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FACULTY OF ECONOMICS AND BUSINESS ADMINISTRATION

A Systematic Review Investigating Successful Behavior Change Methods and Strategies to Reduce Animal-based Protein Consumption

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This study contributes to the objective of Eat4Change, a European project aiming at the transition towards more sustainable consumption and production in Belgium and Europe, with a special focus on the livestock sector.

More specifically, by 2024 targeted European Youth will:

- ✓ Have **greater awareness** of the impact of diets on "People and Planet" and a critical understanding of their role as consumers and active citizens.
- ✓ **Contribute to SDGs and climate actions** by embracing more sustainable diets & influencing peers
- ✓ **Support engagement** with corporates and policy makers for improved practices and policy coherence.

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Content

1 Introduction

WWF has been granted the 4-year Eat4Change project, funded by the EU Development Cooperation. Eat4Change wants to engage citizens on the topic of sustainable food, demonstrating how individual lifestyle choices can directly contribute to limiting warming to 1.5 degrees, and support the achievement of the Sustainable Development Goals. To engage youth as "active global citizens", sustainable food consumption is used as a lens and focus of the project.

One part of the Eat4Change project is the evidence base output, which will create a consolidated scientific base that informs all Eat4Change interventions, creating momentum for sustainable dietary change. This report carries out part of the first work-package by conducting a systematic literature review on effective behavior change interventions. Literature was reviewed on existing food consumption behavior change interventions, more specifically on behavior change interventions that focus on meat reduction or shifting preferences and choices from animal-based to plant-based diets.

The report not only gives an overview of the literature, but also aims to categorize the different interventions and working mechanisms according to the Socio-ecological model (Kok et al., 2008) and the Taxonomy of behavior change methods by Kok and colleagues (2016). You will find more insight in these theories in section 3.1 in the report.

2 Methodology

To accurately and reliably summarize evidence, we used a systematic process by applying the PRISMA approach (Liberati et al., 2009). This approach relies on systematic methods that are selected to minimize bias and consists of a structured flow in which the review needs to be carried out.

Before we started screening literature, together with WWF we agreed on some criteria for considering studies:

Type of studies. We included randomized controlled trials (RCTs) and (quasi-) experimental designs. We preferred to only include controlled trials/experiments with an evaluation design (e.g. pre-post). However, in case we came across relevant studies providing insight into acceptability, usability and feasibility of behavior change methods[1] among the target groups, these studies were kept apart too.

Type of participants. The focus was on young citizens of age 15 to 35, but if a study targeted a broader age group that also encompassed the group of young citizens, the study was also selected for review. We aimed to segment our findings on the different transitional life stages, such as children, adolescents, higher education students, young professionals without and with children (parents), but since we almost solely found studies with adults, we did not segment the findings according to life stages.

Type of interventions. We looked for behavior change interventions that report on behavior change methods (and their determinants), but also intervention studies that only reported an effect on a specific outcome measure were considered for reviewing. The interventions either focused on meat reduction, and/or on a shift from animal- to plant-based diets/proteins and transitional phases such as moving from all-meat diets to flexitarian or vegetarian diets.

Type of outcome measures. Objective or self-reported measures of actual or intended meat/animal-based protein consumption and/or purchase of meat or animal-based products.

Four scientific, electronic databases were searched: Pubmed, WebofScience, Cochrane and Scopus, with following search key words: meat AND (behav* OR reduc* OR consum* OR substitut* OR curtail* OR alternat* OR replac* OR choice* OR choos* OR purchas* OR shop* OR avoid*) OR vegetarian OR vegan OR flexitarian OR animal-based product* AND change* OR technique* OR strateg* OR intervention* OR program* OR nudg* OR polic* OR initiative* OR experiment* OR campaign* OR communication OR action* NOT muscle OR mouse OR insect OR receptor OR cell OR DNA OR serum.

[1] For more information on behavior change methods look at section 3.1 Theoretical background: Socio-ecological model and taxonomy of behavior change methods

We screened titles and abstracts following specific inclusion and exclusion criteria (see table 1).

Inclusion criteria	Exclusion criteria
Articles/reviews published since 2010	Articles/reviews published before 2010
Articles/reviews published in English only	
Articles/reviews with a research location in Europe, North-America, Oceania.	
Must focus on meat reduction or a shift in diets Change in intention or actual selection/purchasing/consumption of a specific product, food or dish	Any study that only focuses on eating more vegetables, pulses, but does not include meat consumption/purchase
Articles/reviews preferably report on used behavioral change strategies and determinants	
Articles targeting healthy children, adolescents, students, young professionals and parents	Exclude elderly, and adults receiving treatment for illness
Randomized controlled trials (RCTs) and (quasi-) experimental designs. Only controlled trials with an evaluation design (e.g. pre-post). However, relevant studies on usability, acceptability and feasibility of behaviour change methods were kept apart even if they do not match the abovementioned design.	Studies that have non-experimental study designs (i.e., observational or case studies, studies reporting prevalence or trend data, feasibility studies, measurement studies and theoretical papers)

Table 1. Inclusion – Exclusion criteria

The PRISMA flow diagram gives an overview of the steps taken, and the results in each step (see figure 1).

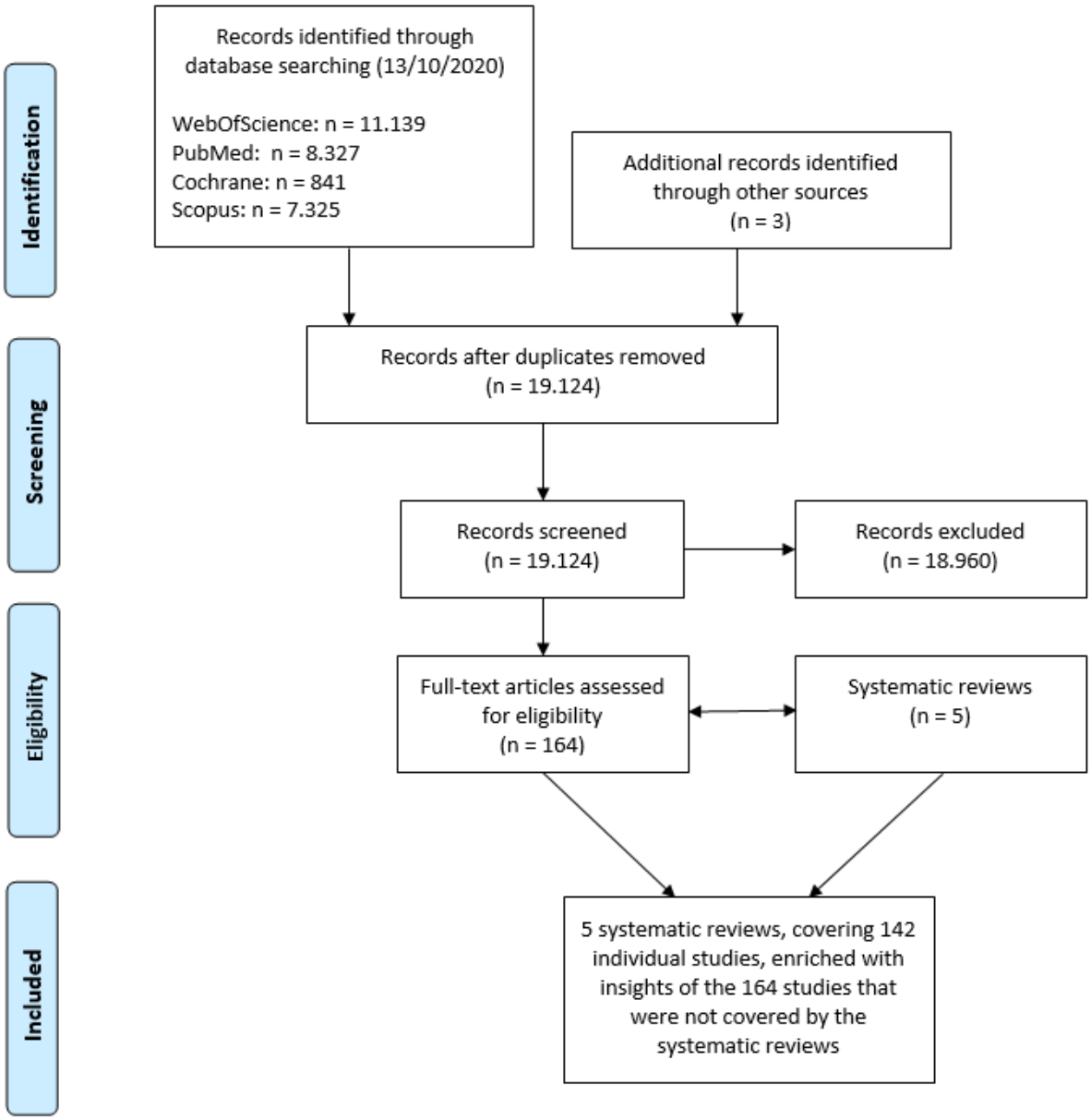

Fig. 1. Flow diagram (adapted PRISMA approach)

In total 28.748 records were identified through the four databases. After removing the duplicates, 19.124 titles and abstracts were left to be screened by eight researchers, indicating if the record should be included or excluded. In cases where the reviewers doubted about the inclusion (n=189), two researchers reread the abstracts and decided together. Finally, 164 papers were kept aside for full-text screening.

Of these 164 papers, we identified five relevant systematic reviews that were similar to the research objective of the current review for WWF's Eat4Change project. In agreement with WWF, we decided to start describing results of the systematic reviews, and afterwards look into individual papers for additional results and insights. Taking into account the time limit to conduct this review, as well as the number of selected papers (n=164), this approach would also yield the best results. Hence, this report focuses on describing the systematic reviews and adding results from individual papers when deemed necessary to address the research objective of this review. Appendix 7.1 gives an overview of the objectives and inclusion/exclusion criteria of the included systematic reviews.

3 Results

3.1 Theoretical background: Socio-ecological model and taxonomy of behavior change methods

The design of effective interventions requires that interventions are adapted to the setting or domain in which they are applied, to their target audience and to the specific goals of the involved stakeholders. Many examples show that interventions that were successful in a specific setting are not necessarily applicable to other settings. Hence, we will **first categorize** interventions ***according to the settings*** and domains they were implemented in, while ***using the socio-ecological model*** (Kok et al., 2008) (see Figure 2).

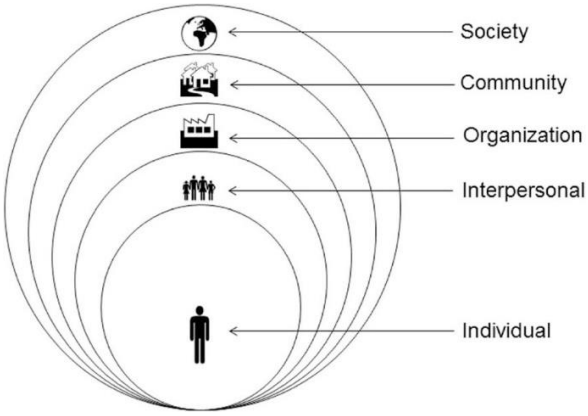

Fig. 2 Socio-ecological model (Kok et al., 2008)

A second categorization will be based on the taxonomy of behavior change methods (Kok et al., 2016). This taxonomy categorizes ***theoretical behavior change methods according to determinants*** they work on (e.g. knowledge, awareness, attitudes, habits, etc.), and has been developed in the framework of the Intervention Mapping protocol (Bartholomew et al. 2016), a protocol for systematically developing theory- and evidence-based behavior change interventions. The figures in Box 1 provide more insight in the taxonomy of Kok and the table gives a short example of the taxonomy, which is also added in Appendix 7.3.

In the next sections (3.2 and following), the behavior change methods are presented according to the determinants they can successfully influence. This is because it is crucial to first identify the relevant changeable determinants (e.g. knowledge, attitude) of a target behavior (in this case a reduction in meat consumption) before selecting theoretical methods that match these determinants. In box 1 you find an example to make this more clear: if the goal is to reduce meat intake (behavior) by increasing adults' skills (*determinant*) to cook meatless meals, the corresponding theoretical *behavior change methods* might be modeling (see the taxonomy of Kok and colleagues, 2016 in Appendix 7.3 for a complete overview of behavior change methods to change skills). The behavioral change methods are thus rather generic and need to be translated into practical applications. One *practical application* for the method modeling could be a videotaped step-by-step demonstration by peers in which it is shown how you can easily make a vegetarian meal.

In what follows we listed the interventions, as discussed in the identified systematic reviews, according to the setting (socio-ecological model) and the theoretical behavior change methods linked to specific determinants (the taxonomy of Kok and colleagues, 2016). However, the systematic reviews do not always report on the used behavior change methods and/or the targeted determinants. If this was the case, we tried to infer the used theoretical methods and/or the targeted determinants, and categorized the study to the best of our abilities. All results are bundled in an overview table in Appendix 7.2. In addition, because giving insight in the relevant and modifiable determinants to reduce meat consumption is crucial too, we also added some (systematic) studies we found (not exhaustive) on determinants in section 3.3 Determinants of meat curtailment.

Behavior change methods as working mechanisms for an intervention

Kok and colleagues (2016) define theory-based methods, or **behavior change methods** as **general techniques** or processes that have been shown to be able **to change one or more determinants of behavior** of individuals. Note that by 'theory based', the authors mean that the methods "have their origins in behavioral and social science theories" (Bartholomew et al., 2016), and it is not uncommon that evidence for a method is provided in several theories.

A theory explains how the mechanism of action works, and thus testifies as to why we can expect a causal link between application of the method and behavior change. **In almost all cases, general methods are studied for influencing generic determinants, such as attitude or self-efficacy, that in turn are supposed to influence the behavior.** The generic nature of these determinants and the methods to change them is consistent with psychologists' aim to study human behavior and psychology in general; yet at the same time, this means that **such behavior change methods cannot immediately be applied in behavior change interventions**. After all, such interventions will always take place in specific populations and environments: they must contain specific messages that target selected beliefs within the determinants of interest, **and require specific translation to practical applications** to reach optimal fit.

Kok and colleagues (2016) define **practical applications as specific translations of theory-based methods for practical use in ways that fit the intervention population and the context in which the intervention will be conducted** (Bartholomew et al., 2016). For a behavior change method to be effective: 1) it must target a determinant that predicts behavior, 2) it must be able to change the determinant, 3) it must be translated into a practical application.

What is the target behavior?
- Eat less meat

What are the determinants of behavior change?
- Increase skills to cook meatless meals

Which Behavior Change Methods may influence determinants?
- Modeling

Socio-ecological model & practical applications

Evidence-based Intervention
- Videotaped demonstration by peers

Method	Definition	Parameters to take into account when translating into a practical application	Practical application
Methods to change Skills, Capability, and Self-Efficacy and to Overcome barriers			
Guided practice	Prompting individuals to rehearse and repeat the behavior various times, discuss the experience, and provide feedback.	Subskill demonstration, instruction, and enactment with Individual feedback; requires supervision by an experienced person; some environmental changes cannot be rehearsed.	A trainer models the behavior and asks the trainees to do the behavior. The trainer gives feedback.
Self-monitoring of behavior	Prompting the person to keep a record of specified behavior(s).	The monitoring must be of the specific behavior (that is, not of a physiological state or health outcome). The data must be interpreted and used. The reward must be reinforcing to the individual.	The participant keeps a journal on the amount of meat or meat substitutes eaten every day.
Goal-setting	Prompting planning what the person will do, including a definition of goal-directed behaviors that result in the target behavior.	Commitment to the goal; goals that are difficult but available within the individual's skill level.	The participant sets a goal that is acceptable to reach in a specific time.
For a full overview with more behavior change methods, definitions, and parameters of use see Appendix 7.3			

Box 1. The taxonomy of behavior change methods explained (based on Kok et al., 2016)

3.2 Intervention studies

3.2.1 Individual level

3.2.1.1 Basic methods at the individual level targeting most determinants

The Taxonomy of Kok et al. (2016) describes different behavior change methods at individual level (see Appendix 7.3). These are a range of general methods that can target different determinants, for example ***Tailoring and Persuasive communication***. The method Tailoring is defined as matching the intervention to previously measured characteristics of the participant. A practical application of this method could be matching messages with people's values on intention to reduce meat consumption, as conducted by Graham et al. (2017) and Schnabelrauch Arndt (2016). These studies though did not find an effect of tailoring on (intention to reduce) meat consumption. Persuasive communication is defined as guiding individuals and environmental agents toward the adoption of an idea, attitude, or action by using arguments or other means. A practical application was tested by Vainio et al. (2018) who found a positive effect on intentions to reduce meat (i.e., persuasive communications results in higher intentions to reduce meat).

In Bianchi et al. (2018a) four RCTs evaluated ten tailored educational interventions, of which none effectively reduced actual (Klöckner & Ofstad, 2017) or intended meat consumption (Schnabelrauch Arndt, 2016). Messages were ***tailored*** (tailoring = behavior change method) to participants' readiness and willingness to change their behavior (Klöckner & Ofstad, 2017), and/or to their most valued consequence of meat consumption, and/or to their self-schema (i.e. a summary of people's beliefs, experiences and generalizations, e.g. being responsible, adventurous, etc.), and/or their personal levels of meat intakes (Schnabelrauch Arndt, 2016).

Harguess et al. (2020) explored the role of experimental ***tailoring*** of information in four studies. When messages were framed to fit people's values (self-transcendence and self-enhancement) on intention to reduce meat consumption, Graham et al. (2017) found that there was no difference in effect between tailored and non-tailored messages. Verain et al. (2017) found that "conscious" consumers decreased the intention to consume "regular types and portions of meat" when they received a combined health and environmental sustainability message frame. According to Vainio et al. (2018) individuals' prior beliefs played a key role in determining responses to ***persuasive messages***. Reading any message changed behavioral intentions to reduce meat consumption among "meat-sceptics" but not among "meat believers".

Take away message #1: Targeted persuasive messages may increase the intention to eat less meat while tailoring has no effect on intentions to reduce meat intake.

The table in Appendix 7.2 provides a comprehensive overview of all results.

3.2.1.2 Behavior change methods to change Habitual, Automatic and Impulsive Behaviors

The Taxonomy of Kok et al. (2016) describes different behavior change methods to change habitual, automatic and impulsive behaviors (see Appendix 7.3), for example ***Implementation intentions*** is defined as prompting making if-then plans that link situational cues with responses that are effective in attaining goals or desired outcomes. A practical application of this method is asking participants to think of if-then plans, as conducted in the study of Rees et al. (2018) where meat consumption was reduced after the intervention.

Harguess et al. (2020) described a study where participants who frequently ate meat were asked to think of a concrete 'if-then plan' ***(implementation intentions)***. Forming an implementation intention means deliberating about a goal and making a concrete plan about how to attain the goal. For example in the experiment of Rees et al. (2018) participants were asked to write down the goal in their own words and then imagine a concrete situation (time and location) to implement this goal. Next they were asked to plan what they would eat in this imagined situation instead of meat (written in an "if-then

plan"). The participants significantly consumed less meat post-intervention compared to the control group (Rees et al., 2018).

Take away message #2: Implementation intentions may influence a reduction in meat consumption.

3.2.1.3 Behavior change methods to change Attitudes, Beliefs, and Outcome Expectations

The Taxonomy of Kok et al. (2016) describes different behavior change methods to change attitudes, beliefs and outcome expectations (see Appendix 7.3), for example ***Environmental reevaluation*** and ***arguments.*** Environmental reevaluation is defined as encouraging people to realize the negative impact of the unhealthy behavior and the positive impact of the healthful behavior. A practical application of this method could be watching a video about the negative health outcomes of eating meat and the health benefits of low meat diets (Fehrenbach., 2015). Arguments is defined as using a set of one or more meaningful premises and a conclusion. Many studies used this method by exposing participants to a webpage about the environmental/health impact of eating meat, with significant results on the intention to eat less meat.

Kok also describes the behavior change methods ***Shifting perspective*** and ***Empathy training.*** Shifting perspective is defined as encouraging to take the perspective of the other. Tian et al. (2016) used an image of a cow with the statement that the cow was going to the slaughter house, which can be a practical application of "Shifting perspective", to encourage taking the perspective of the animal. Empathy training is described as a method to reduce public stigma. This means stimulating people to empathize with another person, i.e., imagine how the other person would feel. In the study of Zickfeld et al. (2018) increasing empathy by using cute images of animals resulted in reduced willingness to eat the animal.

