

ARTICLE

Turning Theory Into Action: Intervention Mapping Program Design

Gido Metz, Jeroen Bruinsma and Tugce Varol

Abstract

The Intervention Mapping (IM) framework has been widely used to develop behavior change interventions. This paper outlines Step 3 of IM, program design, which focuses on three core tasks: generating program ideas, selecting behavior change methods, and translating these methods into practical applications that meet parameters for effectiveness. In addition, Acyclic Behavior Change Diagrams (ABCDs) are introduced as a tool to support program design and adaptation, illustrated with real-world examples. By providing a practical guide to applying Step 3, we aim to support scholars in developing new behavior change interventions or strengthening existing ones.

Key words: Intervention Mapping, program design, behavior change

Intervention Mapping (IM) is a six-step framework to create theory- and evidence-based behavior change interventions (Bartholomew Eldredge et al., 2016; Fernandez et al., 2019). In close collaboration with a planning group comprising end-users and relevant stakeholders, an iterative and participatory co-development process begins with the creation of a *Logic Model of the Problem* (Step 1). This involves analyzing the health problem and its implications for quality of life, as well as identifying related behaviors and the psychological determinants of these behaviors. This step is essential to ensure that the intervention is targeted at a real-world problem and aims to change the behavior of individuals as well as that of agents who control the environment (e.g., parents, teachers, policy advocates). Once the problem analysis is complete, the focus shifts to planning for change by constructing a *Logic Model of Change* (Step 2). Together with planning group members, this step involves defining outcomes, desired behaviors, sub-behaviors, and the most relevant determinants needed to facilitate behavioral change. This serves as the foundation for selecting theory-based behavior change methods and translating them into appropriate practical applications while accounting for relevant parameters for effectiveness (Step 3). The result is a blueprint for the intervention, where theory-based and evidence-driven behavior change methods are operationalized into actionable intervention components. Subsequent IM steps outline the process to produce (Step 4), implement (Step 5), and evaluate the intervention (Step 6) (Bartholomew Eldredge et al., 2016).

In this piece, we focus on Step 3 of IM by clarifying important tasks and illustrating the use of Acyclic Behavior Change Diagrams (ABCDs, Metz et al., 2022). Given that interventions require regular updates to remain relevant, we demonstrate how ABCDs can be used to strengthen existing interventions with behavior change methodology. By providing a practical guide and illustrative examples, we hope to inspire those developing new health promotion interventions or strengthening existing ones.

Intervention Mapping Step 3

Step 3 of IM, which focuses on *Intervention Design*, is particularly critical when developing new interventions or updating existing ones (Bartholomew Eldredge et al., 2016). This step includes specific tasks that are essential for ensuring that the intervention incorporates behavior change methods targeting relevant psychological determinants to initiate or sustain behavioral changes. The tasks include:

1. Generating program ideas: Developing an intervention is complex, and it is crucial to involve the planning group and use research insights to ensure the intervention meets real-world needs and the perspectives of end-users. Actively engaging end-users and stakeholders is also vital when making decisions about the intervention theme, which encompasses the overall idea and the brand communicated to end-users and implementers. In the case of an existing intervention, this process involves mapping the current intervention to generate new ideas for updating it or adapting it to a different context (Bartholomew Eldredge et al., 2016).

2. Selecting behavior change methods: Using the right behavior change methods is crucial for modifying relevant psychological constructs that determine behavior (Kok et al., 2016). This increases the likelihood that end-users engage in sub-behaviors (i.e., performance objectives) that contribute to the desired behavioral outcome, as outlined in IM Step 2. To illustrate, behavior change methods to alter risk perceptions differ from those designed to strengthen perceived behavioral control (Bartholomew Eldredge et al., 2016). When updating or adapting an existing intervention, this task of IM Step 3 includes mapping behavior change methods that are currently embedded within the existing intervention and identifying what psychological determinants they aim to change. This serves as a foundation for determining which methods need to be altered, added, or maintained in the update or redesign process.

