energy-density food items) + 4 group sessions in which participants learned more on energy density. 	Non-behavioural / Behavioural • Total energy intake as a result of cafetaria intake	Non-behavioural / Behavioural • No difference in energy intake between the two groups of participants





Author(s)	Year	Setting	Target group	Type of intervention(s)	Outcome variables	Effectiveness
Mackison, Mooney, Macleod, Anderson	2016	Worksites	Employees	 The EatSMART intervention: A reduced price Healthy meal combination Promotions (stickers, posters, weekly and daily point of sale menus, content for electronic bulletins, etc. 	Non-behavioural • Consumer evaluation • Intention to continue with intervention delivery Behavioural • Sales data	 Non-behavioural Consumers reported improved value for money and quality. Both sites reported an intention to continue the intervention delivery. Behavioural Sales data indicated that the uptake of promoted items varied by week (range 60–187 items) and by site.
Patsch et al.	2016	Hospital cafetarias	Hospital employees	 During baseline phase, healthy versions of existing unhealthy items were introduced. The intervention phase included marketing and price incentives/disincentives for healthy and unhealthy items, with a 35% price differential. 	Non-behavioural / Behavioural • Average and proportional change in sales and impact on financial outcomes	 Non-behavioural / Behavioural Significant impact was demonstrated on all burger sales in the desired direction during intervention. Cafeteria gross sales and burger profit (P < .001) increased at both cafeterias.
Sorensen, Barbeau, Stoddard, Hunt, Kaphingst, Wallace	2005	Worksites	Employees	 The intervention programme consisted of multiple components: participatory strategies, social context approaches, small-group discussions, health fairs, behavioral self- assessments with feedback. 	Non-behavioural / Behavioural Increase in fruit and vegetable consumption Reduction red meat consumption Increase multivitamin use Increase physical activity	Non-behavioural / Behavioural • Employees at intervention worksites improved more for every outcome than did employees at control worksites (but only statistically significant for multivitamin use and physical activity).



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Author(s)	Year	Setting	Target group	Type of intervention(s)	Outcome variables	Effectiveness
Steenhuis, Van Assema, Van Breukelen,	2004	Worksite canteens	Employees	 Implementation of educational programme consisting of information on healthy nutrition via brochures, table tents, self-help manual and posters (vs. control group). Implementation of food supply programme which increased the availability of low-fat products and fruit and vegetables in worksite canteens. Labelling programme: labelling of low-fat products Conditions: 1. Only educational programme, 2. food supply + educational programme, 4. Control. 	Non-behavioural / Behavioural • Reduction fat intake • Increase in fruit and vegetable consumption	 Non-behavioural / Behavioural For the whole study population, no significant effects on consumption was found for any of the programmes. A beneficial and significant treatment effect of labelling on total fat intake was found for respondents who believed they ate a high-fat diet Sales data revealed a significant effect of labelling on desserts, but not for the other products.
Stites, Singletar, Menasha, Cooblall, Hantula, Axelrod, Figueredo, Phipps	2015	An urban hospital	Employees of the hospital	 Mindful eating training Online pre-ordering Price discounts toward lunch purchases 	 Non-behavioural Mindful eating behaviors Intention to use pre-ordering system if offered in the future Behavioural Healthier lunch purchases Kilocalories Grams of fat 	 Non-behavioural At the end of the study, a moderate increase in participants' mindful eating behaviours was found. The majority of participants (92%) said they would use the pre-ordering system if offered in the future. Behavioural The treatment group purchased lunches with an average of 144.6 fewer kcal and 8.9 fewer grams of fat Participants also decreased the average number of calories in their meals by 114.6 kcal per lunch compared to baseline.





Author(s)	Year	Setting	Target group	Type of intervention(s)	Outcome variables	Effectiveness
Thorndike, Riis, Levy	2016	Hospital cafeteria	Employees of the hospital who used their platinum plate card	 All items labelled green (healthy), yellow (less healthy), or red (unhealthy) a monthly letter with social norm feedback about healthy food purchases, comparing employee to 'all' and to 'healthiest' customers (feedback-only) a small financial incentive for increasing green purchases (feedback-incentive) 	Non-behavioural / Behavioural • Green-labelled purchases	 Non-behavioural / Behavioural The percentage increase in green-labelled purchases was larger in the feedback-incentive group compared to control The rate of increase in green-labelled purchases was higher in both feedback-only and feedback-incentive compared to control. At the end of the study, there was no effect of both interventions anymore.
Thunström, Nordström & Shogren	2016	Lunch restaurant at industrial company	Employees	 Three meals were listed on a whiteboard-style menu where the subjects entered the restaurant. The order in which the healthy meal was listed changed each day, listed either first, second or third throughout the study period. The Keyhole label was displayed in two ways: (1) highlighting the healthy meal on the daily whiteboard-style menu inside and outside the restaurant, and (2) highlighting the healthy meal on the menu sent to the e-mail list. 	Non-behavioural / Behavioural • Restaurant sales	Non-behavioural / Behavioural • The estimated coefficient for the dummy variable indicating that the restaurant offers a healthy-labelled meal is both small and not statistically significant.
Van Berkel, Boot, Proper, Bongers, Van der Beek	2014	Worksites	Employees	 Intervention based on mindfulness training. 8 weeks, each week had a different mindfulness activity (e.g. meditation, yoga balance) 	Non-behavioural / Behavioural • Physical activity in leisure time • Fruit and vegetable intake • Sedentary behavior at work	 Non-behavioural / Behavioural No significant effects of the mindfulness intervention were found



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Author(s)	Year	Setting	Target group	Type of intervention(s)	Outcome variables	Effectiveness
Van Kleef, Otten, van Trijp	2012	Hospital staff restaurant	Hospital staff	 Shelf arrangement (i.e. accessibility) Putting healthy snacks at higher shelves Assortment structure (i.e. availability) Offering an assortment that either included 25% or 75% healthy snacks 	Non-behavioural /	Non-behavioural /
					 Behavioural Sales of (un)healthy and total snacks 	 Behavioural The lab and field study both showed a higher probability of healthy snack choice when 75% of the assortment consisted of healthy snacks No differences were observed regarding shelf display location Sales of unhealthy and total snacks were not impacted by manipulations
Vanderlee, Hammond	2014	Hospital cafetarias	Employees	 The 'intervention' site featured energy (calorie), sodium and fat content on digital menu boards, as well as a health logo for 'healthier' items. The intervention site had also revised its menu items to improve the nutrient profiles. The 'control' site provided limited nutrition information at the point of sale. 	Non-behavioural / Behavioural • Energy intake • Sodium intake • Fat intake	 Non-behavioural / Behavioural At the intervention site significantly less energy (-21 %, P < .001), sodium (-23%, P < .001), saturated fat (-33%, P<.001) and total fat (-37%, P<.001) was consumed compared to the control site.
Vermeer, Steenhuis, Leeuwis, Heymans, Seidell	2011	Worksite cafeterias	Employees of the worksite	 Offering a small portion size of hot meals in addition to the existing size Proportionally priced (that is, the price per gram was comparable regardless of the size) Value size pricing was employed. 	Non-behavioural / Behavioural • Sales	 Non-behavioural Behavioural The ratio of small meals sales in relation to large meals sales was 10.2% No effect of proportional pricing was found 19.5% of the participants who had selected a small meal often-to-always purchased more products than usual in the worksite cafeteria