Both the reviews of Bianchi et al. (2018a), as well as of Harguess et al. (2020) described interventions that address different perspectives/reasons for people to eat less meat: health, environment, animal welfare, social issues, and multiple consequences of meat consumption. The different perspectives are explained in the next paragraphs, in each paragraph focusing on one perspective. Bianchi et al. (2018a) and Harguess et al. (2020) described five studies (2 RCT, 1 CT, 1 crossover, 1 pre-post) that evaluated six interventions providing written information or informational videos about health consequences of eating meat. Four interventions led to or were associated with intended reductions in meat consumption (Cordts et al., 2014; Fehrenbach, 2013; Fehrenbach., 2015). Fehrenbach (2013) exposed participants to a webpage on the health impact of eating meat ***(arguments)***, recommending practical strategies to eat less meat. After the intervention the intention to eat less meat was significantly higher in the intervention group than in the control group. In a pre-post study by Cordts et al. (2014) participants read an article on the health impact of eating meat ***(arguments)***. The percentage of participants intending to reduce meat consumption increased significantly from pre- (13.1%) to post-intervention (23.5%). Furthermore Fehrenbach (2015) conducted an RCT where participants watched a 7 minute video about the negative health outcomes of eating meat highlighting participants' susceptibility to these outcomes, the health benefits of low meat diets ***(environmental reevaluation)*** and strategies to eat less meat. Results show that reported meat intakes did not differ between intervention and control group, but intended meat reduction was higher in intervention group compared to control group one week later.

Bianchi et al. (2018a) reported on six studies (3 RCT, 1 crossover, 2 pre-post) that evaluated eight interventions providing written information about the environmental consequences of meat consumption. Fehrenbach (2013) exposed participants to a webpage on the environmental impact of eating meat, recommending practical strategies to eat less meat ***(arguments)***. The intention to eat less meat was significantly higher in the intervention group than in the control group. Similarly Scrimgeour et al. (2012) found higher intentions to eat less meat post intervention than at baseline. Also Cordts et al. (2014) found that participants who read an article on the environmental impact of eating meat, had 5.4% higher intentions to eat less meat post-intervention. Graham et al. (2017) conducted two RCTs where participants read either a self-transcendent framed (i.e. altruism) or a self-enhancement framed (i.e. self-interest) paragraph ***(tailoring)*** on the

livestock related greenhouse gas emissions in New-Zealand and the mitigation potential of reduced consumption. Both RCTs found significant effects on the intention to reduce meat consumption. Vibhuti et al. (2016) conducted an RCT where participants read an essay on the environmental impact of meat consumption and production, and found that participants of the intervention group afterwards selected less meat products in a virtual environment than did the control group participants. Finally, a pre-post study by Godfrey et al. (2014) found no evidence to suggest that two informational posters on livestock's water footprint reduced meat purchases in a university canteen.

In Bianchi et al. (2018a) two studies (1 crossover, 1 pre-post) evaluated two interventions providing written information about animal welfare implications of eating meat (Scrimgeour et al., 2012; Cordts et al., 2014). Both studies, providing an article or paragraph to read, were associated with significant reductions in intended meat consumption, and were more promising than comparable messages on health and environmental consequences of meat consumption.

Harguess et al. (2020) described three studies aimed to increase empathy ***(empathy training)*** for animals by using images of animals. Zickfeld et al. (2018) found that using cute images of animals displayed in hypothetical meat advertisements resulted in increasing empathy and reduced willingness to eat the animal in the intervention group compared to the control group. Another study of Kunst and Palacios (2018) found that when using images of meat alone and meat with the head of the animal attached, empathy was significantly higher in the meat with head condition. Similar effects were found for participants from Ecuador (Kunst & Hohle, 2016). Showing images with the head attached resulted in empathy mediating the effect on reducing meat consumption.

Harguess et al. (2020) discussed four studies that targeted cognitive dissonance or state dissociation, and disgust. Tian et al. (2016) found that using an image of a cow with the statement that the cow was heading to the slaughter house ***(shifting perspective)***, resulted in reduced willingness to eat the animal. Kunst and Hohle (2016) found that state dissociation increased when viewing meat alone, compared to viewing meat with the head attached, and increased willingness to eat the meat. State dissociation is the mental separation of meat from its animal origin. In another study, the researchers found that the effect of the image with the head attached reduced state dissociation, which in turn increased disgust. This resulted in less willingness to eat meat (Kunst & Hohle, 2016). In multiple experiments, Tybur et al. (2016) attempted to elicit disgust and pair it with meat. Images of meats were paired with images that cued the participant to think of pathogens and elicit disgust (e.g. a photo of an infected toe nail). Willingness to eat the meat was reduced, compared to when meat images were paired with neutral images.

Mathur et al. (under revision) performed a meta-analysis evaluating the effectiveness of interventions appealing to animal welfare. The interventions consistently reduced meat consumption, purchase or related intentions, at least in the short term with meaningfully large effects. Most interventions contained text, visuals, graphic verbal or visual depictions of welfare conditions in factory farms. Fewer interventions invoked social norms, identified a named victim and depicted pets (with or without explicitly comparing them to farm animals). The studies with the largest effects used interventions consisting of: brief factual passages that described or visually depicted conditions on factory farms or fish farms, sometimes combined with health or environmental appeals; a leaflet with detailed information and portrayals of farm conditions along with health appeals; a mock newspaper article with graphic photos and gestation crates along with discussion of legislation to ban these; a virtual reality video graphically depicting conditions on factory farms; and meat-animal reminders consisting of photos of meat dishes alongside the animals they came from. Overall, 77% were randomized studies, the remaining percentage were nonrandomized designs with a separate control group or in which participants' meat consumption was measured before and after the intervention. 24% of a total of 34 articles were published in peer-reviewed journals, all others were dissertations, theses, conference proceedings or reports by nonprofits.

Bianchi et al. (2018a) described two studies (1 CT, 1 pre-post) that evaluated two interventions focusing on the social consequences or antecedents of eating meat. Reading an article on adverse social consequences was associated with increased intentions to eat less meat (Cordts et al., 2014). However similar articles on meat consumption and health, the environment and animal welfare, showed more promise. Conversely another study found no association with reductions in intended consumption and providing information about the association between pursuing high meat diets and holding social dominance values (Allen et al., 2002).

In Bianchi et al. (2018a) nine studies (4 RCT, 1 CT, 2 pre-post, 2 retrospective evaluations) evaluated 14 interventions providing written information (i.e. printed or online information) about multiple consequences (i.e. health, environmental, animal welfare, social, personal appearance and economic consequences) of meat consumption. Loy et al. (2016) conducted two interventions that were associated with lower meat intakes. The first intervention was a paragraph on environmental and ethical, health, and socio-economic consequences of eating meat, and written instructions for ***mental contrasting*** (although mental contrasting was not explicitly identified as behavior change methods by Kok et al., it is recognized as behavior change technique by Cross & Sheffield, 2016) and ***intention implementation***. The second intervention was a paragraph on environmental and ethical, health, and socio-economic consequences of eating meat. However, five other interventions (a paragraph on animal welfare, health, and environmental impact of meat (Berndsen et al., 2005); access to a webpage outlining why and how to eat less beef and how to master challenges associated with eating less beef (Klöckner et al., 2017) did not find evidence for lower meat intakes. The webpage included health, environmental and social reasons for eating less beef, practical strategies, statements triggering personal values ***(tailoring)***, links to scientific sources and videos of people's stories (Klöckner et al., 2017). Similarly Arndt et al. (2016) found no difference in intended meat intake when paragraphs on the impact of meat consumption on health, personal finances, animal welfare and the environment, and personal appearance or stating that eating less meat can help fulfill one's altruistic duty was shown to participants. However one pre-post study suggested that providing information about health and environmental consequences of meat consumption was associated with reduced meat selection in a virtual food choice experiment (Marette et al., 2016). Two interventions providing the Meatless Monday toolkit on the US healthcare accounts of a large food service company measured actual food purchases. The toolkit included information about various benefits of eating less meat, and practical suggestions for implementing a Meatless Monday campaign. Only one intervention showed significant declines in meat purchases (Leidig et al., 2012).

Take away message #3: Arguments, environmental reevaluation, tailoring and shifting perspective may increase the intention to eat less meat, as well as the willingness to eat less meat.

3.2.1.4 Behavior change methods to change Skills, Capability and Self-efficacy and to Overcome Barriers

The Taxonomy of Kok et al. (2016) describes different behavior change methods to change skills, capability and self-efficacy and to overcome barriers (see Appendix 7.3), for example ***Self-monitoring of behavior*** or ***Goal-setting***. Self-monitoring means prompting the person to keep record of specified behaviors. The effectiveness of self-monitoring has been shown in many studies for different types of behavior. Also, Carfora et al. (2017a+b) and Loy et al. (2016) found that journaling and monitoring own meat consumption had an effect on the intent to reduce meat consumption. Goal-setting means prompting planning what the person will do, including a definition of goal-directed behaviors that result in the target behavior.

The systematic reviews of Harguess et al. (2020), Bianchi et al. (2018a) and Taufik et al. (2019) described studies that were effective at reducing intentions or consumption of meat when an additional intervention component, ***goal-setting and/or self-monitoring***, was added to an informational intervention component. Carfora et al. (2017a+b) found that information provision and daily text message reminders to monitor meat consumption was effective at increasing intent to reduce meat consumption. Similar results were shown for self-reported consumption of meat in the same study. Also Loy et al. (2016) found similar results, when participants receive information and journal daily, they significantly reduced their self-reported meat consumption. Amiot et al. (2018) implemented a multi-component 4-week intervention with adult men, with information provision, goal-setting, self-monitoring and mind attribution to animals and found that participants in the treatment group reported less red meat consumption.

Harguess et al. (2020) described the underlying mechanism in the study of Carfora et al. (2017a). The researchers found that participants who received daily message reminders to limit and ***monitor*** their red meat consumption had significantly higher perceived behavior control (PBC) compared to the control group (M=4.09). However, Carfora et al. (2017b) found no difference between treatment and control group regarding PBC. Scrimgeour (2012) examined PBC as a predictor of intentions to reduce meat consumption. Participants were introduced three different arguments for reducing meat

consumption (i.e. environmental, health and ethical) but PBC was not a predictor of intentions to change for none of the message scenarios.

Take away message #4: Interventions that use goal-setting and self-monitoring of behavior have an effect on intended reductions on self-reported meat consumption.

3.2.1.5 Multicomponent interventions

Looking at the Taxonomy of Kok et al. (2016), ***guided practice*** is a method to change skills, capability and self-efficacy and to overcome barriers, and ***elaboration*** is a method to increase knowledge. Guided practice is defined as prompting individuals to rehearse and repeat the behavior various times, discuss the experience and provide feedback, for example plant-based cooking demonstrations. Elaboration is defined as stimulating the learner to add meaning to the information that is processed, for example taster sessions with information about the unhealthy effects of eating meat. Both theoretical methods are applied in multicomponent interventions that were effective at reducing meat consumption (Flynn et al., 2013; Holloway et al., 2012).

Bianchi et al. (2018a) described six studies (2 RCT, 1 CT, 3 pre-post) that evaluated the effectiveness of six lifestyle counselling interventions to reduce red and/or processed meat consumption (Emmons et al., 2005a+b; Grimmet et al., 2016; Hawkes et al., 2009; Hawkes et al., 2012; Schlavon et al., 2015). All studies found evidence for reduced meat consumption. The interventions were delivered individually by a trained health professional through face-to-face and/or phone sessions, and consisted of ***goal-setting, action planning, self-monitoring,*** supporting materials (e.g. recipes), etc. Most counselling interventions targeted individuals affected by, or at increased risk of chronic diseases, and only one such intervention targeted healthy working-class individuals (Emmons et al., 2005b). This last intervention focused on social determinants of behavior, and comprised a ***tailored*** prescription by a clinician to prompt behavior change, in person and telephone counseling sessions with a health advisor and tailored supporting material including information on barriers to change. Results showed a rise in participants consuming less than 3 servings of red meat by 11.8% in the intervention group compared to the control group (Emmons et al., 2005b).

In Bianchi et al. (2018b) three pre-post studies evaluating three interventions providing, amongst others, meat alternatives were associated with significant reductions in meat purchases or consumption (Clark et al., 2017; Flynn et al., 2013; Holloway et al., 2012). The first intervention provided meat substitutes, plant-based recipes, monthly motivational newsletters and emails, and found a lower red and processed meat consumption during the last intervention month and two months after the intervention (Clark et al., 2017). Another intervention by Flynn et al. (2013) provided plant-based recipes, sufficient meat-free foods to prepare, weekly 30 min. plant-based cooking demonstrations ***(guided practice)***, taster sessions and information that consuming meat daily is not necessary for health ***(elaboration)***. Results showed that the amount of money spent on meat declined from baseline to after intervention. The last intervention provided meat substitutes, a 60 min information-based motivational event about vegetarianism, four face to face sessions to motivate lower meat intakes, plant-based recipes and information about vegetarianism. During the fourth week of the intervention red and white meat consumption was lower (Holloway et al., 2012).

Take away message #5: Interventions with goal-setting, self-monitoring, elaboration and guided practice may decrease meat consumption or purchase.

3.2.2 Interpersonal level

3.2.2.1 Behavior change methods accounting for Social Influence/Social Norms

The Taxonomy of Kok et al. (2016) describes different behavior change methods to change social norms (see Appendix 7.3). In the paragraph below we found that ***modeling*** (defined as providing an appropriate model being reinforced for the desired action) had an effect on the dishes with or without meat that were ordered in an on-campus café (Christie & Chen, 2017).

Both Harguess et al. (2020) and Taufik et al. (2019) described a study by Sparkman and Walton (2017) who examined social norms in a series of experiments. In a virtual setting two different message conditions were created: dynamic norm and static norm. The dynamic norm message stated that "30% of Americans have now started to make an effort to limit their meat consumption.." and the static norm message stated "30% of Americans make an effort to limit their meat consumption …". Participants in the dynamic norm had higher intent to reduce their meat consumption compared to the static norm participants. Also, this study found that café customers were more likely to order a meatless meal when exposed to the dynamic norm message, while waiting in line to order a meal. Sparkman et al. (2020) conducted four field experiments where dynamic-norm messages were incorporated in restaurant and web-based menus. Three studies found increases in vegetarian orders when dynamic norms were included in the menus, but the effects did not always reach statistical significance and varied across populations, for instance a larger effect was found for prior customers and those with a university affiliation at a campus eatery. In the last study, contrary to what was expected, the intervention reduced vegetarian ordering at dinner in a fine-dining restaurant, especially among those guests who bought more items. This could be explained, consistent with past research, by reactance against normative messages by "big spenders" (Sparkman et al., 2020).

Two studies about social norms were described by Harguess et al. (2020). Stea et al. (2018) found no difference in intention to reduce meat consumption between participants in a "social norms message" group (32.2%) and a control group (28.2%, $p > .05$). Allen and Baines (2002) studied the assigned value to meat by informing participants that meat symbolizes human dominance over nature. Participants were informed that people who scored high on a social dominance scale ate more meat. Self-reported meat consumption remained unchanged in a three week follow-up in both treatment and control group (Allen and Baines, 2002).

In a social ***modeling*** observational study in an on-campus café in Canada the lunchtime orders of clients were tracked. The goal was to find out if participants ordered the same main-dish (meat or vegetarian) as the prior order. As predicted, there was a significant relationship between the prior orders and the participants' orders, with 72% of participants ordering the same type of dish as the prior order, and vegetarian main dishes were selected 27% of the time. When calculated for chance alone, the modeling rates of 61% would be expected (Christie & Chen, 2017)

Take away message #6: Interventions using modeling may influence meat purchasing behavior in a positive way.

3.2.3 Organizational level

Most of the following (environmental) intervention strategies can be categorized under the behavior change method ***nudges***, described by Kok et al. (2016) as simple changes in the presentation of choice alternatives that make the desired choice the easy, automatic or default choice. According to Cadario & Chandon (2019) nudges can be categorized in one of the following three categories: 1) cognitively oriented interventions to influence what consumers know, 2) affectively oriented interventions to influence how consumers feel without changing what they know and 3) behaviorally oriented interventions to influence what consumers do (e.g. their motor responses) without changing what they know or how they feel. Within each type, following subtypes are distinguished: 1.1) descriptive nutrition labeling, 1.2) evaluative nutrition labeling, 1.3) visibility enhancements, 2.1) hedonic enhancements, 2.2) healthy eating calls, 3.1) convenience enhancements, 3.2) size enhancements. In what follows we will categorize the nudge interventions according to this model.

3.2.3.1 Behavior change methods applied in University canteens

Cognitive nudges. Bianchi et al. (2018b) found that two interventions repositioning meat products to decrease their prominence at point of purchase were associated with reductions in meat demand. These interventions repositioned meat options to appear after vegetarian options in online meal booking systems (to select meal options in university canteens) (Stewart et al., 2016), or repositioned meat options from standard food menus onto a board 3,5m away from participants in a simulated canteen setting (Campbell-Arvai et al., 2016). Two interventions displaying vegetarian options as the default option of an online meal booking system (Stewart et al., 2016) or repositioning a meat product from the middle to the end of a buffet aisle in a laboratory setting (Kongsbak et al., 2016) were associated with reductions in meat demand but did not reach significant effects.

Also Kurz (2018) found evidence for increasing the salience of a vegetarian option on the menu order and enhancing the visibility of the vegetarian dish at the point-of-purchase, in a university restaurant in Sweden. Results show that the nudge increased the share of vegetarian lunches sold by on average 6%, and that the treatment effect increased over time. Moreover the change in behavior is partly persistent, since the share of vegetarian lunches sold remained 4% higher after the intervention ended.

In Bianchi et al. (2018b) one intervention changed the verbal description or label by altering the university meal booking system, referring to meat options as 'meat' rather than 'standard' or 'normal' (Stewart et al., 2016). This was associated with reduced meat purchases. In two studies conducted by Piester et al. (2020) labels about food sustainability would increase purchases of sustainable foods by women in university cafés, but not men. In the first study the guests saw a menu that had sustainability labels indicating the degree of environmental impact of each item. The magnitude of the effect for women in this study was a 32% increase in the choice of the vegetarian option. In the second study, women were significantly more likely to purchase the veggie burger if they learned it was sustainable (16% increase) or "tasty" (27% increase). Furthermore Taufik et al. (2019) described a study by Brunner et al. (2018) who did not find a significant effect of introducing the traffic light label on sales of meat and vegetarian dishes in Sweden. The sales of the meat dishes increased by 11.5% when labeled green, and decreased by 4.9% when labeled red (only meat containing dishes had a red label). Similarly Slapo et al. (2019) conducted a study at a university cafeteria in Norway looking into the effects of three types of traffic light labeling (i.e. traffic-light for three dishes, single-green label for most environmental friendly, and a single red-label for least environmental friendly). The traffic-light labels significantly reduced sales of meat dishes with 9% in the first period (= immediate effect) but not in the second period (=sustained effect). Single-green and single-red labeling had no effect on sales share of meat, fish or vegetarian dishes.

Behavioral nudges. Harguess et al. (2020) described a study where providing meat-free meals as the default options on a hypothetical restaurant menu significantly increased the probability participants would choose a meat-free meal (Odds Ratio=4.10 compared to the control group Odds Ratio=2.05), both with and without information about the environmental

benefits of reducing meat consumption (Campell-Arvai et al., 2014). Garnett et al. (2019) found that there was an impact of increasing vegetarian availability on meal selection and sales in student cafeterias in the UK. The largest effects were found in the diners with the lowest prior levels of vegetarian meal selection.

Mix of interventions. Finally, Bianchi et al. (2018b) described an RCT that assessed a marketing campaign in university canteens, featuring examples of meat-free dishes at the entrance, indicators of healthy meat-free options, and educational flyers, and was associated with reduced meat consumption (Mcclain et al., 2013)

3.2.3.2 Behavior change methods applied in High school canteens

Mix of interventions. Ensaff et al. (2015) used the setting of a school canteen in a secondary school in England to implement a set of small changes to the choice architecture. Some of the nudge strategies implemented for designated food items during the intervention were stickers on sandwiches containing salad, a poster promoting sandwiches containing salad, stickers and end-of-shelf labels for fruit pots, etc. Results showed that small adjustments to the choice architecture nudged students towards more plant-based food choices. Overall, students were 2.5 times more likely to choose a designated promoted item. Selection of the vegetarian daily specials significantly increased from 0.2% of 'main' foods to 0.6% during the intervention.

3.2.3.3 Behavior change methods applied at Work

Behavioral nudges. Reinders et al. (2020) conducted a study in six company canteens where the recipes of six luxury sandwiches were adapted to contain less meat or fish and more vegetables. Portions of meat/fish were reduced by 20-50% and vegetable content on average tripled (237%). In both the control and the intervention group, the sandwiches were generally consumed in full, and there was no statistical difference in satisfaction with the restaurant and the meal.

Mix of interventions. Bianchi et al. (2018b) described an RCT that evaluated an 18-month multicomponent intervention in small businesses targeting red meat consumption and other health behaviors and found no evidence for reduced meat consumption. The interventions included policies aimed at offering healthful food options at company meetings, system oriented interventions, interactive activities and education (Sorensen et al., 2005).

