Altering choice architecture to change population health behaviour: a large-scale conceptual and empirical scoping review of interventions within micro-environments

Gareth J. Hollands, Ian Shemilt, Theresa M. Marteau*, Susan A. Jebb, Michael P. Kelly, Ryota Nakamura, Marc Suhrcke, David Ogilvie

A concise summary of this report is also available as a journal article:

http://www.biomedcentral.com/1471-2458/13/1218


*Contact author: theresa.marteau@medschl.cam.ac.uk
Contents

Executive Summary 3
Introduction 7
Methods 12
Results 18
Discussion 34
Acknowledgements 42
References 43
- References from report 43
- Included articles by intervention type 50
- Included articles by behaviour 88
- Included articles by intervention type and behaviour 120
- Excluded articles 160
- Articles identified but not assessed 175

Appendix I: Search strategies, dates and yields 188

How to cite this report:

Boxes

Box 1. Operational definition of choice architecture interventions in micro-environments 19

Tables

Table 1. Numbers of study reports identified by intervention type and target behaviour 26
Table 2. Distribution of primary and secondary research reports 27
Table 3. Intervention types identified and brief summaries of respective evidence 28

Figures

Figure 1. PRISMA flow diagram 19
Figure 2. Emergent typology of intervention types 25
Executive Summary

Background
There is considerable public policy interest in choice architecture, an approach that involves altering features of physical or social environments to change behaviour. To date there has been no systematic attempt to clarify the concept and definition or describe the evidence base for such interventions. We conducted a systematic scoping review of empirical evidence, and related conceptual material, to identify the effects of choice architecture interventions in micro-environments on diet-, physical activity-, alcohol- and tobacco-related behaviours.

Methods
Highly sensitive systematic electronic searches were conducted in parallel with snowball searches because of the variation in terms used to describe choice architecture. Retrieved records were prioritised for manual screening using novel computer-aided approaches. A core dataset was extracted from eligible full-text articles to inform both assessment of the existing empirical evidence and concurrent conceptual work.

Results
804,919 unique records were retrieved, with 54,651 abstracts manually screened for eligibility. 346 full-text articles were included in the final review.

We developed an operational definition of choice architecture interventions in micro-environments for changing health-related behaviour as follows:
‘Interventions that involve altering the properties or placement of objects or stimuli within micro-environments with the intention of changing health-related behaviour. Such interventions are implemented within the same micro-environment as that in which the target behaviour is performed, typically require minimal conscious engagement, can in principle influence the behaviour of many people simultaneously, and are not targeted or tailored to specific individuals.’

Most (70.2%) of the relevant primary research and reviews had been undertaken in relation to diet-related behaviours, compared to 19.1% for physical activity, 7.3% for alcohol and 3.4% for tobacco. We categorised studies according to an emergent typology of nine categories of micro-environmental interventions: sizing; presentation; labelling; functional design; ambience; proximity;
availability; prompting; priming. These categories were further grouped into broader classes according to whether they primarily involved altering the properties of objects or stimuli, their placement, or both. The categories with most study reports were labelling (primarily in relation to point-of-choice labelling and diet, representing ~22% of total reports), and prompting (primarily in relation to motivational prompts for stair use, representing ~19% of total reports). Notably, these types of interventions were the ones most closely related to more traditional information-giving approaches to eliciting behaviour change. Beyond these examples, few types of intervention had been examined in substantive, consistent bodies of apparently similar studies. In most categories, studies were heterogeneous with respect to the populations, interventions, comparators or counterfactuals, outcomes and moderators assessed. Although a number of non-systematic reviews and broad overviews had attempted to summarise parts of the overall evidence base, few high-quality systematic reviews were identified.

The available evidence as reported by study authors (but not critically appraised in this review) is summarised by intervention category, as follows:

**Interventions that primarily alter properties of objects or stimuli**

- **Ambience** (e.g. aesthetic improvements): a wide variety of interventions was identified, mostly studied in field trials with a variety of outcomes. The majority of studies reported an effect of the intervention on behaviour.

- **Functional design** (e.g. size or shape of food and drink receptacles): a wide variety of interventions and study outcomes was identified. There was no consistent overall pattern of findings, with some studies reporting an effect of the intervention on behaviour and others reporting no effect.

- **Labelling** (e.g. point-of-choice nutritional labelling): most primary research involved field trials, with many studies reporting multiple outcomes. There was no consistent overall pattern of reported findings (as above).

- **Presentation** (e.g. packaging design): a wide variety of interventions were identified. Most primary research was laboratory-based. There was no consistent overall pattern of findings (as above).

- **Sizing** (e.g. food and drink portion sizing): these were mostly laboratory-based studies, with the majority reporting an effect of portion size on consumption, a conclusion that is also supported by specific systematic review evidence.

**Interventions that primarily alter placement of objects or stimuli**
• **Availability** (e.g. increasing healthier food options): primary studies were identified in diet and physical activity only, mostly studied in field trials concerning food and drink options in restaurants and vending machines and the use of stairs or lifts. The majority of studies reported an effect of the intervention on behaviour, although this was often complicated by the concurrent implementation of multiple interventions or the assessment of multiple outcomes

• **Proximity** (e.g. altering proximity of options by changing layouts): all primary studies identified related to dietary behaviours, with a variety of outcomes reflecting changes in consumption, purchasing or selection of products. The majority of studies reported an effect of the intervention on behaviour.

*Interventions that alter both properties and placement of objects or stimuli*

• **Prompting** (e.g. motivational prompts for stair versus lift or escalator use): primary studies were identified within all four behavioural domains, using field-based (mainly time-series) designs. In relation to physical activity, the majority of studies reported an effect of the intervention on behaviour, supported by specific systematic review evidence. In relation to diet, many studies reported multiple outcomes and there was no consistent overall pattern of findings (as above)

• **Priming** (e.g. introduction of incidental cues to behaviour): primary studies of a wide variety of interventions were identified within all four behavioural domains, with a variety of outcomes. The majority of studies reported an effect of the intervention on behaviour.

Within most of these categories at least some of the available research concerned the effectiveness of interventions in increasing the purchase or consumption of a less healthy product, rather than in promoting health-enhancing behaviours.

**Implications for research**

This scoping review has identified two clear gaps in the evidence base that could be addressed through original primary research:

i) Interventions to change physical activity-related behaviours within micro-environments: the majority of primary research studies within the physical activity domain concerned interventions to prompt stair use, suggesting that opportunities for primary research in under-represented areas merit further attention
ii) Interventions to change alcohol- and tobacco-related behaviours within micro-environments: research on interventions to change these behaviours comprised only ~11% of the total studies identified, and these did not make a substantial contribution to the available evidence in any of the nine intervention categories (relative to other behavioural domains).

There is clear scope for further and more rigorous evidence synthesis in at least three areas of the evidence base:

i) Interventions that primarily alter the properties of objects or stimuli within micro-environments: all of the intervention categories grouped under this heading (ambience, functional design, labelling, presentation and sizing) had either not been the subject of systematic reviews, or those systematic reviews were in some way limited in their quality or relevance

ii) Interventions that primarily alter the placement of objects or stimuli within micro-environments: we identified no systematic reviews relating to the ‘proximity’ category of interventions

iii) Interventions that target automatic psychological processes: we identified no systematic reviews relating to the ‘priming’ category of interventions.

We also identified a need for more conceptual work to develop taxonomies or typologies of population-level interventions underpinned by a theoretical understanding of behaviour change processes. It is also important that future work should recognise and examine issues relating to the durability of intervention effects and the distribution of such effects between social groups, and hence their potential to reduce health inequalities.

**Conclusion**

This scoping review has made the following three key contributions to the evidence base:

i) Development of a definition and a provisional typology of choice architecture interventions in micro-environments

ii) Description of a large body of relevant primary and secondary research

iii) Identification of significant opportunities for further primary research and evidence synthesis as well as conceptual work to contribute to international efforts to change behaviour to improve population health and reduce health inequalities.
Introduction

Non-communicable conditions, principally cardiovascular diseases, diabetes, cancers, and chronic respiratory diseases, accounted for an estimated 36 million deaths worldwide in 2008 (56% of all deaths globally) and in the UK accounted for 83% of years of life lost due to premature death (WHO, 2011). These conditions are strongly related to potentially modifiable patterns of behaviour. Achieving health behaviour change is clearly important but is also difficult (NICE, 2007). To this end, there is a continuing public health imperative to develop effective interventions to promote behaviour change.

Interventions to change health behaviour have traditionally been developed in accordance with models of rational decision-making, viewing human actions as reasoned, conscious and intentional acts requiring an individual’s volitional control. Many theoretical models of health-related decisions and behaviour emphasise the importance of the rational cognitive appraisal of presenting stimuli in determining a person’s response (e.g. Schwarzer, 2001; Rogers, 1983; Ajzen, 1991). It follows from such models that providing information that allows the recipient to reflect on behavioural options that are beneficial to health may be sufficient to bring about change. In many contexts, however, empirical evidence indicates that the effectiveness of behavioural interventions that deliberately target rational or reflective decision-making, for example by giving information, is limited (Albarracin et al, 2005; WHO, 2008). In addition, significant discrepancies have consistently been found between individuals’ behavioural intentions and their actual behaviour (Webb & Sheeran, 2006). One proposed explanation for this is that there are considerable influences on behaviour outside of the individual’s control. This has led to increasing policy and research attention on other mechanisms key to understanding behaviour and behaviour change, such as the role of automatic or non-conscious cognitive, emotional and behavioural processes, and the effect of the environment in shaping people’s actions (Marteau et al 2011; Marteau et al, 2012).

In recent years, a more comprehensive approach to understanding behaviour change has been adopted, with the development of dual-system models of cognition and behaviour (e.g. Strack & Deutsch, 2004; Gawronski & Bodenhausen, 2006; Hofmann et al, 2008). Such models propose two systems of information processing; one consisting of the aforementioned processes of reflective, syllogistic reasoning, and requiring cognitive capacity; and the other consisting of the automatic or non-conscious processes of learned associations, giving rise to behavioural impulses. The latter are characterised by their relation to specific situational and environmental cues and the inclusion of a
behavioural urge to approach or engage with a stimulus, thus limiting or directing behaviour beyond immediate conscious control (Bargh & Morsella, 2009). Coexisting with this shift in theoretical understanding, is a recognition that individual-level factors are rarely sufficient to explain human behaviour and that physical and social environments directly and indirectly shape our behaviour and thus health outcomes. This awareness is manifest in explicit recognition of these processes within both the primary and secondary research literature and within conceptual frameworks that attempt to represent determinants of human behaviour and/or health (e.g. Dolan et al, 2010; Michie et al, 2011; Solar & Irwin, 2010; Dahlgren & Whitehead, 1991; Bonnefoy et al, 2007). These developments provide the context for an emergence of interest in interventions targeting these mechanisms to improve individual and population health and well-being.

Choice architecture and nudge interventions

One such approach is that of so-called ‘choice architecture’ (or ‘nudge’) interventions. These terms have been used to refer to interventions that involve altering physical or social environments or settings to cue healthier behaviour, principally via the engagement of automatic cognitive processes. These ideas have been brought to the forefront of public awareness in recent times through the work of Thaler and Sunstein (Nudge: Improving decisions about health, wealth and happiness, Thaler & Sunstein, 2008) and whilst the ideas (and their related terminology) remain contentious and have been the focus of considerable debate in the specialist and mainstream media, they have proven influential within the UK and US governments in regards to behavioural intervention and public health policy (MINDSPACE, Dolan et al, 2010; Cabinet Office Behavioural Insights Team, 2010, 2011). It is this public policy interest, in conjunction with the emergence of key scientific questions, that underpins this review.

Objectives

The objectives of this scoping review were to:

- to formulate an operational definition of choice architecture within micro-environments applicable to public health interventions;
- to develop a provisional typology of such interventions;
- to map the available empirical evidence for their effects on diet, physical activity, alcohol and tobacco use; and

---

1 We note that the increasing interest in these interventions cannot be attributed solely to shifts in theoretical understanding or a belief that such interventions may be more effective than existing options, but is also determined by issues of political acceptability (as where possible, governments and the public may prefer ‘light-touch’ intervention rather than legislation and regulation), feasibility, and likely cost (such interventions, at least as commonly perceived, may be considered inexpensive and easily implemented without complex legislative or regulatory processes).
to identify next steps for the development and evaluation of choice architecture interventions designed to change health behaviour at population level.

Defining the topic area

In order to adequately describe and assess a body of evidence, some level of definitional clarity is required. The term ‘choice architecture’ is typically used to refer to the ways in which choices or behavioural options are presented, and their influence on behaviour. This principle is central to the definition of a ‘nudge’, which according to the eponymously-titled book (Thaler & Sunstein, 2008) is “any aspect of the choice architecture that alters people’s behaviour in a predictable way without forbidding any options or significantly changing their economic incentives”. However, there is no precise operational definition of what these terms actually mean in an applied sense (Marteau et al, 2011) and in relation to our specified behavioural and environmental context. Although Thaler and Sunstein provide some definitions of key terms and concepts, the principal aim of their book is to outline a specific political philosophy and broad approach to intervention, rather than to provide a conceptual framework for research. While subsequent policy-oriented work has linked these principles to real-world examples, we are not aware of any explicit attempt to systematically conceptualise or categorise interventions or their components in detail, and the terminology continues to be used inconsistently (House of Lords, 2011).