Author(s)	Year	Setting	Target group	Type of intervention(s)	Outcome variables	Effectiveness
Vyth, Steenhuis, Heymans, Roodenburg, Brug, Seidell	2011	Worksites	Employees	 Use of nutrition logo ('ik kies bewust') in intervention group 	 Non-behavioural Behavioral determinants of food choice (ie, attitude, self-efficacy, and intention) Intention to eat healthier Paying attention to product information Behavioural Sales 	 Non-behavioural No significant differences in behavior determinants between the intervention and control groups were found. Intention to eat healthier and paying attention to product information were positively associated with self-reported consumption of foods with the Choices logo.
					• Sen reported consumption of roous with logo.	 Behavioural No nutritionally meaningful intervention effects were found in the sales of sandwiches, soups, snacks, fruit, and salads. The intervention did not have a significant effect on employees' lunchtime food choices.
Wilson, Bogomolova, Buckley	2015	A university-based research institute	Staff members and research students	 A sign with the message 'Pick me! I am low calorie' was then placed on the low-fat milk 	Non-behavioural / Behavioural • Choice for low-fat milk vs. full-cream milk	Non-behavioural / Behavioural • No effects on healthier milk choices • Sub-analysis indicate an increase in selection of both milk types, but with a greater increase in low-fat milk selection. However, after two weeks milk selection returned towards baseline during the rest of the intervention period



Appendix 3: *Health care* table

Appendix 1: *Out-of-home* table

Appendix 2: Working environment table

Appendix 3: Health care table

Appendix 4: Final search strings used to retrieve articles


Author(s)	Year	Setting	Target group	Type of intervention(s)	Outcome variables	Effectiveness
Basak et al.	2019	Hospital	hospitalised children	A randomised controlled trial among hospitalised children was performed over a 1-month period comparing the control menu layout and the intervention menu. The intervention menu contained the same choices but was labelled to encourage healthy eating.	Non-behavioural • N.a. Behavioural • patient meal orders • consumption	 Non-behavioural N.a. Behavioural Children receiving the intervention ordered more 'green-light' healthy choices and fewer 'red- light' items, but with effects waning over time. There were trends toward increased intake of fruits and vegetables and decreased intake of 'foods to limit', but no impact on the consumption of sugar-sweetened beverages.
Beattie et al.	2004	Nursing home	nursing home residents with probable Alzheimer's disease	Multiple case design study (n=3) with an embedded experiment. The embedded experiment was conducted for each resident individually over a five-week period with two repeats of the intervention. Intervention involved systematic reinforcement of sitting-at-table behaviour by the resident using two communication strategies: 1) focused conversation about the meal, eating and social comments related to the mealtime experience, and 2) specific elements of social behaviour (smiling, eye contact).	 Non-behavioural N.a. Behavioural Table-leaving: Two dimensions of table-leaving behaviour were measured: frequency and duration. Three dimensions of food and fluid consumption were measured: weight of food eaten, proportion of fluid accepted. Body weight 	 Non-behavioural N.a. Behavioural Results demonstrate that all cases were able to sit at the table longer and eat more food during the intervention, while body weight for all cases remained stable throughout the study. Two of the three cases left the table fewer times during the intervention. There were no statistically significant changes in proportion of fluids consumed in any case.



Author(s)	Year	Setting	Target group	Type of intervention(s)	Outcome variables	Effectiveness
Campbell et al.	2013	Hospital	Hospitalised older adult patients assessed as malnourished	Consecutive assignment of 98 inpatients assessed as malnourished to conventional commercial supplements (traditional, n = 33), MedPass (n = 32, 2 cal/mL supplement delivered 60 mL four times a day at medication rounds) or mid-meal trolley (n = 33, selective snack trolley offered between meals) for two weeks.	Non-behavioural Quality of life (EQ-5D), Patient satisfaction Cost Behavioural Weight change Supplement compliance Energy and protein intake (3-day food records)	 Non-behavioural Overall quality-of-life ratings (scale 0-100) improved significantly with MedPass and midmeal interventions, however, did not change with traditional intervention (p = 0.05). Patient satisfaction including sensory qualities and perceived benefit (improved health and recovery) was rated highest for mid-meal trolley (all p < 0.05). Overall, mid-meal trolley was the most costeffective, with lower total labour and also product cost.
						 Behavioural Weight change was similar across the three interventions. Energy and protein intakes (% of requirements) were more often achieved with traditional and MedPass compared with mid-meal interventions (<i>ρ</i> = <0.01). Patients achieved the greatest percentage of their goal intakes with supplements (both MedPass or traditional), but patients in the midmeal trolley group reported higher satisfaction and improvements in QOL, at the lowest cost.



Author(s)	Year	Setting	Target group	Type of intervention(s)	Outcome variables	Effectiveness
Crogan et al.	2015	Nursing home	Nursing home residents: Age 65 years or older; Mini- Mental State Examination (MMSE) score >11; residents that consume all meals in the dining room; and residents that feed themselves or require minimal cueing to eat.	A 2-group, repeated measures design, where 61 elderly residents from 2 eastern Washington nursing homes were recruited to participate in a 6-month study. One of the 2 nursing homes was chosen as intervention site and received the Eat Right food delivery system, the other location acted as control. Eat Right is a multilevel, 2-component delivery system. Component 1 is designed to systematically change and update menus to include residents' food ratings, while component 2 supports resident food choice using a select menu and a buffet-style dining programme in the dining room.	 Non-behavioural Mini-Mental State Examination (MMSE) Food and meal service satisfaction Behavioural Body weight Serum prealbumin levels Food intake 	 Non-behavioural Overall, intervention group residents reported significant improvements in 2 of the 4 domains (enjoying food and food service, <i>p</i>=.027; providing food service, <i>p</i>=.014) in comparison to control group residents who improved in only 1 domain, cooking good food (<i>p</i>=.018). MMSE scores were not associated with the changes in serum prealbumin, body weight, or food intake. Behavioural Intervention group residents reported significant improvement in serum prealbumin levels after the intervention (<i>p</i>=0.001). Changes in intervention group body weight improved after the intervention (<i>p</i>=0.029). There were no significant differences in food intake from baseline to post intervention in either group.
Desai et al.	2007	Nursing home	Seniors with cognitive impairment residing in long- term care	Usual energy intakes were compared in subjects residing in cognitive impairment units in either the old (tray delivery, n=23) or new (bulk delivery, cafeteria style with waitress service, n=26) nursing home.	 Non-behavioural Behavioural function (London Psychogeriatric Rating Scale) Behavioural Twenty-one consecutive day investigator-weighed energy and macronutrient intakes. 	 Non-behavioural London Psychogeriatric Rating Scale measures of behavioural function did not interact with type of foodservice, indicating that this measure of disease progression was not an important predictor of response to change in foodservice. Behavioural On average, residents receiving bulk foodservice had higher daily energy intakes, especially at the dinner meal. More importantly, these higher intakes were more apparent in individuals with lower BMIs. Although the higher energy intake was predominantly associated with greater carbohydrate intake, individuals with lower BMIs also experienced higher protein intake.