3.2.3.4 Behavior change methods applied at University

Jalil et al. (2020) conducted a randomized controlled trial to examine the effects of an ***awareness-raising (consciousness raising)*** intervention on meat consumption in undergraduate students in the US. The treatment group received a 50-minute lecture on how food choices affect climate change. Based on students' meal purchases in the college dining halls before and after intervention, they found that participants reduced their purchases of meat and increased their purchases of plant-based alternatives after intervention. Dietary shifts persisted and remained statistically significant through the full academic year. Similarly Jay et al. (2019) conducted an experimental study evaluating the impact of a course series on the carbon footprint of food choices. The course included lecture material on general environmental science and life cycle analyses of food, an analysis of a reading comparing the environmental footprint of various types of meats, and classroom exercises to calculate the environmental footprint of typical foods ***(active learning).*** The students who followed the course decreased their overall dietary carbon footprint for a 2000-kcal normalized diet by 7%, decreased the beef component of their dietary carbon footprint by 19%, and their reported ruminant consumption by 28%. Also Malan et al. (2020) found positive effects of students following a "Foodprint seminar", taught at multiple universities in the US. The curriculum entailed academic readings, ***group discussions***, and skills-based exercises to evaluate the environmental footprint of different foods. Students significantly improved their reported vegetable intake by 4.7 weekly servings relative to the control group. They also reported significantly decreasing intake of ruminant meat and sugar-sweetened beverages, finally decreasing their dietary carbon footprint by 14%.

3.2.4 Community level

Most of the following (environmental) intervention strategies can be categorized under the behavior change method ***nudges***, described by Kok et al. (2016) as simple changes in the presentation of choice alternatives that make the desired choice the easy, automatic or default choice. According to Cadario & Chandon (2019) nudges can be categorized in one of the following three categories: 1) cognitively oriented interventions to influence what consumers know, 2) affectively oriented interventions to influence how consumers feel without changing what they know and 3) behaviorally oriented interventions to influence what consumers do (e.g. their motor responses) without changing what they know or how they feel. Within each type, following subtypes are distinguished: 1.1) descriptive nutrition labeling, 1.2) evaluative nutrition labeling, 1.3) visibility enhancements, 2.1) hedonic enhancements, 2.2) healthy eating calls, 3.1) convenience enhancements, 3.2) size enhancements. In what follows we will categorize the nudge interventions according to this model.

3.2.4.1 Behavior change methods applied in Restaurants

Cognitive nudges. An online study in the Netherlands by De Vaan et al. (2019) investigated how restaurants can effectively stimulate the choice of vegetarian dishes by changing the menu structure. Participants were presented with one of four different menus: Either an all vegetarian menu, an all vegetarian menu with the possibility to add meat to each dish, a menu with an increased offer on vegetarian dishes with explicit indication, and a menu with increased offer on vegetarian dishes without explicit indication. Participants then indicated which dish they would choose. Results show that when people get the option to add meat to the vegetarian dish on a menu, this increases the choice for a vegetarian dish. Furthermore, four interventions (in Bianchi et al., 2018b) manipulated the description or the label of meat or meat alternatives and were not associated with reductions in meat demand: two interventions manipulated virtual food menus to enhance the verbal description of the meat-free options ("Risotto primavera" to "Fresh seasonal risotto primavera" or "Chef's selection") (Bacon and Krpan., 2018), another intervention labelled vegetarian options as environmentally sustainable on food menus (Campbell-Arvai et al., 2014), and the last intervention highlighted the animal origin of meat products by referring to "beef and pork dishes" as "cow and pig dishes" (Kunst and Hohle, 2016). Dos Santos et al. (2020) investigated in a cross-sectional quasi-experimental study whether a nudge strategy would influence adolescents to select a vegetable-based dish when this dish was described as dish of the day. The experiment was implemented in four restaurants in four countries: Denmark, France, Italy and the UK, and individuals between 12 and 19 years old were invited to participate in the experiment. The "Dish of the day" nudging strategy did not show a difference on the choice of the vegetable-based option among adolescents tested.

Affective nudges. Four RCTs (in Bianchi et al., 2018b) suggested that three of four interventions manipulating the sensory properties of meat or meat alternatives significantly reduced the demand for meat in virtual food choices (Campbell-Arvai et al., 2014; Kunst and Hohle, 2016; Kunst and Palacios, 2018). Replacing the vegetarian items by more appealing vegetarian items on a food menu, led to lower odds of selecting meat options (Campbell-Arvai, 2014). Manipulating the visual properties of an image of a pork roast by displaying the animal's head led to greater demand for plant-based alternatives in two of three RCTs (Kunst and Hohle, 2016; Kunst and Palacios, 2018).

Behavioral nudges. Taufik et al. (2019) as well as Bianchi et al. (2018b) described a study conducted by Reinders et al. (2017) that targeted portion size. They found that reducing the portion size of meat and doubling the portion size of vegetables in main dishes by 12.5% in a restaurant led to significantly higher vegetable consumption and lower meat consumption. In a follow up paper by Reinders et al. (2020) three studies examined the effects of meals with reduced amounts of meat, and increased amounts of vegetables on food consumption in four real-life restaurant settings in the Netherlands. The first study was conducted in an a-la-carte restaurant where the amount of fish/meat decreased by 8-16% during intervention period, and the vegetable portions increased by 31%. Participants ate less meat/fish and more vegetables, and were equally satisfied with the restaurant and the meal as the control group participants. The second intervention study was carried out in a self-service restaurant providing less meat/fish, but more and a higher variety of vegetables to improve

taste and appearance. This resulted in a shift in consumption, while guest satisfaction remained the same or even improved. Moreover, in the control and intervention groups, the respondents remained unaware of changes in portion size but in a last group guests could actively choose for the dish with extra vegetables and a bit less meat. 35% of these chose for a dish containing more vegetables. In the last study a buffet (all you can eat) restaurant increased the number of vegetarian options and renewed the salad buffet, which led to an increase in vegetable consumption (112% higher compared to the control group) and a reduction in meat consumption (4% lower).

3.2.4.2 Behavior change methods applied in Supermarkets

Cognitive nudges. Austgulen et al. (2018) conducted an in-store field experiment with control condition and measured the purchase of vegetables, hypothesizing these should increase when providing information about climate benefits of eating less meat. Two stores had an intervention with booklets with vegetarian recipes focusing on health benefits, and two other stores had booklets focusing on climate benefits. The content was exactly the same, but the framing and logos were not. The stores sold approximately 10% more vegetables per day under the intervention period compared to the year before. This is higher than the general increase in Norway of 1%. However, the results also show that the effects of both types of in-store promotion were not significantly different, indicating no effect of type of framing. In two other studies Austgulen et al. (2018) looked into consumer readiness to reduce meat consumption for the purpose of environmental sustainability. The qualitative studies measured the intentions and attitudes to reduce meat consumption via focus groups and a consumer survey in Norway. Participants were confused over what constitutes climate- or environmentally friendly food choices. Few consumers are motivated to change their food consumption patterns for climate- or environmental reasons.

Coucke et al. (2019) conducted a field experiment with a control condition and a pre and post measurement in an ecological supermarket. The visibility of sustainable meat products (i.e. poultry) at a butcher counter of the supermarket was increased by enlarging the display area size and the quantity of displayed poultry products. During the nudging intervention the sales of poultry increased, which gives support for the impact that visual cues can have on consumer behavior.

Ni Mhurchu et al. (2018) conducted an RCT in a supermarket in New-Zealand. Participants were given an app which allowed them to scan product barcodes in store and view **the nutrition labels**. There was a significant association between label use and the healthiness of products purchased, but no clear results on meat purchasing. Labels were viewed least for meat, sugar, eggs, fruit, vegetables, honey and fish.

In a choice experiment through an in-store survey in the UK, consumer preferences for different meat products were explored, via 7 labels: fat, content, carbon footprint, type of mince, production method, brand/point of purchase, price and origin. Type of meat, price and fat content labels have the largest overall impact on consumer choices (Apostolidis et al. 2019).

Behavioral nudges. Taufik et al. (2019) described a study by Vandenbroele et al. (2018) that targeted the determinants portion size and environment food availability and food accessibility. The availability of two smaller meat portion sizes in a store led to significantly more sales of the smaller portions (52%), compared to the default, larger portion (48%). Another study by Vandenbroele et al. (2019) investigated if changes to the choice architecture in a large retail store would increase the purchase of meat substitutes among nonusers. More specific, meat substitutes were placed next to similar meat products in the butchery, instead of in a separate vegetarian section. This led to higher sales of meat substitutes compared to past sales in the experimental store and sales in eight other control stores.

Mix of interventions. In a systematic review conducted by Hedin et al. (2019) one study by Zapico et al. (2016) described a digital intervention to increase organic food purchases via a web page visualizing organic versus total food purchase data, also including suggestions to exchange five products with greatest impact. The results found a 23% increase in organic meat purchases (no specification on which products).

3.2.5 Societal level

3.2.5.1 Behavior change methods on Pricing

Bianchi et al. (2018b) described one RCT study that found that manipulating the price structure of three different portions of chicken nuggets did not effectively promote purchases of smaller portions in a simulated food choice task (Vermeer et al., 2010).

In an online study, described by Taufik et al. (2019) people got a financial incentive, which significantly increased vegetable intake. However, there was no effect of financial incentive on the level of meat consumption or fruit consumption (Kral et al., 2016)

3.2.5.2 Behavior change methods in Social media campaigns

Friedlander & Riedy (2018) investigated international meat reduction social media campaigns through the platforms of Facebook, Instagram and Twitter. Meat Free Week wanted to broaden the reach of campaign messages by involving social media platforms and influencers ***(modeling)***. Over 40 supporters or influencers, including food celebrity Jamie Oliver, were asked to help disseminate meat reduction messages and were encouraged to incorporate their own interpretations of messaging. Twitter was responsible for approximately 60% of the total engagement of the campaigns compared to 40% for Facebook and 25% for Instagram. Overall, the Meat Free Week campaign achieved success in engaging with a wide range of individuals and communities through social media. The research conducted on the Twitter platform of the campaigns indicated that high-profile advocates who either promote or represent different frames such as the environment, health, animal welfare, economizing, and appealing food, as well as being associated with intrinsic values, can have a vital role in raising the agenda of the impacts of meat production and consumption. For food sustainability campaigning to be effective three areas need to be addressed: first, the importance of including messages around sustainability in the campaign's branding or in posts through a collection of ***frames*** (e.g. health, environment); second, collaborating with a range of high-profile experts or celebrities who represent a range of complementary messaging and are seen to be influential; and third, selecting advocates who are perceived as embracing intrinsic values. Results indicated that key influencers and second level associates, were influenced by others' messaging, and attempted to interest even more followers. Hence the network broadened further.

De Groeve et al. (2019) exposed meat-eaters in Belgium to a meat reduction campaign image shared by an advocate on Facebook, where the advocate was portrayed as a meat-eater (ingroup) or a vegetarian (outgroup), who used either inclusive language ("we can eat less meat") or personal language ("you can eat less meat"). The intervention was based on the 'Social Identity Theory', assuming that the effectiveness of meat reduction advocacy would depend on the dietary identity of advocates and their rhetorical style. They found that the meat-eating (versus vegetarian) advocate was more likely perceived as inconsistent when promoting meat reduction. Higher perceptions of inconsistency were significantly associated with a lower perceived legitimacy of the message for both advocate types, especially when the advocate was a vegetarian. Results reveal that participants who perceived the meat reduction message as more legitimate were more willing to eat less meat, and those who identify more strongly as meat-eaters were less willing to eat less meat.

Happer et al. (2019) and Pohjolainen et al. (2020) conducted qualitative studies and no intervention studies, but the results could provide some insight in the impact of media (campaigns) on some participants. Happer et al. (2019) did a focus group study in the UK, US, China & Brazil investigating the impact of media and other socio economic factors on meat consumption. The results indicate there's an impact of traditional and new social media, certainly if media content is close to everyday practices and concerns. Especially in Western countries, where skepticism of climate science remains quite high, focusing on a message to protect against poor health and disease through dietary change, will likely offer the best chance of prompting positive action. Pohjolainen et al. (2020) analyzed blog posts of Finnish citizens who started experimenting with vegetarian foods in the context of a meat reduction social media campaign called "Meatless October'. Results showed that participants' were motivated by the campaign's sustainability frame. The participants were also positively surprised by their ability to learn how to prepare tasty and healthy vegetarian foods.

3.3 Determinants of meat curtailment

Our systematic review focused on effective behavioral change methods to change meat eating behavior. Determinants work as the intermediate targets to subsequently reach this behavior change (see earlier Box 1), so having insight into the determinants that are significantly linked with the target behavior is at least equally important. Some of the reviewed studies and screened literature reviews also incorporated the determinants that may have caused the change in behavior/behavioral intentions, but not all. Interesting in this perspective is Graça and colleagues' systematic review (2019) from which the most important determinants to change meat eating behavior can be inferred. The studies in this review reported findings for variables referring to meat curtailment (61%), plant-based diets (38,2%), plant-based meals and food products (22.7%). The very large majority of studies addressed variables that were framed in the motivation domain (93.6%), and a smaller proportion addressed opportunity (20%) and/or capability variables (6.4%) (i.e. constructs that are deemed important determinants according to the COM-B model (Michie et al., 2014), one of the many existing theories that explain which reasons/determinants are at the basis of behavior). Potential barriers to reduce meat consumption in the capability domain were 'difficulty to get practical reliable information', 'difficulty to acquire new skills and competencies', and 'high sensitivity to bitter tastes'. Hence, interventions that build knowledge and skills (e.g. training cooking skills) could be helpful (see also Take away message #4: interventions that use goal-setting and self-monitoring of behavior have an effect on intended reductions on self-reported meat consumption). Similarly potential barriers in the opportunity domain were 'social prejudice towards consumers following plant-based diets', 'unwillingness and reactance from close others', 'lack of social support for a transition'. On the other hand these barriers could also play a role as enablers, such as receiving support from close others. Recommended interventions could focus on changing physical/material contexts or social contexts, such as adapting perceived norms. Finally, for the motivation domain, attitude, habits and beliefs are often motivational barriers for change. Key enablers and facilitators were for example, perceived convenience, familiarity, and positive taste experiences and expectations with regard to plant-based meals. The role of health, sustainability and/or animal ethics motivations to reduce meat consumption, were often not self-standing facilitators. To address motivation barriers interventions could include persuasion (e.g. using communication techniques to induce positive affect towards plant-based diets), or incentivization (e.g. creating feelings of reward and positive outcome expectations with regard to plant-based diets). The large majority of findings were from observation or cross-sectional studies, so suggested matching barriers/facilitators with intervention functions were mostly driven by hypothesized relationships rather than empirically established mechanisms of change (Graça et al., 2019).

Furthermore, Cheah and colleagues (2020) found that social norm, perceived benefits (e.g. health and taste), as well as environmental concerns had impact on consumers' attitudes and intentions toward reducing meat consumption. The study also shows that 'meat eating habits' are a barrier for both consumer attitudes and intentions towards reducing meat consumption (Cheah et al., 2020). Sanchez-Sabate et al. (2019) conducted a qualitative evidence synthesis and used the theory of behavior stages of change to look at attitudes to change meat consumption (i.e. awareness, willingness and change). They found that consumer awareness is hindered by beliefs about food, meat and personal behavior (i.e. consumers have an overall positive image of meat and perceive food as detached from the environment). With regard to willingness nutrition, health, and taste were found to be both enablers and barriers. Finally environmental concerns are the main reason to adopt a meatless diet for only a minority of the general population. Interestingly, the influence of the environmental motive is stronger for meat-reducers or flexitarians than for vegetarians and vegans, who perceive health and animal welfare as the most prevalent reason to become vegetarian (Sanchez-Sabate et al., 2019).

Based on this evidence, we can conclude that attitudes, beliefs, habits and motivations are strong enablers or barriers for change. As seen in the results of Graça et al. (2019), 'motivations' are the most studied determinants. Possibly other determinants also play a role (such as having a supportive environment, having the skills to cook vegetarian meals, etc.) but have been less studied.

4 Recommendations and discussion

4.1 What works

The table in Appendix 7.2 provides a comprehensive overview of all results

- Many studies have found evidence that **self-monitoring and goal-setting** are behavior change methods that can influence behavior (Compernolle et al., 2019; Michie et al., 2009). Also on meat consumption behavior, these methods seem to have an effect: Interventions that had goal-setting and self-monitoring as behavior change methods, had an effect on intention to eat less meat, as well as on self-reported meat consumption.
- The same goes for the behavior change method **implementation intentions**. This method was already found to be effective to change health behavior (da Silva et al., 2018), and one study in this review found significant effects of prompting if-then plans on the reduction of meat consumption.
- Interventions that focus on **animal welfare implications** of eating meat were associated with reductions in intended meat consumption, and in willingness to eat. Interventions used for example increasing empathy, increasing disgust and reducing state dissociation. A meta-analysis on the effectiveness of interventions appealing to animal welfare found large effects for reduced meat consumption, purchase or related intentions, at least in the short term.
- According to Cadario and Chandon (2019) **behavioral nudges** work best when it comes to healthy eating nudges (compared to cognitive and affective nudges). In fact, all behavioral nudge studies we found had an effect on reducing meat consumption. These studies were almost all set in the field, and used real observations of meat reductions rather than self-report measures, which lends more credibility to the fact that there will be a real-world effect. Interventions included providing meat free meals as default options in university canteens, increasing the vegetarian availability in canteens and restaurants, changing the choice architecture in high school canteens, changing portion sizes in a work canteen and restaurant, and changing portion sizes and availability in a supermarket.
- At university level, where the target group mostly consists of adolescents, **lectures and seminars** about climate effects of meat intake had an impact on meat consumption behavior (the dietary shifts even persisted throughout the whole academic year) as well as on reported meat consumption. A meat reduction campaign could include an intervention at a university in the form of a seminar or a lecture.
- The systematic reviews also described **lifestyle counselling interventions**, mostly with individuals affected by, or at increased risk of chronic diseases. These interventions all found evidence for reduced meat consumption. Looking at the behavior change methods of these counselling interventions, we found that in some studies goal-setting and self-monitoring was used, as well as individual counselling and tailored supporting material.

4.2 What might work

- Education on what the consequences (health, environmental, animal welfare) of meat eating are, could be helpful to change this behavior:
    - Almost all interventions that focused on the **health consequences** of meat eating, led to or were associated with intended reductions in meat consumption. Examples of interventions were: reading a webpage, reading an article and watching a video on the negative health outcomes of meat eating.
    - The same positive effect was found for interventions that highlight **the environmental impact** of meat eating. All interventions provided written information, such as a webpage or an essay, and found an effect on the intention to eat less meat, as well as on the selection of meat products.
    - However, also interventions that implement **a mix of consequences** were measured, and only a few of them found significant results. One study that was associated with lower meat intakes, also used written instructions for mental contrasting and implementation intentions.
    - Based on the description of these studies, we could conclude that following behavior change methods to change attitudes, beliefs and outcome expectations were successful: **environmental reevaluation, and shifting perspective,** whereas **tailoring** resulted in mixed evidence. Hence, making people realize

what negative consequences of their behavior are, and encouraging them to take the other's perspective, could be important components in an intervention campaign.

- **Social norms** with dynamic norm messages were found to be effective in changing intention to eat less meat, but did not find significant effects on increases in vegetarian orders. One study even found a counterintuitive result, where the intervention reduced vegetarian ordering. A field study that used **social modeling** found that the clients at an on-campus café were inclined to order the same as what the client before them ordered (meat as well as vegetarian dishes).
- **Cognitive nudges** were studied quite often and found mixed results. In a university canteen setting repositioning meat products on menus (as well online as offline) was associated with reductions in meat demand. However, interventions positioning vegetarian dishes as the default option online, or repositioning meat from the middle to the end of the buffet aisle, were associated with reductions but did not reach significant effects. Increasing the salience of the vegetarian option and enhancing the visibility of the vegetarian option at point-of-purchase, was associated with more vegetarian lunches sold and even had a partly persistent effect. Also changing the menu structure, giving people the option to add meat to a vegetarian dish on a menu in a restaurant setting increased the choice for a vegetarian dish. Labels were used in university canteens as well as restaurants and found mixed results: Labels about food sustainability would increase purchases of sustainable foods by women, but not in men. Traffic light labels on vegetarian and meat dishes significantly reduced sales of meat dishes, but only in the first period and but not in the second (=no sustained effect). Labels that enhanced the verbal description of meat-free options, or environmentally friendly labeled options, did not find significant effects in restaurants. Similarly a "dish of the day" nudging strategy did not work. One study in a supermarket found that both providing information on climate or health benefits of eating less meat increased the sales of vegetables per day. In a focus group study, Graham et al. (2020) explored the acceptability and feasibility of a university café-based intervention in the UK. Caterers and clients found an information provision intervention to promote healthy and sustainable food acceptable. However labelling products was believed practically unfeasible, which could explain our found mixed results.
- Only few studies looked into the effect of **affective nudges** in a restaurant setting. Changing sensory properties of meat or meat alternatives (e.g. more appealing vegetarian items on the menu) significantly reduced the demand for meat in virtual food choices.
- **Social media campaigns** through influencers ***(=modeling)*** could work to reach the broader public and raise the agenda of the impacts of meat production and consumption. According to the social identity theory influencers should have a dietary identity consistent with the message they bring (e.g. vegetarians and not meat-eaters should promote less meat eating).