3. Accounting for parameters for effectiveness: It is essential to consider the conditions under which behavior change methods are most likely to be effective and to account for these in the development process (Kok, 2014; Bartholomew Eldredge

et al., 2016). For example, the effectiveness of fear appeals heavily depends on an individual's belief in their ability to manage a threat (Peters et al., 2012). Therefore, when using fear appeals, it is critical to ensure that participants perceive themselves as capable of coping with the threat or to combine the fear appeal with a self-efficacy-enhancing component (Peters et al., 2012).

4. Co-designing delivery applications: After selecting behavior change methods and accounting for parameters for effectiveness, the next step involves determining appropriate delivery applications to operationalize these methods. Essentially, these applications are the means through which the behavior change methods are conveyed to end-users, shaping how they interact with the intervention (Kok, 2014; Bartholomew Eldredge et al., 2016). Collaborative reflection with the planning group, supplemented by research on the needs and perspectives of end-users and stakeholders, is crucial for guiding decisions about intervention delivery. To illustrate, this process can support choosing between in-person, digital, or blended approaches as well as deciding on how these approaches are structured, for instance, through group-based workshops, individual coaching, a website, or a smartphone app.

Acyclic Behavior Change Diagrams

Having a clear overview of how different intervention components, practical applications, and behavior change methods are logically combined provides a basis for intervention production (IM Step 4). Visualization can be a useful tool that aids brainstorming and discussion while also helping to track changes to facilitate updates to the intervention. ABCDs have been specifically developed as a visualization tool for this purpose (Metz et al., 2022). An ABCD consists of chains of seven (causal) links (see Figure 1 from Metz et al., 2023) that illustrate (1) which behavior change principles, also known as behavior change methods, have been applied - (2) taking into account the parameters for effectiveness, also known as parameters for use - (3) in a specific application in an intervention, which (4) sub-determinants and (5) determinants have been addressed, and (6) which sub-behaviors should be performed to achieve (7) the target behavior.

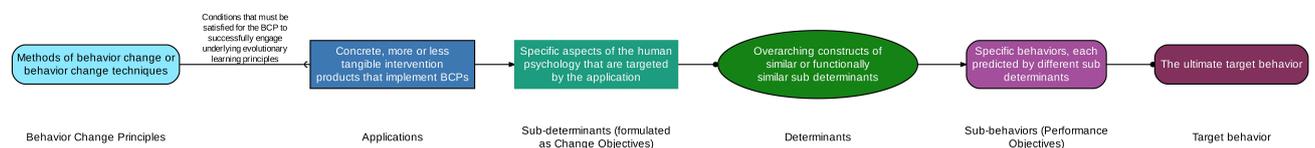


Fig. 1. An ABCD chain.

Using ABCDs for intervention (re-)development, reporting, and evaluation (Metz et al., 2022) is helpful as it makes implicit assumptions explicit. It allows intervention developers to check if all relevant (sub-)determinants are targeted or whether there are missing links. Second, ABCDs facilitate reflecting on, discussing, and communicating the assumptions underlying an intervention. A clear visualization enables intervention developers and other stakeholders to get a better grasp of the working mechanisms of the intervention and makes it possible to discuss those assumptions during the development stage and helps to further improve the intervention. Additionally, ABCDs support thorough intervention evaluation as they can function as a blueprint outlining exactly what to measure in pilot testing or process and effect evaluations.