Author(s)	Year	Setting	Target group	Type of intervention(s)	Outcome variables	Effectiveness
Essed et al.	2007	Nursing home	Residents from nursing homes	Single blind randomised 16 weeks parallel study consisting of a control group (n=23), a monosodium glutamate (MSG) group (n=19), a flavour group (n=19) and a flavour plus MSG group (n=22).	 Non-behavioural Pleasantness Appetite, hunger feelings and sensory perception questionnaire (AHSP) Olfactory sensitivity Geriatric depression scale (GDS) Mini nutritional assessment Behavioural Intake of the cooked meal, which was measured by weighing back leftovers during 14 days Body weight, body composition, knee height 	 Non-behavioural No differences were found in Appetite, Hunger feelings and Sensory Perception between baseline values except for the variable present smell perception which decreased in the flavour group. A lower olfactory performance was related to a higher (positive) change in energy intake Behavioural After 16 weeks, no differences were found in changes in energy intake and body weight between the groups. Enhancing the taste of a cooked meal with flavour and/or MSG does not lead to a higher energy intake and body weight among nursing home elderly.
Goeminne et al.	2012	Hospital	Patients hospitalised at the respiratory disease department	A prospective cohort trial where control and intervention groups. In the control group the current system was evaluated, where patients ordered their meals (breakfast, lunch and dinner) one day beforehand at the nutritional assistant. In the intervention group, meals are ordered and delivered bedside at the same moment (Meals on Wheels), allowing the patient to meet their current appetite.	 Non-behavioural Food appreciation and access questionnaire Behavioural Quantity of food intake per meal (including oral nutritional supplements) Reason for admission defined as the causing pathology, weight, height, body mass index (BMI), age, sex. 	 Non-behavioural For food access and appreciation, patients appreciated Meals on Wheels more than the old system in terms of choice, hunger, food quality and organisation Behavioural Mean total daily food intake was 236g higher in patients in the Meals on Wheels than in controls. There was higher intake of oral nutritional supplements in the Meals on Wheels group compared to controls, resulting in significantly less oral nutritional supplements wasted. There was also significantly less waste in the Meals on Wheels on supplements wasted.



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Author(s)	Year	Setting	Target group	Type of intervention(s)	Outcome variables	Effectiveness
Holst et al.	2015	Hospital	Hospitalised patients (>3 days)	 An observational multi-modal intervention study, including baseline measurements, was followed by a 12 months intervention period, completed by follow-up measurements. Interventions: Based on pre-measurements, nutrition support teams in each department made targeted action plans, supervised by an expert team. Education, diagnose-specific nutrition plans, improved menus and eating environment, and awareness were initiated. 	 Non-behavioural Patient interviews and staff questionnaire Behavioural Process-indicators (Good Nutritional Practice, GNP) included nutrition screening on admission, nutrition plan and nutrition monitoring. These data were obtained from the patient records Energy- and protein-intake by 24-h recall, before and after the intervention 	 Non-behavioural An improvement of patient experienced communication was seen in the questionnaire based patient interviews regarding information about nutrition during disease Screening, information to patients, making nutrition plans, how to measure nutritional requirements, when to monitor and when to consider if goals were met, became clearer to staff. Behavioural Intake of energy and protein as well as GNP improved using a multi-modal top-down and bottom-up approach. In this study, which is found to be similar to daily practice, it was not possible to differentiate which intervention bad the most impact.
Holst et al.	2017	Hospital	Patients admitted to the Departments of Infectious Diseases, Hematology, and Heart Lung Surgery	An interventional study in a baseline and follow-up investigation. The interventions included in this study helped to improve the eating environment and serving, integrated nutrition into the nurse-patient welcome interview, and targeted individual preferences and challenges for eating.	 Non-behavioural Questionnaire and a semi-structured patient interview. Staff-perceived quality of the intervention Behavioural 24-h food intake registrations (FRs) for 3 d consecutively 	 Non-behavioural The questionnaire revealed an overall satisfaction with the interventions. The improvements resulting in a more aesthetically pleasing presentation of the meals were very much welcomed by the patients. A focus on individualised nutrition from the nursing staff improved patients' perceptions. In particular, including communication about nutrition in the welcome interview and inquiring about patients' food preferences was popular. All responses from the staff were very positive. Behavioural Only insignificant improvements to overall energy intake were seen in two of the three departments and in the overall group, and no statistical or clinically significant improvements to protein intake were observed.



Author(s)	Year	Setting	Target group	Type of intervention(s)	Outcome variables	Effectiveness
Mamhidir et al.	2007	Nursing home	Alzheimer's disease patients	In the intervention ward (vs. a control ward) the staff received an integrity-promoting care training programme that focused on human relationships, normal aging, environment, communication, interaction, human territory, integrity, confusion and dementia disorders	Non-behavioural • Psychological parameters • Biochemical parameters Behavioural • Weight	 Non-behavioural No weight changes were related to the type of dementia. The individual weight changes correlated significantly to changes in the intellectual functions. Relationships between weight change, increased motor function and increased appetite were nonsignificant. There was no significant relationship between weight changes and changes in biochemical parameters. According to the staff, increased contact with the patients and a more pleasant atmosphere resulted when the meal environment and routines were changed. Behavioural Weight increases were observed in 13 of 18 patients compared with two of 15 patients in the control ward
Mathey, Siebelink et al.	2001	Nursing home	Elderly residents	The addition of flavour enhancers (chicken flavour, beef bouillon flavour, turkey flavour, and lemon butter (fish) flavour) to the cooked meals in the intervention group (vs. control)	Non-behavioural • Appetite Behavioural • Intake of the cooked meal • Daily dietary intake • Body weight	 Non-behavioural Hunger feelings increased only in the flavour group. Behavioural Body weight of the residents in the flavour group increased compared with that of the control group. Daily dietary intake decreased in the control group but not in the flavour group. Intake of the coaked meal increased in the flavour group but not in the control group.



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Author(s)	Year	Setting	Target group	Type of intervention(s)	Outcome variables	Effectiveness
Mathey, Vanneste, et al.	2001	Nursing home	Elderly residents	The ambiance was improved in the intervention group (vs. control) by improvement of (1) physical environment and atmosphere of the dining room, (2) food service, (3) organisation of the nursing staff assistance.	 Non-behavioural Quality of life Behavioural Dietary intake Biochemical indicators of nutritional and health status Body weight 	 Non-behavioural Quality of life remained stable in the experimental group (compared to negative changes in the control group), indicating relatively stable health conditions. Behavioural Mean body weight significantly increased in the experimental group, not in the control group. Health status biochemical indicators remained stable in the experimental group (compared to negative changes in the control group), indicating relatively stable health conditions. Dietary intake increased in both groups.
McCray, Maunder, Barsha, et al.	2018	Public hospital	Patients	Room service (pre-post study design): patients order meals from a single integrated a la carte style menu anytime between 06.30h and 19.00h by phoning room service. Meals are prepared on demand and aim to be delivered within 45 min of receiving the order. Traditionally, patients ordered their meals by completing a paper menu up to 24h prior to meals, which are collected at a set time by Nutrition Assistant staff. Meals were delivered at set meal times: breakfast 06.30h - 07.30h; lunch 11.45h - 12.45h; and dinner 17.00 h - 18.00 h.	Non-behavioural • Satisfaction Behavioural • Patient nutritional intake • Plate waste • Meal costs	 Non-behavioural Patient satisfaction indicated an improvement with room service, with 98% of patients scoring the service good to very good, compared to 75% for the traditional foodservice model. Behavioural Room service resulted in a statistically significant increase in both energy and protein intake, as well as energy and protein intake as a percentage of requirements. Total average plate waste decreased from 30% to 17%. Patient food costs decreased by 28% per annum with room service.



