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Changing energy-related behavior: An Intervention Mapping approach

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ABSTRACT

This paper's objective is to apply Intervention Mapping, a planning process for the systematic development of theory- and evidence-based health promotion interventions, to the development of interventions to promote energy conservation behavior. Intervention Mapping (IM) consists of six steps: needs assessment, program objectives, methods and applications, program development, planning for program implementation, and planning for program evaluation. Examples from the energy conservation field are provided to illustrate the activities associated with these steps. It is concluded that applying IM in the energy conservation field may help the development of effective behavior change interventions, and thus develop a domain specific knowledge-base for effective intervention design.

1. Introduction

Most policy making efforts to reduce the environmental impact of energy consumption have focused on energy-efficient technology and renewable energy resources. However, changing people's behavior may also significantly reduce energy consumption. It has, for instance, been estimated that household actions could reduce national carbon emissions in the U.S. by 7.4%, with little impact on well-being (Dietz et al., 2009). What is more, the transition towards more energy-efficient technology and renewable energy resources ultimately requires people to make the desired choices and act upon these. In other words, understanding the interaction between technology and human behavior is essential to successful energy policies (Sovacool, 2009).

Even when behavior change has drawn policy makers' attention, energy conservation interventions have frequently failed to take the full range of significant influences on human behavior into account. Policy makers have tended to favor measures informed by economic theory that use financial incentives as their main tool, and have thus often neglected non-financial influences on behavior (Stern, 1986). There are currently many overviews available on how other academic perspectives, such as psychology and sociology, can contribute to various environmental issues (e.g. Oskamp, 2000; Rayner and Malone, 1998; Stern, 1992).

The literature on (non-financial) determinants of energy-related behavior can be divided into two broad, partially overlapping categories. Some have taken the standard economic model of human behavior as the starting point. These researchers have emphasized how human behavior deviates from the standard economic notion of rationality. One important insight is captured in Simon's concept of "bounded rationality." It is argued that human cognitive and emotional limitations as well as external constraints render perfect, calculated rationality unrealistic (Simon, 1983). One energy-related example is Kempton and Layne's study on barriers that consumers face when attempting to conduct a cost analysis of their energy consumption (1994). Well-known examples of systematic deviations from rationality are the heuristics and biases as described by Tversky and Kahneman (1974) that led to the development of Prospect Theory. Applied researchers have suggested that such knowledge of human cognition could vastly improve the effectiveness of financial incentives and persuasive communication aimed at encouraging energy conservation (Lutzenhiser, 1993; Stern, 1986).

Others have started from the premise that energy-related behavior is human social behavior. Various theoretical frameworks have been employed to study determinants of proenvironmental behavior from this perspective—with theory choice often depending on whether one emphasizes self-interest, or concern for others and nature as a motivation for acting proenvironmentally. On the one hand, the Theory of Planned Behavior (TPB) and its precursor the Theory of Reasoned Action (TRA), have been most frequently used as a model when stressing rational, self-interested motivations, although the theory does not restrict itself to self-interest as motivation for behavior (Ajzen, 1991; Fishbein and Ajzen, 2010). A central tenet of their model is that (behavioral) intention is the most important immediate antecedent of behavior. On its turn, intention is determined by attitude, perceived norm, and perceived behavioral control. Perceived

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behavioral control is also postulated to have a direct effect on behavior, although empirical support for this hypothesis is mixed. On the other hand, the Norm-Activation Model (NAM) and its successor in the environmental domain, the Value-Belief-Norm Theory (VBN), have been used for examining the role of norms (Schwartz, 1973; Stern et al., 1999). The Norm Activation Model (NAM) was introduced to explain helping behavior (Schwartz, 1977). A key assumption of the model is that personal norm – the intensity of moral obligation felt by an individual to perform a behavior – is an important immediate antecedent of behavior. Finally, viewing proenvironmental behavior as being motivated by a combination of self-interest and altruism, some researchers have also integrated these models (Bamberg et al., 2007; Harland et al., 1999; Kaiser and Scheuthle, 2003).