4.3 What is unknown

- The impact of incentives, taxes or price changes to meat or vegetarian alternatives remains unclear, yet can be promising. Afshin and colleagues (2017) systematically reviewed long term effects of price changes on diet. They found that both subsidies to increase consumption of healthful foods, and taxation to reduce intake of unhealthful beverages and foods significantly altered dietary consumption. Anecdotal evidence in Belgium also show that price reductions may be a fruitful strategy to promote a healthy and sustainable diet, especially for households that are vulnerable to exclusion. More specifically, a Belgian supermarket chain cooperates with public centers for social welfare to implement a project called "Dinner is ready in 1 2 3 euros". The project offers people with low socio-economic status recipes of healthy and sustainable meals and the ingredients to a reduced price. To receive the price reduction, they only have to scan a regular loyalty card, making the act to get a price reduction non-stigmatizing. The project has only been qualitatively evaluated, indicating clients' satisfaction.
- Providing inspiration for vegetarian recipes, and increasing vegetarian cooking skills could be helpful, but the effects of these interventions are not clear yet.
- Many interventions only measure short-term effects, but do not look into long lasting behavior change.

- Interventions to reduce meat intake in youth (<18) are barely covered in scientific literature. To reach long lasting changes though, interventions should take them into account since at this age children get more autonomy around food choices. Additionally , there are still very few intervention studies with families with children.
- Hedin et al. (2019) concluded in their systematic review that digital behavior change intervention studies for sustainable food consumption practices had major quality issues, and so were not able to conclude if the interventions worked or not. But there might lie promise in digital interventions implemented by supermarkets, for example to promote sustainable choices (e.g. targeting meat consumption behavior) when people shop online. This could also be an ideal way to reach youth/adolescents.
- The long lasting effects of Covid-19 are unclear. Food's significance has increased and people are more aware of the food they eat. Due to the closing of restaurants, consumers find it more important to cook home-made meals and to continue eating more varied foods (EIT Food Consumer Task Force, 2020). This may have a long lasting impact on determinants such as skills, knowledge, etc.
- A lack of interventions to promote both healthy and sustainable consumption. In most cases healthy and sustainable foods are compatible, but this is not always the case (e.g. eating potato chips instead of beef is more sustainable, but less healthy). A recent study by The Lancet Commission (2019) though emphasized the importance of combining healthy and sustainable foods in one definition.
- Psychological and or material rewards are not covered/found in studies, but this may be important to establish long term effects.
- There is no clarity about potential negative effects of behavior change, such as the licensing effect, which means that people allow themselves to do something bad, after doing something good (Merritt et al., 2010).

4.4 Measurements of meat consumption

Studies included different methods to measure meat consumption. There were measures on individual level, such as weighing meat leftovers and others on household level (e.g. analyzing grocery receipts). Also some measures were retrospective (e.g. filling in a questionnaire after the intervention), and others were "in the moment" (e.g. a food diary). We give an overview of the used measurements for objective meat consumption behaviors, for subjective, self-reported behaviors, and for intentions and/or willingness to eat meat.

- Objective meat consumption behavior measurements were: 1) reviewing grocery receipts, 2) meat consumption assessed by weighing meat leftovers in restaurants, 3) selection of dishes in laboratory setting as well as restaurant setting.
- Self-reported consumption behavior measurements were: 1) Food Frequency Questionnaires, 2) food diaries/journals
- Intentions and/or willingness to eat measurements were: 1) scale from 0 (very unlikely) to 100 (very likely) to select a meat dish (Bianchi et al., 2018b; Taufik et al., 2019).

We found that most studies used measurements that focus on intentions or self-reported, subjective behavior.

4.5 Reflection and discussion

Our report gives an overview of the most recent literature (i.e. the past 10 years) on intervention strategies to change meat consumption behavior, more specifically to reduce meat consumption and adopt a more plant-based diet. As the aforementioned recommendations state, many intervention strategies are effective in reaching this goal. Most evidence was found for behavioral nudges, as well as interventions that include self-monitoring and goal-setting as behavior change methods. But interventions focusing on health, environmental and animal welfare implications seem to hold promise for change as well. However, many intervention studies do not measure effects in the long term, and not all interventions look at objective behavior change, but at self-reported or intended behavior change.

Based on the socio-ecological model we categorized interventions that work on an individual level, and interventions that are implemented on an environmental level (interpersonal, organization, community, society). Bianchi and colleagues (2018a+b) conducted two systematic reviews that respectively looked into intervention studies on an individual level and

intervention studies that restructured micro-environments. A combination of both behavioral and environmental approaches is recommended, as well as focusing on reflective and automatic constructs at the individual level (Rothman et al., 2009). Since many individual studies found results on the intention to reduce meat consumption, but not on actual demand for meat, combining interventions that call upon both reflective thoughts (e.g., the remembered content of an educational program) as well as on automatic processes (e.g. the effortless impact of store atmospherics) with appropriate and well-targeted structural environmental interventions, could help bridge the intention-behavior gap to reduce meat consumption. However, not all environmental interventions interact positively with an educational intervention, because this depends on whether the environmental intervention is congruent with the person's beliefs and motivations (Oyserman & Destin, 2010). There is a need to tailor higher level interventions (e.g. micro environment, policies) to lower level interventions (e.g. individual level).

Generally the systematic reviews did not look into theoretical methods and determinants of interventions to find out what the working mechanisms of the interventions are. Consequently, a limitation of this report could be the somewhat subjective nature of assigning theoretical methods and determinants to interventions, when these were not explicitly described in the studies themselves. However, this was necessary to create a structure in a wide variety of interventions to find out what their working mechanisms could be. Hence, we only named the behavior change methods that were applied in the interventions, but there are more behavior change methods to change behavior (Appendix 7.3 provides an exhaustive overview of the possible behavior change methods per determinant). Even though the evidence does not cover all the behavior change methods for meat reduction, it is worth taking a look at the taxonomy to find out what other methods and practical applications there are to change behavior.

Most intervention studies included white and well-educated participants, limiting the generalizability of the data to other population groups. As stated in the methodology, we aimed to segment our findings on different transitional life stages, but almost all studies we found focused on adult population. In a qualitative study with focus groups in New Zealand Kemper (2020) found differences in motivations for meat reduction between young adults, families and retirees. All participants stated to continue to eat meat due to cravings, taste and nutrition beliefs, but took into account health, environmental and cost factors to reduce meat consumption. For young adults and families substituting meat is handled with more creativity and exploration than for retirees, making it important for social marketing campaigns to provide information and recipes, in various formats that appeal to different consumer segments (Kemper, 2020). This illustrates again the importance of tailoring higher level interventions to lower level interventions (e.g. individual level).

Based on the results from the systematic reviews, we could conclude that there was a gap in studies conducted in supermarket settings, in school or university settings (youth) and that (social) media campaigns were understated as well. In the report we tried to fill this gap by adding individual studies, collected through a systematic search we conducted by the start of this project. Furthermore most intervention studies found an effect on meat reduction consumption (as opposed to no effect), possibly due to a publication bias where studies that find effects are published, whereas studies that find no effects remain under the radar.

Non-governmental organizations (NGOs) could play a vital role in encouraging meat consumption changes. A qualitative study conducted in 2013 found that NGOs in Canada, the U.S. and Sweden have worked to reduce or alter domestic meat consumption, but few had established formal campaigns. Animal protection organizations advocated for larger reductions in meat consumption than did environmental groups (Laestadius et al., 2013). Looking at specific discourses, Espinosa & Treich (2020) stated that welfarist NGOs (i.e. moderate discourses) seek to improve conditions for farmed animals and decrease animal-based consumption, and that abolitionist NGOs (i.e. radical discourse) unconditionally refuse animal use and ask for a vegan society. In their controlled experiment they found that both NGO discourses reduce pro-meat justifications (i.e. beliefs), but did not enhance actions in favor of animal welfare. Furthermore, the abolitionist discourse may even produce a backlash effect. However, the study did not measure actual consumption behavior and was conducted in France, not taking into account cultural differences.

Finally, to reach the goal of reducing meat consumption behaviour, a holistic approach is required. Only if the consequences for all actors in the food supply chain are taken into account, we could succeed to reach this goal. For example how should

producers of meat be motivated to grow crops instead of breeding animals? The farm to fork strategy by the European Commission (2020) states that consumers should feel empowered to choose sustainable food, and all actors in the food chain should see it as their responsibility and opportunity. The strategy will support a transition to a more fair, healthy and environmentally-friendly food system by placing emphasis on new opportunities for citizens and food operators alike.

5 Conclusion

Evidence shows that various intervention strategies can be used to change people's meat consumption behavior. We found that interventions using self-monitoring, goal-setting and implementation intentions as behavior change methods, have an effect on eating less meat. Also, many studies looked into nudges and found the strongest effects when behavioral nudges were used, such as meat free meals as default options in canteens, increasing vegetarian availability, and changing portion sizes in restaurants and supermarkets. When it comes to interventions that highlight specific consequences of meat eating (i.e. health, environment, animal welfare), most of these were effective but evidence was especially solid for interventions highlighting animal welfare. Behavior change methods used in these interventions were environmental reevaluation, shifting perspective and tailoring. Still, not all behavior change methods (see Appendix 7.3 for an exhaustive overview of the possible behavior change methods per determinant) were covered in literature so there is a need for evidence on their effect on meat consumption behavior. To develop and implement an effective intervention, it is important to find out what the working mechanism of an intervention is, that is what the behavior change methods are that influence specific determinants in this intervention, to appropriately make the translation to a practical campaign. This does not guarantee success, but limits the chance of failure. Also, organizations preferably focus both on the individual as well as on the environmental level, as the socio-ecological model also foresees. Since many individual intervention studies only measured intentions or willingness to eat less meat, a thoughtful application of both structural environmental changes and changes in personal motivations, knowledge and attitudes, is desirable to overcome this intention-behavior gap, and so reduce meat consumption behavior.

6 References

Afshin, A., Peñalvo, J.L., Del Gobbo L., Silva, J., Michaelson, M., O'Flaherty, M., et al. (2017). The prospective impact of food pricing on improving dietary consumption: A systematic review and meta-analysis. *PLoS ONE, 12* (3), 1-18.

Allen, M.W. & Baines, S. (2002). Manipulating the symbolic meaning of meat to encourage greater acceptance of fruits and vegetables and less proclivity for red and white meat. *Appetite, 38,* 118-130.

Amiot, C.E., El Hajj Boutros, G., Sukhanova, K. & Karelis, A.D. (2018). Testing a novel multicomponent intervention to reduce meat consumption in young men. *PloS One, 13* (10).

Apostolidis, C. & McLeay, F. (2016). Should we stop meating like this? Reducing meat consumption through substitution. *Food Policy, 65,* 74-89.

Austgulen, M.H., Skuland, S.E., Schjoll, A & Alfnes, F. (2018). Consumer readiness to reduce meat consumption for the purpose of environmental sustainability: Insights from Norway. *Sustainability, 10,* 1-24.

Bacon, L. & Krpan, D. (2018). (Not) eating the environment: the impact of restaurant menu design on vegetarian food choice. *Appetite, 125,* 190-200.

Bartholomew, L.K., Markham, C.M., Ruiter, R.A.C., Fernandez, M.E., Kok, G., Parcel, G.S. (2016) *Planning Health Promotion Programs. An Intervention Mapping Approach*. San Fransisco: Jossey -Bass 2016 (Fourth Edition).

Berndsen, M. & van der Pligt, J. (2005). Risks of meat: The relative impact of cognitive, affective and moral concerns. *Appetite, 44* (2), 195-205.

Bertolotti, M., Chirchiglia, G. & Catellani, P. (2016). Promoting change in meat consumption among the elderly: Factual and prefactual framing of health and well-being. *Appetite, 106,* 37-47.

Bianchi, F., Dorsel, C., Garnett, E., Aveyard, P. & Jebb, S.A. (2018a). Interventions targeting conscious determinants of human behaviour to reduce the demand for meat: a systematic review with qualitative comparative analysis. *International Journal of Behavioral Nutrition and Physical Activity, 15* (102), 1-25.

Bianchi, F., Garnett, E., Dorsel, C., Aveyard, P. & Jebb, S.A. (2018b). Restructuring physical micro-environments to reduce the demand for meat: a systematic review and qualitative comparative analysis. *Lancet Planet Health, 2*, 384-397.

Brunner, F., Kurz, V., Bryngelsson, D. & Hedenus, F. (2018). Carbon label at a university restaurant - label implementation and evaluation. *Ecological Economics, 146,* 658-667.

Cadario, R. & Chandon, P. (2019). Which Healthy Eating Nudges Work Best? A Meta-Analysis of Field Experiments. *Marketing Science, Articles in Advance,* 1-22.

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

Carfora, V., Caso, D. & Conner, M. (2017a). Randomized controlled trail of a text messaging intervention for reducing processed meat consumption: The mediating roles of anticipated regret and intention. *Appetite, 117,* 152-160

Carfora, V., Caso, D. & Conner, M. (2017b). Correlational study and randomised controlled trial for understanding and changing red meat consumption: The role of eating identities. *Social Science & Medicine, 175,* 244-252.

Cheah, I., Shimul, A.S., Liang, J. & Phau, I. (2020). Drivers and barriers toward reducing meat consumption. *Appetite, 149,* 1-9.

Christie, C.D. & Chen, F.S. (2018). Vegetarian or meat? Food choice modeling of main dishes occurs outside of awareness. *Appetite, 121,* 50-54.

Clark, M. (2017). *Chronic effects of replacing red and processed meat with non/reduced meat alternatives* (Doctoral dissertation).

Compernolle, S., DeSmet, A., Poppe, L., Crombez, G. De Bourdeaudhuij, I., Cardon, G, et al. (2019). Effectiveness of interventions using self-monitoring to reduce sedentary behavior in adults: a systematic review and meta-analysis. *International Journal of Behavioral Nutrition and Physical Activity, 16* (63), 1-16.

Cordts, A., Nitzko, S. & Spiller, A. (2014). Consumer Response to Negative Information on Meat Consumption in Germany. *The International Food and Agribusiness Management Review 17,* 83-106.

Cross, A. & Sheffield, D. (2016). Mental contrasting as a behaviour change technique: a systematic review protocol paper of effects, mediators and moderators on health. *Systematic Reviews, 5* (201), 1-6.

Da Silva, M.A.V., São-João, T.M., Brizon, V.C., Franco, D.H. & Mialhe, F.L. (2018). Impact of implementation intentions on physical activity practice in adults: A systematic review and meta-analysis of randomized clinical trials. *PLoS One, 13* (11), 1-15.

De Groeve, B., Bleys, B & Hudders, L. (2019). Okay to promote eating less meat, but don't be a cheat – The role of dietary identity, perceived inconsistency and inclusive language of an advocate in legitimizing meat reduction. *Appetite, 138,* 269-279.

De Vaan, J.M., van Steen, T. & Müller, B.C.N. (2019). Meat on the menu? How the menu structure can stimulate vegetarian choices in restaurants. *Journal of Applied Social Psychology, 49* (12), 755-766.

Dos Santos, Q., Perez-Cueto, F.J.A., Rodrigues, V.M., Appleton, K., Giboreau, A., Saulais, L., et al. (2020). Impact of a nudging intervention and factors associated with vegetable dish choice among European adolescents. *European Journal of Nutrition, 59* (2), 1-29.

EIT Food Consumer Task Force. (2020). *COVID-19 impact on consumer food behaviours in Europe.* Retrieved from: https://www.eitfood.eu/media/news-pdf/COVID-19_Study_-_European_Food_Behaviours_-_Report.pdf

Emmons, K.M., McBride, C.M., Puleo, E., Pollak, K.I., Clipp, E., Kuntz, K., et al. (2005a). Project PREVENT: a randomized trial to reduce multiple behavioral risk factors for colon cancer. *Cancer Epidemiology Biomarkers Prevention, 14* (6), 1453-1459.

Emmons, K.M., Stoddard, A.M., Fletcher, R., Gutheil, C., Suarez, E.G., Lobb, R., et al. (2005b). Cancer prevention among working class, multiethnic adults: results of the healthy directions-health centers study. American Journal of Public Health *95* (7), 1200-1205.

Ensaff, H., Homer, M., Sahota, P., Braybrook, D., Coan, S. & McLeod, H. (2015). Food Choice Architecture: An Intervention in a Secondary School and its Impact on Students' Plant-based Food Choices. *Nutrients, 7* (6), 4426-4437.

Espinosa, R. & Treich, N. (2020). Moderate versus radical NGOs. *Agricultural and Applied Economics Association,* 1-24.

European Commission. (2020). *Farm to Fork Strategy. For a fair, healthy and environmentally-friendly food system.* Retrieved from: https://ec.europa.eu/food/sites/food/files/safety/docs/f2f_action-plan_2020_strategy-info_en.pdf

Fehrenbach, K.S. (2013) The health and environmental impacts of meat consumption: using the extended parallel process model to persuade college students to eat less meat. Paper to be presented at the meeting of the National Communication Association, Washington, D.C..

Fehrenbach, K.S. (2015). *Designing Messages to Reduce Meat Consumption: A Test of the Extended Parallel Process Model* (Doctoral dissertation).

Flynn, M.M., Reinert, S. & Schiff, A.R. (2013). A six-week cooking program of plant-based recipes improves food security, body weight, and food purchases for food pantry clients. *Journal of Hunger & Environmental Nutrition, 8* (1), 73-84.

Friedlander, J. & Riedy, C. (2018). Celebrities, credibility, and complementary frames: raising the agenda of sustainable and other 'inconvenient' food issues in social media campaigning. *Communication Research and Practice, 4* (3), 229-245.

Garnett, E.E., Balmford, A., Sandbrook, C., Pilling, M.A. & Marteau, T.M. (2019). Impact of increasing vegetarian availability on meal selection and sales in cafeterias. *PNAS, 116* (42), 20923-20929.

Graça, J., Godinho, C.A. & Truninger, M. (2019). Reducing meat consumption and following plant-based diets: Current evidence and future directions to inform integrated transitions. *Trends in Food Science & Technology, 91*, 380-390.

Graham, F., Barker, M., Menon, M. & Holdsworth, M. (2020). Acceptability and feasibility of a café-based sustainable food intervention in the UK. *Health Promotion International*, *35* (6), 1507-1518.

Graham, T. & Abrahamse, W. (2017). Communicating the climate impacts of meat consumption: The effect of values and message framing. *Global Environmental Change, 44,* 98-108.

Godfrey, D.M. (2014). *Communicating sustainable food: connecting scientific information to consumer action* (Master's thesis).

Happer, C. & Wellesley, L. (2019). Meat consumption, behaviour and the media environment: a focus group analysis across four countries. *Food Security, 11*, 123-139.

Harguess, J.M., Crespo, N.C. & Hong, M.Y (2020). Strategies to reduce meat consumption: A systematic literature review of experimental studies. *Appetite, 144* .

Hawkes, A.L., Gollschewski S., Lynch B.M. & Chambers, S. (2009). A telephone-delivered lifestyle intervention for colorectal cancer survivors 'CanChange': a pilot study. *Psycho-oncology, 18* (4), 449-455.

Hawkes, A.L., Patrao, T.A., Green, A. & Aitken, J.F. (2012). CanPrevent: A telephone-delivered intervention to reduce multiple behavioural risk factors for colorectal cancer. *BMC Cancer, 12* (1), 560.

Hedin, B., Katzeff, C., Eriksson, E. & Pargman, D. (2019). A Systematic Review of Digital Behaviour Change Interventions for More Sustainable Food Consumption. *Sustainability, 11* (9), 1-23.

Holloway, T., Salter, A.M. & McCullough, F.S. (2012). Dietary intervention to reduce meat intake by 50% in university students – a pilot study. *Proceedings of the Nutrition Society, 71.*

Jalil, A.J., Tasoff, J. & Bustamante, A.V. (2020). Eating to save the planet: Evidence from a randomized controlled trial using individual-level food purchase data. *Food Policy, 95,* 1-12.

Jay, J.A., D'Auria, R., Nordby, J.C., Rice, D.A., Cleveland, D.A, Friscia, A., et al. (2019). Reduction of the carbon footprint of college freshman diets after a food-based environmental science course. *Climatic Change, 154,* 547-564.

Kemper, J.A. (2020). Motivations, barriers, and strategies for meat reduction at different family lifecycle stages. *Appetite, 150*, 1-9.

Klöckner, C.A. & Ofstad, S.P. (2017). Tailored information helps people progress towards reducing their beef consumption. *Journal of Environmental Psychology, 50,* 24-36.