Author(s)	Year	Setting	Target group	Type of intervention(s)	Outcome variables	Effectiveness
McCray, Maunder, Norris, et al.	2018	Public hospital	Patients	Bedside Menu Ordering System (BMOS): Nutrition Assistants discuss the meal options compliant to the individual patient's diet at their bedside and enter orders into a hand-held wireless mobile device (Apple iPad). Nutrition Assistants are able to provide meal suggestions that align with patients' therapeutic dietary requirements and personal meal preferences, and the orders are sent directly to the kitchen for production. Traditionally, nutrition Assistants deliver and collect paper menus from patients for dinner the same day and breakfast and lunch the following day, manually process this information and deliver to the kitchen for production.	Non-behavioural • Satisfaction Behavioural • Patient nutritional intake • Plate waste • Meal costs	 Non-behavioural Foodservice satisfaction was very high: 75% of the traditional foodservice model and 74% of BMOS participants rated their overall satisfaction as 'very good' or 'good'. However, significantly more (84%) of the BMOS group also preferred the BMOS. Behavioural BMOS resulted in a significant increase in both mean daily energy and protein intake, as well as mean intake as a percent of daily energy and protein requirements. Mean plate waste decreased significantly from 30% to 26%. BMOS led to a decrease in total patient food costs by 19% compared to the traditional model.
Munk et al.	2013	Hospital	Patients at nutritional risk	A novel hospital menu consisting of 36 naturally energy-enriched small dishes served on demand 24 h a day (historically controlled).	Non-behavioural / Behavioural • Food intake	 Non-behavioural / Behavioural No significant difference in energy and protein intake was observed between the groups. A significant time gradient in total energy intake was observed in the intervention period. A significant time gradient in energy intake received from the novel menu was observed.



Author(s)	Year	Setting	Target group	Type of intervention(s)	Outcome variables	Effectiveness
Munk et al.	2017	Hospital	Patients at nutritional risk	A protein-enriched menu in conjunction with individualised dietary counselling (compared with a historical intervention group provided with the protein-enriched menu as a stand-alone intervention)	<pre>Non-behavioural / Behavioural The number of patients achieving >75% of energy and protein requirements Energy and protein intake Readmission rate The number of patients with a baseline intake <50% of energy and protein requirement, who increased to ≥50%</pre>	 Non-behavioural / Behavioural In the intervention group (IG), 92% vs 76% in the historical group reached >75% of energy requirements. 90% in the IG vs 66% in the historical group reached >75% of protein requirements. The IG had a significantly higher mean intake of energy and protein compared with the historical group. In the IG, more than 85% of the patients with a baseline <50% of the requirement achieved >75% of the energy and protein requirement (comparison to the historical group was not possible since these data were not collected). No difference between readmission rates was found.



Author(s)	Year	Setting	Target group	Type of intervention(s)	Outcome variables	Effectiveness
Rufenacht et al.	2010	Hospital	Undernourished patients	Nutritional therapy: patients received individual nutritional counselling and interventions, including oral nutritional supplements if appropriate, by a dietitian (vs. the oral nutritional supplement group, who received oral nutritional supplements in addition to hospital meals without further instruction or counselling).	Non-behavioural • Quality of life Behavioural • Food intake	 Non-behavioural From baseline to before discharge, quality of life increased in both groups. Quality of life increased further in the nutritional therapy group from discharge to 2 months after discharge, but not in the control group. Behavioural Energy and protein intakes increased between baseline and before discharge in both groups. The nutritional therapy group met the energy requirements before discharge to 10% and of protein by 94%. The control group by 90% and 88%, respectively. Hospital meals alone did not cover the requirements.
Simmons et al.	2001	Nursing home	Incontinent nursing home residents	The intervention consisted of three phases: (1) 16 weeks of four verbal prompts to drink per day, in between meals; (2) 8 weeks of eight verbal prompts per day, in between meals; and (3) 8 weeks of eight verbal prompts per day, in between meals, plus compliance with participant beverage preferences.	 Non-behavioural Cognitive and nutritional status Behavioural Fluid intake Dehydration 	 Non-behavioural Cognitive and nutritional status were predictive of residents' responsiveness to the intervention. Behavioural The majority (78%) of participants increased their fluid intake between meals in response to the increase in verbal prompts. A subset of residents (21%), however, only increased their fluid intake in response to beverage preference compliance. There was a significant reduction in the proportion of intervention participants who had indication of dehydration compared to control.



Author(s)	Year	Setting	Target group	Type of intervention(s)	Outcome variables	Effectiveness
Simmons et al.	2015	Nursing home	Residents with orders for nutrition supplementation	Snack intervention (vs. usual care control group and an oral liquid nutrition supplement intervention group). Research staff provided supplements or snacks consistent with each participant's diet orders twice per day (morning and afternoon), 5 weekdays per week. Participants in the snack intervention group were offered a variety of foods (e.g., yogurts, pudding) and beverages (e.g., assorted juices, liquid supplements).	Non-behavioural / Behavioural • Caloric intake • Staff time • Body weight	 Non-behavioural / Behavioural The oral liquid nutrition supplement (ONS) group took in an average of 265 calories more per day and the snack intervention group an average of 303 calories more per day than the control group. Staff time required to provide each intervention averaged 11 and 14 minutes per person per offer for ONS and snacks, respectively, and 3 minutes for usual care. Neither intervention had a significant effect on body weight, despite positive trends.
Van der Zanden et al.	2015	Hospital	Hospitalised patients	The intervention consisted of a verbal prompt: 'Would you like some [target product] with that?', which was presented to patients by trained telephone operators, after patients finished ordering their lunch. Target products were two foods rich in protein; fruit quark and yoghurt drink. For half of the patients, the verbal prompt was preceded by verbal praise on their lunch order, which was aimed to increase compliance with the verbal prompt.	 Non-behavioural Perceived obtrusiveness Behavioural Number of target products ordered. Protein content of ordered lunch 	 Non-behavioural Verbal prompts were not perceived to be obtrusive. Behavioural Verbal prompts significantly increased ordering of the target products nearly sevenfold. Protein content of ordered lunch and all orders of the day combined of patients receiving a verbal prompt (and verbal praise) showed a trend of containing more protein compared to control. Total protein content of ordered food increased significantly. Verbal praise did not increase compliance with the verbal prompt. Patients consumed most or all of the target product.



Author(s)	Year	Setting	Target group	Type of intervention(s)	Outcome variables	Effectiveness
Wright et al.	2006	An elderly acute ward in a hospital	Elderly patients	The intervention consisted of trained nursing assistants encouraging patients to attend a supervised dining room during lunch as part of the rehabilitation process. The patients on the control ward ate only by their bedside.	Non-behavioural / Behavioural • Weight • Food intake	 Non-behavioural / Behavioural The dining room group had higher intakes of energy compared with the controls. There was no difference in protein intake between the groups. No significant difference in weight gain between
						the two groups was seen. However, there was a trend towards weight gain in the dining room group.
Young et al.	2013	Hospital	Medical inpatients aged ≥ 65 years	Pre-post study compared three mealtime assistance interventions: (1) PM: Protected Mealtimes (where mealtimes are protected from unnecessary and avoidable interruptions, providing an environment conducive to eating) with multidisciplinary education; (2) AIN: additional assistant-in-nursing with dedicated meal role; (3) PM + AIN: combined intervention.	Non-behavioural / Behavioural • Mealtime assistance levels • Energy intake	Non-behavioural / Behavioural • Mealtime assistance levels significantly increased in all interventions. • Post-intervention participants were more likely to achieve adequate energy intake, with no difference noted between interventions.