The lack of clear definition is problematic for any attempt to review existing evidence, because if we take the initial definition at face value, then all interventions intended to impact on behaviour, other than legislation, regulation and changing economic incentives, have components that could be regarded as potentially relevant. This would encompass a broad spectrum of research and present a practically insurmountable challenge with respect to scoping and describing the relevant empirical evidence. In addition, any review undertaken on such a scale and including numerous types of interventions would necessarily duplicate or overlap with the content of many existing evidence syntheses. Clearer delineation of our sphere of primary interest would enable us to better contextualise, structure and interpret the empirical research identified in the scoping review.

Placement within a conceptual framework

Choice architecture interventions are principally intended to be delivered at the population level,

---

2 This wording is in line with Thaler and Sunstein’s original formulation, but we note that most economists would technically consider many choice architecture interventions as changing economic incentives, because they impact on opportunity costs. As such, we have opted to use the term ‘fiscal policy intervention’ elsewhere in this review.
whereas efforts to map the content of behaviour change interventions have typically been limited to the individual- or group-level perspective (e.g. Abraham & Michie, 2008; Michie et al, 2011; Lowe et al, 2011) or focused on a relatively narrow range of interventions or behaviours (Wansink, 2004; Sobal & Wansink, 2007; Stroebele & De Castro, 2004; Turley & Milliman, 2000). For the current review, we required a broader consideration of the entire range of interventions possible within our definitional scope, and across multiple health behaviours. While frameworks from the conceptual literature are available to help structure the task (e.g. Thaler & Sunstein, 2008; Dolan et al, 2010), they may not be suitable for this purpose because they lack clear definitions, representative exemplars and evidence of systematic development. There are, however, some general organisational frameworks of determinants of behaviour and health which help provide some conceptual clarity.

For example, the ANGELO framework, originally developed in relation to obesity, proposes two key dimensions along which to conceptualise environmental factors: environmental scale (micro-environmental 'settings' and macro-environmental 'sectors', the former being geographically distinct, small-scale environments in which groups of people gather for specific purposes and activities, such as shops, schools, and homes) and type (physical, economic, political and sociocultural) (Swinburn et al, 1999). Based on current knowledge, we anticipated that most choice architecture interventions could be regarded as forming a subset of interventions within physical micro-environments.

**Empirical component of the review**

The second key component of the scoping review was an assessment of the available primary and secondary research on the impact of choice architecture interventions on health behaviour. Although there are non-systematic overviews of relevant evidence (e.g. Marteau et al, 2011; Dolan et al, 2010; Thaler & Sunstein, 2008), we were not aware of any systematic, comprehensive reviews explicitly framed in relation to the concept of choice architecture. Whilst there is a large body of systematic and non-systematic review evidence of the effects of a wide variety of environmental factors and interventions on health behaviour and outcomes (e.g. Faith et al, 2007; French et al, 2001; Matson-Koffman et al, 2005; de Vet et al, 2011; Davison & Lawson, 2006), these reviews have typically addressed the effects of much narrower, or much broader, classes of intervention, generally only within a solitary behavioural domain. This review aimed to address the call for greater conceptual clarity to support the development of a robust evidence base for ‘environmental interventions’ (Sallis et al, 1998; Kirk et al, 2010) by adopting a relatively narrow
focus on interventions that alter choice architecture within micro-environments, while systematically mapping the available evidence across multiple domains of health behaviour. The expectation was that this process would also allow us to identify specific research questions for further in-depth systematic review or primary research.

Given the lack of conceptual and definitional clarity outlined above, any attempt to map this evidence required a set of highly sensitive literature searches which are liable to produce extremely large records sets that it would not be practicable to screen using conventional methods. We therefore developed a novel approach to the searching and screening process, outlined in the Methods section.
Methods

Criteria for considering studies for this review

Types of studies
Studies that described empirical research of any design (primary or secondary) were eligible for consideration, as were articles that provided highly relevant conceptual or theoretical material such as descriptions or explanations of terms or concepts pertaining to nudge or choice architecture and applied within a behavioural intervention context.

Types of participants
Studies were eligible for inclusion irrespective of their focus on individuals, dyads, families, households, organisations, areas or communities. We applied no restrictions on geographical or social setting of the study, or the age, health or clinical characteristics of participants.

Types of interventions
Preliminary analysis of relevant literature in conjunction with subsequent cycles of discussion and development within the review team led to a provisional working definition of choice architecture within micro-environments:

'Interventions that have the potential to change health-related behaviour and are implemented within the same micro-environment as that in which the targeted behaviour is enacted.'

Initial research suggested that relevant studies would lack a common theoretical basis or vocabulary to describe interventions and would not allow us to capture the intervention concept satisfactorily in any database search strategies. We therefore adopted extremely broad search strategies that focused on the broad nature of potentially relevant manipulations and obviated the need to rely on presence of specific terms or labels such as “choice architecture” or “micro-environments”. We did include a range of terms that would potentially reflect alterations to spatial or quantitative properties of environments, or indicate studies of the effects of interventions (e.g. change$, alter$, add$, decreas$).

As the review proceeded, the definition was developed and refined iteratively through identifying, discussing and clarifying specific ‘boundary issues’ as they arose. Any changes to operational
definitions were agreed by consensus and documented to ensure transparency in the selection of studies for inclusion. Three key developments were as follows:

1) The above provisional working definition was initially supplemented with explicit reference to automatic or non-conscious psychological processes, whereby an additional condition to be met by eligible interventions was that they targeted these processes. However, it was agreed, upon considering extant literature and discussion between the review team, that the majority of studies would not explicitly reference such underlying theoretical concepts, meaning assessment would be overly subjective and complex to implement. A similar term was included in our final definition because it reflected a concept common to prior research on choice architecture, but it did not need to be met for inclusion.

2) The above provisional working definition was initially supplemented with the criterion that interventions would be excluded should they contain significant levels of information provision. It was agreed that this was not a workable exclusion criterion, given that visual, as well as verbal and textual information is communicated via changes to the environment and its amount is not readily assessed.

3) The above provisional working definition was initially supplemented with the criterion that eligible interventions are in principle scalable for implementation at population level. It became clear that the term scalable is open to a number of interpretations and potentially applies to all interventions, and that a more workable operationalisation was that interventions are not targeted or tailored to specific individuals and can influence the behaviour of many people simultaneously.

We also consulted with external experts to discuss and validate our developing conceptual positions and definitions. This process centred around a one-day expert workshop organised midway through the scoping process. Those who attended the expert workshop or also provided additional feedback and discussion were as follows:

- Dr. Amy Ahern, MRC Human Nutrition Research, Cambridge, UK (psychology, nutrition)
- Professor John Frank, Scottish Collaboration for Public Health Research and Policy, University of Edinburgh, UK (public health and policy)
- Professor Simon Griffin, MRC Epidemiology Unit, Cambridge, UK (epidemiology, public health)
- Michael Hallsworth, Institute for Government, UK (policy)
• Dr. Vivien Hendry, Centre for Diet and Activity Research, University of Cambridge, UK (public health)
• Professor Ann Louise Kinmonth, Primary Care Unit, University of Cambridge (primary care)
• Dr. Rachel Pechey, Behaviour and Health Research Unit, University of Cambridge, UK (psychology)
• Professor Mark Petticrew, London School of Hygiene and Tropical Medicine, UK (evidence synthesis, policy)
• Dr. Andrew Prestwich, University of Leeds, UK (psychology)
• Dr. Catherine Swann, National Institute for Health and Clinical Excellence, UK (public health and policy)
• Professor Daniel Zizzo, University of East Anglia, UK (economics)

The core review team’s disciplinary background is characterised as follows:

Health psychology (Hollands, Marteau), evidence synthesis (Shemilt), public health (Ogilvie), public health and policy (Kelly), nutrition (Jebb), economics (Nakamura, Suhrcke).

Further inclusion/exclusion criteria for interventions were guided by the scope of previous conceptualisations of choice architecture and practical considerations. For example, consistent with Thaler and Sunstein (Thaler and Sunstein, 2008), interventions involving legislation, regulation or fiscal policy interventions were included only if they also featured components that met the operational definition of choice architecture interventions. Furthermore, we were already conducting in parallel a scoping review of the effects of the economic environment on diet and physical activity (Shemilt et al, 2013). Mass-media interventions, interventions with content personalised to the recipient, brief interventions in primary care (NICE, 2006), and interventions that involved major changes to existing physical infrastructure were excluded, irrespective of the nature of other intervention components. Interventions involving ‘choice editing’ (the addition or removal of behavioural options) were included providing equivalent options or behaviours from the previous potential behaviour set remained available within the micro-environment3.

3 This is only a guiding principle, with its application being dependent on the level of explanation regarding the equivalence of available behaviours or options. For example, in relation to dietary behaviour, removing several types of a given food category e.g. confectionery, but still leaving the available option of another food from that category, may not be regarded as significantly restricting the available options. Alternatively, an equivalent available option may be regarded as needing to be more (having the option to eat a specific type or brand of chocolate bar) or less specific (having the option to eat any high-sugar food).
See ‘Results’ for our final working definition.

**Types of outcomes**
The primary outcomes were engagement in behaviours related to diet, physical activity, or the use of alcohol or tobacco. Included studies needed to report a behavioural outcome relating to food, alcohol or tobacco consumption or the performance of physical activity, or a measure of a proximal direct consequence (e.g. dietary intake, energy expenditure, tobacco or alcohol intake) or determinant of such behaviour (e.g. food, alcohol or tobacco purchasing).

**Search methods**
We searched the following electronic literature databases, with no date restrictions: MEDLINE; Embase; PsycINFO; Cochrane Database of Systematic Reviews; Database of Abstracts of Reviews of Effects; Health Technology Assessment Database; Database of Promoting Health Effectiveness Reviews (DoPHER); Social Sciences Citation Index; Science Citation Index Expanded; Applied Social Sciences Index and Abstracts (ASSIA); SPORTDiscus; EconLit; NHS Economic Evaluation Database (NHS EED). We also searched grey literature databases (Conference Proceedings Citation Index – Science; Conference Proceedings Citation Index – Social Science & Humanities) and organisational websites including those of the World Health Organization, National Institute for Health and Clinical Excellence (UK) and Agency for Health Care Research and Quality (USA). Search strategies are included as Appendix 1.

Snowball search techniques (Greenhalgh & Peacock, 2005) (i.e. searching reference lists and electronic citation tracking from published reports within a corpus of eligible studies) and personal contacts with colleagues and through our academic research networks were used to identify further potentially eligible studies.

**Data collection and analysis**
In this section we describe the key elements but for further details please see a complementary methods paper (Shemilt et al, 2013). Data collection and analysis were managed using EPPI Reviewer 4 systematic review software (Thomas et al, 2010). Records retrieved were imported into the software for title and abstract screening by two reviewers (GJH and RN). Studies judged potentially eligible for inclusion at this stage were grouped using pre-specified rules into three categories (A, B and C) according to the probability of final inclusion: category A (those judged to have a high probability of meeting inclusion criteria); category B (those judged likely to be excluded, but requiring careful consideration because the intervention was close to a borderline of
eligibility criteria with respect to interventions or outcomes); and category C (those judged likely to be excluded but with insufficient information in the title and abstract to warrant their definitive exclusion).

We initially screened a random sample of titles and abstracts to estimate the baseline inclusion rate (BIR). The BIR is a figure that represents the frequency at which we could expect to find eligible records in the complete record set if we were able to screen it in its entirety. This allowed us to gauge our overall progress and the performance of our methods in identifying eligible records at a better than random chance. For the substantive body of the title and abstract screening process we employed novel software-based methods to increase the efficiency of this work by prioritising our screening of the overall record set. These methods comprised a ‘prioritisation method’, which employs text-mining methods to order the large record set, drawing on words frequently used in a researcher-specified initial corpus of eligible studies to cluster the record set; and a ‘classification method’, which employs machine learning to prioritise screening based on a large researcher-specified list of terms indicative of inclusion or exclusion. The use of multiple methods reduces the likelihood of only certain types of studies being identified (and of this becoming ever more likely as the reference body of studies increases in size). Concurrently, we also screened records identified through snowball searching.

From screened records determined to fall in category A, we obtained full-text reports (where possible), completed a further stage of full-text screening to confirm the inclusion of each study, and extracted a core dataset from each paper. This consisted of the citation; year of publication; study design; target behavioural domain; study population; details of the intervention; the primary outcome measure(s); and principal findings. These data were then used in a range of analyses including the production of tabulated and textual summaries of included studies, drawing on narrative and meta-narrative synthesis approaches (Greenhalgh et al, 2005; Rodgers et al, 2009) to map the available evidence and inform the iterative development of a typology of the interventions of interest.

**Typology development**

Having extracted a description of the intervention from all included studies, on multiple occasions we formed a list of all interventions encountered up to that point, at a relatively detailed level of explanation. We then looked for commonalities between similar interventions and considered forming broader categories based on emergent clusters of intervention types. We took a relatively cautious approach to reducing the level of granularity in this way, testing the capacity of the
emergent typology to accommodate new material as it was encountered and reaching consensus through internal and external discussion and expert consultation.

Three examples of this process are as follows. For each, it was felt that the similarity in form of these interventions outweighed differences in their potential content, and reflected a coherent category in the context of attempting to broadly describe the evidence base.

1) The intervention category ‘labelling’ combines what were originally five individual categories, those being: labelling (nutrient claims); labelling (reference portion); labelling (nutritional labelling); labelling (health warning labels); endorsements on packaging.

2) The intervention category ‘sizing’ combines what were originally three individual categories: portion sizing; unit sizing; package sizing.

3) The intervention category ‘proximity’ combines what were originally two individual categories: altering proximity of behavioural options; altering visibility of behavioural options.