It should be noted that the key concepts presented in these two categories of literature are closely interlinked. Biased processing of information clearly affects attitude, which is the general evaluation of a relevant behavior. Another example is adherence to social or perceived norms as a deviation from economic rationality and the (overall) perceived norm as a predictor of behavioral intention. Finally, imperfect information could obviously affect people's perceived control over a behavior or a situation.

Despite the fact that many ideas, concepts, and theories from the psychological literature have long been recognized as powerful means to improve the effectiveness of energy conservation interventions, translating theory to practice has proven to be challenging. Although planned intervention development (e.g. McKenzie-Mohr, 2000; Steg and Vlek, 2009) and the use of theories and evidence (e.g. Abrahamse et al., 2007; Bamberg et al., 2007; Staats et al., 2004) are found in the energy conservation field, too often interventions are not systematically developed and/or not well-described which impedes program replication or larger scale dissemination beyond the intervention trial. Recent reviews of intervention studies suggest that methodological and theoretical limitations, and little consideration of the situational context and the impact on total energy consumption have limited the practical use and generalizability of such research findings (Abrahamse et al., 2005; Lo et al., in press; Uitdenbogerd et al., 2007). For example, Abrahamse et al. (2005) concluded that "often, an intervention's effectiveness is studied without examining underlying psychological determinants of energy use and energy savings." Uitdenbogerd et al. (2007) found "no intervention strategy based on an analysis of behavioral determinants."

The central argument of this paper is that shortcomings found in previous energy-related behavior change studies can largely be avoided by adopting a systematic approach to every phase of intervention development, implementation, and evaluation. Therefore, the paper's objective is to introduce Intervention Mapping – an existing planning process for the systematic development of health promotion interventions – and apply this to the domain of energy conservation. Although the health promotion field and energy conservation field have different traditions, both are concerned with changing personal, social, and economic barriers to performing desirable behaviors. The general guidelines for intervention development provided by Intervention Mapping are thus transferable to energy conservation.

Systematic behavior change is not new to the energy conservation field. For instance, Steg and Vlek (2009) advocate a planning process for interventions directed at encouraging proenvironmental behavior in four steps: identification of the behavior to be changed, examination of the main factors underlying this behavior, design and application of interventions to change behavior to reduce environmental impact, and evaluation of the effect of interventions (see also McKenzie-Mohr, 2000). They suggest that the energy conservation field may benefit from such a systematic evidence-based approach, which is also the objective of Intervention Mapping. However, Intervention Mapping may extend current protocols for program design in four ways. First, it specifies agents in the environment and their roles in realizing improved environmental conditions. Second, it provides tools to systematically describe the relation between specific determinants and specific methods for change. Third, it anticipates implementation planning. Finally, it links evaluation outcomes with formulated performance and program objectives.

Applying Intervention Mapping may improve interventions by providing more detail and guidance for the planning process and the logic of change. Intervention Mapping helps to clarify the program theory and components to those who search to improve the quality of interventions. It also enables them to ask relevant questions about interventions one is interested in, so adoption decisions are based on adequate insights about an intervention. In the remainder of this paper, the theory- and evidence-based intervention development process will be described. Following a brief overview of the general principles, the six steps of Intervention Mapping are outlined. We will focus on energy-related behaviors, although it should be re-emphasized that Intervention Mapping may be applied to behaviors in other domains as well.

2. Intervention Mapping principles

The Intervention Mapping (IM) protocol is a planning framework for the development of theory- and evidence-based behavior change programs (Bartholomew et al., 2006, 2011). Intervention Mapping requires interventionists to identify intervention change objectives (or change targets) and specify behavior change methods that have been proven effective to bring about these planned changes. By basing such decisions on previous evidence and documenting the way in which intervention materials are designed, interventionists can communicate clearly about the intervention content, which facilitates replication and subsequent intervention development and improvement (Abraham et al., 2011).