Appendix 1: *Out-of-home* table

Appendix 2: Working environment table

Appendix 3: Health care table

Appendix 4: Final search strings used to retrieve articles



Search term literature review 1a: Setting out-of-home

TS=((intervention OR 'field experiment' OR 'field experiments' OR RCT OR 'randomized controlled trial' OR 'randomized controlled trials' OR 'randomized trials' OR 'randomized trials' OR 'randomized controlled trials' OR 'randomized trials' '

AND

(behav* OR intent* OR intake OR consum* OR choice OR choos* OR decid* OR 'decision making' OR buy* OR purchas* OR eat* OR drink* OR WTP OR 'willingness to pay' OR cook* OR prepar* OR dispos* OR spend* OR 'behavior change' OR 'behaviour change')

AND

(food OR vegetable OR fruit OR meat OR dairy OR fish OR snack OR breakfast OR lunch OR dinner OR dessert OR meal)

AND

(restaurant OR school OR canteen OR hotel OR 'fast food' OR cafeteria OR 'train station' OR 'train stations' OR 'gas station' OR 'gas stations' OR airport OR 'on the go' OR 'vending machine' OR 'vending machines'))



Search term literature review 1b: Setting working environment

TS=((intervention OR 'field experiment' OR 'field experiments' OR RCT OR 'randomized controlled trial' OR 'randomized controlled trials' OR 'randomized controlled trials' OR 'randomized controlled trials' OR 'natural experiments' OR quasi-experiment OR 'independent group design' OR 'non-randomized trial' OR 'non-randomized trials')

AND

(behav* OR intent* OR intake OR consum* OR choice OR choos* OR decid* OR 'decision making' OR buy* OR purchas* OR eat* OR drink* OR WTP OR 'willingness to pay' OR cook* OR prepar* OR dispos* OR spend* OR 'behavior change' OR 'behaviour change')

AND

(food OR vegetable OR fruit OR meat OR dairy OR fish OR snack OR breakfast OR lunch OR dinner OR dessert OR meal)

AND

(canteen OR work OR office OR employee OR restaurant OR cafeteria OR 'meeting room' OR 'meeting rooms' OR pantry OR 'vending machine' OR 'vending machines'))



Search term literature review 1c: Setting online food context

TS=((intervention OR 'field experiment' OR 'field experiments' OR RCT OR 'randomized controlled trial' OR 'randomized controlled trials' OR 'randomised controlled trials' OR 'randomised controlled trials' OR 'natural experiment' OR 'natural experiments' OR quasi-experiment OR 'independent group design' OR 'non-randomized trial' OR 'non-randomized trials')

AND

(behav* OR intent* OR intake OR consum* OR choice OR choos* OR decid* OR 'decision making' OR buy* OR purchas* OR eat* OR drink* OR WTP OR 'willingness to pay' OR cook* OR prepar* OR dispos* OR spend* OR 'behavior change' OR 'behaviour change')

AND

(food OR vegetable OR fruit OR meat OR dairy OR fish OR snack OR breakfast OR lunch OR dinner OR dessert OR meal)

AND

('food box' OR 'food boxes' OR 'meal box' OR 'meal boxes' OR 'online store' OR 'online stores' OR internet OR e-commerce OR website OR mobile OR virtual OR 'meal kit' OR 'meal kits' OR 'food kit' OR 'food kits' OR 'f



Search term literature review 1d: Health care context

TS=((intervention OR 'field experiment' OR 'field experiments' OR RCT OR 'randomized controlled trial' OR 'randomized controlled trials' OR 'randomized trials' OR 'randomized trials' OR 'randomized controlled trials' OR 'randomized trials' '

AND

(behav* OR intent* OR intake OR consum* OR choice OR choos* OR decid* OR 'decision making' OR buy* OR purchas* OR eat* OR drink* OR WTP OR 'willingness to pay' OR cook* OR prepar* OR dispos* OR spend* OR 'behavior change' OR 'behaviour change')

AND

(food OR vegetable OR fruit OR meat OR dairy OR fish OR snack OR breakfast OR lunch OR dinner OR dessert OR meal)

AND

(hospital* OR 'health-care centre' OR 'health-care center' OR disabilit* OR disabile* OR 'mental health clinic' OR 'mental health hospital' OR 'mental health institution' OR 'psychiatric hospital' OR 'psychiatric institution' OR 'nursing home' OR 'retirement home' OR 'residential care centre' OR 'retirement community'))



References



References

Overall references

Bianchi, F., Garnett, E., Dorsel, C., Aveyard, P., & Jebb, S. A. (2018). Restructuring physical micro-environments to reduce the demand for meat: A systematic review and qualitative comparative analysis. Lancet Planet Health, 2, e384–e397.

Kraak, V.I., Englund, T., Misyak, S., & Serrano, E.L. (2017). A novel marketing mix and choice architecture framework to nudge restaurant customers toward healthy food environments to reduce obesity in the United States. Obesity Reviews, 18, 852–868.

Lorenz, B.A., & Langen, N. (2018). Determinants of how individuals choose, eat and waste: Providing common ground to enhance sustainable food consumption out-of-home. International Journal of Consumer Studies, 42, 35–75.

Nuffield Council on Bioethics (2007). Public health ethical issues. London, Nuffield Council on Bioethics, 2007.

Reinders, M., Bouwman, E., & Taufik, D. (2019). Overview of existing knowledge concerning food behaviour interventions out-of-home, in the working environment and in online settings: a literature quick scan -WP1 -Food, Value, Impact. Wageningen Economic Research.

Rothschild, M.L. (1999). Carrots, sticks, and promises: A conceptual framework for the management of public health and social issue behaviors. Journal of Marketing, 63(4), 24-37.

Skov, L.R., Lourenco, S., Hansen, G.L., Mikkelsen, B.E., & Schofield, C. (2013). Choice architecture as a means to change eating behaviour in self-service settings: a systematic review. Obesity Reviews, 14(3), 187-196.

Wansink, B. (2015). Change their choice! Changing behavior using the CAN approach and activism research. Psychology & Marketing, 32(5), 486-500.



Acharya, R.N., Patterson, P.M., Hill, E.P., Schmitz, T.G., & Bohm, E. (2006). An evaluation of the 'TrEAT Yourself Well' restaurant nutrition campaign. Health Education & Behavior, 33(3), 309-324. doi:10.1177/1090198105284875

Backman, D., Gonzaga, G., Sugerman, S., Francis, D., & Cook, S. (2011). Effect of Fresh Fruit Availability at Worksites on the Fruit and Vegetable Consumption of Low-Wage Employees. Journal of Nutrition Education and Behavior, 43(4), S113-S121. doi:10.1016/j.jneb.2011.04.003

Basak, S., Steinberg, A., Campbell, A., Dupuis, A., Chen, S.Y., Bar Dayan, A., . . . Hamilton, J. (2019). All Aboard Meal Train: Can Child-Friendly Menu Labeling Promote Healthier Choices in Hospitals? Journal of Pediatrics, 204, 59-65. doi:10.1016/j.jpeds.2018.08.073

Beattie, E.R.A., Algase, D.L., & Song, J. (2004). Keeping wandering nursing home residents at the table: improving food intake using a behavioral communication intervention. Aging & Mental Health, 8(2), 109-116. doi:10.1080/13607860410001649617