Further methodological considerations

We formulated approximate stopping rules for the scoping process dependent on having found a majority (>50%) of the eligible studies that would be expected to be found based on the BIR. It was not intended (and certainly not practicable) for the review to be exhaustive in identifying all existing literature meeting our criteria. Due to the large quantity of literature identified within category A, studies in categories B and C were not subjected to routine full-text screening nor data extraction, although their content was discussed when this was deemed informative to the previously-outlined processes of definition development. It should also be noted that, given the scale of the review, we did not consider it practicable to attempt to appraise the quality or risk of bias of included studies.

4 Whilst the methods we applied potentially significantly increase the efficiency of the overall process, their performance will inevitably show a decline over time. Whilst text-mining approaches get progressively ‘better’ at ‘learning’ to identify eligible studies, it concurrently gets more difficult to actually locate such studies (as fewer remain to be found).
Results

Search results
After accounting for the removal of duplicates, our electronic literature database searches identified 804,919 unique records. Of these we manually screened 54,651 records at the title and abstract stage and marked 358 records as eligible within category A. We can assess how this compares to the number of records we would have expected to find had we been able to manually screen titles and abstracts for the entire record set, by reference to the BIR. The BIR for studies in category A was calculated as 0.066%, suggesting that we could have expected to identify 533 such studies within the complete record set. We therefore estimate that the degree of completion of the title and abstract screening process was 358/533 or ~67%\(^5\). To get to this point, we screened ~7% of all the records retrieved (54,651/804,919), indicating that our method for detecting eligible records performed over 9 times better than we would have expected had we simply screened records at random (see methods paper (Shemilt et al, 2013)). With the addition of 495 articles identified via the snowball searching process, 853 articles were designated for full-text screening. 346 articles passed the full-text screening stage and had data extracted for inclusion in analysis. See Figure 1 for PRISMA flow diagram (Moher et al, 2009).

Development of an operational definition of choice architecture interventions in micro-environments
The first objective of the current review was to develop and refine a working definition and a conceptual framework for choice architecture interventions in micro-environments. Our original working definition was sufficiently inclusive that it allowed us to begin the scoping process, but it resulted in the provisional inclusion of studies whose characteristics did not meet our conception of choice architecture (and that the working definition had attempted to capture). As a result of the iterative process described in our methods, including a broad consensus being reached regarding key definitional elements during the expert workshop, we produced the final version in Box 1.

\(^5\) These figures do not give a reliable assessment of the degree of completion of the overall scoping process, as they do not account for eligibility at the full-text stage, and we do not know for certain that all possible eligible studies were ever present in the set of 804,919 records on which the calculations are based. However, we did check that the records within a researcher-identified initial corpus of relevant studies were captured by our searches, and, such was the scale of the overall record set, it is unlikely that a substantial proportion of existing eligible studies were not included therein. Furthermore, the snowball searching process we used enabled us to incorporate literature not captured through the other processes, and which may have proven not to be within the as-yet-unscreened portion of the overall record set.
Box 1 – Operational definition of choice architecture interventions in micro-environments for changing health-related behaviour

‘Interventions that involve altering the properties or placement of objects or stimuli within micro-environments with the intention of changing health-related behaviour.

Such interventions are implemented within the same micro-environment as that in which the target behaviour is performed, typically require minimal conscious engagement, can in principle influence the behaviour of many people simultaneously, and are not targeted or tailored to specific individuals.’
The term ‘placement’ includes interventions that involve placing one or more new objects or stimuli within a micro-environment, as well as those that involve altering the placement of objects or stimuli that were already present. The placement of these objects can be incidental to or intrinsically linked to undertaking a given behaviour. Use of the term ‘typically require minimal conscious engagement’ reflects our view that interventions of this kind most closely embody the outlined concept of choice architecture, while also recognising the potential for some degree of conscious engagement with the intervention (e.g. people may consciously engage with nutritional labelling or motivational signage by reading it, or with auditory stimuli by listening to them).

The core inclusion and exclusion criteria detailed previously remained largely consistent throughout the development of the definition.

Treatment of boundary issues and implications for inclusion/exclusion criteria

Whilst we think the working definition effectively captures the essence of choice architecture interventions in the context of public health, we recognised that applying such a definition to a wide range of existing interventions would result in an imperfect fit. Treatment of the boundary issues we encountered was therefore important in attempting to limit our operational definition and the scope of the review. Inevitably the principles could not always be applied without some degree of discretion by the review team. We judged the following boundary issues as the most salient:

1) Interventions not obviously scalable to population level
We excluded (by coding as category B) studies of interventions that did not appear practically feasible for replication or application in a similar form at a population level. Two notable groups of studies in this category were laboratory studies of individually administered interventions, and interventions reliant on manipulations of the behaviour or characteristics of other individuals within a social environment. The former involved, for example, the completion of computerised or information-processing tasks requiring significant instruction from the experimenter (e.g. Field et al, 2007; Wiers et al, 2010; Hollands et al, 2011). This contrasted with, for example, laboratory studies of the effect of portion sizing on food consumption, where there is no reason in principle why an essentially similar intervention could not be applied at a group or population level. The latter involved, for example, altering the physical appearance of waiting staff in a restaurant, or
altering the number of people sharing an environment with a target participant (e.g. McFerran et al, 2010).

2) Interventions that depend on provision of equipment or adaptation of environments

We excluded (by coding as category B) interventions consisting of the simple provision of equipment (such as installation of gym equipment) to provide previously unavailable behavioural options. However, we identified a boundary issue regarding interventions featuring the superficial physical adaptation of existing environments (such as painting a school playground surface to encourage active play) or the addition of equipment where the original purpose or function is not altered (such as equipping a school classroom with desks suitable for standing). In light of the difficulty in applying inclusion criteria consistently at this boundary, we included all such studies in category A.

3) Interventions delivered through ‘new media’

The content of interventions delivered via the Internet or mobile phones is potentially accessible at all times, including in the micro-environments in which particular behavioural decisions are made. Some studies of interventions of this kind may therefore have been capable of meeting our operational definition of choice architecture interventions. However, we found it impossible to ascertain this level of detail at the title and abstract screening stage. These studies were therefore grouped in category C.

Development of a typology of choice architecture interventions

The second component of the first objective concerned the development of a conceptual framework or typology for choice architecture interventions, allowing us to map the range of such interventions and locate this within the broader array of public health interventions. We envisaged this process as drawing on both conceptual material and analysis of the empirical studies encountered, although ultimately the predominant focus was on the latter. During the scoping exercise, we captured only a small amount of conceptual or theoretical material considered highly relevant to the current review i.e. containing descriptions or explanations of terms or concepts pertaining to nudge or choice architecture and applied within a behavioural intervention context. Most of this was well known to us.

6 By primarily searching for conceptual work that explicitly referenced choice architecture, we necessarily excluded a large amount of material focusing on broader issues regarding environmental interventions or influences on behaviour and health. This wider evidence base may be useful in framing attempts to systematically map the broader terrain in which the subset of choice architecture interventions is nested. We intend to address this and related issues in future work.
We present an emergent typology of intervention types in Figure 2. This is a preliminary attempt to categorise the content of choice architecture interventions according to our operational definition. It primarily serves a descriptive function, needing further work to be able to integrate more complex theoretical or conceptual ideas. The typology comprises a list of nine categories of micro-environmental interventions, each encompassing a range of interventions with key common characteristics. A more detailed explanation of the content of each category is contained within Table 3. Within the typology, we suggest three broad classes that reflect the operational definition. The first class comprises intervention categories that primarily alter the properties of objects or stimuli, the second class comprises intervention categories that primarily alter the placement of objects or stimuli, and the third class comprises those interventions that alter both the properties and the placement of objects or stimuli. We observe that these groupings map well onto one of the most detailed models describing how environmental stimuli elicit behavioural responses outside of awareness, through perceptual, evaluative, motivational and emotional processes (Bargh & Morsella 2009).

Mapping the available evidence

The second objective of the review was to identify and describe existing empirical research on the effects of interventions that met our operational definition. These data are presented in Tables 1, 2 and 3. Tables 1 and 2 show the numbers of study reports identified in the scoping review by behavioural domain and intervention category. Whilst we do not claim that the table shows all the available primary or secondary research, given the systematic large-scale approach taken to the review, the table should broadly reflect the true overall distribution of evidence, highlighting areas of relative paucity and abundance of evidence.

It is clear that most of the relevant primary research and systematic and non-systematic reviews had been undertaken in relation to diet-related behaviours, representing 70.2% of total study reports. No cell in the table is empty within this behavioural domain. Evidence relating to physical activity was the next most represented (19.1%), followed by that relating to alcohol (7.3%) and then to tobacco (representing just 3.4% of total study reports). The apparent relative scarcity of evidence on physical activity may reflect the fact that physical activity behaviours do not necessarily involve the use of a product, and therefore some of the intervention categories may be

---

7 We discussed but did not implement alternative ways of organising the intervention categories, including in relation to the cognitive and emotional mechanisms likely to be engaged (such as automatic versus reflective processing systems), the spatial scale of the intervention relative to the target behaviour, and the level of declarative information given. Whilst it was agreed by consensus that the figure presented was an appropriate way to structure this information, it could also have been structured at a higher (i.e. linking broad commonalities or themes) or lower level (sub-classifications by e.g. behavioural domain, setting, detailed analysis of intervention components) with ever more granularity.
less applicable. But it is less clear why the types of intervention studied in relation to diet might not also, in principle, be applicable to alcohol and tobacco. Within physical activity, one cluster of studies – examining the use of motivational prompts for stair use – has received a great deal of research attention and been comprehensively reviewed, but we found no comparable examples of intense research activity relating to choice architecture and alcohol or tobacco.

Across intervention categories, the two most studied types of intervention were point-of-choice labelling (representing ~22% of total study reports, primarily in relation to diet), and prompting, such as standardised information or motivational prompts (representing ~19% of total reports, primarily in relation to physical activity). It is notable that these two most prevalent intervention types, labelling and prompting, were those that are most closely related to the tradition of information-giving interventions (and its corresponding theoretical foundations) and lie farthest from the centre of our outlined conception of choice architecture interventions. Outside of these examples, few intervention types were represented in substantive, consistent bodies of apparently similar studies. Only the prompting and priming categories were represented by at least one study report within all four behavioural domains.

Point-of-choice labelling was the category containing the greatest number of both primary and secondary research reports. However, it had not received much focused systematic review work, being covered either in (predominantly non-systematic) broader-scale reviews and overviews, or in narrow reviews examining specific implementation contexts. Prompting via standardised information or motivational prompts formed a somewhat unique area of the evidence mapped in this review: in relation to the principal cluster of interventions to promote stair use, it comprised a consistent body of primary research, undertaken within broadly equivalent settings and using similar methods, which had been covered in a series of systematic reviews that continue to be updated.

A further observation on the identified evidence is that there were relatively few high-quality systematic reviews that had been conducted within the scope of this review, with non-systematic reviews and broad overviews far more prevalent. Furthermore, relevant systematic reviews often encompassed a wide range of interventions, making it difficult to reliably assess the likely effect of specific intervention types.

Table 3 maps onto the typology outlined in Figure 2. Here we present a definition of each category of intervention types, detail the range of interventions within each category identified in the review, and briefly summarise the body of research found. This includes a qualitative overview
of the effects of the intervention on behavioural outcomes as reported in the primary studies or systematic reviews. It is important to note that it has not been possible either to critically appraise the studies mapped in this scoping review or to verify authors’ conclusions regarding effectiveness. As such, for the most part we were unable to indicate the direction or magnitude of the effects with any confidence. The qualitative summaries varied between intervention categories. In some instances (in relation to sizing and prompting, the latter when applied to physical activity) there were a large number of studies of which the majority reported an effect of the intervention on behaviour, additionally supported by the conclusions of specific systematic review evidence. Within other categories (proximity, priming, availability, ambience) the majority of studies reported an effect on behaviour. A qualitative overview of the remaining intervention categories (presentation, labelling, functional design) revealed no consistent overall pattern of findings, with some studies reporting an effect of the intervention on behaviour and others reporting no effect. These observations should be interpreted with due caution. First, the reporting of an effect does not necessarily equate to an effect beneficial to health. For example, within most of the categories, at least some of the available research concerned the effectiveness of interventions in promoting behavioural outcomes that would be undesirable for health, such as the purchase or consumption of a less healthy product. While evidence from studies of this kind can suggest potential for mechanistically similar interventions to alter behaviour in the opposite direction, it is important to note that they do not provide direct evidence of effectiveness in promoting health-enhancing behaviours. Second, in most categories, studies were heterogeneous with respect to the populations, interventions, comparators or counterfactuals, outcomes and moderators assessed, and all studies remain to be examined in relation to potential confounders, the reporting of multiple outcome measures, subgroup effects and many other aspects of design, analysis and reporting.
Figure 2. Emergent typology of intervention types

Primarily alter **properties** of objects or stimuli:
- AMBIENCE
- FUNCTIONAL DESIGN
- LABELLING
- PRESENTATION
- SIZING