IM describes the iterative path from problem identification to problem solving or mitigation. An IM approach is characterized by four perspectives that are applied during the entire planning process and in all steps. Firstly, from a participation perspective, it is acknowledged that the target population (and program implementers) should be involved in all aspects of decision making. This results in empowerment, which can be defined as having the knowledge, skills-set, and attitude needed to cope with the changing world and the circumstances in which one lives (Wendel et al., 2009). Secondly, IM stimulates an eclectic use of theories. Theories are by definition abstractions of reality and real life problems should be approached from multiple theories (Buunk and Van Vugt, 2008). Thirdly, from the systems perspective, interventions are seen as events occurring in systems (Hawe et al., 2009). Other factors within a system can reinforce or dampen the influence of an intervention on the target behavior or environmental change.

Fourthly, from an ecological perspective, the relevance of social and physical environmental conditions that influence energy-related behaviors is recognized. These social and physical environmental conditions may have a much stronger impact on the target behavior than individual-related factors (Kok et al., 2008). The ecological perspective guides the interpretation of the problem from the start. Environmental conditions may be visualized as a series of progressively larger circles around the individual: interpersonal circle (e.g. family), organizational (e.g. worksite), community (e.g. neighborhood), and societal (e.g. Netherlands, EU). Environmental conditions influence individuals and other environmental conditions, while individuals may also influence higher level environments (i.e. voting for a government). At all levels, environmental conditions are determined by decision makers, or environmental agents (Kok et al., 2008). Examples of possibly relevant environmental agents for energy conservation are energy management professionals, product manufacturers, managers of housing associations, worksite managements, newspaper editors, and politicians. Of course, identifying all relevant decision makers and involving them in the intervention is a challenge. One way to approach this challenge is to collaborate with organizations that represent groups of decision makers, for example an association of energy management professionals, or working from an organization that is seen by the target group as a relevant stakeholder (see e.g. Egmond et al., 2005: SenterNovem, a Dutch governmental agency for the environment, worked with managers of Dutch housing associations).

These environmental agents have reasons for their behavior which are termed "determinants". These determinants are not necessarily the same as the reasons planners have for their intervention, namely energy conservation. For instance, managers of housing associations focus primarily on housing quality, worksite managers on profit, newspaper editors on news value, and politicians on re-election (Egmond et al., 2005; Gottlieb et al., 2003).

3. IM step 1: needs assessment

The first step in IM is the analysis of the problem, its consequences, the behaviors that are related to the problem, and the relevant environmental conditions. The seriousness of the problem is decided based on scientific evidence and consensus among experts. In the case of energy conservation, considering current energy consumption levels, there is clearly a justification for intervening (see e.g. IPPC, 2007). The behaviors related to this problem are diverse and depend on the environmental conditions and the target population, but all are concerned with using more energy than is needed or feasible in the long term. The completion of step 1 results in a list of energy-wasting behaviors and environmental conditions that have been shown to contribute to the problem that functions as a starting point for the systematic development of an intervention.

We will discuss components of two existing, (relatively) successful energy conservation intervention studies to illustrate the desired result for this and the subsequent IM steps (Abrahamse et al., 2007; Siero et al., 1989). The first intervention aimed at encouraging household energy conservation; the second intervention promoted a fuel saving driving style among van drivers of a mail company.

Examples of relevant energy-wasting behaviors for households are:

- Leaving thermostat on in empty rooms.
- Showering for a long time.
- Leaving appliances on stand-by.

Important energy-wasting behaviors among van drivers included:

- Pressing the gas pedal down fully when accelerating.
- Only shifting gears when they reach the highest possible speed.
- Braking abruptly.

4. IM step 2: program objectives

In step 2 of IM the problem-increasing behaviors and environmental conditions are translated to their problem-reducing behavioral and environmental counterparts. Planners ask the '*Who*, *What* and *Why*' question for individuals and environmental agents: *Who* is going to do *What* behavior and *Why* would they do that?