Beresford, S.A.A., Shannon, J., McLerran, D., & Thompson, B. (2000). Seattle 5-a-Day Work-Site Project: Process evaluation. Health Education & Behavior, 27(2), 213-222. doi:10.1177/109019810002700207

Beresford, S.A.A., Thompson, B., Feng, Z.D., Christianson, A., McLerran, D., & Patrick, D.L. (2001). Seattle 5 a day worksite program to increase fruit and vegetable consumption. Preventive Medicine, 32(3), 230-238. doi:10.1006/pmed.2000.0806

Campbell, K.L., Webb, L., Vivanti, A., Varghese, P., & Ferguson, M. (2013). Comparison of three interventions in the treatment of malnutrition in hospitalised older adults: A clinical trial. Nutrition & Dietetics, 70(4), 325-331. doi:10.1111/1747-0080.12008



Crogan, N.L., Short, R., Dupler, A.E., & Heaton, G. (2015). The Influence of Cognitive Status on Elder Food Choice and Meal Service Satisfaction. American Journal of Alzheimers Disease and Other Dementias, 30(7), 679-685. doi:10.1177/1533317512461556

Desai, J., Winter, A., Young, K.W.H., & Greenwood, C. E. (2007). Changes in type of foodservice and dining room environment preferentially benefit institutionalized seniors with low body mass indexes. Journal of the American Dietetic Association, 107(5), 808-814. doi:10.1016/j.jada.2007.02.018

Dorresteijn, J.A.N., van der Graaf, Y., Zheng, K.L., Spiering, W., & Visseren, F.L.J. (2013). The daily 10 kcal expenditure deficit: a beforeand-after study on low-cost interventions in the work environment. Bmj Open, 3(1). doi:10.1136/bmjopen-2012-002125

Ellison, B., Lusk, J.L., & Davis, D. (2014). THE IMPACT OF RESTAURANT CALORIE LABELS ON FOOD CHOICE: RESULTS FROM A FIELD EXPERIMENT. Economic Inquiry, 52(2), 666-681. doi:10.1111/ecin.12069

Engbers, L. H., van Poppel, M.N.M., Paw, M.C.A., & van Mechelen, W. (2006). The effects of a controlled worksite environmental intervention on determinants of dietary behavior and self-reported fruit, vegetable and fat intake. Bmc Public Health, 6. doi:10.1186/1471-2458-6-253

Essed, N.H., van Staveren, W.A., Kok, F.J., & de Graaf, C. (2007). No effect of 16 weeks flavor enhancement on dietary intake and nutritional status of nursing home elderly. Appetite, 48(1), 29-36. doi:10.1016/j.appet.2006.06.002

Feldman, C.H., Hartwell, H., Brusca, J., Su, H.Y., & Zhao, H. (2015). Nutrition information and its influence on menu choice within higher education establishments. British Food Journal, 117(4), 1399-1410. doi:10.1108/bfj-06-2014-0219



Finkelstein, E.A., Strombotne, K.L., Chan, N.L., & Krieger, J. (2011). Mandatory Menu Labeling in One Fast-Food Chain in King County, Washington. American Journal of Preventive Medicine, 40(2), 122-127. doi:10.1016/j.amepre.2010.10.019

Fiske, A., & Cullen, K.W. (2004). Effects of promotional materials on vending sales of low-fat items in teachers' lounges. Journal of the American Dietetic Association, 104(1), 90-93. doi:10.1016/j.jada.2003.10.011

Franco, A.D., de Castro, I.R.R., & Wolkoff, D.B. (2013). Impact of the promotion of fruit and vegetables on their consumption in the workplace. Revista De Saude Publica, 47(1), 29-36.

French, S.A., Harnack, L.J., Hannan, P.J., Mitchell, N.R., Gerlach, A.F., & Toomey, T.L. (2010). Worksite environment intervention to prevent obesity among metropolitan transit workers. Preventive Medicine, 50(4), 180-185. doi:10.1016/j.ypmed.2010.01.002

Gans, K.M., Risica, P.M., Dulin-Keita, A., Mello, J., Dawood, M., Strolla, L.O., & Harel, O. (2015). Innovative video tailoring for dietary change: final results of the Good for you! cluster randomized trial. International Journal of Behavioral Nutrition and Physical Activity, 12. doi:10.1186/s12966-015-0282-5

Geaney, F., Harrington, J., Fitzgerald, A.P., & Perry, I.J. (2011). The impact of a workplace catering initiative on dietary intakes of salt and other nutrients: a pilot study. Public Health Nutrition, 14(8), 1345-1349. doi:10.1017/s1368980010003484



Goeminne, P.C., De Wit, E.H., Burtin, C., & Valcke, Y. (2012). Higher food intake and appreciation with a new food delivery system in a Belgian hospital. Meals on Wheels, a bedside meal approach A prospective cohort trial. Appetite, 59(1), 108-116. doi:10.1016/j.appet.2012.04.008

Hammond, D., Goodman, S., Hanning, R., & Daniel, S. (2013). A randomized trial of calorie labeling on menus. Preventive Medicine, 57(6), 860-866. doi:10.1016/j.ypmed.2013.09.020

Hoefkens, C., Pieniak, Z., Van Camp, J., & Verbeke, W. (2012). Explaining the effects of a point-of-purchase nutrition-information intervention in university canteens: a structural equation modelling analysis. International Journal of Behavioral Nutrition and Physical Activity, 9. doi:10.1186/1479-5868-9-111

Hoist, M., Beermann, T., Mortensen, M. N., Skadhauge, L. B., Lindorff-Larsen, K., & Rasmussen, H. H. (2015). Multi-modal intervention improved oral intake in hospitalized patients. A one year follow-up study. Clinical Nutrition, 34(2), 315-322. doi:10.1016/j.clnu.2014.05.001

Holdsworth, M., Raymond, N.T., & 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. doi:10.1093/heapro/dah207

Holst, M., Beermann, T., Mortensen, M. N., Skadhauge, L. B., Kohler, M., Lindorff-Larsen, K., & Rasmussen, H. H. (2017). Optimizing protein and energy intake in hospitals by improving individualized meal serving, hosting and the eating environment. Nutrition, 34, 14-20. doi:10.1016/j.nut.2016.05.011



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. doi:10.4278/ajhp.130522-QUAN-2157

Kallbekken, S., & Saelen, H. (2013). 'Nudging' hotel guests to reduce food waste as a win-win environmental measure. Economics Letters, 119(3), 325-327. doi:10.1016/j.econlet.2013.03.019

Krieger, J.W., Chan, N.L., Saelens, B.E., Ta, M.L., Solet, D., & Fleming, D.W. (2013). Menu Labeling Regulations and Calories Purchased at Chain Restaurants. American Journal of Preventive Medicine, 44(6), 595-604. doi:10.1016/j.amepre.2013.01.031

Kroese, F.M., Marchiori, D.R., & de Ridder, D.T.D. (2016). Nudging healthy food choices: a field experiment at the train station. Journal of Public Health, 38(2), E133-E137. doi:10.1093/pubmed/fdv096

Krogholm, K.S., Bredsdorff, L., Alinia, S., Christensen, T., Rasmussen, S.E., & Dragsted, L.O. (2010). Free fruit at workplace intervention increases total fruit intake: a validation study using 24 h dietary recall and urinary flavonoid excretion. European Journal of Clinical Nutrition, 64(10), 1222-1228. doi:10.1038/ejcn.2010.130