Primarily alter **placement** of objects or stimuli:
- AVAILABILITY
- PROXIMITY

Alter both **properties and placement** of objects or stimuli:
- PRIMING
- PROMPTING
<table>
<thead>
<tr>
<th>Intervention class</th>
<th>Intervention type</th>
<th>Number of studies</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Diet 309/440=70.2%</td>
<td>Physical activity 84/440=19.1%</td>
</tr>
<tr>
<td>AMBIENCE - alter aesthetic or ambient aspects of the surrounding environment</td>
<td>33</td>
<td>10</td>
</tr>
<tr>
<td>FUNCTIONAL DESIGN - design or adapt equipment or function of the environment</td>
<td>27</td>
<td>11</td>
</tr>
<tr>
<td>LABELLING - apply labelling or endorsement information to product or at point-of-choice</td>
<td>78</td>
<td>7</td>
</tr>
<tr>
<td>PRESENTATION - alter sensory qualities or visual design of the product</td>
<td>21</td>
<td>2</td>
</tr>
<tr>
<td>SIZING - change size or quantity of the product</td>
<td>66</td>
<td>1</td>
</tr>
<tr>
<td>AVAILABILITY - add behavioural options within a given micro-environment</td>
<td>28</td>
<td>6</td>
</tr>
<tr>
<td>PROXIMITY - make behavioural options easier (or harder) to engage with, requiring reduced (or increased) effort</td>
<td>21</td>
<td>1</td>
</tr>
<tr>
<td>PRIMING - place incidental cues in the environment to influence a non-conscious behavioural response</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>PROMPTING - use non-personalised information to promote or raise awareness of a behaviour</td>
<td>26</td>
<td>55</td>
</tr>
</tbody>
</table>
Table 2 – Distribution of primary and secondary research reports
(NB Numbers include reports featuring multiple intervention types and across multiple behaviours)

<table>
<thead>
<tr>
<th>Intervention type</th>
<th>Behaviour</th>
<th>Diet (n=309/440=70.2%)</th>
<th>Physical activity (n=84/440=19.1%)</th>
<th>Alcohol (n=32/440; 7.3%)</th>
<th>Tobacco (n=15/440; 3.4%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Primary</td>
<td>Secondary</td>
<td>Primary</td>
<td>Secondary</td>
</tr>
<tr>
<td>Primarily alter properties of objects or stimuli</td>
<td>Ambience (n=57/440; 13.0%)</td>
<td>22</td>
<td>11</td>
<td>10</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Functional design (n=43/440; 9.8%)</td>
<td>17</td>
<td>10</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Labelling (n=95/440; 21.6%)</td>
<td>69</td>
<td>9</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Presentation (n=23/440; 5.2%)</td>
<td>15</td>
<td>6</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Sizing (n=67/440; 15.2%)</td>
<td>48</td>
<td>18</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Primarily alter placement of objects or stimuli</td>
<td>Availability (n=34/440; 7.7%)</td>
<td>17</td>
<td>11</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Proximity (n=22/440; 5.0%)</td>
<td>14</td>
<td>7</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Alter both properties and placement of objects or stimuli</td>
<td>Priming (n=16/440; 3.6%)</td>
<td>7</td>
<td>2</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Prompting (n=83/440; 18.9%)</td>
<td>17</td>
<td>9</td>
<td>42</td>
<td>13</td>
</tr>
</tbody>
</table>
### Table 3 - Intervention types identified and brief summaries of respective evidence

<table>
<thead>
<tr>
<th>Intervention type</th>
<th>Range of interventions identified</th>
<th>Summary of evidence</th>
</tr>
</thead>
</table>
| Primarily alter properties of objects or stimuli | - Decoration, including colour, artwork, carpeting, use of different materials (e.g. painting stairwells or school playgrounds to enhance appeal);  
- Brightness of lighting;  
- Music volume, tempo (e.g. altering music played in food or alcohol purchasing/consumption environments);  
- Distraction via television or radio | Represented ~13% of total studies. A wide variety of interventions was identified. The majority of primary research studies were field studies with a range of study designs. There was substantial variety in primary outcomes. A number of non-systematic reviews were identified that took a broader or narrower perspective, or that mapped relatively closely on to the parameters of this category. Only one systematic review was identified, which was comparatively less relevant and included primarily observational evidence. The majority of studies reported an effect of the intervention on behaviour. |
| AMBIENCE                      | Interventions or manipulated factors that alter ambient, atmospheric or aesthetic aspects of the micro-environment surrounding a behaviour, but which are independent of or incidental to it. Differentiated from priming interventions as the latter category contains interventions which, whilst also independent of or incidental to a behaviour, are explicitly designed to activate non-conscious behavioural processes via their content |                                                                                                                                                                                                                  |
| FUNCTIONAL DESIGN             | The design or adaptation of the physical micro-environment, through changes to equipment or objects. Excludes labelling and presentation  
- Demarcation of supermarket trolley space for fruit and vegetables;  
- Supermarket trolleys necessitating increased effort to push;  
- Supermarket trolleys with handle displays to indicate qualities of products;  
- Trays versus lack of trays within cafeterias;  
- Trolley versus basket use within supermarket environments; | Represented ~10% of total studies. A wide variety of interventions was identified, with one relatively substantive cluster of studies that altered size, shape or design of food and drink receptacles. Primary research studies were both laboratory- and field-based using a wide variety of study designs including controlled trials and time series designs. There was substantial variety in primary outcomes. One systematic review was identified, focusing on the effect of environmental factors within alcohol drinking venues, but comprised primarily observational evidence. There was no consistent overall pattern of findings, with |
| School classroom and desk design to encourage standing; | some studies reporting an effect of the intervention on behaviour and others reporting no effect |
| Work desks adapted to include exercise opportunities; |  |
| Painting of school playgrounds to indicate and create activity opportunities; |  |
| Marking physical activity routes within existing micro-environments; |  |
| Changes in amounts of seating available in consumption environments; |  |
| Tableware design (e.g. plates with surface markings to suggest food consumption, such as portion control plates); |  |
| Shape and size of plates and drinking glasses; |  |
| Type or size of eating utensils |  |

**LABELLING**

Interventions that present labelling or endorsement information specific to a product, either directly applied to the product itself or at point-of-choice (e.g. shelf-edge labelling, menu labelling)

- Indication of typical reference portion;
- Nutritional labelling indicating quantity of nutrients contained (e.g. calories, fat or multi-nutrient, traffic light, Guideline Daily Amounts);
- Health warnings;
- Nutrient claims (e.g. 'low fat', 'reduced salt');
- Product endorsements (e.g. sporting or celebrity endorsements)

This was the largest single category, and represented ~22% of total studies. The majority of primary research studies were field studies using a wide variety of study designs including controlled trials and time series designs. There was substantial variety in primary outcomes including consumption, purchasing and selection, and multiple outcomes were often assessed within studies. A number of systematic and non-systematic reviews were identified. In relation to diet, these typically had a scope markedly wider than this category. There were also highly relevant systematic reviews within alcohol and tobacco domains. There was no consistent overall pattern of findings, with some studies reporting an effect of the intervention on behaviour and others reporting no effect, and many studies reporting multiple outcomes. In relation to alcohol, systematic review evidence reported that the intervention had little or no effect on purchasing or consumption. In relation to tobacco, systematic review evidence reported the difficulty in ascertaining the effect of health warnings on smoking behaviour.
<table>
<thead>
<tr>
<th>PRESENTATION</th>
<th>Interventions that alter the sensory qualities or visual design of the product itself, including that actually consumed and its packaging, but not factors external to that. Excludes labelling</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Elements of packaging design including plain versus branded packaging, colour of packaging;</td>
</tr>
<tr>
<td></td>
<td>• Presenting different amounts of a product on packaging illustration (to alter consumption anchors);</td>
</tr>
<tr>
<td></td>
<td>• Characteristics of the consumed substance itself including manipulating variety in appearance through altering colour of food / way food is arranged, e.g. shaping or presenting food to enhance visual appeal</td>
</tr>
<tr>
<td></td>
<td>Represented ~5% of total studies. All but two studies were in relation to diet, with a wide variety of interventions identified. The majority of primary research studies were laboratory-based using both within- and between-subject designs. Consumption was the predominant primary outcome. Two relevant systematic reviews were identified, each focusing on small areas within this category. One reviewed the effect of sensory properties of foods including appearance and variety; the other reviewed the effect of plain packaging of tobacco products. There was no consistent overall pattern of findings, with some studies reporting an effect of the intervention on behaviour and others reporting no effect</td>
</tr>
<tr>
<td>SIZING</td>
<td>Interventions that change the size or quantity of the product itself. This can relate to size of the overall package, size of a portion served or contained within the overall package, or size of an individual unit within a portion</td>
</tr>
<tr>
<td></td>
<td>• Changes to package size, portion size or unit size of a product (these may be interchangeable or synonymous depending on the targeted product)</td>
</tr>
<tr>
<td></td>
<td>Represented ~15% of total studies. All but one study were in relation to diet, with most studies examining the effects of changes to portion size. The majority of primary research studies were laboratory-based and both within- and between-subject designs were used. Consumption was the predominant primary outcome. Wide coverage in non-systematic reviews. One systematic review was identified that mapped closely on to the parameters of this category (Steenhuis &amp; Vermeer, 2009). This review identified 13 studies on the effects of portion size on food intake, although there were methodological limitations in terms of search strategy and lack of adequate quality assessment. Our search identified all 13 of these studies. The specific systematic review supports the same conclusion as the broader range of primary research studies identified, reporting that there was an effect of portion size on consumption</td>
</tr>
<tr>
<td>Primarily alter placement of objects or stimuli</td>
<td><strong>AVAILABILITY</strong> Interventions that alter availability through adding behavioural options, or changing capacity for engagement with behavioural options, providing broadly equivalent options/behaviours from the previous potential behaviour set remain available within the micro-environment</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>• Increasing available healthier food options via e.g. increasing variety of healthy options or providing more or less of specific nutrients/foods in available options, such as introducing more low-fat items in vending machines;</td>
<td></td>
</tr>
<tr>
<td>• Altering quantity of specific available products within a given environment (i.e. stockpiling);</td>
<td></td>
</tr>
<tr>
<td>• Altering availability of stairs or of alternatives to stair use i.e. escalators and lifts, altering lift use speed, increasing stair width, implementing ‘skip-stop’ lifts that do not serve every floor of a building</td>
<td></td>
</tr>
<tr>
<td>Represented ~8% of total studies. The majority of primary studies were within the diet domain with none in alcohol or tobacco. Two marked clusters of studies were identified specific to behavioural domains: increasing availability of healthier food and drink options in restaurants and vending machines; and a small group of studies of interventions to increase or decrease the availability of stairs, lifts or escalators to impact on their respective use. The majority of primary research studies were field studies with a range of study designs including controlled trials and time series designs being used. There was substantial variety in primary outcomes, and multiple outcomes were often assessed within studies. A number of systematic and non-systematic reviews were identified although these typically had a scope markedly wider than this category thus not providing specific in-depth coverage. The majority of studies reported an effect of the intervention on behaviour, although this was often complicated by the concurrent implementation of multiple interventions or the assessment of multiple outcomes</td>
<td></td>
</tr>
<tr>
<td><strong>PROXIMITY</strong> Interventions that facilitate engagement with available behavioural options by making such options more immediately salient or reducing required effort, primarily through altering proximity, but also accessibility or visibility</td>
<td></td>
</tr>
<tr>
<td>• Altering layouts within micro-environments to increase/decrease distance of products from routes of passage or seating e.g. placing area for dispensing certain foods at greater distance;</td>
<td></td>
</tr>
<tr>
<td>• Placing products out of immediate sight or making them less visible e.g. displayed within or behind opaque versus transparent materials;</td>
<td></td>
</tr>
<tr>
<td>• Changing item positions within a food menu;</td>
<td></td>
</tr>
<tr>
<td>• Making purchasing process more or less convenient for certain products;</td>
<td></td>
</tr>
<tr>
<td>Represented ~5% of total studies. All primary studies identified were in relation to diet. The majority of primary research studies were field studies or naturalistic laboratory studies, with a range of study designs including between- and within-subjects designs and time series designs. There was substantial variety in primary outcomes, reflecting changes in consumption, purchasing or selection of products. No relevant systematic reviews were identified although this category was covered within a number of broadly focused non-systematic reviews. The majority of studies reported an effect of the intervention on behaviour</td>
<td></td>
</tr>
<tr>
<td>Highlighting potential swaps for healthier products within a shopping environment</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td></td>
</tr>
</tbody>
</table>

**Alter both properties and placement of objects or stimuli**

**PRIMING**
Interventions that involve the placement of incidental cues, objects or stimuli within the micro-environment, or within material that a person is exposed to, to induce or influence non-conscious behavioural response via the activation of e.g. semantic relationships or associative processes

- Priming of dieting goals via recipe on shop door;
- Placing decorative objects within restaurants to prime consumption of specific food types;
- Placing smoking-related objects in a room incidental to an assigned task;
- Content of music to evoke associations (origin of music, lyrical content);
- Décor and table furniture of restaurants to suggest ethnic theme or elicit associations with snack versus meal consumption

This was the smallest category, and represented ~4% of total studies, with examples identified within every behavioural domain. In addition, a wide variety of interventions was identified, with no obvious clusters of highly-related studies. The majority of primary research studies were field or naturalistic laboratory studies with a range of study designs being used. There was substantial variety in primary outcomes. No relevant systematic reviews were identified, although this category was covered within non-systematic reviews. The majority of studies reported an effect of the intervention on behaviour.