At the individual level, the *Who* may be households, at the organizational level employees and management, and at the societal level politicians. The *What* may be investment energy-related behaviors (e.g. purchase of a hybrid car) or repeated energy-related behaviors (e.g. switching off electrical equipment) at the individual and higher levels (Uitdenbogerd et al., 2007). There should be consensus among experts about the relationship between reducing total energy consumption and the recommended changes in energy-related behaviors and environmental conditions.

Following this, the desired energy-related behaviors are translated into specific performance objectives: *what* is it exactly, that planners want people *to do*?

To return to our example of mail van drivers, the performance objectives for a fuel saving driving style may include (Siero et al., 1989):

- Press down the gas pedal to 2/3 of the maximum.
- Shift gears at 15/35/55 km p/h (2000 revolutions).
- Anticipate when there is a need to brake (i.e. less use of the brake).

For household energy consumption, some possible performance objectives are:

- Turn down thermostats in empty rooms.
- Limit showering time to 5 min
- Switch off appliances completely instead of leaving them on stand-by.

At the environmental level, again, performance objectives are formulated so that they answer the question "*What* is it exactly that planners want the environmental agents *to do*?" In the mail company example, the managers (agents) could order cars with much more fuel saving potential (environmental condition).

After the *What* question is answered, the *Why* question follows. The *Why* question asks for determinants of the specific performance objectives of individuals and environmental agents. Most interventions are directed at reasons for deliberate behavior, but not all behavior is deliberate. Some behavior is impulsive (Hofmann et al., 2009) and some behavior is habitual (Hassin et al., 2005). When behavior is deliberate, there is consensus among experts that people will change their behavior under the following conditions (Institute of Medicine, 2002):

- A strong positive intention, following from:
  - Advantages outweigh disadvantages of the recommended action (Attitude).
  - Perceived social norms/support.
  - Behavior is consistent with self-image/self-evaluation.
  - Positive emotional/affective reaction.
  - Perceived capability/self-efficacy.
- No environmental constraints.
- Necessary skills.

Determinants of behavior are usually identified with qualitative and quantitative research among the relevant populations. In one review of studies on energy conservation in households, the following general determinants were supported by evidence: knowledge, awareness, attitude, having goals, positive experience, and self-efficacy (Uitdenbogerd et al., 2007). In addition, two more energy-specific determinants, comfort and price, were also

Table 1
Sample matrix of performance objectives, determinants end change objectives.

Drivers: energy saving driving style	Determinants		
	Attitude	Self-efficacy	Habit
Performance objective: shifting gears at 15/35/55 km/h	*Explain: does not make the engine lazy*	*Express confidence in shifting gears at 15/35/55*	*Identify own habitual patterns and list adequate coping responses*
Performance objective: press gas pedal to 2/3rds	*Etc.*		

found to be of relevance. Finally, several environmental conditions were found to influence individual household energy conservation behaviors: ability to choose, income, type of housing, building-related measures, and technical provisions. In a review of studies on proenvironmental in organizations, the following determinants for conservation behavior of employees were reported: intention, attitude/beliefs, personal norm, perceived social norm, self-efficacy, and past behavior (Lo et al., in press). The same review reported the following relevant environmental conditions as perceived by employees: general organizational determinants (e.g. general trust in management), proenvironmental policies, proenvironmental management, and physical facilitation of proenvironmental behavior (e.g. placing easily accessible recycling bins).

To create immediate targets for behavior change programs, the program objectives, the *Who*, *What*, and *Why* are combined in separate matrices for each target group with the performance objectives corresponding to rows (on the left side) and the determinants corresponding to columns (on top).