Kushida, O., & Murayama, N. (2014). Effects of Environmental Intervention in Workplace Cafeterias on Vegetable Consumption by Male Workers. Journal of Nutrition Education and Behavior, 46(5), 350-358. doi:10.1016/j.jneb.2014.05.001



Lachat, C.K., Verstraeten, R., De Meulenaer, B., Menten, J., Huybregts, L.F., Van Camp, J., . . . Kolsteren, P. W. (2009). Availability of free fruits and vegetables at canteen lunch improves lunch and daily nutritional profiles: a randomised controlled trial. British Journal of Nutrition, 102(7), 1030-1037. doi:10.1017/s000711450930389x

Lassen, A. D., Ernst, L., Poulsen, S., Andersen, K. K., Hansen, G. L., Biltoft-Jensen, A., & Tetens, I. (2012). Effectiveness of a Canteen Take Away concept in promoting healthy eating patterns among employees. Public Health Nutrition, 15(3), 452-458. doi:10.1017/s1368980011001431

Lassen, A., Hansen, K.S., & Trolle, E. (2007). Comparison of buffet and a la carte serving at worksite canteens on nutrient intake and fruit and vegetable consumption. Public Health Nutrition, 10(3), 292-297. doi:10.1017/s1368980007246610

Lassen, A., Thorsen, A.V., Trolle, E., Elsig, M., & Ovesen, L. (2004). Successful strategies to increase the consumption of fruits and vegetables: results from the Danish '6 a day' Work-site Canteen Model Study. Public Health Nutrition, 7(2), 263-270. doi:10.1079/phn2003532

Lassen, A.D., Beck, A., Leedo, E., Andersen, E.W., Christensen, T., Mejborn, H., . . . Tetens, I. (2014). Effectiveness of offering healthy labelled meals in improving the nutritional quality of lunch meals eaten in a worksite canteen. Appetite, 75, 128-134. doi:10.1016/j.appet.2013.12.005



Lassen, A.D., Beck, A.M., Leedo, E., Andersen, E.W., Christensen, T., Mejborn, H., . . . Tetens, I. (2013). EFFECTIVENESS OF OFFERING KEYHOLE LABELLED MEALS IN IMPROVING THE NUTRITIONAL QUALITY OF LUNCH MEALS EATEN IN WORKSITE CANTEENS. Annals of Nutrition and Metabolism, 63, 954-954.

Lassen, A.D., Thorsen, A.V., Sommer, H.M., Fagt, S., Trolle, E., Biltoft-Jensen, A., & Tetens, I. (2011). Improving the diet of employees at blue-collar worksites: results from the 'Food at Work' intervention study. Public Health Nutrition, 14(6), 965-974. doi:10.1017/s1368980010003447

Lee-Kwan, S.H., Bleich, S.N., Kim, H., Colantuoni, E., & Gittelsohn, J. (2015). Environmental Intervention in Carryout Restaurants Increases Sales of Healthy Menu Items in a Low-Income Urban Setting. American Journal of Health Promotion, 29(6), 357-364. doi:10.4278/ajhp.130805-QUAN-408

Levy, D.E., Riis, J., Sonnenberg, L.M., Barraclough, S.J., & Thorndike, A.N. (2012). Food Choices of Minority and Low-Income Employees A Cafeteria Intervention. American Journal of Preventive Medicine, 43(3), 240-248. doi:10.1016/j.amepre.2012.05.004

Loureiro, M.L., & Rahmani, D. (2016). The incidence of calorie labeling on fast food choices: A comparison between stated preferences and actual choices. Economics & Human Biology, 22, 82-93. doi:10.1016/j.ehb.2016.03.001

Lowe, M.R., Tappe, K.A., Butryn, M.L., Annunziato, R.A., Coletta, M.C., Ochner, C.N., & Rolls, B.J. (2010). An intervention study targeting energy and nutrient intake in worksite cafeterias. Eating Behaviors, 11(3), 144-151. doi:10.1016/j.eatbeh.2010.01.002



Mackison, D., Mooney, J., Macleod, M., & Anderson, A.S. (2016). Lessons learnt from a feasibility study on price incentivised healthy eating promotions in workplace catering establishments. Journal of Human Nutrition and Dietetics, 29(1), 86-94. doi:10.1111/jhn.12283

Mamhidir, A.G., Karlsson, I., Norberg, A., & Kihlgren, M. (2007). Weight increase in patients with dementia, and alteration in meal routines and meal environment after integrity promoting care. Journal of Clinical Nursing, 16(5), 987-996. doi:10.1111/j.1365-2702.2006.01780.x

Martinez-Donate, A.P., Riggall, A.J., Meinen, A.M., Malecki, K., Escaron, A.L., Hall, B., . . . Nitzke, S. (2015). Evaluation of a pilot healthy eating intervention in restaurants and food stores of a rural community: a randomized community trial. Bmc Public Health, 15. doi:10.1186/s12889-015-1469-z

Mathey, M., Siebelink, E., de Graaf, C., & Van Staveren, W. A. (2001). Flavor enhancement of food improves dietary intake and nutritional status of elderly nursing home residents. Journals of Gerontology Series a-Biological Sciences and Medical Sciences, 56(4), M200-M205. doi:10.1093/gerona/56.4.M200

Mathey, M., Vanneste, V.G.G., de Graaf, C., de Groot, L., & van Staveren, W.A. (2001). Health effect of improved meal ambiance in a Dutch nursing home: A 1-year intervention study. Preventive Medicine, 32(5), 416-423. doi:10.1006/pmed.2001.0816

McCray, S., Maunder, K., Barsha, L., & Mackenzie-Shalders, K. (2018). Room service in a public hospital improves nutritional intake and increases patient satisfaction while decreasing food waste and cost. Journal of Human Nutrition and Dietetics, 31(6), 734-741. doi:10.1111/jhn.12580



McCray, S., Maunder, K., Norris, R., Moir, J., & MacKenzie-Shalders, K. (2018). Bedside Menu Ordering System increases energy and protein intake while decreasing plate waste and food costs in hospital patients. Clinical Nutrition Espen, 26, 66-71. doi:10.1016/j.clnesp.2018.04.012

Munk, T., Bruun, N., Nielsen, M. A., & Thomsen, T. (2017). From Evidence to Clinical Practice: Positive Effect of Implementing a Protein-Enriched Hospital Menu in Conjunction With Individualized Dietary Counseling. Nutrition in Clinical Practice, 32(3), 420-426. doi:10.1177/0884533616688432

Munk, T., Seidelin, W., Rosenbom, E., Nielsen, A. L., Klausen, T. W., Nielsen, M. A., & Thomsen, T. (2013). A 24-h a la carte food service as support for patients at nutritional risk: a pilot study. Journal of Human Nutrition and Dietetics, 26(3), 268-275. doi:10.1111/jhn.12017

Olstad, D.L., Goonewardene, L.A., McCargar, L.J., & Raine, K.D. (2014). Choosing healthier foods in recreational sports settings: a mixed methods investigation of the impact of nudging and an economic incentive. International Journal of Behavioral Nutrition and Physical Activity, 11. doi:10.1186/1479-5868-11-6

Papies, E.K., & Veling, H. (2013). Healthy dining. Subtle diet reminders at the point of purchase increase low-calorie food choices among both chronic and current dieters. Appetite, 61, 1-7. doi:10.1016/j.appet.2012.10.025

Patsch, A.J., Smith, J.H., 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. doi:10.1177/0890117116658237