Kok, G., Gottlieb, N.H., Commers, M. & Smerecnik, C. (2008). The ecological approach in health promotion programs: A decade later. *American Journal of Health promotion, 22,* 437-442.

Kok, G., Gottlieb, N.H., Peters, G.-J. Y., Mullen, P.D., Parcel, G.S., Ruiter, R.A.C., Fernández, M.E., Markham, C., & Bartholomew, L.K. (2016). A taxonomy of behaviour change methods: An intervention mapping approach. *Health Psychology Review, 10* (3), 297–312.

Kongsbak, I., Skov, L.R., Nielsen, B.K., Ahlmann, F.K., Schaldemose, H., Atkinson, L., et al. (2016). Increasing fruit and vegetable intake among male university students in an ad libitum buffet setting: a choice architectural nudge intervention. *Food Quality and Preference, 49,* 183–188.

Kral, T.V., Bannon, A.L. & Moore, R.H. (2016). Effects of financial incentives for the purchase of healthy groceries on a dietary intake and weight outcomes among older adults: A randomized pilot study. *Appetite, 100,* 110-117.

Kunst, J.R. & Hohle, S.M. (2016). Meat eaters by dissociation: How we present, prepare and talk about meat increases willingness to eat meat by reducing empathy and disgust. *Appetite, 105,* 758-774.

Kunst, J.R. & Palacios Haugestad, C..A. (2018). The effects of dissociation on willingness to eat meat are moderated by exposure to unprocessed meat: A cross-cultural investigation. *Appetite, 120,* 356-366.

Kurz, V. (2018). Nudging to reduce meat consumption: Immediate and persistent effects of an intervention at a university restaurant. *Journal of Environmental Economics and Management, 90*, 317-341.

Laestadius, L., Neff, R., Barry, C. & Frattaroli, S. (2013). Meat consumption and climate change: The role of non-governmental organizations. *Climatic Change, 120* (1), 25-38.

Leidig, R. (2012). Sodexo meatless Monday survey results. *The Johns Hopkins Center For A Livable Future, The John Hopkins School of Public Health*

Liberati, A., Altman, D.G., Tetzlaff, J., Mulrow, C., Gotzsche, P.C., et al. (2009). The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: explanation and elaboration. *PLoS Medicine, 6* (7), 1-28.

Loy, L.S., Wieber, F., Gollwitzer, P.M. & Oettingen, G. (2016). Supporting sustainable food consumption: mental contrasting with implementation intentions (MCII) aligns intentions and behavior. *Frontiers in Psychology, 29*(7).

Malan, H., Challamel, G.A., Silverstein, D., Hoffs, C., Spang, E., Pace, S.A., et al. (2020). Impact of a Scalable, Multi-Campus "Foodprint" Seminar on College Students' Dietary Intake and Dietary Carbon Footprint. *Nutrients, 12* (9), 1-17.

Marette, S. & Miller, G. (2016). Can information about health and environment beef up the demand for meat alternatives? *SUSFANS Food systems for health – environment - enterprise*

Mathur, M.B., Peacock, J., Reichling, D.B., Nadler, J., Bain, P.A., Garnder, C.D & Robinson, T. (2021). Interventions to Reduce Meat Consumption by Appealing to Animal Welfare: Meta-Analysis and Evidence-Based Recommendations. *Manuscript submitted for publication.*

McClain, A.D., Hekler, E.B. & Gardner, C.D. (2013). Incorporating prototyping and iteration into intervention development: a case study of a dining hall-based intervention. *Journal of American college Health, 61* (2), 122-131.

Merritt, A., Effron, D. & Monin, B. (2010). Moral self-licensing: When being good frees us to be bad. *Social and Personality Psychology Compass, 4,* 344-357.

Michie, S., Abraham, C., Whittington, C., McAteer, J. & Gupta, S. (2009). Effective techniques in healthy eating and physical activity interventions: a meta-regression. *Health Psyhcology, 28* (6), 690-701.

Michie, S., Atkins, L.& West, R. (2014). *The behavior change wheel: A guide to designing interventions.* London: Silverback Publishing.

Ni Mhurchu, C., Eyles, H., Jian, Y. & Blakely, T. (2018). Do nutrition labels influence healthier food choices? Analysis of label viewing behaviour and subsequent food purchases in a labelling intervention trial. *Appetite, 121,* 360-365.

Oyserman, D. & Destin, M. (2010). Identity-based motivation: Implications for intervention. *The Counseling Psychologist, 38* (7), 1-29.

Piernas, C., Tate, D.F., Wang, X. & Popkin, B.M. (2013). Does diet-beverage intake affect dietary consumption patterns? Results from the choose healthy options consciously everyday (CHOICE) randomized clinical trial. *American Journal of Clinical Nutrition, 97* (3), 604-611.

Piester, H.E., DeRieux, C.M., Tucker, J., Buttrick, N.R., Galloway, J.N. & Wilson, T.D. (2020). "I'll try the veggie burger": Increasing purchases of sustainable foods with information about sustainability and taste. *Appetite, 155,* 1-9.

Pohjolainen, P. & Jokinen, P. (2020). Meat Reduction Practices in the Context of a Social Media Grassroots Experiment Campaign. *Sustainbility, 12* (9), 1-19

Rees, J.H., Bamberg, S., Jager, A., Victor, L., Bergmeyer, M. & Friese, M. (2018). Breaking the habit: On the highly habitualized nature of meat consumption and implementation intentions as one effective way of reducing it. *Basic and Applied Social Psychology, 40*(3), 136-147.

Reinders, M.J., Huitink, M., Dijkstra, S.C., Maaskant, A.J. & Heijnen, J. (2017). Menu-engineering in restaurants – adapting portion sizes on plates to enhance vegetable consumption: a real-life experiment. *International Journal of Behavioral Nutrition and Physical Activity, 14* (41), 1-11.

Reinders, M.J., van Lieshout, L., Pot, G.K., Neufingerl, N., van den Broeck, E., Battjes-Fries, M. & Heijnen, J. (2020). Portioning meat and vegetables in four different out of home settings: A win-win for guests, chefs and the planet. *Appetite, 147,* 1-10.

Rothman, A. J., Sheeran, P. & Wood, W. (2009). Reflective and automatic processes in the initiation and maintenance of dietary change. *Annals of Behavioral Medicine, 38* (1), 4-17.

Schlavon, C.C., Vieira, F.G.K., Ceccatto, V., de Liz, S., Cardoso, A.L., Sabel, C., et al. (2015). Nutrition education intervention for women with breast cancer: effect on nutritional factors and oxidative stress. *Journal of Nutrition Education and Behavior, 47* (1), 2-9.

Schnabelrauch Arndt, C.A. (2016). *Tailoring feedback and messages to encourage meat consumption* reduction (Doctoral dissertation).

Scrimgeour, L. R. (2012). *Digital Persuasion: Effects of web-based information and beliefs on meat consumption attitudes and intention* (Master's Thesis).

Slapo, H.B. & Karevold, K.I. (2019). Simple Eco-Labels to Nudge Customers Toward the Most Environmentally Friendly Warm Dishes: An Empirical Study in a Cafeteria Setting. *Frontiers in Sustainable Food Systems, 3,* 1-9.

Sorensen, G. ,Barbeau, E., Stoddard, A.M., Hunt, M.K., Kaphingst, K. & Wallace, L. (2005). Promoting behavior change among working-class multiethnic workers: results of the healthy directions – small business study. *American Journal of Public Health, 95,* 1389-1395.

Sparkman, G. & Walton, G.M. (2017). Dynamic norms promote sustainable behavior even if it is counternormative. *Psychological Science, 28* (11), 1663-1674.

Sparkman, G., Weitz, E., Robinson, T.N., Malhotra, N. & Walton, G.M. (2020). Developing a Scalable Dynamic Norm Menu-Based Intervention to Reduce Meat Consumption. *Sustainability, 12* (6), 1-41.

Stea, S. & Pickering, G. (2018). Optimizing messaging to reduce red meat consumption. *Environmental Communication A Journal of Nature and Culture, 13* (2), 1-16.

Stewart, G., Patel, R. & Sucharitakul, G. (2016). Report Summary: Can simple nudges reduce meat consumption? *University of Cambridge*

Taufik, D., Verain M.C.D., Bouwman, E.P. & Reinders, M.J. (2019). Determinants of real-life behavioural interventions to stimulate more plant-based an less animal-based diets: A systematic review. *Trends in Food Science & Technology, 93,* 281-303.

Tian, Q., Hilton, D. & Becker, M. (2016). Confronting the meat paradox in different cultural contexts: Reactions among Chinese and French participants. *Appetite, 96,* 187-194.

Tybur, J.M., Laakasuo, M., Ruff, J. & Klauke, F. (2016). How pathogen cues shape impressions of foods: The omnivore's dilemma and functionally specialized conditioning. *Evolution and Human Behaviour, 37* (5), 376-386.

Vainio, A., Irz, X. & Hartikainen, H. (2018). How effective are messages and their characteristics in changing behavioural intentions to substitute plant-based foods for red meat? The mediating role of prior beliefs. *Appetite, 125,* 217-224.

Vandenbroele, J., Slabbinck, H., Van Kerckhove, A. & Vermeir, I. (2018). Curbing portion size effects by adding smaller portions at the point of purchase. *Food Quality and Preference, 64,* 82-87.

Vandenbroele, J., Slabbinck, H., Van Kerckhove, A., & Vermeir, I. (2019). Mock meat in the butchery: Nudging consumers toward meat substitutes. *Organizational Behavior and Human Decision Processes,* 1-12.

Verain, M.C.D., Sijtsema, S.J., Dagevos, H. & Antonides, G. (2017.) Attribute segmentation and communication effects on healthy and sustainable consumer diet intentions. *Sustainability, 9,* 734.

Vermeer, W.M., Alting, F., Steenhuis, I.H. & Seidell, J.C. (2010). Value for money or making the healthy choice: the impact of proportional pricing on consumers' portion size choices. *European Journal of Public Health, 20,* 65-69.

Vibhuti, P. (2017). *Rainforest, reef and our appetite for beef: Communication for sustainable behaviour change* (Master's thesis).

Willett, W., Rockström J, Loken B, Springmann M, Lang T, Vermeulen S, et al. (2019). Food in the Anthropocene: the EAT-Lancet Commission on healthy diets from sustainable food systems. *Lancet, 2* (393), 447-492.

Zapico, J.L., Katzeff, C., Bohné, U. & Milestad, R. (2016). Eco-feedback Visualization for Closing the Gap of Organic Food Consumption. *NordiCHI '16: Proceedings of the 9th Nordic Conference on Human-Computer Interaction, 75,* 1-9.

Zickfeld, J.H., Kunst, J. R., & Hohle, S. M. (2018). Too Sweet To Eat: Exploring the Effects of Cuteness on Meat Consumption. *Appetite, 120,* 181-195.

7 Appendix

7.1 Overview of systematic reviews

We identified five systematic reviews that were similar to the research objective of WWF for this project. In what follows we give a brief overview of each systematic review, and in the next chapter discuss the theoretical methods and practical strategies of the interventions, captured in these reviews, according to the socio-ecological model.

Bianchi et al. (2018a) systematically reviewed interventions targeting conscious determinants of human behavior to reduce the demand for meat. All adult populations were included in the review, except people diagnosed with clinical conditions for whom it is required to consume specific amounts of meat. Interventions that aim to promote a general dietary pattern (e.g. Mediterranean diet) and interventions restructuring elements of the physical micro-environment were excluded (as the latter were captured in a separate systematic review paper). The authors included experimental designs, with eligible comparators no or minimal intervention controls, a pre-intervention baseline, or other eligible interventions. The outcomes included were objective or self-reported measures of demand for meat (actual or intended consumption), purchase or selection of meat in real or virtual environments.

Bianchi et al. (2018b) systematically reviewed interventions restructuring physical micro-environments to reduce the demand for meat. All populations were included in the review, except people diagnosed with clinical condition(s) for whom it is required to consume specific amounts of meat. The authors included all sorts of experimental intervention studies, including pilot and feasibility studies, that evaluated the effectiveness of interventions restructuring physical micro-environments to reduce the demand for meat, purchase or selection. Eligible comparators were no or minimal intervention controls, a pre-intervention baseline, or other eligible interventions. Interventions that promote a general dietary pattern and interventions not featuring any component of environmental restructuring, as well as qualitative and non-experimental studies were excluded. A study could be included if the outcome was an objective or self-reported measure of meat consumption.

Harguess et al. (2020) described factors associated with lower meat consumption and reviewed experimental studies that targeted those factors to either change behavior or intention/willingness to reduce meat consumption. Study inclusion criteria were experimental and quasi-experimental study designs, studies that measured variables directly or indirectly related to meat consumption (e.g. behavior or intention), and studies written in English.

Taufik et al. (2019) systematically reviewed determinants of real-life behavioral interventions to stimulate more plant-based and less animal-based diets. The authors excluded studies dealing with children, patients with specific diseases, people with an individual risk of disease, and people recovered/recovering from disease. No experimental studies were excluded, that is non-empirical studies, qualitative studies, other quantitative studies (modeling, correlational, etc.), and choice experiments. Papers were excluded when no behavioral outcomes were reported, such as attitudes, perceptions, preferences. In our overview we will only focus on studies aiming to reduce animal-based food, as well as studies promoting simultaneous increase of plant-based food consumption and decrease of animal-based food consumption. Hence, the studies that are solely concerned with promoting plant-based food are out of scope.

The fifth paper by Mathur and colleagues *(under revision)* conducted a meta-analysis focusing on interventions to reduce meat consumption by appealing to animal welfare. We reached out to the authors who stated that their meta-analysis is completed and under revision to be published in Appetite. We included some preliminary results in the report. The inclusion criteria were: studies recruiting subjects from any human population; studies needed to assess an intervention that was intended to reduce meat consumption or purchase, and needed to include any mention or portrayal of animal suffering, slaughter or welfare; studies needed to include a control group, condition or time period not subjected to any form of intervention.; studies needed to report an outcome regarding the consumption or purchase of meat or all edible animal products (i.e. by direct behavioral measure, self-reported behavior or self-reported intended behavior).

7.2 Overview table of interventions

Socio-ecological level	Behavior Change methods	Intervention & General findings	Effect and direction
Individual (see 3.2.1)			
Basic methods	Tailoring Persuasive communication	Matching messages with people's values or stages of change, did not have an effect on intention. Persuasive messages changed behavioral intentions when fit to people's prior beliefs (e.g. meat believers vs sceptics)	/ +
Change habitual, automatic & impulsive behavior	Implementation intentions	Prompting if-then plans reduced meat consumption	+
Change attitudes, beliefs & outcome expectations	Arguments Environmental reevaluation	Health consequences interventions (e.g. webpage, article, video): effect on intended reductions	++
	Arguments Tailoring	Environmental impact interventions (e.g. webpage, essay): effect on intended reductions and selection of meat products	++
	Shifting perspective	Animal welfare implications interventions (e.g. increasing empathy, disgust and reducing state dissociation): effect on intended reductions and willingness to eat meat. Meta-analysis: large effects, but short-term.	++
	/	Social consequences interventions: one study with effect on intended reductions, another linking meat eating with high social dominance values no effect.	+ /
	Implementation intentions Tailoring	Mix of consequences (health, environment, ethical): a few studies found an effect. Most of the interventions did not find evidence for lower meat intakes.	+ /
Change skills, capability & self-efficacy	Self-monitoring Goal-setting	Interventions that use self-monitoring and goal-setting have an effect on intended reductions and on self-reported meat consumption	++
Multicomponent interventions	Self-monitoring & goal-setting Elaboration, guided practice	Lifestyle counselling with individuals affected by or at increased risk of chronic disease: evidence for reduced meat consumption Multicomponent interventions providing meat alternatives, recipes, cooking demonstrations, information, taster sessions, etc.: sign reductions in meat consumption or purchase	+ +
Interpersonal (see 3.2.2)			
Social modeling	Modeling	Clients ordering the same lunch order as the prior order.	++

Social norms	/	Dynamic norm messages found increases in vegetarian orders, but not sign. Other study even found decreases in vegetarian orders.	+ -
Organization (see 3.2.3)			
University canteen	Cognitive nudges	Mixed results: repositioning meat products, sustainable foods labels (only sign. for women), traffic light labels (sign. but not long term) Sign. results: enhancing the visibility of the vegetarian option	+ ++
	Behavioral nudges	Sign. results with providing meat free meals as default options and increasing vegetarian availability	++
High school canteen	Behavioral nudges	Changing choice architecture nudged students towards more plant-based food choices	+
Work	Behavioral nudges	Reducing portions of meat/fish in sandwiches did not change satisfaction or eating behavior	+
University	Consciousness raising Active learning Discussions	Lectures and seminars about climate effects of meat intake, had impact on meat consumption behavior and reported meat consumption.	++
Community (see 3.2.4)			
Restaurant	Cognitive nudges	Optional adding meat on a menu increased choice of vegetarian dishes No effect on meat reduction with labels: environmentally friendly or "dish of the day"	+ /
	Affective nudges	Sign. results with manipulating sensory properties of meat	+
	Behavioral nudges	Sign. results with targeting portion sizes (reducing meat, doubling vegetables in dishes) and increasing vegetarian availability in buffet restaurant	++
Supermarket	Cognitive nudges	Sign. results on vegetable sales with providing information about climate or health benefits of eating less meat	+
	Behavioral nudges	The availability of smaller portion sizes led to sign. more sales of the smaller portions of meat.	+
Society (see 3.2.5)			
Pricing	Financial incentive	Financial incentive did not have effect on level of meat or fruit consumption	/
Social media campaigns	Modeling	Influencers could reach the broader public and raise the agenda of the impacts of meat production and consumption.	/

Table 3. Effect and direction: Desired direction: ++ strong effect, + effect; Undesired direction: -- strong effect, - effect; / no effect; Odds Ratio (OR)

7.3 Taxonomy of Behavior Change Methods (Kok et al., 2016)

Tables and Figure for

A Taxonomy of Behavior Change Methods; an Intervention Mapping Approach

This document contains the Tables and Figure that accompany the publication "A Taxonomy of Behavior Change Methods; an Intervention Mapping Approach" that was accepted for publication (and published online) in Health Psychology Review in 2015:

Kok, G., Gottlieb, N. H., Peters, G.-J. Y., Mullen, P. D., Parcel, G. S., Ruiter, R. A. C., Fernández, M. E., Markham, C., & Bartholomew, L. K. (2015). A Taxonomy of Behavior Change Methods; an Intervention Mapping Approach. *Health Psychology Review.* DOI: 10.1080/17437199.2015.1077155

Note that the final citation will likely be different (e.g. the article may be published in 2016 or later), but the DOI will remain the same.

This document is available as supplemental material accompanying the publication in Health Psychology Review (http://dx.doi.org/10.1080/17437199.2015.1077155), and in the Open Science Framework repository at http://osf.io/sqtuz. Note that introductory material to this publication and these tables with behavior change methods is available at http://effectivebehaviorchange.com.

If you wish to cite these supplemental materials, instead please cite the original paper to which they belong (see http://dx.doi.org/10.1080/17437199.2015.1077155).

This document contains four sections: first, the abstract of the original Health Psychology Review publication; second, an excerpt from that publication where use of the tables is explained; third, Tables 1-15 and Figure 1 from the publication; and fourth, the references cited in Tables 1-15.

The next page first starts with a Table of Contents.

Table of contents

Abstract

In this paper, we introduce the IM taxonomy of behavior change methods and its potential to be developed into a coding taxonomy. That is, although IM and its taxonomy of behavior change methods are not in fact new, because IM was originally developed as a tool for intervention development, this potential was not immediately apparent. Second, in explaining the IM taxonomy and defining the relevant constructs, we call attention to the existence of parameters for effectiveness of methods, and explicate the related distinction between theory-based methods and practical applications and the probability that poor translation of methods may lead to erroneous conclusions as to method-effectiveness. Third, we recommend a minimal set of intervention characteristics that may be reported when intervention descriptions and evaluations are published. Specifying these characteristics can greatly enhance the quality of our meta-analyses and other literature syntheses.

In conclusion, the dynamics of behavior change are such that any taxonomy of methods of behavior change needs to acknowledge the importance of, and provide instruments for dealing with, three conditions for effectiveness for behavior change methods. For a behavior change method to be effective: 1) it must target a determinant that predicts behavior; 2) it must be able to change that determinant; 3) it must be translated into a practical application in a way that preserves the parameters for effectiveness and fits with the target population, culture, and context. Thus, taxonomies of methods of behavior change must distinguish the specific determinants that are targeted, practical, specific applications, and the theory-based methods they embody. In addition, taxonomies should acknowledge that the lists of behavior change methods will be used by, and should be used by, intervention developers. Ideally, the taxonomy should be readily usable for this goal; but alternatively, it should be clear how the information in the taxonomy can be used in practice. The IM taxonomy satisfies these requirements, and it would be beneficial if other taxonomies would be extended to also meet these needs.