**PROMPTING**
Interventions that contain standardised explicit verbal, visual and/or numeric information intending to promote or raise awareness of, and thus motivation for, a given behaviour. Differentiated from labelling interventions by not being specific to the content of individual products and providing more general motivational prompting

- Promotional signage and materials including posters, screens, audio, public announcements;
- Motivational prompts (signs, posters, footprint symbols) for stair versus lift or escalator use including on surfaces proximal to stairwells and on stair risers

This was the second largest category, and represented ~19% of total studies, with examples identified within every behavioural domain. The majority of the studies were within the physical activity domain, with a dominant cluster of studies of motivational point-of-decision prompts for stair versus lift or escalator use. Primary research studies were all field-based, using mainly time series designs. Stair use was the predominant primary outcome. A number of systematic reviews were identified that map closely on to the parameters of this category. The most recent systematic review evidence concerning stair use interventions included 12 eligible studies and conducted systematic searches, assessment of study quality and quantitative synthesis (Soler et al, 2010). Our search identified all 12 of these studies. In relation to physical activity, the majority of studies reported an effect of the intervention on behaviour, supported by the specific systematic review.
evidence. In relation to the minority of studies concerning diet, many studies reported multiple outcomes and there was no consistent overall pattern of findings, with some studies reporting an effect of the intervention on behaviour and others reporting no effect.
Discussion

Principal findings

This review has developed a definition and a provisional typology of choice architecture interventions, and has identified and described a large body of relevant primary and secondary research. This body of literature was characterised by a predominance of research on diet-related behaviours (relative to physical activity-, alcohol- and tobacco-related behaviours), and of the interventions of labelling and prompting, which are most closely related to the tradition of information-giving. The literature was also characterised by a lack of good quality systematic review evidence. It has revealed significant opportunities for further primary and secondary research as well as conceptual work to inform international efforts to change behaviour to improve population health and reduce health inequalities. For the most part, we do not yet have a clear indication of the direction and magnitude of the effects of interventions on short-term behavioural outcomes (and certainly not on enduring behaviour change), and how such effects might be distributed between social groups.

Strengths, limitations and challenges

The primary strengths of this review derive from its broad-ranging scope in attempting to systematically map the entire range of choice architecture interventions represented in the empirical research literature. Concurrently we have been able to apply a level of focus sufficient to delineate intervention types and components, and also to identify and describe the majority of the relevant evidence, a conclusion supported by the fact that our searches detected every study included in substantive systematic reviews within our intervention categories. Irrespective of our use of the contentious and ill-defined choice architecture terminology to frame this review, we have applied operational definitions that mean the review has essentially encompassed interventions that change micro-environments. As such, its content has value beyond current popular thinking and its specific terminology, and resonates with more traditional concepts of the lifeworld and the social structure and the ways that these impact on social actors (Kelly, 2006). Whilst the conceptual and definitional work is presented as provisional rather than definitive, it provides a solid starting point for future work, with no such substantive foundation having existed previously.
An inherent component of such a comprehensive approach has been the deliberate crossing of disciplinary boundaries throughout the review process, giving recognition to the unique explanatory power each perspective offers in a way that is often proposed but rarely done. The review team incorporates academic backgrounds in public health, psychology, economics, nutrition, sociology and specific evidence synthesis and other methodological expertise, as well as knowledge and experience of public policy processes. This is important, as the design, evaluation and implementation of behaviour change programmes and the translation of evidence into policy has arguably been hampered by being located within single disciplines.

A final key strength of this review is that its completion validates our chosen methods, having made manageable what initially seemed an impossible task. Applied more generally, this can inform the development of scoping reviews (i.e. those not predicated on exhaustively identifying every eligible study) in which it is not possible to apply common structural approaches (i.e. the PICOS approach\(^8\)) in developing search strategies, or in which part of the goal is to iteratively define and focus on the target itself. This review illustrates that such work can be conducted in a systematic manner, increasing confidence that a broad range of evidence has been captured.

The scale of the review and its specific aims necessarily also result in some limitations and challenges. First, whilst we are able to represent the likely relative distribution, and the overall range, of existing evidence, the review is not (and was never intended to be) exhaustive. The range and heterogeneity of the interventions covered, and prior lack of definitional clarity (with corresponding implications for the search process), precluded in-depth systematic review as the starting point. The implication is that inevitably we will not have identified (or at least not extracted into the review) all informative individual studies and thus sections of the landscape may be misrepresented in scale or content, or not represented at all. This concern is mitigated by reference to the explicitly iterative nature of this work, allowing it to be built upon by future research. Second, we were unable to undertake detailed assessment of study quality, characteristics or results. Had we been able to do this, we would inevitably have identified potentially important considerations and perhaps summarised the evidence differently\(^9\). This means

---

\(^8\) The PICOS approach helps to structure the research question(s) by using five components where each letter refers to a component: the patient population or the disease being addressed (P), the interventions or exposure (I), the comparator group (C), the outcome or endpoint (O), and the study design chosen (S) (O’Connor et al, 2008).

\(^9\) As illustration, looking across the cluster of studies of point-of-decision motivational prompts for stair use, the evidence appears consistently promising, and it seems reasonable to extract such a gist. Upon closer inspection, the picture is more complex, with, for example, an apparent lack of evidence of the long-term duration of effects (Soler et al, 2010), and evidence of the interactive effects of participant characteristics and message content used (Lewis & Eves, 2011, 2012), and of the intervention context (behavioural options are stairs versus escalators, or stairs versus lifts) (Eves, 2010).
that the brief evidence summaries provided are highly provisional and should be interpreted with
due caution. Finally, given that the priority here is to consider the potential of interventions to
change behaviour, attention was not paid to issues of implementation, such as cost, the potential
need for regulatory or legislative frameworks to enable the use of other types of interventions, or
public acceptability (Ipsos MORI, 2010).

Further comments on the conceptual component

Our proposed definition reflects our stated focus on physical and social dimensions of micro-
environments. In practice we did not encounter empirical studies of interventions that involve
altering social dimensions of micro-environments (such as those centred on changing social norms
(Moreira et al, 2009)) that met our definition. We excluded interventions that involve the use of
economic instruments (e.g. taxes, subsidies, income transfers), in line with prior formulations of
choice architecture. However, these exclusions do not represent an undermining of their potential
value. The latter is the result of a deliberate a priori decision, in the knowledge of a parallel
workstream on the effects of economic interventions on diet and physical activity.

Only one included study used the term ‘choice architecture’ in its title (Thorndike et al, 2012) and
only three used the term ‘nudge’ (Rozin et al, 2011; Dayan & Bar-Hillel, 2011; Kalnikaite et al,
2011). This affirms our search strategy because it suggests that traditional search methods may
have failed to detect relevant studies. The lack of overlap between the terms used in current
policy spheres and the academic literature may reflect the time needed to conduct and publish
studies. It may also reflect the lack of conceptual clarity required for fruitful translation between
the two communities and links between different literatures, which would support the need to
develop a stronger conceptual framework and associated typology or taxonomy. Given the lack of
prior consideration of the terms, producing workable definitions was a challenging element of this
review. The difficulty of reaching agreement is neatly highlighted by objections raised within the
scoping process to the term at the very centre of this review – choice architecture – with it having
been suggested that neither ‘choice’ nor ‘architecture’ express the desired meaning. We reached a
consensus to continue to use the term for pragmatic reasons, but note that a desirable potential
outcome of the further mapping of public health interventions described in this review would be
the refinement of this and associated terms.

Further comments on the empirical component

Key to improving population health and reducing health inequalities, is understanding the short-
term and sustained effects of interventions, both singly and in combination, and their effects not
just in aggregate but within and across social groups. Whilst these issues could not be examined in
detail within the scope of the review, it is clear that the next generation of primary and secondary
research (including those suggestions proposed in this review) would benefit from attempting to
address them, preferably concurrently where possible. For example, regarding sustained behaviour
change, it appears that there was typically little reporting of the durability of effects. As many of
the interventions rely on brief exposures limited to time and place, such as point-of-choice
prompts, or altering layouts within buildings, a one-off exposure to an intervention would not
necessarily be expected to have an enduring behavioural impact. Accordingly, we are instead most
interested in the consistency of an effect evoked on multiple occasions over time within the same
population. This requires long-term alteration of aspects of the micro-environment within an
evaluative framework.

On a more practical note, in attempting to summarise the evidence within each category,
producing a qualitative overview of the reported evidence for each was difficult. It required, for
example, consideration of evidence from complex interventions with multiple components (some,
such as pricing and educational programmes, potentially falling outside the boundaries of choice
architecture) where it may not be possible to isolate the effects of specific active elements. It was
also not feasible to consider subgroup effects within such overviews. In addition, particularly in
relation to studies of diet-related behaviours, multiple outcomes were often reported with no
clear identification of which were the primary outcomes. Finally, within this review, we have
typically considered the evidence within intervention categories across all four behavioural
domains, and looking at each domain separately might have resulted in different readings.

**Differences in research focus between behavioural domains**

Most of the extant research relates to the effects of interventions on diet-related behaviours. In
considering the reasons for this, the pertinent comparison is between diet and the two other
consumptive behaviours, alcohol- and tobacco-related behaviours, where we might expect similar
interventions to be feasible in principle. Alcohol and tobacco products have historically been more
subject to interventions based on regulation, restriction and pricing than to the types of
interventions within the scope of this review. From an economic perspective, there is a more
obvious case for these types of approaches in alcohol and tobacco than there is in the case of diet:
it is harder in the latter case to argue for the presence of external effects (i.e. the ‘harm to
others’), the classical market failure that would justify public policy intervention in the traditional
welfare economic sense (Suhrcke et al, 2006). In addition, diet-related behaviours arguably offer
greater scope for research in general; therefore it is not surprising that we should have found
more evidence for choice architecture interventions. Unlike the consumption of alcohol and tobacco, eating and drinking are essential to survival, and diet-related behaviours offer a greater variety of opportunities for intervention over a range of products, situations and environments. Furthermore, larger proportions of the population (including children) are identified as being at increased risk of chronic disease through being overweight or obese, compared with those who use tobacco or consume alcohol in harmful ways. Such factors may also influence the applicability or feasibility of specific choice architecture interventions. For example, those intervening to improve dietary intake by altering availability can choose to decrease the availability of a wide variety of less healthy products, or increase the availability of a wide variety of more healthy products. There are fewer comparable intervention options for alcohol and tobacco, although there are examples of healthier alternatives, such as low alcohol or alcohol-free drinks, and, more contentiously, so-called ‘safer’ (e.g. electronic) cigarettes.

Scarcity of evidence for the physical activity domain probably reflects the fact that the intervention categories cannot be consistently applied, as well as the greater focus in existing research on the external built environment and the relative difficulty of undertaking small-scale laboratory research comparable to that in other domains.

**Implications for research**

1) Identifying candidates for in-depth systematic review

Unlike in a review of a clearly conceptualised area, in which apparent gaps in the evidence and their significance would be readily identified, the greatest contribution of this review has been to attempt to map and define a previously undefined set of interventions. It follows that some of the apparent gaps mapped in the available evidence may not be particularly meaningful, instead reflecting the fact that some types of intervention may simply not be applicable to some target behaviours. Furthermore, all of these areas require closer examination and specific searches to determine more definitively whether we have represented them fairly and whether they do indeed merit further review. With these caveats in mind, we identified the following potential areas for in-depth systematic reviews:

i) Interventions that primarily alter the properties of objects or stimuli within micro-environments. All of the intervention categories we grouped in this way, namely sizing, presentation, labelling, functional design, and ambience, had either not been the subject of systematic reviews, or those systematic reviews typically had limitations relating to search

---

10 The mechanisms may also differ between behavioural domains. Regarding physical activity, the public health problem is a result of people not engaging in these behaviours or not engaging enough, whereas regarding consumptive behaviours, this is principally a problem of overconsumption.
strategies, replicable methodology or synthesis of findings; were not up-to-date, or did not map closely on to the parameters of the intervention categories. This suggests that well-conducted systematic review work within or across any of these areas would have potential to significantly enhance the evidence base for choice architecture interventions. This primarily applies to diet-related behaviours, reflecting the lack of primary research in other behavioural domains.

ii) Interventions that primarily alter the placement of objects or stimuli within micro-environments. Although the intervention category of proximity comprised a relatively small number of primary research studies, we identified no systematic review of the area, suggesting value in a review focusing on the effects of the layout of internal built environments.

iii) Interventions that target automatic or non-conscious psychological processes. The intervention category of priming was the only one that inherently suggests its mechanism of effect i.e. evoking a behavioural response via activation of automatic semantic relationships or associative processes. Although there were a relatively small number of studies, we identified no systematic review of the area.

However, there were examples of primary research studies across all behavioural domains. These observations suggest need for a more theoretically-driven systematic review that would need to address how such concepts translate into public health intervention contexts.

2) Identifying candidates for primary research
In such a large scoping review it has not been possible to identify methodological issues or highly specific unanswered research questions arising from the body of existing primary research within those areas that are heavily populated. As such, it was not possible to identify with rigour or confidence, specific avenues of enquiry that are likely to be fruitful. However, we were able to identify broad areas where there was a relative paucity of existing primary research and where we think there exists a range of potentially tractable research questions.

i) Interventions to change physical activity-related behaviours within micro-environments. The majority of primary research studies within the physical activity domain concerned stair use interventions (categorised within the prompting category). Whilst a number of intervention categories that we identified do not readily translate to physical activity, several do, as evidenced by the fact that at least some primary research was identified in a further four categories. This suggests that opportunities for primary research in all such under-represented areas merit further attention.
ii) Interventions to change alcohol- and tobacco-related behaviours within micro-environments. Research on these behaviours comprised only ~11% of the total studies identified and no intervention categories were heavily populated relative to other behavioural domains. This is notable because, as with diet, these are consumptive behaviours, and we would have expected to identify a more comparable level of primary research. For example, in relation to alcohol, no primary research studies on sizing, presentation or proximity were identified, but work in these areas could address the potential impact of factors such as the size and packaging of alcohol products, and layouts of retail outlets.