Rufenacht, U., Ruhlin, M., Wegmann, M., Imoberdorf, R., & Ballmer, P. E. (2010). Nutritional counseling improves quality of life and nutrient intake in hospitalized undernourished patients. Nutrition, 26(1), 53-60. doi:10.1016/j.nut.2009.04.018

Schwartz, J., Riis, J., Elbel, B., & Ariely, D. (2012). Inviting Consumers To Downsize Fast-Food Portions Significantly Reduces Calorie Consumption. Health Affairs, 31(2), 399-407. doi:10.1377/hlthaff.2011.0224

Simmons, S. F., Alessi, C., & Schnelle, J. F. (2001). An intervention to increase fluid intake in nursing home residents: Prompting and preference compliance. Journal of the American Geriatrics Society, 49(7), 926-933. doi:10.1046/j.1532-5415.2001.49183.x

Simmons, S. F., Keeler, E., An, R. P., Liu, X. L., Shotwell, M. S., Kuertz, B., . . . Schnelle, J. F. (2015). Cost-Effectiveness of Nutrition Intervention in Long-Term Care. Journal of the American Geriatrics Society, 63(11), 2308-2316. doi:10.1111/jgs.13709

Sonnenberg, L., Gelsomin, E., Levy, D.E., Riis, J., Barraclough, S., & Thorndike, A.N. (2013). A traffic light food labeling intervention increases consumer awareness of health and healthy choices at the point-of-purchase. Preventive Medicine, 57(4), 253-257. doi:10.1016/j.ypmed.2013.07.001

Sorensen, G., Barbeau, E., Stoddard, A.M., Hunt, M.K., Kaphingst, K., & Wallace, L. (2005). Promoting behavior change among workingclass, multiethnic workers: Results of the healthy directions-small business study. American Journal of Public Health, 95(8), 1389-1395. doi:10.2105/ajph.2004.038745



Steenhuis, I., Van Assema, P., Van Breukelen, G., Glanz, K., Kok, G., & De Vries, H. (2004). The impact of educational and environmental interventions in Dutch worksite cafeterias. Health Promotion International, 19(3), 335-343. doi:10.1093/heapro/dah307

Stites, S.D., Singletary, S.B., Menasha, A., Cooblall, C., Hantula, D., Axelrod, S., . . . Phipps, E. J. (2015). Pre-ordering lunch at work. Results of the what to eat for lunch study. Appetite, 84, 88-97. doi:10.1016/j.appet.2014.10.005

Thorndike, A.N., Riis, J., & Levy, D.E. (2016). Social norms and financial incentives to promote employees' healthy food choices: A randomized controlled trial. Preventive Medicine, 86, 12-18. doi:10.1016/j.ypmed.2016.01.017

Thunstrom, L., Nordstrom, J., & Shogren, J.F. (2016). Healthy meals on the menu: A Swedish field experiment on labelling and restaurant sales. African Journal of Agricultural and Resource Economics-Afjare, 11(1), 63-68.

Timmerman, G.M., & Brown, A. (2012). The Effect of a Mindful Restaurant Eating Intervention on Weight Management in Women. Journal of Nutrition Education and Behavior, 44(1), 22-28. doi:10.1016/j.jneb.2011.03.143

van Berkel, J., Boot, C.R.L., Proper, K.I., Bongers, P.M., & van der Beek, A. J. (2014). Effectiveness of a worksite mindfulness-based multicomponent intervention on lifestyle behaviors. International Journal of Behavioral Nutrition and Physical Activity, 11. doi:10.1186/1479-5868-11-9



van der Zanden, L.D.T., van Essen, H., van Kleef, E., de Wijk, R.A., & van Trijp, H. C. M. (2015). Using a verbal prompt to increase protein consumption in a hospital setting: a field study. International Journal of Behavioral Nutrition and Physical Activity, 12. doi:10.1186/s12966-015-0271-8

van Genugten, L., van Empelen, P., Boon, B., Borsboom, G., Visscher, T., & Oenema, A. (2012). Results from an Online Computer-Tailored Weight Management Intervention for Overweight Adults: Randomized Controlled Trial. Journal of Medical Internet Research, 14(2). doi:10.2196/jmir.1901

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. doi:10.1186/1471-2458-12-1072

van Kleef, E., van den Broek, O., & van Trijp, H.C.M. (2015). Exploiting the Spur of the Moment to Enhance Healthy Consumption: Verbal Prompting to Increase Fruit Choices in a Self-Service Restaurant. Applied Psychology-Health and Well Being, 7(2), 149-166. doi:10.1111/aphw.12042

Vanderlee, L., & Hammond, D. (2014). Does nutrition information on menus impact food choice? Comparisons across two hospital cafeterias. Public Health Nutrition, 17(6), 1393-1402. doi:10.1017/s136898001300164x

Vermeer, W.M., Steenhuis, I.H.M., Leeuwis, F.H., Heymans, M.W., & Seidell, J.C. (2011). Small portion sizes in worksite cafeterias: do they help consumers to reduce their food intake? International Journal of Obesity, 35(9), 1200-1207. doi:10.1038/ijo.2010.271



Vyth, E.L., Steenhuis, I.H.M., Heymans, M.W., Roodenburg, A.J.C., Brug, J., & Seidell, J.C. (2011). Influence of Placement of a Nutrition Logo on Cafeteria Menu Items on Lunchtime Food Choices at Dutch Work Sites. Journal of the American Dietetic Association, 111(1), 131-136. doi:10.1016/j.jada.2010.10.003

Wansink, B., Painter, J., & van Ittersum, K. (2002). How descriptive menu labels influence attitudes and repatronage. In S. M. Broniarczyk & K. Nakamoto (Eds.), Advances in Consumer Research, Volume Xxix (Vol. 29, pp. 168-172).

Wilson, A.L., Bogomolova, S., & Buckley, J.D. (2015). Lack of Efficacy of a Salience Nudge for Substituting Selection of Lower-Calorie for Higher-Calorie Milk in the Work Place. Nutrients, 7(6), 4336-4344. doi:10.3390/nu7064336

Wolfenden, L., Kingsland, M., Rowland, B.C., Dodds, P., Gillham, K., Yoong, S.L., . . . Wiggers, J. (2015). Improving availability, promotion and purchase of fruit and vegetable and non sugar-sweetened drink products at community sporting clubs: a randomised trial. International Journal of Behavioral Nutrition and Physical Activity, 12. doi:10.1186/s12966-015-0193-5

Wright, L., Hickson, M., & Frost, G. (2006). Eating together is important: using a dining room in an acute elderly medical ward increases energy intake. Journal of Human Nutrition and Dietetics, 19(1), 23-26. doi:10.1111/j.1365-277X.2006.00658.x

Young, A. M., Mudge, A. M., Banks, M. D., Ross, L. J., & Daniels, L. (2013). Encouraging, assisting and time to EAT: Improved nutritional intake for older medical patients receiving Protected Mealtimes and/or additional nursing feeding assistance. Clinical Nutrition, 32(4), 543-549. doi:10.1016/j.clnu.2012.11.009



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This study was carried out by Wageningen Economic Research as part of and was commissioned and financed by the Dutch Topsectors Agri & Food and Tuinbouw & Uitgangsmaterialen within the context of the publicprivate partnership <u>Food, Value & Impact</u> (project number BO-45-002-011) and of the public-private partnership *Gezonde Voeding in de Zorg en Horeca* (project number BO-62-001-003).

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