The following is an excerpt from the original open access paper in Health Psychology Review (http://dx.doi.org/10.1080/17437199.2015.1077155). If you have not yet read that paper, we strongly recommend doing so first to provide the necessary background for understanding these tables. Two introductory open access articles, "A practical guide to effective behavior change: How to identify what to change in the first place" and "A practical guide to effective behavior change: How to apply theory- and evidence-based behavior change methods in an intervention" are available at http://effectivebehaviorchange.com, and can also be ofhelp.

How to use the tables

This description assumes that the intervention developer has identified which behavior to change, and whose behavior this is (i.e., either of a target population individual or of an environmental agent). It also assumes that the relevant determinants and underlying beliefs have been identified. When selecting methods for individuals from the target population, for each determinant, Tables 1-8 can be consulted to get an initial list of methods that can be used to change that determinant. For example, Table 1 contains methods that can be used for most determinants, whereas Table 3 contains methods to change awareness and risk perception, and Table 6 contains methods to change perceived social influence. For each potential method, inspect the definition and the parameters to determine whether the method is applicable given the situation. Then, use the references included in the Tables to study the relevant literature, and use bibliographic databases such as Google Scholar to locate more recent literature. Repeat these steps for all determinants, until methods have been identified to target all determinants and beliefs. Then, translate these methods into practical applications, making sure that the parameters for effectiveness are respected. It is important to note that these parameters for effectiveness are subject to change as new literature is published. Also, the strength of the evidence for each method varies, new methods can emerge, and evidence can accumulate that certain methods are better avoided (e.g., threatening communication in populations low in self-efficacy).

When selecting methods to target environmental agents, the process is similar. Depending on the environmental level of the agent, consult Tables 9-14 to get an initial list of methods. For example, Table 9 contains basic methods that can be used for agents at all environmental levels, whereas Table 11 contains methods that can be used to target agents at the organizational level. Because each environmental agent is a person (or several), in addition to these environmental methods, Tables 1-8 can also be consulted to get a list of methods at the individual level. Of course, at the environmental level, it is also necessary to consult the literature, both those publications cited in the tables and recent updates.

Nota bene: The theoretical background for all methods is provided in Bartholomew et al. (2011; 2016) and mentioned in the tables. Use the Bartholomew et al. book to find the essential background information.

Tables and figure

Table 1: Basic Methods at the Individual Level (Adapted from Bartholomew et al., 2011)

Method (related theories and references)	Definition	Parameters
Participation (Diffusion of Innovations Theory; Theories of Power; Organizational Development Theories; Models of Community Organization; Cummings & Worley, 2015; McCullum, Pelletier, Barr, Wilkins, & Habicht, 2004; Rogers, 2003; World Health Organization Regional Office for Europe, 2002)	Assuring high level engagement of the participants' group in problem solving, decision making, and change activities; with highest level being control by the participants' group.	Requires willingness by the health promoter or convener to accept the participants as having a high level of influence; Requires participants' group to possess appropriate motivation and skills.
Belief selection (Theory of Planned Behavior; Reasoned Action Approach; Fishbein & Ajzen, 2010)	Using messages designed to strengthen positive beliefs, weaken negative beliefs, and introduce new beliefs.	Requires investigation of the current attitudinal, normative and efficacy beliefs of the individual before choosing the beliefs on which to intervene.
Persuasive communication (Communication-Persuasion Matrix; Elaboration Likelihood Model; Diffusion of Innovations Theory; McGuire, 2012; Petty, Barden, & Wheeler, 2009; Rogers, 2003)	Guiding individuals and environmental agents toward the adoption of an idea, attitude, or action by using arguments or other means.	Messages need to be relevant and not too discrepant from the beliefs of the individual; can be stimulated by surprise and repetition. Will include arguments.
Active learning ((Elaboration Likelihood Model; Social Cognitive Theory; Kelder, Hoelscher, & Perry, 2015; Petty et al., 2009)	Encouraging learning from goal-driven and activity-based experience.	Time, information, and skills.
Tailoring (Trans-Theoretical Model; Precaution Adoption Process Model; Protection Motivation Theory; Communication-Persuasion Matrix; Lustria, Cortese, Noar, & Glueckauf, 2009; McGuire, 2012; Weinstein, Sandman, & Blalock, 2008; Werrij, Ruiter, van `t Riet, & de Vries, 2012)	Matching the intervention or components to previously measured characteristics of the participant.	Tailoring variables or factors related to behavior change (such as stage) or to relevance (such as culture or socioeconomic status).
Individualization (L K Bartholomew et al., 2000; L. K. Bartholomew, Czyzewski, Swank, McCormick, & Parcel, 2000; Prochaska, Redding, & Evers, 2015)	Providing opportunities for learners to have personal questions answered or instructions paced according to their individual progress.	Personal communication that responds to a learner's needs.
Modeling (Social Cognitive Theory; Theories of Learning; Kazdin, 2008; Kelder et al., 2015)	Providing an appropriate model being reinforced for the desired action.	Attention, remembrance, self-efficacy and skills, reinforcement of model; identification with model, coping model instead of mastery model.
Feedback (Theories of Learning; Goal-Setting Theory, Social Cognitive Theory; Kazdin, 2008; Kelder et al., 2015; Latham & Locke,	Giving information to individuals and environmental agents regarding the extent to which they are accomplishing learning or	Feedback needs to be individual, follow the behavior in time, and be specific.

2007)	performance, or the extent to which performance is having an impact.	
Reinforcement (Theories of Learning; Social Cognitive Theory; Kazdin, 2008; Kelder et al., 2015; McSweeney & Murphy, 2014)	Providing reinforcement: linking a behavior to any consequence that increases the behavior's rate, frequency or probability.	Reinforcement need to be tailored to the individual, group, or organization, to follow the behavior in time, and to be seen as a consequence of the behavior.
Punishment (Theories of Learning; Kazdin, 2008; McSweeney & Murphy, 2014)	Providing punishment: linking a behavior to any consequence that decreases the behavior's rate, frequency or probability.	Punishment need to be tailored to the individual, group, or organization, to follow the behavior in time, and to be seen as a consequence of the behavior. Punishment should be avoided because of negative side effects. If used, emphasis should be on positive reinforcement.
Motivational interviewing, MI (Self-determination theory; Theories of self-regulation; Miller & Rollnick, 2012; Ng et al., 2012; Ryan & Deci, 2000)	Providing a collaborative, goal-oriented style of communication with particular attention to the language of change; designed to strengthen personal motivation for and commitment to a specific goal by eliciting and exploring the person's own reasons for change within an atmosphere of acceptance and compassion.	A supportive relationship between client and professional combined with the evocation of patient change talk. Professionals must recognize that MI involves collaboration not confrontation, evocation not education, autonomy rather than authority, and exploration instead of explanation.
Facilitation (Social Cognitive Theory; Bandura, 1986)	Creating an environment that makes the action easier or reduces barriers to action.	Requires real changes in the environment instead of in the perceptions of the environment. Requires the identification of barriers and facilitators and the power for making the appropriate changes. Facilitating conditions on one environmental level are usually dealt with by intervening on a higher environmental level.
Nudging (Theories of Automatic, Impulsive and Habitual Behavior; de Ridder, 2014; Thaler & Sunstein, 2008)	Simple changes in the presentation of choice alternatives that make the desired choice the easy, automatic or default choice.	Requires autonomy: freedom of choice, a sense of awareness, and the healthy choice being default: easy and attractive.

Table 2: Methods to Increase Knowledge (Adapted from Bartholomew et al., 2011)

Method (related theories and references)	**Definition**	**Parameters**
Chunking (Theories of Information Processing; Gobet et al., 2001; Smith, 2008)	Using stimulus patterns that may be made up of parts but that one perceives as a whole.	Labels or acronyms are assigned to material to aid memory.
Advance organizers (Theories of Information Processing; Kools, van de Wiel, Ruiter, Crüts, & Kok, 2006; Kools, 2011)	Presenting an overview of the material that enables a learner to activate relevant schemas so that new material can be associated.	Schematic representations of the content or guides to what is to be learned.
Using imagery (Theories of Information Processing; Steen, 2007; Wright, 2011)	Using artifacts that have a similar appearance to some subject.	Familiar physical or verbal images as analogies to a less familiar process.
Discussion (Theories of Information Processing; Petty et al., 2009)	Encouraging consideration of a topic in open informal debate.	Listening to the learner to ensure that the correct schemas are activated.
Elaboration (Petty et al., 2009; Theories of Information Processing; Smith, 2008)	Stimulating the learner to add meaning to the information that is processed.	Individuals with high motivation and high cognitive ability; messages that are personally relevant, surprising, repeated, self-pacing, not distracting, easily understandable, and include direct instructions; messages that are not too discrepant and cause anticipation of interaction.
Providing cues (Theories of Information Processing; Godden & Baddeley, 1975)	Assuring that the same cues are present at the time of learning and the time of retrieval.	Cues work best when people are allowed to select and provide their own cues.

Table 3: Methods to Change Awareness and Risk Perception (Adapted from Bartholomew et al., 2011)

Method (related theories and references)	Definition	Parameters
Consciousness raising (Health Belief Model; Precaution-Adoption Process Model; Trans-Theoretical Model; Prochaska et al., 2015; Skinner, Tiro, & Champion, 2015; Weinstein et al., 2008)	Providing information, feedback, or confrontation about the causes, consequences, and alternatives for a problem or a problem behavior.	Can use feedback and confrontation; however, raising awareness must be quickly followed by increase in problem-solving ability and (collective) self-efficacy.
Personalize risk (Precaution-Adoption Process Model; Skinner et al., 2015)	Providing information about personal costs or risks of action or inaction with respect to target behavior.	Present messages as individual and undeniable, and compare them with absolute and normative standards.
Scenario-based risk information (Precaution-Adoption Process Model; Mevissen, Meertens, Ruiter, Feenstra, & Schaalma, 2009)	Providing information that may aid the construction of an image of the ways in which a future loss or accident might occur.	Plausible scenario with a cause and an outcome; imagery. Most effective when people generate their own scenario or when multiple scenarios are provided.
Framing (: Van 't Riet et al., 2014; Werrij et al., 2010) (Protection Motivation Theory; Van 't Riet et al., 2014; Werrij et al., 2012)	Using gain-framed messages emphasizing the advantages of performing the healthy behavior; or loss-framed messages, emphasizing the disadvantages of not performing the healthy behavior.	Requires high self-efficacy expectations. Gain frames are more readily accepted and prevent defensive reactions.
Self-reevaluation (Trans-Theoretical Model; Prochaska et al., 2015)	Encouraging combining both cognitive and affective assessments of one's self-image with and without an unhealthy behavior.	Stimulation of both cognitive and affective appraisal of self-image. Can use feedback and confrontation; however, raising awareness must be quickly followed by increase in problem-solving ability and self-efficacy.
Dramatic relief (Trans-Theoretical Model; Prochaska et al., 2015)	Encouraging emotional experiences, followed by reduced affect or anticipated relief if appropriate action is taken	Preferably should be done in counseling context so that emotions can be aroused and subsequently relieved.
Environmental reevaluation (Trans-Theoretical Model; Prochaska et al., 2015)	Encouraging combining the affective and cognitive assessments of how the presence or absence of a personal behavior affects one's social environment.	May include awareness about serving as a role model for others.
Fear arousal (Protection Motivation Theory; Extended Parallel Process Model; Peters, Ruiter, & Kok, 2013; Ruiter, Kessels, Peters, & Kok, 2014)	Arousing negative emotional reactions in order to promote self-protective motivation and action.	Requires high self-efficacy expectations rather than high outcome expectations alone; is rarely effective.
Self-affirmation (Self-Affirmation Theory; Cohen & Sherman, 2014)	Increasing people's self-image by having them elaborate on their relevant values or desirable characteristics.	Must be tailored to individual self-image.

Table 4: Methods to Change Habitual, Automatic and Impulsive Behaviors (Adapted from Bartholomew et al., 2011)

Method (related theories and references)	Definition	Parameters
Deconditioning (Theories of Learning; Robbins, Schwartz, & Wasserman, 2001)	Letting people experience a lack of reinforcement or even negative outcomes of the undesired behavior.	Slow process, especially when reinforcement schedule was intermittent. It may be necessary to create a continuous lack of positive reinforcement.
Counterconditioning (Wood & Neal, 2007)	Encouraging the learning of healthier behaviors that can substitute for problem behaviors.	Availability of substitute behaviors.
Implementation intentions (Theories of Goal Directed Behavior; Theories of Automatic, Impulsive and Habitual Behavior; Gollwitzer & Sheeran, 2006; Verplanken & Aarts, 1999)	Prompting making if-then plans that link situational cues with responses that are effective in attaining goals or desired outcomes.	Existing positive intention.
Cue altering (Verplanken & Aarts, 1999; Wood & Neal, 2007)	Teaching people to change a stimulus that elicits or signals a behavior.	Existing positive intention.
Stimulus control (Prochaska et al., 2015; Wood & Neal, 2007)	Encouraging removing cues for unhealthy habits and adding prompts for healthier alternatives.	Needs insight in the behavioral chain leading to the automatic response.
Planning coping responses (Attribution Theory and Relapse Prevention Theory; Theories of Goal Directed Behavior; Hofmann, Friese, & Wiers, 2008; Marlatt & Donovan, 2005)	Getting the person to identify potential barriers and ways to overcome these.	Identification of high-risk situations and practice of coping response.
Early commitment (Theories of Learning; Robbins et al., 2001)	Having people choose a (larger) delayed reward far in advance.	Making the choice may be forced but the choice for the delayed reward needs to be voluntary.
Public commitment (Theories of Automatic, Impulsive and Habitual Behavior; Ajzen, Czasch, & Flood, 2009)	Stimulating pledging, promising or engaging oneself to perform the healthful behavior, and announcing that decision to others.	Most effective when publicly announced; may include contracting.
Training executive function (Theories of Automatic, Impulsive and Habitual Behavior; Diamond, 2013)	Improving the top-down mental control processes that are used when going on automatic or relying on instinct or intuition would be ill-advised, insufficient, or impossible.	The task has to be challenging and substantial repetition is required to sufficiently train the executive functions.

Table 5: Methods to Change Attitudes, Beliefs, and Outcome Expectations (Adapted from Bartholomew et al., 2011)

Method (related theories and references)	Definition	Parameters
Classical conditioning (Theories of Learning; Kazdin, 2008)	Stimulating the learning of an association between an unconditioned stimulus (UCS) and a conditioned stimulus (CS).	Most effective when the time interval is short and the CS precedes the UCS.
Self-reevaluation (Trans-Theoretical Model; Prochaska et al., 2015)	Encouraging combining both cognitive and affective assessments of one's self-image with and without an unhealthy behavior.	Stimulation of both cognitive and affective appraisal of self-image. Can use feedback and confrontation; however, raising awareness must be quickly followed by increase in problem-solving ability and self-efficacy.
Environmental reevaluation (Trans-Theoretical Model; Prochaska et al., 2015)	Encouraging realizing the negative impact of the unhealthy behavior and the positive impact of the healthful behavior.	Stimulation of both cognitive and affective appraisal to improve appraisal and empathy skills.
Shifting perspective (Theories of Stigma and Discrimination; Batson, Chang, Orr, & Rowland, 2002)	Encouraging taking the perspective of the other.	Initiation from the perspective of the learner; needs imaginary competence.
Arguments (Communication-Persuasion Matrix; Elaboration Likelihood Model; McGuire, 2012; Petty & Wegener, 2010)	Using a set of one or more meaningful premises and a conclusion.	For central processing of arguments they need to be new to the message receiver.
Direct experience (Theories of Learning; Maibach & Cotton, 1995)	Encouraging a process whereby knowledge is created through the interpretation of experience.	Rewarding outcomes from the individual's experience with the behavior or assurance that the individual can cope with and reframe negative outcomes.
Elaboration (Theories of Information Processing; Elaboration Likelihood Model; Petty et al., 2009; Smith, 2008)	Stimulating the learner to add meaning to the information that is processed.	Individuals with high motivation and high cognitive ability; messages that are personally relevant, surprising, repeated, self-pacing, not distracting, easily understandable, and include direct instructions; messages that are not too discrepant and cause anticipation of interaction.
Anticipated regret (Theory of Planned Behavior; Reasoned Action Approach; Richard, van der Pligt, & de Vries, 1995)	Stimulating people to focus on their feelings after unintended risky behavior, before any losses actually materialize.	Stimulation of imagery; assumes a positive intention to avoid the risky behavior.
Repeated exposure(Theories of Learning; Zajonc, 2001)	Making a stimulus repeatedly accessible to the individual's sensory receptors.	Neutrality of original attitude.
Cultural similarity (Communication-Persuasion Matrix; Kreuter & McClure, 2004)	Using characteristics of the target group in source, message, and channel.	Using surface characteristics of the target group enhances receptivity. Using social-cultural characteristics leads to a more positive reception of the message.

Table 6: Methods to Change Social Influence (Adapted from Bartholomew et al., 2011)

Method (related theories and references)	**Definition**	**Parameters**
Information about others' approval (Theory of Planned Behavior; Reasoned Action Approach; Social Comparison Theory; Forsyth, 2014; Mollen, Ruiter, & Kok, 2010)	Providing information about what others think about the person's behavior and whether others will approve or disapprove of any proposed behavior change.	Positive expectations are available in the environment.
Resistance to social pressure (Theory of Planned Behavior; Reasoned Action Approach; Evans, Getz, & Raines, 1992; Evans, 1984)	Stimulating building skills for resistance to social pressure.	Commitment to earlier intention; relating intended behavior to values; psychological inoculation against pressure.
Shifting focus (Theory of Planned Behavior; Reasoned Action Approach; Fishbein & Ajzen, 2010)	Prompting hiding of the unpopular behavior or shifting attention away from the behavior.	Preferably shift focus to a new reason for performing the behavior.
Mobilizing social support (Diffusion of Innovations Theory; Theories of Social Networks and Social Support; Holt-Lunstad & Uchino, 2015; Valente, 2015)	Prompting communication about behavior change in order to provide instrumental and emotional social support.	Combines caring, trust, openness, and acceptance with support for behavioral change; positive support is available in the environment.
Provide opportunities for social comparison (Social Comparison Theory; Suls, Martin, & Wheeler, 2002)	Facilitating observation of nonexpert others in order to evaluate one's own opinions and performance abilities.	Upward comparison may help setting better goals; downward comparison may help feeling better or more self-efficacious.

Table 7: Methods to Change Skills, Capability, and Self-Efficacy and to Overcome Barriers (Adapted from Bartholomew et al., 2011)

Method (related theories and references)	Definition	Parameters
Guided practice (Social Cognitive Theory; Theories of Self-Regulation; Kelder et al., 2015)	Prompting individuals to rehearse and repeat the behavior various times, discuss the experience, and provide feedback.	Subskill demonstration, instruction, and enactment with Individual feedback; requires supervision by an experienced person; some environmental changes cannot be rehearsed.
Enactive mastery experiences (Social Cognitive Theory; Theories of Self-Regulation; Kelder et al., 2015)	Providing increasingly challenging tasks with feedback to serve as indicators of capability.	Requires willingness to accept feedback.
Verbal persuasion (Social Cognitive Theory; Theories of Self-Regulation; Kelder et al., 2015)	Using messages that suggest that the participant possesses certain capabilities.	Credible source.
Improving physical and emotional states (Theories of Self-Regulation; Kelder et al., 2015)	Prompting interpretation of enhancement or reduction of physiological and affective states, to judge own capabilities.	Must carefully interpret and manage emotional states.
Reattribution training (Attribution Theory and Relapse Prevention Theory; Theories of Self-Regulation; Marlatt & Donovan, 2005)	Helping people reinterpret previous failures in terms of unstable attributions and previous successes in terms of stable attributions.	Requires counseling or bibliotherapy to make unstable and external attributions for failure.
Self-monitoring of behavior (Theories of Self-Regulation; Creer, 2000; Harkin et al., n.d.)	Prompting the person to keep a record of specified behavior(s).	The monitoring must be of the specific behavior (that is, not of a physiological state or health outcome). The data must be interpreted and used. The reward must be reinforcing to the individual.
Provide contingent rewards (Theories of Learning; Theories of Self-Regulation; Bandura, 1986)	Praising, encouraging, or providing material rewards that are explicitly linked to the achievement of specified behaviors.	Rewards need to be tailored to the individual, group or organization, to follow the behavior in time, and to be seen as a consequence of the behavior.
Cue altering (Theories of Automatic, Impulsive, and Habitual Behavior; Theories of Self-Regulation; Achtziger, Gollwitzer, & Sheeran, 2008)	Teaching changing a stimulus, either consciously or unconsciously perceived, that elicits or signals a behavior.	Existing positive intention.
Public commitment (Theories of Automatic, Impulsive, and Habitual Behavior; Ajzen et al., 2009)	Stimulating pledging, promising, or engaging oneself to perform the healthful behavior and announcing that decision to others.	Needs to be a public announcement; may include contracting.
Goal setting (Goal-Setting Theory; Theories of Self-Regulation; Latham & Locke, 2007)	Prompting planning what the person will do, including a definition of goal-directed behaviors that result in the target behavior.	Commitment to the goal; goals that are difficult but available within the individual's skill level.
Set graded tasks (Social Cognitive Theory; Theories of Self-Regulation; Kelder et al., 2015)	Setting easy tasks and increase difficulty until target behavior is performed.	The final behavior can be reduced to easier but increasingly difficult sub-behaviors.