3) Conceptual development
The conceptual and definitional work within this review encompasses the operational definition and an emergent typology of choice architecture interventions in micro-environments. These primarily serve a descriptive function and whilst they have been extensively and carefully developed throughout the scoping process, are presented as provisional rather than definitive in nature. They will likely evolve and be refined and elaborated upon through exposure to new evidence and immersion in salient theoretically grounded work on behaviour. In addition, we propose that there would be significant value in work attempting to integrate these broad descriptive sketches of the area with more complex theoretical and conceptual ideas, in order to examine the social, cognitive, emotional and behavioural processes and mechanisms that may underlie observed effects of interventions. Significant conceptual and practical issues encountered within the scoping process also suggest a number of other opportunities to more widely inform the field. Examples include detailed conceptual analysis of other existing frameworks of population health interventions and important work on how to define key behaviours and behavioural outcomes. We also note that the relative scarcity of intervention evidence in many areas means that there may be value in reviews of correlational research (which was excluded from this review) to provide guidance as to likely effect sizes and targets for intervention.

Whilst the present review focuses on a specific subset of interventions within the micro-environment, the general iterative approach we have taken and the specific methods developed may also be extended to detailed mapping of other areas of the far larger landscape of population-level interventions. Combined with efforts to improve definitional and conceptual clarity concerning interventions, outcomes and their measurement, this could aid in the process of generating a systematic and rigorous evidence base for the effects of all interventions to change
population health behaviour, helping to structure existing evidence, inform future research and provide a framework for understanding potential mechanisms of effect.

**Conclusion**

This scoping review has made the following three key contributions to the evidence base for choice architecture interventions:

i) Development of a definition and a provisional typology of choice architecture interventions in micro-environments

ii) Description of a large body of relevant primary and secondary research

iii) Identification of significant opportunities for further primary research and evidence synthesis as well as conceptual work to contribute to international efforts to change behaviour to improve population health and reduce health inequalities.
Acknowledgements

The scoping review was conducted in collaboration with colleagues at the Evidence for Policy and Practice Information and Co-ordinating Centre (EPPI-Centre), Social Science Research Unit, Institute of Education, University of London. In particular, we acknowledge the contributions of the following EPPI-Centre staff: James Thomas, Jeff Brunton, Sergio Graziosi, Alison O’Mara-Eves and Claire Stansfield. We also acknowledge the support provided by colleagues in MRC Human Nutrition Research, the UKCRC Centre for Diet and Activity Research (CEDAR) and the wider BHRU team, including members of the BHRU Scientific Advisory Board, plus the contributions of attendees at an expert workshop held in Cambridge in 2011.
References

References from report (Cited in Introduction, Methods or Discussion)


Ipsos MORI (2010). National Health? Citizens’ views of health services around the world. Ipsos MORI.


Thomas, J., Brunton, J., & Graziosi, S. (2010) EPPI-Reviewer 4.0: software for research synthesis. EPPI-Centre Software. London: Social Science Research Unit, Institute of Education.


Included articles by intervention type

**AMBIENCE**


Moray, J., Fu, A., Brill, K., & Mayoral, M. S. (2007). Viewing television while eating impairs the ability to accurately estimate total amount of food consumed. Bariatric Nursing and Surgical Patient Care, 2(1), 71-76.


**AVAILABILITY**


**FUNCTIONAL DESIGN**


**LABELLING**


**PRESENTATION**


**PRIMING**


**PROMPTING**


**PROXIMITY**


**SIZING**


Levitsky, D. A., & Youn, T. (2004). The more food young adults are served, the more they overeat. *Journal of Nutrition, 134*(10), 2546-2549.


Included articles by behaviour

DIET


Levitsky, D. A., & Youn, T. (2004). The more food young adults are served, the more they overeat. *Journal of Nutrition, 134*(10), 2546-2549.


Moray, J., Fu, A., Brill, K., & Mayoral, M. S. (2007). Viewing television while eating impairs the ability to accurately estimate total amount of food consumed. *Bariatric Nursing and Surgical Patient Care, 2*(1), 71-76.


ALCOHOL


*Journal of Consumer Research, 13*(2), 286-289.


*Environment and Behavior, 35*(5), 712-718.


*Centre of Addictions Research of BC*. Victoria, BC: Centre for Addictions Research of British Columbia.

Stockley, C. S. (2001). The effectiveness of strategies such as health warning labels to reduce alcohol-related harms: An Australian perspective. 

*Journal of Business Research, 49*(2), 193-211.

*Journal of Consumer Research, 30*(3), 455-463.

Wansink, B. (2004). Environmental factors that increase the food intake and consumption volume of unknowing consumers. 

*British Medical Journal, 331*(7531), 1512-1514.

Wansink, B. (2010). From mindless eating to mindlessly eating better. 
*Physiology & Behavior, 100*(5), 454-463.


*Chemosensory Perception, 3*(1), 57-67.
TOBACCO


Included articles by intervention type and behaviour

**AMBIENCE / DIET**


Moray, J., Fu, A., Brill, K., & Mayoral, M. S. (2007). Viewing television while eating impairs the ability to accurately estimate total amount of food consumed. *Bariatric Nursing and Surgical Patient Care, 2*(1), 71-76.


**AMBIENCE / PHYSICAL ACTIVITY**


**AMBIENCE / ALCOHOL**


AVAILABILITY / DIET


Sorensen, G., Linnan, L., & Hunt, M. K. (2004). Worksite-based research and initiatives to increase fruit and vegetable consumption. Preventive Medicine, 39 (Suppl.2), s94-s100.


**AVAILABILITY / PHYSICAL ACTIVITY**


**FUNCTIONAL DESIGN / DIET**


**FUNCTIONAL DESIGN / PHYSICAL ACTIVITY**


**FUNCTIONAL DESIGN / ALCOHOL**


**LABELLING / DIET**


**LABELLING / ALCOHOL**


**LABELLING / TOBACCO**


**PRESENTATION / DIET**


**PRESENTATION / TOBACCO**


PRIMING / DIET


PRIMING / PHYSICAL ACTIVITY

**PRIMING / ALCOHOL**


---

**PRIMING / TOBACCO**


---

**PROMPTING / DIET**


**PROMPTING / PHYSICAL ACTIVITY**


**PROMPTING / ALCOHOL**


**PROMPTING / TOBACCO**


**PROXIMITY / DIET**


**PROXIMITY / PHYSICAL ACTIVITY**


**SIZING / DIET**


Levitsky, D. A., & Youn, T. (2004). The more food young adults are served, the more they overeat. *Journal of Nutrition, 134*(10), 2546-2549.


**SIZING / TOBACCO**

**Excluded articles (excluded at full-text screening stage)**


Veltkamp, M., Custers, R., & Aarts, H. (2011). Motivating consumer behavior by subliminal conditioning in the absence of basic needs: Striking even while the iron is cold. *Journal of Consumer Psychology, 21*(1), 49-56.


Articles identified but not assessed (Full-text could not be readily obtained)


Appendix 1 – Search strategies, dates and yields

MEDLINE (OvidSP) search strategy - 1948 to June Week 5 2011

Yield = 418,040 records

1. exp diet/
2. exp diet therapy/
3. exp food/
4. exp beverages/
5. food habits/
6. food preferences/
7. fasting/
8. adolescent nutritional physiological phenomena/
9. elder nutritional physiological phenomena/
10. exp food industry/
11. exp hunger/
12. exp appetite regulation/
13. exp appetite/
14. exp digestion/
15. exp eating/
16. exp eating disorders/
17. exp child nutrition disorders/
18. exp infant nutrition disorders/
19. nutritional requirements/
20. nutritional status/
21. nutrition assessment/
22. nutrition disorders/
23. exp nutritive value/
24. (nutri$ or calori$ or diet$ or food$ or eat$ or meal$ or snack$ or cook$ or restaurant$ or supermarket$ or cafe$).ti,ab.
25. (drink$ or beverage$).ti,ab.
26. exp Alcohol Drinking/
27. exp Alcohol-Related Disorders/
28. (drink$ or drunk$ or alcohol$ or beer$ or lager$ or wine$ or cider$ or alcopop$ or spirit$ or liquor$ or distilled beverage$ or whisky$ or whiskey$ or whiskies or schnapps or liqueur$ or brandy or brandies or gin$ or rum$ or tequila$ or vodka$).ti,ab.
29. exp Tobacco/
30. exp Smoking/
31. exp Smoking Cessation/
32. (cigar$ or smoking or smoke$ or tobacco$).ti,ab.
33. exp physical exertion/
34. exp human activities/
35. exp leisure activities/
36. exp locomotion/
37. exp physical education/
38. lifestyle/
39. sedentary lifestyle/
40. yoga/
41. fitness centers/
42. motor activity/
43. (physical$ adj5 (exercis$ or train$ or activit$ or fit$ or endur$)).ti,ab.
44. (aerobic adj5 (exercis$ or train$ or activit$ or fit$ or endur$)).ti,ab.
45. (strength$ adj5 (exercis$ or train$ or activit$ or fit$ or endur$)).ti,ab.
46. (flexibil$ adj5 (exercis$ or train$ or activit$ or fit$ or endur$)).ti,ab.
47. (balance$ adj5 (exercis$ or train$ or activit$ or fit$ or endur$)).ti,ab.
48. (exercise$ adj5 (train$ or activit$ or fit$ or endur$)).ti,ab.
49. ((occupation$ or work$ or recreation$2 or leisure or play or household or home or domestic or commut$3 or transport$) adj5 (energ$ or exercis$ or train$ or activit$ or fit$ or endur$)).ti,ab.
50. ((walk$3 or hike or hiking or climbing or run$3 or jog$3 or swim$1 or swimming or bicycl$3 or cycl$3 or bike$1 or biking or gym$ or rowing or canoe$ or kayak$ or sailing or windsurf$3 or surf$3 or diving or sport$3 or rollerblading or rollerskating or skating or skiing or yoga or pilates or calisthenics or (jump$3 adj rope$1) or (lift$3 adj weight$1) or gym$ or circuit or resistance or resilience or dance or dancing or fishing or hunting or shooting) adj5 (energ$ or exercis$ or train$ or activit$ or fit$ or endur$)).ti,ab.
51. (led walk$ or health walk$).ti,ab.
52. ((leisure or fitness) adj5 (centre$ or center$ or facilit$)).ti,ab.
53. (fitness adj class$).ti,ab.
54. (fitness adj (regime$ or program$)).ti,ab.
55. cardiorespiratory fitness.ti,ab.
56. aerobic capacity.ti,ab.
57. (intensity adj2 (rest or quiet or light or moderate or vigorous)).ti,ab.
58. ((car or cars or bus or buses or train or trains or transport$) and (energ$ or activit$ or exercis$)).ti,ab.
59. (active adj (travel$4 or transport$ or commut$)).tw.
60. ((promot$ or uptak$ or encourag$ or increas$ or start$ or adher$ or sustain$ or maintain$)
adj5 gym$).ti,ab.
61. ((promot$ or uptak$ or encourag$ or increas$ or start$ or adher$ or sustain$ or maintain$)
adj5 physical activit$).ti,ab.
62. ((promot$ or uptak$ or encourag$ or increas$ or start$ or adher$ or sustain$ or maintain$)
adj5 (circuit$ or aqua$)).ti,ab.
63. ((promot$ or uptak$ or encourag$ or increas$ or start$ or adher$ or sustain$ or maintain$)
adj5 (exercis$ or exertion or keep fit or fitness class or yoga or aerobic$)).ti,ab.
64. ((decreas$ or reduc$ or discourag$) adj5 (sedentary or deskbound or inactiv$)).ti,ab.
65. (exercis$ adj aerobic$).tw.
66. (physical$ adj5 (fit$ or train$ or activ$ or endur$)).tw.
67. (exercis$ adj5 (train$ or physical$ or activ$)).tw.
68. ((lifestyle or life-style) adj5 physical$).tw.
69. ((lifestyle or life-style) adj5 activ$).tw.
70. exp behavior/
71. behavior$.ti,ab.
72. behaviour$.ti,ab.
73. environment$.ti,ab.
74. consum$.ti,ab.
75. intake$.ti,ab.
76. perform$.ti,ab.
77. exp health promotion/
78. exp primary prevention/
79. exp attention/
80. exp visual perception/
81. exp feedback, psychological/
82. exp feedback, sensory/
83. exp perception/
84. exp illusions/
85. exp psychomotor performance/
86. (change$ or alter$ or adjust$ or modif$ or adapt$ or add$ or subtract$ or restrict$ or shrink$ or shrunk or extend$ or expand$ or supplement$ or improve$ or increas$ or higher or larger or longer or remov$ or constrain$ or restrain$ or limit$ or lower$ or reduc$ or decreas$ or smaller or greater or less$ or fewer or more or choice$ or choose or chose$ or option$).ti,ab.
87. or/1-69
88. or/70-85
89. and/86-88
90. limit 89 to (english language and humans)
Embase (OvidSP) search strategy - 1980 – 2011 Week 27