In the mail company example, the study focused on professional van drivers (see Table 1). As stated earlier, one of the performance objectives for the drivers was: shifting gears at 15/35/55 km p/h. The determinants of this performance objective were: attitude, self-efficacy, and habit. In the cell where this performance objective is crossed with the determinant attitude, one program objective is to explain drivers that shifting gears at 15/35/55 km p/h does not make the engine of the car lazy—a relevant belief for drivers that came up in preceding qualitative research. In the cell corresponding to the determinant self-efficacy, one program objective is that drivers express confidence in shifting gears at 15/35/55 km p/h. In the cell corresponding to habit, drivers identify their own habitual patterns and list adequate coping responses. At a higher level, the management of the mail company could order cars with much more saving potential. A performance objective would be for mail company managers to look for information on hybrids as an alternative for the current car fleet. A relevant determinant could be attitude, and a corresponding program objective could be explaining managers why finding information on hybrids may be profitable for the company—which is a relevant belief for managers. The end products of step 2 are matrices for each target population, listing performance objectives, determinants, and program objectives.

5. IM step 3: methods and applications

A number of systematic reviews and meta-analyses in the health promotion field show that adequate use of theory-based methods increases the effectiveness of interventions to change behavior (Albarracín et al., 2005; De Bruin et al., 2009; Fisher et al., 2002; Mullen et al., 1985; van Achterberg et al., 2010). In the third step of IM, all program objectives are organized by determinant (i.e. the columns in the matrices are collapsed over rows). Then, theoretical methods are identified that may help reach the program objectives, which in turn are translated into practical applications. A theoretical method is a general technique for changing a behavioral determinant of individuals or environmental agents. A practical application is a specific technique for applying the theoretical method in ways that fit the target group and the setting. There are no 'magic bullet' methods; some methods can be used for a range of determinants, some only for a specific determinant.

Bartholomew et al. (2006, 2011) provide tables with theoretical methods and their limiting conditions for every major determinant and for all higher environmental levels. Examples of theoretical methods at the individual level are participation, persuasive communication, active learning, tailoring, individualization, modeling, feedback, reinforcement, and facilitation. Additional theoretical methods at higher environmental levels are, for instance, advocacy/lobbying, and technical assistance.

More recently, methods have also been suggested to change habitual energy-related behaviors. Habits are automatic; people do not consciously decide or even think about their behavior. Successful interventions must change the environmental cues that sustain habits. An example from the energy conservation field is an intervention to promote stair use (instead of elevator use). Through stickering orange footsteps that led towards the stairs, employees were successfully triggered to take the stairs instead of their habitual route to the elevators (Van Nieuw-Amerongen et al., 2011). Another recent development is the use of methods mobilizing social norms. For instance, in a study on towel reuse by hotel guests the control message was: "*Help save the environment. You can show your respect for nature…by reusing your towels during your stay*". The experimental message was: "*Join your fellow guests in helping to save the environment. Almost 75% of the guests who are asked to participate…do help by using their towels more than once. You can join….by reusing your towels…*" (Goldstein et al., 2008). The experimental message increased towel reuse by 44%, whereas the control message led to 31% more reuse. Specifying that 75% of the guests staying in the same room (cf. guests in general) participated further significantly increased reuse to 49%.

It is important to bear in mind that theoretical methods are only effective under certain conditions (Kok et al., 2004; Schaalma and Kok, 2009). Modeling, for instance, is only effective when the model is reinforced (rewarded), observers pay attention, have sufficient self-efficacy and skills, identify with the model, and observe a coping model instead of a mastery model (Bartholomew et al., 2006, 2011). Under those conditions, modeling is a very effective method to change many determinants. Other theoretical methods have other conditions that need to be met, e.g. goal setting is effective when the chosen goal is challenging but feasible (Latham and Locke, 2007). For feedback to be effective it needs to be specific, given individually, and follow shortly after the performance of the relevant behavior (McAlister et al., 2008). Abrahamse's et al. (2005) review also showed that mass media campaigns were generally ineffective. At least one reported study, had a heavy focus on environmental problem awareness which could be argued to lead to fear arousal (Staats et al., 1996). Lay people often expect fear arousal to be effective: arousing negative emotional reactions in order to promote self-protective motivation

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and action. However, fear arousal as a method requires high self-efficacy expectations about the behavior; a condition that is very rare because of the complex nature of most behavior change settings, resulting in no effect or even a counter-effect of fear appeals (Ruiter et al., 2001; De Hoog et al., 2007).