Planning coping responses (Attribution Theory and Relapse Prevention Theory; Theories of Self-Regulation; Marlatt & Donovan, 2005)	Prompting participants to list potential barriers and ways to overcome these.	Identification of high-risk situations and practice of coping response.

Table 8: Methods to Reduce Public Stigma (Adapted from Bartholomew et al., 2011)

Method (related theories and references)	**Definition**	**Parameters**
Stereotype-inconsistent information (Theories of Stigma and Discrimination; Bos, Schaalma, & Pryor, 2008)	Providing positive examples from the stigmatized group.	Only effective when there are many different examples. Examples are not too discrepant from original stereotype.
Interpersonal contact (Theories of Stigma and Discrimination; Pettigrew & Tropp, 2006)	Bringing people in contact with members of the stigmatized group.	Requires positive experiences. Most effective when: no status differences; externally sanctioned; intensive contact; common or shared goals.
Empathy training (Theories of Stigma and Discrimination; Batson et al., 2002)	Stimulating people to empathize with another person, i.e., imagine how the other person would feel.	Requires being able and willing to identify with the stigmatized person. Imagine how the other person would feel (this leads to empathy). Do not imagine how you would feel (this leads to both empathy and distress).
Cooperative learning (Theories of Stigma and Discrimination; Aronson, 2011)	Engineering lessons in a way that students must learn from one another.	Requires careful organization of lesson information distribution.
Conscious regulation of impulsive stereotyping and prejudice (Theories of Stigma and Discrimination; Bos et al., 2008)	Forcing oneself to control impulsive negative reactions related to stigma.	Mere suppression almost always leads to counterproductive effects and is not advisable. Conscious self-regulation of automatic stereotyping can be used effectively.
Reducing inequalities of class, race, gender and sexuality (Theories of Stigma and Discrimination; Link & Phelan, 2001)	*See methods for changes at higher Environmental levels (see Tables 9 - 14).*	

Table 9: Basic Methods for Change of Environmental Conditions. (Adapted from Bartholomew et al., 2011)

Method (related theories and references)	Definition	Parameters
Systems change (Systems Theory: Best et al., 2012; National Cancer Institute, 2007)	Interacting with the environment to change the elements and relationship among elements of a system at any level, especially through dialogue with stakeholders, action, and learning through feedback.	Methods and actors depend on the level of the system.
Participatory problem solving (Organizational Development Theories; Social Capital Theory; Models of Community Organization; Butterfoss, Kegler, & Francisco, 2008; Cummings & Worley, 2015; Wallerstein, Minkler, Carter-Edwards, Avila, & Sanchez, 2015)	Diagnosing the problem, Generating potential solutions, developing priorities, making an action plan, and obtaining feedback after implementing the plan.	Requires willingness by the health promoter or convener to accept the participants as equals and as having a high level of influence; requires target group to possess appropriate motivation and skills. Will often include goal setting, facilitation, feedback and consciousness raising.
Coercion (Theories of Power; Freudenberg & Tsui, 2014; Turner, 2005)	Attempting to control others against their will.	Requires or creates a power differential.
Advocacy and lobbying (Stage Theory of Organizational Change; Models of Community Organization; Agenda-Building Theory; Multiple Streams Theory; Christoffel, 2000; Galer-Unti, Tappe, & Lachenmayr, 2004; Kingdon, 2003; Wallack, Dorfman, Jernigan, & Themba, 1993; Weible, Sabatier, & McQueen, 2009)	Arguing and mobilizing resources on behalf of a particular change; giving aid to a cause; active support for a cause or position.	Form of advocacy must match style and tactics of the people, communities or organizations represented, and the nature of the issue; includes policy advocacy; often tailored to a specific environmental agent. Will often include persuasive communication, information about others' approval and consciousness raising.
Modeling (Social Cognitive Theory; Organizational Development Theories; Diffusion of Innovations Theory; Empowerment Theory; Bandura, 1997; Kelder et al., 2015; Rogers, 2003)	Providing an appropriate model being reinforced for the desired action.	Appropriate models will vary by level, including group members and organizational, community, and policy change agents.
Technical assistance (Organizational Development Theories, Diffusion of Innovations Theory, Social Capital Theory, Models of Community Organization; Flaspohler, Duffy, Wandersman, Stillman, & Maras, 2008; R. E. Mitchell, Florin, & Stevenson, 2002)	Providing technical means to achieve desired behavior.	Nature of technical assistance will vary by environmental level, but must fit needs, culture, and resources of the recipient.

Table 10: Methods to Change Social Norms (Adapted from Bartholomew et al., 2011)

Method (related theories and references)	**Definition**	**Parameters**
Mass media role-modeling (Bandura, 1997; Rogers, 2003)	Providing appropriate models being reinforced for the desired action through the mass media.	Conditions for modeling; conditions for persuasive communication (see Table 1).
Entertainment education (Moyer-Gusé, 2008; Petraglia, 2007; Shen & Han, 2014; Wilkin et al., 2007)	Providing a form of entertainment designed to educate (about health behavior) as well as to entertain.	Consideration of source and channel; balance of media professional's and health promoter's needs.
Behavioral journalism (Diffusion of Innovations Theory; Social Cognitive Theory; Social norm theories; A. L. McAlister, 1991; A. McAlister et al., 2000; Ramirez et al., 2010; Reininger et al., 2010)	Using by the mass and local media of appropriate role-model stories of behavior change based on authentic interviews with the target group.	Adequate role models from the community and elicitation interviews to describe the behavior and the positive outcome.
Mobilizing social networks (Theories of Social Networks and Social Support; Social norm theories; Valente, 2012)	Encouraging social networks to provide informational, emotional, appraisal, and instrumental support.	Availability of social network and potential support givers. Will often include information about others' approval, facilitation and persuasive communication.

Table 11: Methods to Change Social Support and Social Networks (Adapted from Bartholomew et al., 2011)

Method (related theories and references)	**Definition**	**Parameters**
Enhancing network linkages (Theories of Social Networks and Social Support; Holt-Lunstad & Uchino, 2015; Valente, 2015)	Training network members to provide support and members of the target group to mobilize and maintain their networks.	Available network.
Developing new social network linkages (Theories of Social Networks and Social Support; Valente, 2015)	Linking members to new networks by mentor programs, buddy systems, and self-help groups.	Willingness of networks to reach out; availability of networks that can provide appropriate support and linkage agents.
Use of lay health workers; peer education (Theories of Social Networks and Social Support; Models of Community Organization; Tolli, 2012)	Mobilizing members of the target population to serve as boundary spanners, credible sources of information, and role models.	Natural helpers in community with opinion leader status and availability to volunteer for training.

Table 12: Methods to Change Organizations (Adapted from Bartholomew et al., 2011)

Method (related theories and references)	Definition	Parameters
Sense-making (Organizational Development Theory; Weick & Quinn, 1999)	Leaders reinterpret and relabel processes in organization, create meaning through dialogue, and model and redirect change.	Used for continuous change, including culture change.
Organizational diagnosis and feedback (Organizational Development Theory; Cummings & Worley, 2015)	Assessing of organizational structures and employees' beliefs and attitudes, desired outcomes and readiness to take action, using surveys and other methods.	Methods appropriate to organizational characteristics, for example, size and information technology. Will often include feedback and consciousness raising.
Team building and human relations training (Organizational Development Theory; Cummings & Worley, 2015)	Grouping development activities based on the values of human potential, participation, and development.	Compatible with the culture.
Structural redesign (Organizational Development Theory; Cummings & Worley, 2015; Jones, 2004)	Change organizational elements such as formal statements of organizational philosophy, communication flow, reward systems, job descriptions, and lines of authority.	Management authority and agreement.
Increasing stakeholder influence (Stakeholder Theory; Brown, Bammer, Batliwala, & Kunreuther, 2003; Kok, Gurabardhi, Gottlieb, & Zijlstra, 2015; R. K. Mitchell, Agle, & Wood, 1997)	Increase stakeholder power, legitimacy, and urgency, often by forming coalitions and using community development and social action to change an organization's policies.	The focal organization perceives that the external organization or group is one of its stakeholders.

Table 13: Methods to Change Communities (Adapted from Bartholomew et al., 2011)

Method (related theories and references)	Definition	Parameters
Problem-posing education (Conscientization Theory; Empowerment Theory; Freire, 1973a, 1973b; Wallerstein, Sanchez, & Velarde, 2004)	Participatory analysis using critical reflection, self-disclosure, and dialogue regarding the social forces underlying a problem and a commitment to change self and community.	A safe environment for participation and disclosure; a critical stance.
Community assessment (Models of Community Organization; Rothman, 2004)	Assessing a community's assets and needs, with feedback of results to the community.	Requires expert assistance and possibilities for feedback.
Community development (Models of Community Organization; Theories of Power; Minkler & Wallerstein, 2012; Rothman, 2004; Wallerstein et al., 2015)	A form of community organization, based on consensus, in which power is shared equally and members engage together in participatory problem solving.	Starting where the community is; may be grassroots or professional driven. Will often include consciousness raising, facilitation, goal setting and information about others' approval.
Social action (Theories of Power; Stakeholder Theory; Kok et al., 2015; Minkler & Wallerstein, 2012; Rothman, 2004; Wallerstein et al., 2015)	A form of community organization, based in conflict, in which disenfranchised people wrest power from the official power.	Starting where the community is; may be grassroots or professional driven. Will often include consciousness raising, persuasive communication, information about others' approval and modeling.
Forming coalitions (Models of Community Organization; Social Capital Theory; Butterfoss & Kegler, 2009; Butterfoss, 2007; Clavier & de Leeuw, 2013)	Forming an alliance among individuals or organizations, during which they cooperate in joint action to reach a goal in their own self-interest.	Requires collaboration across various agendas; requires attention to stages of partnership development. Will often include persuasive communication, consciousness raising, goal setting, facilitation and information about others' approval.
Social planning (Models of Community Organization; Rothman, 2004)	Using information based on research to address issues.	Requires credible source of the information.
Framing to shift perspectives (Models of Community Organization; Snow, 2004)	Assigning meaning and interpretation to relevant events and conditions in order to mobilize potential constituents, gain bystander support, and demobilize antagonists.	Match with culture.

Table 14: Methods to Change Policy (Adapted from Bartholomew et al., 2011)

Method (related theories and references)	**Definition**	**Parameters**
Media advocacy (Models of Community Organization; Dorfman & Krasnow, 2014; Wallack et al., 1993; Wallack, 2008)	Expose environmental agents' behaviors in the mass media to order to get them to improve health-related conditions. A type of advocacy.	Requires the media to approve the news value of the message and accept the message without changing its essential content.
Agenda setting (Multiple Streams Theory, Advocacy Coalition Theory, Theories of Power; Clavier & de Leeuw, 2013; Sabatier, 2003; Weible et al., 2009; Weible, 2008)	Process of moving an issue to the political agenda for action; may make use of broad policy advocacy coalitions and media advocacy.	Requires appropriate timing (see policy window) and collaboration of (media) gatekeepers. Will often include persuasive communication and consciousness raising.
Timing to coincide with policy windows (Multiple Streams Theory; Kingdon, 2003; Zahariadis, 2007)	Advocating policy when politics, problems and policy solutions are aligned to be receptive to a policy issue.	Requires an astute policy advocate who is well prepared
Creating and enforcing laws and regulations (Multiple Streams Theory, Theories of Power; Clavier & de Leeuw, 2013; Kingdon, 2003; Longest, 2006)	Forcing compliance or dictating or precluding choices. Sometimes Implementing existing laws to Accomplish change. Laws and regulations may also provide incentives.	Requires unequal power and availability of control and sanctions.

Table 15: Description of determinants, methods and applications; examples from Long Live Love, a school-based sex education program (Schaalma et al., 2011)

Determinants & Change objectives for Adolescents	Methods	Parameters	Applications	How population, context and parameters were taken into account
Risk perception:				
Recognize that they might land in situations in which contracting HIV and STIs can't be ruled out	Scenario-based risk information	Plausible scenario with a cause and an outcome; imagery. Most effective when people generate their own scenario or when multiple scenarios are provided.	Role-model stories in textbooks; videotaped role modeling, where the videos were discussed in class	Population: adolescent models are used Context: videos can be shown in class and discussed Parameters: plausible scenario with a cause and an outcome; multiple scenarios; models are peers that are reinforced for the right behavior
Attitude:				
Describe their strong perception of the advantages of condom use and other safe-sex options	Active learning	Time, information, and skills.	Inquiry teaching; group discussion; quiz; interviews	Population: experts indicated that adolescents are familiar with and like a quiz setting Context: teacher available for guidance and facilitation of the discussion and inquiry teaching Parameters: sufficient time and information; professional guidance
Recognize that advantages of safe sex outweigh disadvantages	Anticipated regret	Stimulation of imagery; assumes a positive intention to avoid the risky behavior.	Role-model stories; videotaped role modeling	Population: scenarios were selected that were realistic given situations that were common for the target population Context: videos can be shown in class and discussed Parameters: realistic scenarios, positive risk avoidance intention; models are peers that are reinforced for the right behavior
Social influences:				
Explain that peers plan to use condoms	Information about others' approval	Positive expectations available in social environment	Role-model stories; videotaped role modeling; group discussion	Population: adolescents are particularly sensitive to social influence from peers, so peers' approval was communicated Context: by showing the videos in class, real life norms are also activated Parameters: peer norms are positive

Skills & Self-efficacy:				
Express confidence in ability to buy condoms Demonstrate effective condom use	Modeling	Attention, remembrance, self-efficacy and skills, reinforcement; identification, coping model.	Role-model stories; videotaped role modeling	Population: target population did not easily discuss openly buying and using condoms. Therefore, starting from a video that was watched together provided a relatively safe starting point. Context: Watching the video in class together provides a shared experience that facilitates frank discussion. Parameters: models are peers that are reinforced for the right behavior; application is combined with skills and self-efficacy training

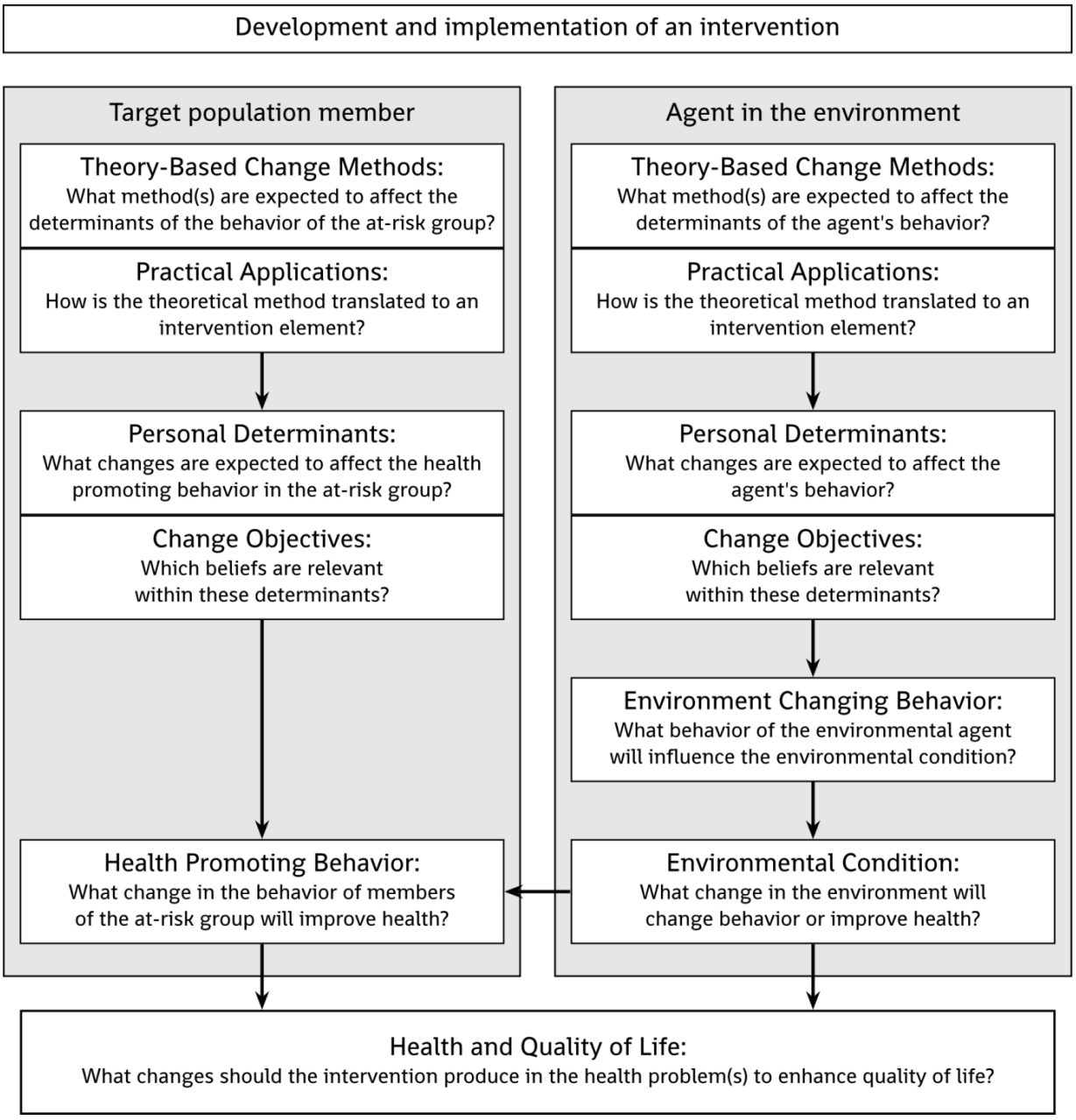

Figure 1: Similarity of the processes of change at the individual and environmental levels.

References

Achtziger, A., Gollwitzer, P. M., & Sheeran, P. (2008). Implementation intentions and shielding goal striving from unwanted thoughts and feelings. *Personality and Social Psychology Bulletin*, *34*, 381–393. doi:10.1177/0146167207311201

Ajzen, I., Czasch, C., & Flood, M. G. (2009). From Intentions to Implementation: Implementation Intention, Commitment, and Conscientiousness. *Journal of Applied Social Psychology*, *39*(6), 1356–1372.

Aronson, E. (2011). *The Social Animal* (11th ed.). New York: MacMillan Education.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Upper Saddle River, NJ, US: Prentice-Hall, Inc.

Bandura, A. (1997). Self-efficacy: the exercise of control. New York: W. H. Freeman.

Bartholomew, L. K., Czyzewski, D. I., Swank, P. R., McCormick, L., & Parcel, G. S. (2000). Maximizing the impact of the cystic fibrosis family education program: Factors related to program diffusion. Family & Community Health, 22, 27–47.

Bartholomew, L. K., Gold, R. S., Parcel, G. S., Czyzewski, D. I., Sockrider, M. M., Fernandez, M.,… Berlin, N. (2000). Watch, Discover, Think, and Act: Evaluation of computer-assisted instruction to improve asthma self-management in inner-city children. Patient Education and Counseling, 39(2-3), 269–280.

Bartholomew, L. K., Parcel, G. S., Kok, G., Gottlieb, N. H., & Fernández, M. E. (2011). Planning health promotion programs: an Intervention Mapping approach (3rd ed.). San Francisco, CA: Jossey-Bass.

Bartholomew, L. K., Markham, C. M., Ruiter, R. A. C., Fernàndez, M. E., Kok, G., & Parcel, G. S. (2016). Planning Health Promotion Programs: An Intervention Mapping Approach (4th ed.). Hoboken, NJ: Wiley.

Batson, C. D., Chang, J., Orr, R., & Rowland, J. (2002). Empathy, Attitudes, and Action: Can Feeling for a Member of a Stigmatized Group Motivate One to Help the Group?

Personality and Social Psychology Bulletin. doi:10.1177/014616702237647 Best, A., Greenhalgh, T., Lewis, S., Saul, J. E., Carroll, S., & Bitz, J. (2012). Large-Scale

Transformation in Health Care: A Realist View. The Milbank Quarterly, 90(3), 421–456.

Bos, A. E. R., Schaalma, H. P., & Pryor, J. B. (2008). Reducing AIDS-related stigma in developing countries: the importance of theory- and evidence-based interventions. Psychology*, Health & Medicine*, *13*(4), 450–460. doi:10.1080/13548500701687171

Brown, L. D., Bammer, G., Batliwala, S., & Kunreuther, F. (2003). Framing Practice-Research Engagement for Democratizing Knowledge. *Action Research*, *1*(1), 81–102. doi:10.1177/14767503030011006

Butterfoss, F. D. (2007). Coalitions and partnerships in community health. San Francisco: Jossey-Bass.