Yield = 402,410 records

1. exp diet/
2. exp diet therapy/
3. exp food/
4. exp beverage/
5. exp feeding behavior/
6. exp dietary intake/
7. exp food intake/
8. exp child nutrition/
9. exp food handling/
10. exp food processing/
11. exp hunger/
12. exp digestion/
13. exp eating disorder/
14. exp nutritional disorder/
15. nutritional requirement/
16. nutritional status/
17. nutritional assessment/
18. nutritional value/
19. (nutri$ or calori$ or diet$ or food$ or eat$ or meal$ or snack$ or cook$ or restaurant$ or supermarket$ or cafe$).ti,ab.
20. (drink$ or beverage$).ti,ab.
21. exp alcohol consumption/
22. exp alcohol abuse/
23. (drink$ or drunk$ or alcohol$ or beer$ or lager$ or wine$ or cider$ or alcopop$ or spirit$ or liquor$ or distilled beverage$ or whisky$ or whiskey$ or whiskies or schnapps or liqueur$ or brandy or brandies or gin$ or rum$ or tequila$ or vodka$).ti,ab.
24. exp tobacco/
25. exp smoking/
26. exp smoking cessation/
27. (cigar$ or smoking or smoke$ or tobacco$).ti,ab.
28. exp exercise/
29. exp physical activity/
30. exp human activities/
31. exp recreation/
32. exp leisure/
33. exp locomotion/
34. exp physical education/
35. exp lifestyle/
36. sedentary lifestyle/
37. exp fitness/
38. health center/
39. yoga/
40. motor activity/
41. (physical$ adj5 (exercis$ or train$ or activit$ or fit$ or endur$)).ti,ab.
42. (aerobic adj5 (exercis$ or train$ or activit$ or fit$ or endur$)).ti,ab.
43. (strength$ adj5 (exercis$ or train$ or activit$ or fit$ or endur$)).ti,ab.
44. (flexib$ adj5 (exercis$ or train$ or activit$ or fit$ or endur$)).ti,ab.
45. (balanc$ adj5 (exercis$ or train$ or activit$ or fit$ or endur$)).ti,ab.
46. (exercise adj (train$ or activit$ or fit$ or endur$)).ti,ab.
47. ((occupation$ or work$ or recreation$ or leisure or play or household or home or domestic or commut$ or transport$) adj (energ$ or exercis$ or train$ or activit$ or fit$ or endur$)).ti,ab.
48. ((walk$ or hike or hiking or climbing or run$ or jog$ or swim$ or bicycl$ or cycl$ or bike$ or biking or gym$ or rowing or canoe$ or kayak$ or sailing or windsurf$ or surf$ or diving or sport$ or rollerblading or rollerskating or skating or skiing or yoga or pilates or calisthenics or (jump$ adj rope$) or (lift$ adj weight$) or gym$ or circuit or resistance or resilience or dance or dancing or fishing or hunting or shooting) adj (energ$ or exercis$ or train$ or activit$ or fit$ or endur$)).ti,ab.
49. (led walk$ or health walk$).ti,ab.
50. ((leisure or fitness) adj (centre$ or center$ or facilit$)).ti,ab.
51. (fitness adj class$).ti,ab.
52. (fitness adj (regime$ or program$)).ti,ab.
53. cardiorespiratory fitness.ti,ab.
54. aerobic capacity.ti,ab.
55. (intensity adj2 (rest or quiet or light or moderate or vigorous)).ti,ab.
56. ((car or cars or bus or buses or train or trains or transport$) and (energ$ or activit$ or exercis$)).ti,ab.
57. (active adj (travel$ or transport$ or commut$)).tw.
58. ((promot$ or uptak$ or encourag$ or increas$ or start$ or adher$ or sustain$ or maintain$) adj5 gym$).ti,ab.
59. ((promot$ or uptak$ or encourag$ or increas$ or start$ or adher$ or sustain$ or maintain$) adj5 physical activit$).ti,ab.
60. ((promot$ or uptak$ or encourag$ or increas$ or start$ or adher$ or sustain$ or maintain$) adj5 (circuit$ or aqua$)).ti,ab.
61. ((promot$ or uptak$ or encourag$ or increas$ or start$ or adher$ or sustain$ or maintain$) adj5 (exercis$ or exertion or keep fit or fitness class or yoga or aerobic$)).ti,ab.
62. ((decreas$ or reduc$ or discourag$) adj5 (sedentary or deskbound or inactiv$)).ti,ab.
63. (exercis$ adj aerobic$).tw.
64. (physical$ adj5 (fit$ or train$ or activ$ or endur$)).tw.
65. (exercis$ adj5 (train$ or physical$ or activ$)).tw.
66. ((lifestyle or life-style) adj5 physical$).tw.
67. ((lifestyle or life-style) adj5 activ$).tw.
68. exp behavior/
69. behavior$.ti,ab.
70. behaviour$.ti,ab.
71. consum$.ti,ab.
72. intake$.ti,ab.
73. perform$.ti,ab.
74. exp health promotion/
75. exp primary prevention/
76. exp attention/
77. exp perception/
78. exp feedback, psychological/
79. exp feedback, sensory/
80. exp illusion/
81. exp psychomotor performance/
82. (change$ or alter$ or adjust$ or modif$ or adapt$ or add$ or subtract$ or restrict$ or shrink$ or shrank or extend$ or expand$ or supplement$ or improve$ or increas$ or higher or larger or longer or remov$ or constrain$ or restrain$ or limit$ or lower$ or reduc$ or decreas$
or smaller or greater or less$ or fewer or more or choice$ or choose or chose$ or option$).ti,ab.
83. or/1-67
84. or/68-81
85. and/82-84
86. limit 85 to (human and english language)
PsycINFO search strategy – 1806 to July 2011 Week 2

Yield = 150,325 records

1. exp diets/
2. exp food/
3. exp beverages/
4. food preferences/
5. food intake/
6. eating behavior/
7. drinking behavior/
8. nutrition/
9. exp appetite/
10. digestion/
11. dietary restraint/
12. binge eating/
13. eating attitudes/
14. "rumination (eating)"
15. satiation/
16. exp nutritional deficiencies/
17. exp eating disorders/
18. dietary supplements/
19. (nutri$ or calor$ or diet$ or food$ or eat$ or meal$ or snack$ or cook$ or restaurant$ or supermarket$ or cafe$).ti,ab.
20. (drink$ or beverage$).ti,ab.
21. exp Alcohol Drinking Patterns/
22. exp Drinking Behavior/
23. exp Alcohol Abuse/
24. (drink$ or drunk$ or alcohol$ or beer$ or lager$ or wine$ or cider$ or alcopop$ or spirit$ or liquor$ or distilled beverage$ or whisky$ or whiskey$ or whiskies or schnapps or liqueur$ or brandy or brandies or gin$ or rum$ or tequila$ or vodka$).ti,ab.
25. exp Tobacco Smoking/
26. exp Smoking Cessation/
27. (cigar$ or smoking or smoke$ or tobacco$).ti,ab.
28. exp physical activity/
29. physical health/
30. physical education/
31. physical fitness/
32. physical endurance/
33. physical strength/
34. physical agility/
35. physical dexterity/
36. leisure time/
37. exp recreation/
38. exp lifestyle/
39. locomotion/
40. exp motor processes/
41. "activities of daily living"
42. daily activities/
43. exp sports/
44. sports medicine/
45. athletic performance/
86. exp Prevention/
87. exp Attention/
88. exp Perception/
89. exp Feedback/
90. exp Cognitive Processes/
91. (change$ or alter$ or adjust$ or modif$ or adapt$ or add$ or subtract$ or restrict$ or shrink$ or shrunk or extend$ or expand$ or supplement$ or improve$ or increas$ or higher or larger or longer or remov$ or constrain$ or restrain$ or limit$ or lower$ or reduc$ or decreas$ or smaller or greater or less$ or fewer or more or choice$ or choose or chose$ or option$).ti,ab.
92. or/1-75
93. or/76-90
94. and/91-93
95. limit 94 to (human and english language)
Web of Knowledge search strategy (Science Citation Index (EXPANDED), Social Science Citation Index, Conference Proceedings Citation Index- Science (CPCI-S), Conference Proceedings Citation Index- Social Science & Humanities (CPCI-SSH)) – All years – 19/7/2011

Yield = 168,250 records

(((TS=(nutri* or calori* or diet* or food* or eat* or meal* or snack* or cook* or restaurant* or supermarket* or café* or drink* or beverage* or drunk* or alcohol* or beer* or lager* or wine* or cider* or alcopop* or spirit* or liquor* or distilled beverage* or whisky* or whiskey* or whiskies or schnapps or liqueur* or brandy or brandies or gin* or rum* or tequila* or vodka* or cigar* or smoking or smoke* or tobacco* or exercis* or train* or activit* or fit* or endur* or aerobic* or flexib* or balance* or recreation* or leisure or walk* or hike or hiking or climbing or run* or jog* or swim* or swimming or bicycle* or cycl* or bike* or biking or gym* or rowing or canoe* or kayak* or sailing or windsurf* or surf* or diving or sport* or rollerblading or rollerskating or skating or skiing or yoga or pilates or calisthenics or jump* or weight* or circuit or aqua* or resistance or resilience or dance or dancing or fishing or hunting or shooting or led walk* or health walk* or aerobic capacity or exertion or keep fit or yoga or inact* or sedentary or deskbound)) AND (TS=(behav* or consum* or intake* or perform*))) AND (TS=(Change* or alter* or adjust* or modif* or adapt* or add* or subtract* or restrict* or shrink* or shrink* or extend* or expand* or supplement* or improve* or increas* or higher or larger or longer or remov* or constrain* or restrain* or limit* or lower* or reduc* or decreas* or smaller or greater or less* or fewer or more or choice* or choose or chose* or option*)) NOT (TS=(animal model* OR animal* OR animal experiment* OR animal disease model* OR laboratory animal*)) AND Language=(English)

Refined by: [excluding] Web of Science Categories=( ENGINEERING ELECTRICAL ELECTRONIC OR CARDIAC CARDIOVASCULAR SYSTEMS OR PEDIATRICS OR MATERIALS SCIENCE MULTIDISCIPLINARY OR CLINICAL NEUROLOGY OR PHYSICS APPLIED OR RADIOLOGY NEURAL MEDICINE MEDICAL IMAGING OR THERMODYNAMICS OR CHEMISTRY PHYSICAL OR BIOPHYSICS OR ENVIRONMENTAL SCIENCES OR GENETICS HEREDITARY OR MEDICINE GENERAL INTERNAL OR MEDICINE RESEARCH EXPERIMENTAL OR BIOCHEMISTRY MOLECULAR BIOLOGY OR INSTRUMENTS INSTRUMENTATION OR ENGINEERING INDUSTRIAL OR PHARMACOLOGY PHARMACY OR MARINE FRESHWATER BIOLOGY OR BIOLOGY OR CHEMISTRY ANALYTICAL OR POLYMER SCIENCE OR FISHERIES OR CHEMISTRY APPLIED OR SUBSTANCE ABUSE OR ENGINEERING CHEMICAL OR WATER RESOURCES OR MANAGEMENT OR ENGINEERING MECHANICAL OR MECHANICS OR PHYSICS MULTIDISCIPLINARY OR PSYCHIATRY OR VETERINARY SCIENCES OR COMPUTER SCIENCE THEORY METHODS OR ENGINEERING BIOMEDICAL OR OPTICS OR NANO SCIENCE NANOTECHNOLOGY OR RESPIRATORY SYSTEM OR COMPUTER SCIENCE SOFTWARE ENGINEERING OR ORTHOPEDICS OR COMPUTER SCIENCE ARTIFICIAL INTELLIGENCE OR METALLURGY METALLURGICAL ENGINEERING OR OBSTETRICS GYNECOLOGY OR AUTOMATION CONTROL SYSTEMS OR ENERGY FUELS OR MICROBIOLOGY OR SURGERY OR TOXICOLOGY OR ASTRONOMY ASTROPHYSICS OR TELECOMMUNICATIONS OR PLANT SCIENCES OR AGRONOMY OR ONCOLOGY OR NUCLEAR SCIENCE TECHNOLOGY OR ENDOCRINOLOGY METABOLISM OR MATERIALS SCIENCE COATINGS FILMS OR UROLOGY NEPHROLOGY OR PHYSICS ATOMIC MOLECULAR CHEMICAL OR OCEANOGRAPHY OR BIOTECHNOLOGY APPLIED MICROBIOLOGY OR GEOSCIENCES MULTIDISCIPLINARY OR HEMATOLOGY OR PHYSICS CONDENSED MATTER OR REHABILITATION OR CHEMISTRY MULTIDISCIPLINARY OR ZOOLOGY OR DENTISTRY ORAL SURGERY MEDICINE OR COMPUTER SCIENCE HARDWARE ARCHITECTURE OR ENGINEERING MANUFACTURING OR AGRICULTURE MULTIDISCIPLINARY OR ELECTROCHEMISTRY OR PERIPHERAL
VASCULAR DISEASE OR CONSTRUCTION BUILDING TECHNOLOGY OR AGRICULTURE
DAIRY ANIMAL SCIENCE OR CELL BIOLOGY OR BUSINESS OR ECOLOGY OR
GASTROENTEROLOGY HEPATOLOGY OR SPECTROSCOPY OR COMPUTER SCIENCE
INFORMATION SYSTEMS OR METEOROLOGY ATMOSPHERIC SCIENCES OR
ENGINEERING AEROSPACE OR BIOCHEMICAL RESEARCH METHODS OR IMMUNOLOGY
OR COMPUTER SCIENCE INTERDISCIPLINARY APPLICATIONS ) AND [excluding] Web of
Science Categories=( FORESTRY OR COMPUTER SCIENCE CYBERNETICS OR IMAGING
SCIENCE PHOTOGRAPHIC TECHNOLOGY OR SOIL SCIENCE OR DERMATOLOGY OR
MATHEMATICS APPLIED OR VIROLOGY OR OTORHINOLARYNGOLOGY OR
AGRICULTURAL ECONOMICS POLICY OR CRYSTALLOGRAPHY OR PSYCHOLOGY
EDUCATIONAL OR PATHOLOGY OR ACOUSTICS OR INFECTIOUS DISEASES OR PHYSICS
MATHEMATICAL OR OPTHALMOLOGY OR NURSING OR HORTICULTURE OR
DEVELOPMENTAL BIOLOGY OR BUSINESS FINANCE OR GEOCHEMISTRY GEOPHYSICS
OR MATERIALS SCIENCE CHARACTERIZATION TESTING OR ENTOMOLOGY OR
MATERNAL SCIENCE PAPER WOOD OR MATHEMATICS INTERDISCIPLINARY
APPLICATIONS OR ROBOTICS OR MATERIALS SCIENCE CERAMICS OR MEDICINE LEGAL
OR GERIATRICS GERONTOLOGY OR REMOTE SENSING OR CRITICAL CARE MEDICINE
OR MATERIALS SCIENCE TEXTILES OR CHEMISTRY ORGANIC OR ORNITHOLOGY OR
MATERIALS SCIENCE COMPOSITES OR RHEUMATOLOGY OR PHYSICS NUCLEAR OR
MINERALOGY OR ENGINEERING GEOLOGICAL OR REPRODUCTIVE BIOLOGY OR
EDUCATION EDUCATIONAL RESEARCH OR CHEMISTRY MEDICINAL OR CHEMISTRY
INORGANIC NUCLEAR OR MEDICAL INFORMATICS OR PSYCHOLOGY CLINICAL OR
PARASITOLOGY OR ANATOMY MORPHOLOGY OR EMERGENCY MEDICINE OR LAW OR
PHYSICS FLUIDS PLASMAS OR INFORMATION SCIENCE LIBRARY SCIENCE OR MINING
MINERAL PROCESSING OR ANESTHESIOLOGY OR AGRICULTURAL ENGINEERING OR
GERONTOLOGY OR TROPICAL MEDICINE OR EVOLUTIONARY BIOLOGY OR GEOLOGY
OR MEDICAL LABORATORY TECHNOLOGY OR PHYSICS PARTICLES FIELDS OR SOCIAL
WORK OR STATISTICS PROBABILITY )
Timespan=All Years. Databases=SCI-EXPANDED, SSCI, CPCI-S, CPCI-SSH.
Lemmatization=On
EconLit (EBSCO) search strategy – 1922 – 21/7/2011