For illustrative purposes, the theoretical method of modeling, which involves presenting an appropriate model who performs the desired action, will be further elaborated on with the use of the mail company example (McAlister et al., 2008). The practical application for van drivers would be a fellow driver demonstrating the fuel saving driving style, showing less fuel use while driving the same car, over the same distance, and within the same time (Siero et al., 1989). The practical application for company managers would be a manager from another company explaining that after replacing the current fleet with hybrids, the costs of fuel had decreased substantially which resulted in better cost-effectiveness. Indeed, a review of household energy conservation intervention studies also found that modeling – in combination with tailoring towards the target group – was an effective method. Commitment, goal setting, tailoring, individual and comparative feedback, and rewards, were also often found to be effective (Abrahamse et al., 2005).

In brief, the end product of step 3 is a series of practical applications, which are based on theoretical methods.

6. IM step 4: program development

Step 4 of IM concerns the actual development of the program (i.e. the intervention), integrating the various applications that were chosen in the previous step. Planners decide about the overall structure of the program, themes, channels, and vehicles of the program. They design and produce materials while striving for cultural sensitivity. They work with other professionals and they pilot test the relevant elements of the program. Individual components of the intervention program should be pilot tested on their effectiveness before final production and implementation, which can be done relatively easy using experimental research designs (Whittingham et al., 2008).

The internet has had a huge impact on the possibilities for behavior change programs, as it provides means for tailored communication on a mass scale, sometimes using so-called computational artifacts: animated virtual persons designed to build and maintain social–emotional relationships with their users (Kok et al., 2007). In the health promotion field, internet interventions and computer tailoring have been shown to be effective in reaching and changing the behavior of large numbers of people (Kroeze et al., 2006; Ruiter et al., 2006). Abrahamse et al. (2007) developed an intervention to encourage households to reduce their energy use, applying tailored information, goal setting, and tailored feedback through a website designed for this purpose.

Returning to the example of the mail van drivers, the program consisted of an intervention package composed of several practical applications of theoretical methods which were combined to complement and reinforce the effect of the other applications. The theoretical methods underlying these applications were information, (physical) facilitation, model demonstrations, task assignment and control, and feedback (Siero et al., 1989). The information included persuasive communication about relevant beliefs and misconceptions about car engines, fuel use, and driving speed. The (physical) facilitation involved stickers on the dashboard as cues for action, and tachometers and gas flow meters for making the fuel saving behavior easier. The model demonstrations triggered interest and active learning of skills. The task assignment and control were methods at the organizational level, based on power differences: energy saving was presented as a task for the drivers which was monitored by their local supervisor. Finally, weekly feedback on fuel consumption was provided with the aim to reinforce, monitor, and sustain performance.

Thus, the end product of step 4 is the intervention program ready for implementation.

7. IM step 5: planning for program implementation

Programs that are developed to change people's behavior are only effective when they are implemented correctly. Therefore, from the start of the IM process, planners must anticipate their implementation at a later stage. Research shows that the number of implementers usually decreases drastically in the course of the implementation process (Paulussen et al., 1995). For example, while around 70% of potential implementers are aware of the program, 50% adopt the program (intention), only 30% implement the program (actual use), and a scant 10% eventually institutionalizes the program (continued use). Thus, the actual effect of the intervention is merely 10% of the potential effect. The best way to improve actual implementation is working with a linkage system (Orlandi et al., 1990): collaborating with the future program implementers from the very beginning of the planning process, thereby linking program developers with program implementers. Because most implementers are professionals working in organizations, planning for implementation is in itself an intervention at the organizational level. Therefore, to implement the intervention, planners ask again: *Who* has to do *What* implementation behavior and *Why* would they do that? And again, matrices of program objectives can be generated, where the program objectives are the objectives for implementation.