Butterfoss, F. D., & Kegler, M. C. (2009). The community coalition action theory. In R. J. DiClemente, R. A. Crosby, & M. C. Kegler (Eds.), Emerging theories in health promotion practice and research (pp. 237–276). San Francisco: Jossey-Bass.

Butterfoss, F. D., Kegler, M. C., & Francisco, V. T. (2008). Mobilizing organizations for health promotion: Theories of organizational change. In K. Glanz, B. K. Rimer, & K. Viswanath

(Eds.), Health behavior and health education: Theory, research, and practice (pp. 335– 362). San Francisco: Jossey-Bass.

Christoffel, K. K. (2000). Public health advocacy: Process and product. American Journal of Public Health, 90(5), 722–726. doi:10.2105/AJPH.90.5.722

Clavier, C., & de Leeuw, E. (2013). Health Promotion and the Policy Process. Oxford: Oxford University Press.

Cohen, G. L., & Sherman, D. K. (2014). The psychology of change: self-affirmation and social psychological intervention. Annual Review of Psychology, 65, 333–71. doi:10.1146/annurev-psych-010213-115137

Creer, T. L. (2000). Self-management of chronic illness. In M. Boekaerts, P. R. Pintrich, & M. Zeidner (Eds.), Handbook of self-regulation (pp. 601–629). San Diego, CA, US: Academic Press.

Cummings, T. G., & Worley, C. G. (2015). Organization development and change (10th ed.). Mason, OH, US: South-Western Cengage Learning.

De Ridder, D. (2014). Nudging for Beginners. The European Health Psychologist, 16(1), 2–6. Diamond, A. (2013). Executive functions. Annual Review of Psychology, 64, 135–68. doi:10.1146/annurev-psych-113011-143750

Dorfman, L., & Krasnow, I. D. (2014). Public health and media advocacy. Annual Review of Public Health, 35, 293–306. doi:10.1146/annurev-publhealth-032013-182503

Evans, R. I. (1984). A social inoculation strategy to deter smoking in adolescents. In J. D. Matarazzi, S. M. Weiss, J. A. Herd, N. E. Miller, & S. M. Weiss (Eds.), *Behavioral Health: A Handbook of Health Enhancement and Disease Prevention* (pp. 765-774). New York: John Wiley & Sons.

Evans, R. I., Getz, J. G., & Raines, B. S. (1992). Applying social inoculation concepts to prevention of HIV/AIDS in adolescents: Just say no is obviously not enough. In the meeting of the Society of Behavioral Medicine. New York.

Fishbein, M., & Ajzen, I. (2010). Predicting and changing behavior: The reasoned action approach. New York: Psychology Press.

Flaspohler, P., Duffy, J., Wandersman, A., Stillman, L., & Maras, M. A. (2008). Unpacking prevention capacity: An intersection of research-to-practice models and community-centered models. American Journal of Community Psychology, 41(3-4), 182–196. doi:10.1007/s10464-008-9162-3

Forsyth, D. R. (2014). Group dynamics (6th ed.). Belmont, CA, US: Thomson Higher Education. Freire, P. (1973a). Education for critical consciousness. New York: Seabury Press.

Freire, P. (1973b). Pedagogy of the oppressed. New York: Seabury Press.

Freudenberg, N., & Tsui, E. (2014). Evidence, power, and policy change in community-based participatory research. American Journal of Public Health, 104(1), 11–14. doi:10.2105/AJPH.2013.301471

Galer-Unti, R. A., Tappe, M. K., & Lachenmayr, S. (2004). Advocacy 101: getting started in health education advocacy. Health Promotion Practice, 5(3), 280–288. doi:10.1177/1524839903257697

Gobet, F., Lane, P. C. R., Croker, S., Cheng, P. C.-H., Jones, G., Oliver, I., & Pine, J. M. (2001). Chunking mechanisms in human learning. Trends in Cognitive Sciences, 6613(June), 236–243. doi:10.1016/S1364-6613(00)01662-4

Godden, D. R., & Baddeley, A. D. (1975). Context-dependent Memory in Two Natural Environments: On Land and Underwater. British Journal of Psychology, 66(3), 325–331. doi:10.1111/j.2044-8295.1975.tb01468.x

Gollwitzer, P. M., & Sheeran, P. (2006). Implementation Intentions and Goal Achievement: A Meta-analysis of Effects and Processes. Advances in Experimental Social Psychology, 38(06), 69–119. doi:10.1016/S0065-2601(06)38002-1

Harkin, B., Webb, T., Chang, B., Prestwich, A., Conner, M., Kellar, I., … Sheeran, P. (n.d.). Does Monitoring Goal Progress Promote Goal Attainment? A Meta-Analysis of the Experimental Evidence. Psychological Bulletin, Accepted for publication.

Hofmann, W., Friese, M., & Wiers, R. W. (2008). Impulsive versus reflective influences on health behavior: a theoretical framework and empirical review. Health Psychology Review. doi:10.1080/17437190802617668

Holt-Lunstad, J., & Uchino, B. (2015). Social Support and Health. In K. Glanz, B. K. Rimer, & K. Viswanath (Eds.), Health Behavior: Theory, Research and Practice (pp. 183-204). San Francisco, CA, US: Jossey-Bass.

Jones, G. R. (2004). Organizational theory, design, and change. Upper Saddle River, NJ, US: Pearson/Prentice-Hall.

Kazdin, A. E. (2008). Behavior modification in applied settings (6th ed.). Long Grove, IL, US: Waveland Press.

Kelder, S., Hoelscher, D., & Perry, C. L. (2015). How individuals, environments and health behaviors interact: Social Cognitive Theory. In K. Glanz, B. K. Rimer, & K. Viswanath (Eds.), Health behavior: Theory, research, and practice (5th ed., pp. 159-182). San Francisco, CA, US: John Wiley & Sons.

Kingdon, J. W. (2003). Agendas, alternatives, and public policies (2nd ed.). New York: Longman.

Kok, G., Gurabardhi, Z., Gottlieb, N. H., & Zijlstra, F. R. H. (2015). Influencing Organizations to Promote Health : Applying Stakeholder Theory. doi:10.1177/1090198115571363

Kools, M. (2011). Making written materials easy to use. In C. Abraham & M. Kools (Eds.), Writing health communication: An evidence-based guide (pp. 43-62). London: Sage Publications.

Kools, M., van de Wiel, M. W. J., Ruiter, R. A. C., Crüts, A., & Kok, G. (2006). The effect of graphic organizers on subjective and objective comprehension of a health education text. Health Education & Behavior, 33(6), 760–772. doi:10.1177/1090198106288950

Kreuter, M. W., & McClure, S. M. (2004). The role of culture in health communication. Annual Review of Public Health, 25, 439–455. doi:10.1146/annurev.publhealth.25.101802.123000

Latham, G. P., & Locke, E. A. (2007). New developments in and directions for goal-setting research. European Psychologist, 12(4), 290–300. doi:10.1027/1016-9040.12.4.290

Link, B. G., & Phelan, J. C. (2001). Conceptualizing Stigma. Annual Review of Sociology. doi:10.1146/annurev.soc.27.1.363

Longest, B. B. (2006). Health policymaking in the United States (4th ed.). Chicago: Health Administration Press.

Lustria, M. L. A., Cortese, J., Noar, S. M., & Glueckauf, R. L. (2009). Computer-tailored health interventions delivered over the web: Review and analysis of key components. Patient Education and Counseling. doi:10.1016/j.pec.2008.08.023

Maibach, E. W., & Cotton, D. (1995). Moving people to behavior change: a staged social cognitive approach to message design. In E.W. Meibach & R.L. Parrot (Eds.), Designing Health Messages. Approaches from communication theory and public health practice (pp. pp. 41–64). Thousand Oaks, CA: Sage.

Marlatt, G. A., & Donovan, D. M. (Eds.). (2005). Relapse prevention; maintenance strategies in the treatment of addictive behaviors (2nd ed.). New York: Guilford Press.

McAlister, A., Johnson, W., Guenther-Grey, C., Fishbein, M., Higgins, D., & O'Reilly, K. (2000). Behavioral Journalism for HIV Prevention: Community Newsletters Influence Risk-Related Attitudes and Behavior. *Journalism & Mass Communication Quarterly*. doi:10.1177/107769900007700111

McAlister, A. L. (1991). Population behavior change: a theory-based approach. Journal of Public Health Policy, 12(3), 345–361. doi:10.2307/3342846

McCullum, C., Pelletier, D., Barr, D., Wilkins, J., & Habicht, J.-P. (2004). Mechanisms of Power Within a Community- Based Food Security Planning Process. Health Education & Behavior, 31(2), 206–222. doi:10.1177/1090198103259163

McGuire, W. J. (2012). McGuire's classic Input-Output Framework for constructing persuasive messages. In R.E. Rice & C.K. Atkin (Eds.), Public communication campaigns (4th ed., pp. 133–146). Thousand Oaks, CA: Sage Publications.

McSweeney, F. K., & Murphy, E. S. (2014). The Wiley Blackwell Handbook of Operant and Classical Conditioning. Chichester, England: John Wiley & Sons.

Mevissen, F. E. F., Meertens, R. M., Ruiter, R. A. C., Feenstra, H., & Schaalma, H. P. (2009). HIV/STI risk communication: the effects of scenario-based risk information and frequency-based risk information on perceived susceptibility to chlamydia and HIV. Journal of Health Psychology, 14(1), 78–87. doi:10.1177/1359105308097948

Miller, W. R., & Rollnick, S. (2012). Motivational Interviewing. New York: Guilford Press.

Minkler, M., & Wallerstein, N. (2012). Improving health through community organization and community building: Perspectives from health education and social work. In M. Minkler (Ed.), Community organizing and community building for health and welfare (3rd ed., pp. 37–58). New Brunswick, NJ, US: Rutgers University Press.

Mitchell, R. E., Florin, P., & Stevenson, J. F. (2002). Supporting community-based prevention and health promotion initiatives: developing effective technical assistance systems.

Health Education & Behaviorehavior, 29(5), 620–639. doi:10.1177/109019802237029 Mitchell, R. K., Agle, B. R., & Wood, D. J. (1997). Toward a theory of stakeholder identification and salience: Defining the principle of who and what really counts. Academy of Management Review, 22(4), 853–886. doi:10.5465/AMR.1997.9711022105

Mollen, S., Ruiter, R. A. C., & Kok, G. (2010). Current issues and new directions in Psychology and Health: What are the oughts? The adverse effects of using social norms in health communication. Psychology & Health, 25(3), 265–70. doi:10.1080/08870440903262812

Moyer-Gusé, E. (2008). Toward a Theory of Entertainment Persuasion: Explaining the Persuasive Effects of Entertainment-Education Messages. Communication Theory, 18(3), 407–425. doi:10.1111/j.1468-2885.2008.00328.x

National Cancer Institute. (2007). Greater than the sum: Systems thinking in tobacco control (Publication No. 06–6085, Tobacco Control Monograph No. 18). Bethesda, MD.

Ng, J. Y. Y., Ntoumanis, N., Thogersen-Ntoumani, C., Deci, E. L., Ryan, R. M., Duda, J. L., & Williams, G. C. (2012). Self-Determination Theory Applied to Health Contexts: A Meta-Analysis. Perspectives on Psychological Science, 7(4), 325–340. Retrieved from http://cat.inist.fr/?aModele=afficheN&cpsidt=26177089

Peters, G.-J. Y., Ruiter, R. a C., & Kok, G. (2013). Threatening communication: a critical re-analysis and a revised meta-analytic test of fear appeal theory. Health Psychology Review, 7(Suppl 1), S8–S31. doi:10.1080/17437199.2012.703527

Petraglia, J. (2007). Narrative intervention in behavior and public health. Journal of Health Communication, 12(5), 493–505. doi:10.1080/10810730701441371

Pettigrew, T. F., & Tropp, L. R. (2006). A meta-analytic test of intergroup contact theory. Journal of Personality and Social Psychology, 90(5), 751–783. doi:10.1037/0022-3514.90.5.751

Petty, R. E., Barden, J., & Wheeler, S. C. (2009). The Elaboration Likelihood Model of Persuasion: Developing Health promotions for Sustained Behavioral Change. In R. J. DiClemente, R. A. Crosby, & M. Kegler (Eds.), Emerging theories in health promotion practice and research (2nd ed., pp. 185–214). San Francisco: Jossey-Bass.

Petty, R. E., & Wegener, D. T. (2010). Attitude change: Multiple roles for persuasion variables.In R.F. Baumeister & E.J. Finkel (Eds.) Advanced social psychology: The state of the science (pp. 217–259). Oxford, UK: Oxford University Press.

Prochaska, J. O., Redding, C. A., & Evers, K. E. (2015). The Transtheoretical Model and stages of change. In K. Glanz, B. K. Rimer, & K. Viswanath (Eds.), Health behavior: Theory, research, and practice (pp. 125-148). San Francisco: Jossey-Bass.

Ramirez, a G., Villarreal, R., McAlister, a, Gallion, K. J., Suarez, L., & Gomez, P. (2010). Advancing the role of participatory communication in the diffusion of cancer screening among Hispanics. Journal of Health Communication, 4(1), 31–36. doi:10.1080/108107399127075

Reininger, B. M., Barroso, C. S., Mitchell-Bennett, L., Cantu, E., Fernandez, M. E., Gonzalez, D. A., … McAlister, A. (2010). Process evaluation and participatory methods in an obesity-prevention media campaign for Mexican Americans. Health Promotion Practice, 11(3), 347–357. doi:10.1177/1524839908321486

Richard, R., van der Pligt, J., & de Vries, N. (1995). Anticipated affective reactions and prevention of AIDS. The British Journal of Social Psychology / the British Psychological Society, 34 (Pt 1), 9–21. doi:10.1111/j.2044-8309.1995.tb01045.x

Robbins, S. J., Schwartz, B., & Wasserman, E. A. (2001). Psychology of learning and behavior. New York: Norton.

Rogers, E. M. (2003). Diffusion of innovations. New York: Free Press.

Rothman, J. (2004). Three models of community organisation practice, their mixing and phasing. In F. M. Cox, J. L. Erlich, J. Rothman, & J. E. Tropman (Eds.), Strategies of community organisation: a book of readings (pp. 25-44). Itasca, IL, US: F. E. Peacock.

Ruiter, R. A. C., Kessels, L. T. E., Peters, G.-J. Y., & Kok, G. (2014). Sixty years of fear appeal research: Current state of the evidence. International Journal of Psychology, 49(2), 63–70.

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. The American Psychologist, 55(1), 68–78. doi:10.1037/0003-066X.55.1.68

Sabatier, P. A. (2003). Policy change over a decade or more. In P. R. Lee, C. L. Estes, & F. M. Rodriguez (Eds.), The nation's health (pp. 143–174). Sudbury, MA, US: Jones and Bartlett.

Shen, F., & Han, J. (Ashley). (2014). Effectiveness of entertainment education in communicating health information: a systematic review. Asian Journal of Communication, (July), 1–12. doi:10.1080/01292986.2014.927895

Skinner, C. S., Tiro, J., & Champion, V. L. (2015). The Health Belief Model. In K. Glanz, B. Rimer & K. Viswanath (Eds.), Health behavior: Theory, research, and practice (5th ed., pp. 131–167). San Francisco, CA, US: Jossey-Bass.

Smith, R. M. (2008). Conquering the content: A step-by-step guide to web-based course development. San Francisco, CA, US: Jossey-Bass.

Snow, D. A. (2004). Framing processes, ideology, and discursive fields. In D. A. Snow, S. A. Soule, & H. Kriesi (Eds.), Blackwell companion to social movements (pp. 380–412). Oxford, England: Blackwell.

Steen, R. G. (2007). The evolving brain: The known and the unknown. Amherst, NY, US: Prometheus Books.

Suls, J., Martin, R., & Wheeler, L. (2002). Social Comparison: Why, With Whom, and With What Effect? Current Directions in Psychological Science. doi:10.1111/1467-8721.00191

Thaler, R. H., & Sunstein, C. R. (2008). Nudge: Improving decisions about health, wealth, and happiness. New Haven, CT, US: Yale University Press.

Tolli, M. V. (2012). Effectiveness of peer education interventions for HIV prevention, adolescent pregnancy prevention and sexual health promotion for young people: A systematic review of European studies. Health Education Research, 27(5), 904–913. doi:10.1093/her/cys055

Turner, J. C. (2005). Explaining the nature of power: A three-process theory. European Journal of Social Psychology. doi:10.1002/ejsp.244

Valente, T. (2012). Network Interventions. Science, 337(6090), 49–53. doi:10.1126/science.1217330

Valente, T. (2015). Social networks and health behavior. In K. Glanz, B. K. Rimer, & K. Viswanath (Eds.), Health Behavior: Theory, Research and Practice (5th ed., pp. 204-222). San Francisco: John Wiley & Sons, Ltd.

Van 't Riet, J., Cox, A. D., Cox, D., Zimet, G. D., De Bruijn, G.-J., Van den Putte, B., … Ruiter, R. a C. (2014). Does perceived risk influence the effects of message framing? A new investigation of a widely held notion. Psychology & Health, (March), 37–41.

doi:10.1080/08870446.2014.896916

Verplanken, B., & Aarts, H. (1999). Habit, Attitude, and Planned Behaviour: Is Habit an Empty Construct or an Interesting Case of Goal-directed Automaticity? European Review of Social Psychology, 10(781062661), 101–134. doi:10.1080/14792779943000035

Wallack, L. (2008). Media Advocacy: A strategy for empowering people and communities. In M. Minkler (Ed.), Community Organizing and Community Building for Health (pp. 419–432). New Brunswick, NJ, US: Rutgers University Press.

Wallack, L., Dorfman, L., Jernigan, D., & Themba, M. (1993). Media advocacy and public health: Power for prevention. Thousand Oaks, CA, US: Sage Publications.

Wallerstein, N., Minkler, M., Carter-Edwards, L., Avila, M., & Sanchez, V. (2015). Improving health through community engagement, community organization, and community building. In K. Glanz, B. K. Rimer, & K. Viswanath (Eds.), Health behavior: Theory, research, and practice (5th ed., pp. 277-300). San Francisco, CA, US: Jossey-Bass.

Wallerstein, N., Sanchez, V., & Velarde, L. (2004). Freirian praxis in health education and community organizing: A case study of an adolescent prevention program. In M. Minkler (Ed.), Community organizing and community building for health (2nd ed., pp. 218–236). Piscataway, NJ: Rutgers University Press.

Weible, C. M. (2008). Expert-based information and policy subsystems: A review and synthesis. Policy Studies Journal, 36(4), 615-635.

Weible, C. M., Sabatier, P. A., & McQueen, K. (2009). Themes and variations: Taking stock of the advocacy coalition framework. Policy Studies Journal, 37(1), 121–140.

Weick, K. E., & Quinn, R. E. (1999). Organizational change and development. Annual Review of Psychology, 50, 361–86. doi:10.1146/annurev.psych.50.1.361

Weinstein, N. D., Sandman, P. M., & Blalock, S. J. (2008). The Precaution Adoption Process Model. In K. Glanz, B. K. Rimer, & K. Viswanath (Eds.), Health behavior and health education: Theory, research, and practice (4th ed., pp. 123–165). San Francisco, CA, US: Jossey-Bass.

Werrij, M. Q., Ruiter, R. A. C., van `t Riet, J., & de Vries, H. (2012). Message Framing. In C. Abraham & M. Kools (Eds.), Writing health communication: An evidence-based guide (pp. 123–143). London: Sage Publications.

Wilkin, H. a, Valente, T. W., Murphy, S., Cody, M. J., Huang, G., & Beck, V. (2007). Does entertainment-education work with Latinos in the United States? Identification and the effects of a telenovela breast cancer storyline. Journal of Health Communication, 12(5), 455–469. doi:10.1080/10810730701438690

Wood, W., & Neal, D. T. (2007). A new look at habits and the habit-goal interface. Psychological Review, 114(4), 843–863. doi:10.1037/0033-295X.114.4.843

World Health Organization Regional Office for Europe. (2002). Community participation in local health and sustainable development: Approaches and techniques. Kopenhagen. Retrieved from http://euro.who.int/document/e78652.pdf

Wright, P. (2011). Using graphics effectively in text. In C. Abraham & M. Kools (Eds.), Writing health communication: An evidence-based guide (pp. 63-82). London: Sage Publications.

Zahariadis, N. (2007). The Multiple Streams Framework. In P.A. Sabatier (Ed.), Theories of the Policy Process (pp. 65–92). Boulder, CO: Westview Press.

Zajonc, R. B. (2001). Mere Exposure: A Gateway to the Subliminal. Current Directions in Psychological Science. doi:10.1111/1467-8721.00154

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