Yield = 31,660 records

(TI(nutri* or calori* or diet* or food* or eat* or meal* or snack* or cook* or restaurant* or supermarket* or café* or drink* or beverage* or drunk* or alcohol* or beer* or lager* or wine* or cider* or alcopop* or spirit* or liquor* or distilled beverage* or whisky* or whiskey* or whiskies or schnapps or liqueur* or brandy or brandies or gin* or rum* or tequila* or vodka* or cigar* or smoking or smoke* or tobacco* or exercis* or train* or activit* or fit* or endur* or aerobic* or flexib* or balance* or recreation* or leisure or walk* or hike or hiking or climbing or run* or jog* or swim* or swimming or bicycle* or cycl* or bike* or biking or gym* or rowing or canoe* or kayak* or sailing or windsurf* or surf* or diving or sport* or rollerblading or rollerskating or skating or skiing or yoga or pilates or calisthenics or jump* or weight* or circuit or aqua* or resistance or resilience or dance or dancing or fishing or hunting or shooting or led walk* or health walk* or aerobic capacity or exertion or keep fit or yoga or inactiv* or sedentary or deskbound)) OR (AB(nutri* or calori* or diet* or food* or eat* or meal* or snack* or cook* or restaurant* or supermarket* or café* or drink* or beverage* or drunk* or alcohol* or beer* or lager* or wine* or cider* or alcopop* or spirit* or liquor* or distilled beverage* or whisky* or whiskey* or whiskies or schnapps or liqueur* or brandy or brandies or gin* or rum* or tequila* or vodka* or cigar* or smoking or smoke* or tobacco* or exercis* or train* or activit* or fit* or endur* or aerobic* or flexib* or balance* or recreation* or leisure or walk* or hike or hiking or climbing or run* or jog* or swim* or swimming or bicycle* or cycl* or bike* or biking or gym* or rowing or canoe* or kayak* or sailing or windsurf* or surf* or diving or sport* or rollerblading or rollerskating or skating or skiing or yoga or pilates or calisthenics or jump* or weight* or circuit or aqua* or resistance or resilience or dance or dancing or fishing or hunting or shooting or led walk* or health walk* or aerobic capacity or exertion or keep fit or yoga or inactiv* or sedentary or deskbound))

AND

(TI(behav* or consum* or intake* or perform*)) OR (AB(behav* or consum* or intake* or perform*))

AND

(TI(change* or alter* or adjust* or modif* or adapt* or add* or subtract* or restrict* or shrink* or shrunken or extend* or expand* or supplement* or improve* or increas* or higher or larger or longer or remov* or constrain* or restrain* or limit* or lower* or reduc* or decreas* or smaller or greater or less* or fewer or more or choice* or choose or chose* or option*)) OR (AB(change* or alter* or adjust* or modif* or adapt* or add* or subtract* or restrict* or shrink* or shrunken or extend* or expand* or supplement* or improve* or increas* or higher or larger or longer or remov* or constrain* or restrain* or limit* or lower* or reduc* or decreas* or smaller or greater or less* or fewer or more or choice* or choose or chose* or option*)))
Database of promoting health effectiveness reviews (DoPHER) search strategy – 27/7/11

Yield = 1854 records

nutri* OR calori* OR diet* OR food* OR eat* OR meal* OR snack* OR cook* OR restaurant* OR supermarket* OR café* OR drink* OR beverage* OR drink* OR drunk* OR alcohol* OR beer* OR lager* OR wine* OR cider* OR alcopop* OR spirit* OR liquor* OR distilled beverage* OR whisky* OR whiskey* OR whiskies OR schnapps OR liqueur* OR brandy OR brandies OR gin* OR rum* OR tequila* OR vodka* OR cigar* OR smoking OR smoke* OR tobacco* OR exercis* OR train* OR activit* OR fit* OR endur* OR aerobic* OR flexib* OR balance* OR recreation* OR leisure OR walk* OR hike OR hiking OR climbing OR run* OR jog* OR swim* OR swimming OR bicycle* OR cycl* OR bike* OR biking OR gym* OR rowing OR canoe* OR kayak* OR sailing OR windsurf* OR surf* OR diving OR sport* OR rollerblading OR rollerskating OR skating OR skiing OR yoga OR pilates OR calisthenics OR jump* OR weight* OR circuit OR aqua* OR resistance OR resilience OR dance OR dancing OR fishing OR hunting OR shooting OR led walk* OR health walk* OR aerobic capacity OR exertion OR keep fit OR yoga OR inactiv* OR sedentary OR deskbound

AND

behav* OR consum* OR intake* OR perform*

AND

change* OR alter* OR adjust* OR modif* OR adapt* OR add* OR subtract* OR restrict* OR shrink* OR shrunk OR extend* OR expand* OR supplement* OR improve* OR increas* OR higher OR larger OR longer OR remov* OR constrain* OR restrain* OR limit* OR lower* OR reduc* OR decreas* OR smaller OR greater OR less* OR fewer OR more OR choice* OR choose OR chose* OR option*

This search was repeated at EPPI-Centre using same terms but with quotation marks placed around wildcard terms (i.e. those ending in *) on 11/8/11
Yield = 5334 records

(TI(nutri* or calori* or diet* or food* or eat* or meal* or snack* or cook* or restaurant* or supermarket* or café* or drink* or beverage* or drunk* or alcohol* or beer* or lager* or wine* or cider* or alcopop* or spirit* or liquor* or distilled beverage* or whisky* or whiskey* or whiskies or schnapps or liqueur* or brandy or brandies or gin* or rum* or tequila* or vodka* or cigar* or smoking or smoke* or tobacco* or exercis* or train* or activit* or fit* or endur* or aerobic* or flexib* or balance* or recreation* or leisure or walk* or hike or hiking or climbing or run* or jog* or swim* or swimming or bicycle* or cycl* or bike* or biking or gym* or rowing or canoe* or kayak* or sailing or windsurf* or surf* or diving or sport* or rollerblading or rollerskating or skating or skiing or yoga or pilates or calisthenics or jump* or weight* or circuit or aqua* or resistance or resilience or dance or dancing or fishing or hunting or shooting or led walk* or health walk* or aerobic capacity or exertion or keep fit or yoga or inactiv* or sedentary or deskbound)) OR (AB(nutri* or calori* or diet* or food* or eat* or meal* or snack* or cook* or restaurant* or supermarket* or café* or drink* or beverage* or drunk* or alcohol* or beer* or lager* or wine* or cider* or alcopop* or spirit* or liquor* or distilled beverage* or whisky* or whiskey* or whiskies or schnapps or liqueur* or brandy or brandies or gin* or rum* or tequila* or vodka* or cigar* or smoking or smoke* or tobacco* or exercis* or train* or activit* or fit* or endur* or aerobic* or flexib* or balance* or recreation* or leisure or walk* or hike or hiking or climbing or run* or jog* or swim* or swimming or bicycle* or cycl* or bike* or biking or gym* or rowing or canoe* or kayak* or sailing or windsurf* or surf* or diving or sport* or rollerblading or rollerskating or skating or skiing or yoga or pilates or calisthenics or jump* or weight* or circuit or aqua* or resistance or resilience or dance or dancing or fishing or hunting or shooting or led walk* or health walk* or aerobic capacity or exertion or keep fit or yoga or inactiv* or sedentary or deskbound))

AND

(TI(behav* or consum* or intake* or perform*)) OR (AB(behav* or consum* or intake* or perform*))

AND

(TI(change* or alter* or adjust* or modif* or adapt* or add* or subtract* or restrict* or shrink* or shrunk or extend* or expand* or supplement* or improve* or increas* or higher or larger or longer or remov* or constrain* or restrain* or limit* or lower* or reduc* or decreas* or smaller or greater or less* or fewer or more or choice* or choose or chose* or option*)) OR (AB(change* or alter* or adjust* or modif* or adapt* or add* or subtract* or restrict* or shrink* or shrunk or extend* or expand* or supplement* or improve* or increas* or higher or larger or longer or remov* or constrain* or restrain* or limit* or lower* or reduc* or decreas* or smaller or greater or less* or fewer or more or choice* or choose or chose* or option*))

AND

In English language
ASSIA – Applied Social Sciences Index and Abstracts (CSA) search strategy – 1987 - 28/7/11

Yield = 28,358 records

nutri* or calori* or diet* or food* or eat* or meal* or snack* or cook* or restaurant* or supermarket* or café* or drink* or beverage* or drunk* or alcohol* or beer* or lager* or wine* or cider* or alcopop* or spirit* or liquor* or distilled beverage* or whisky* or whiskey* or whiskies or schnapps or liqueur* or brandy or brandies or gin* or rum* or tequila* or vodka* or cigar* or smoking or smoke* or tobacco* or exercis* or train* or activit* or fit* or endur* or aerobic* or flexib* or balance* or recreation* or leisure or walk* or hike or hiking or climbing or run* or jog* or swim* or swimming or bicycle* or cycl* or bike* or biking or gym* or rowing or canoe* or kayak* or sailing or windsurf* or surf* or diving or sport* or rollerblading or rollerskating or skating or skiing or yoga or pilates or calisthenics or jump* or weight* or circuit or aqua* or resistance or resilience or dance or dancing or fishing or hunting or shooting or led walk* or health walk* or aerobic capacity or exertion or keep fit or yoga or inactiv* or sedentary or deskbound

AND

behav* or consum* or intake* or perform*

AND

change* or alter* or adjust* or modif* or adapt* or add* or subtract* or restrict* or shrink* or shrank or extend* or expand* or supplement* or improve* or increas* or higher or larger or longer or remov* or constrain* or restrain* or limit* or lower* or reduc* or decreas* or smaller or greater or less* or fewer or more or choice* or choose or chose* or option*

AND

In English language
Cochrane library search strategy - Cochrane Database of Systematic Reviews, Database of Abstracts of Reviews of Effects, Health Technology Assessment Database, NHS Economic Evaluation Database – 2/8/11

Yield = 1380 records

nutri* or calori* or diet* or food* or eat* or meal* or snack* or cook* or restaurant* or supermarket* or café* or drink* or beverage* or drunk* or alcohol* or beer* or lager* or wine* or cider* or alcopop* or spirit* or liquor* or distilled beverage* or whisky* or whiskey* or whiskies or schnapps or liqueur* or brandy or brandies or gin* or rum* or tequila* or vodka* or cigar* or smoking or smoke* or tobacco* or exercis* or train* or activit* or fit* or endur* or aerobic* or flexib* or balance* or recreation* or leisure or walk* or hike or hiking or climbing or run* or jog* or swim* or swimming or bicycle* or cycl* or bike* or biking or gym* or rowing or canoe* or kayak* or sailing or windsurf* or surf* or diving or sport* or rollerblading or rollerskating or skating or skiing or yoga or pilates or calisthenics or jump* or weight* or circuit or aqua* or resistance or resilience or dance or dancing or fishing or hunting or shooting or led walk* or health walk* or aerobic capacity or exertion or keep fit or yoga or inactiv* or sedentary or deskbound

AND

behav* or consum* or intake* or perform*

AND

change* or alter* or adjust* or modif* or adapt* or add* or subtract* or restrict* or shrink* or shrunk or extend* or expand* or supplement* or improve* or increas* or higher or larger or longer or remov* or constrain* or restrain* or limit* or lower* or reduc* or decreas* or smaller or greater or less* or fewer or more or choice* or choose or chose* or option*