In sum, similar to step 2, the end product of step 5 is an implementation plan with performance objectives, determinants, and program objectives for program adopters and implementers.

8. IM step 6: planning for evaluation

Similar to Step 5, planners need to anticipate later process and effect evaluation of the program from the start of the planning process. Therefore, all objectives should be formulated as measurable concepts: performance objectives serve as indicators for behavioral change of individuals and environmental agents, and program objectives serve as indicators for changes in determinants. Adequate evaluation research is based on (quasi-) experimental designs and provides planners with information on successes and failures as well as information on where in the planning process the failures were located, thereby indicating where improvement of the program is needed. The end product of step 6 is an evaluation plan.

In the mail company example, the program was evaluated in a field experiment. First, differences in fuel use between the experimental and control group were examined. The experimental group was found to have achieved an 8% reduction in fuel use compared to the control group. Second, reported behaviors were also compared. Van drivers in the experimental group shifted gears timely, and anticipated braking significantly more often than those in the control group. However, there were no differences in the use of the gas pedal when accelerating. Here, evaluation of the reported behaviors may help to pinpoint where the program did not achieve its full energy-saving potential. Third, differences in attitudes, social norms, and specific beliefs pre- and post-intervention were measured. Similar to the evaluation of reported behaviors, these could also provide valuable information to further increase intervention effectiveness in future programs.

9. Limitations

Some critical comments on Intervention Mapping have been made. IM has been described by users as tiresome, complex, elaborate, and most importantly, expensive and time consuming. IM guides the intervention planner through a thorough process. In practice, intervention development often is bound by (short-term) in time and financial constraints. It is therefore useful to have an indication of the most common failures made during intervention development and implementation. There is some evidence that the identification of relevant determinants is the frequent stumbling block. Godin et al. (2007) analyzed 123 Canadian community-based health promotion projects using a checklist based on IM. In terms of IM, the most important limitation in planned intervention development was that very few projects specified the determinants to be acted upon. Consequently, it was impossible to identify change objectives and appropriate theoretical methods. Even though practical applications had been proposed those applications were rarely theory-based. As mentioned before, the same can be noticed in interventions for energy conservation (Abrahamse et al., 2005; Uitdenbogerd et al., 2007). In real life, intervention decision makers often jump from a problem definition to intervention development. In short, IM provides a theory- and evidence-based planning process, but to use that process effectively, planners need adequate resources which may help to increase cost-effectiveness in the long run.

10. Conclusion

The objective of this paper was to present a planning process for the development of behavior change interventions, Intervention Mapping, and apply this process to the development of energy conservation interventions. As noted earlier, the key words in IM are planning, research, and theory. IM helps planners to move away from intuition-driven behavior change approaches and guides planners in developing interventions based on the current state of the art in theory and empirical research. IM requires interventionists to identify intervention change objectives (or change targets) and specify commonly-understood behavior change methods that have been proven to bring about these planned changes. IM provides a vocabulary for intervention planning, procedures for planning activities, and technical assistance with identifying theory-based determinants and methods for change. In the health promotion field, IM has been successfully applied in various settings, to a wide range of different behaviors and populations (Bartholomew et al., 2006; 2011). Given the substantial overlap between the conceptual determinants and theoretical change methods proposed in both fields, IM may help planners to develop theory- and evidence-based interventions aimed at promoting energy conservation behavior. More specifically, Intervention Mapping ensures that theoretical models and empirical evidence guide planners in two areas: (1) the identification of the determinants of behaviors and environmental conditions related to an energy problem of interest, and (2) the selection of the most appropriate theoretical methods and practical applications to address the relevant determinants. Although IM is a complex and time-consuming process, the benefits of its consistent application may outweigh its costs by ensuring more effectiveness and efficient learning through its evaluation processes.

To conclude, applying IM to energy conservation may provide valuable guidance to the development of more effective behavior change interventions and a domain-specific knowledge base for effective intervention design.

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