Several recent projects have used ABCDs to capture both newly developed and existing interventions in terms of their active ingredients and underlying assumptions (e.g., Marcos et al., 2024; Metz et al., 2023; Metz, 2024; Moore, 2024a,b; Schelleman-Offermans et al., 2022). For instance, the Sense.info evaluation and optimization project used ABCDs for the evaluation of the Chlamydia page on the Dutch sexual health platform for young people (Sense.info), as well as for the development of new intervention content. Sense.info was originally developed using IM following a Logic Model of Change, but over time the medical knowledge progressed and the website was regularly updated with new elements. The changes required an update of the Logic Model underlying the intervention to facilitate meaningful evaluation. Therefore, in the first phase of the project evaluating Sense.info, a reverse engineering approach was adopted: in close consultation with the Sense.info developers, the page was coded using the IM taxonomy and put in an ABCD (Metz et al., 2023). This provided an accurate picture of which behavior change principles were applied to address which determinants, and how the developers envisioned each element contributing to behavior change. This ABCD served as the blueprint for a mixed methods evaluation (Metz et al., 2023; Metz, 2024).

After the mixed methods evaluation of the Sense.info Chlamydia page, ABCDs were used in the development of new intervention content in the form of role model stories (Metz et al., 2025). During the evaluation, participants expressed a need to hear about peers' experiences with Chlamydia and Sexually Transmitted Infection (STI) testing, with some suggesting that personal stories would act as a motivator for STI testing, as they could learn what steps to take and how to do it. These findings were consistent with Social Cognitive Theory (Bandura, 2003), which emphasizes the influential role of self-efficacy in individuals' adoption and maintenance of health behaviors, and that one of the ways to increase self-efficacy is through modeling (i.e., observing a similar other succeed through persistent effort which increases the observer's belief in his or her own abilities, Bandura, 2003). Modeling is included in the IM Taxonomy of Behavior Change Methods as one of the Behavior Change Principles (BCPs) able to strengthen determinants like skills and self-efficacy (Kok, 2014). Therefore, we collaboratively decided to develop role model stories together with young individuals who had experience with Chlamydia, guided by the principles and conditions for effectiveness underlying the BCP modeling.

Ahead of the collection of personal stories, ABCDs underlying the role model stories were created. The ultimate target behavior was formulated as 'young individuals prevent the transmission of STIs'. The identified sub-behaviors were STI testing, STI treatment, and partner notification. The earlier conducted evaluation demonstrated the relevance of determinants skills and self-efficacy, which would be strengthened by using modeling as a behavior change method while accounting for the following parameters for effectiveness: (1) the reader's attention must be drawn to the story; (2) they must be able to remember the main message; (3) they must be able to identify with the protagonist; (4) the role model story should target skills and self-efficacy; (5) include

reinforcement of the target behaviors; and (6) the protagonist should be a coping model rather than a mastery model (Kok, 2014; Metz et al., 2025), see Figure 2.

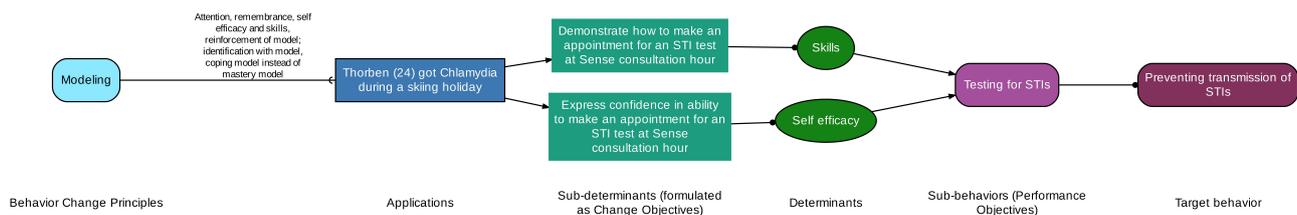


Fig. 2. An ABCD for one of the role model stories.

An interview guide based on the ABCD was used to conduct 10 interviews with young individuals who had personal experiences with Chlamydia. Considering the parameters for effectiveness of the BCP modeling, we included aspects of the young individuals' personal backgrounds and everyday lives in the stories to help readers identify with the role model characters and be drawn to the narratives due to their personal relevance. Moreover, interview topics covered initial reactions to suspecting Chlamydia, steps taken for STI testing, treatment experiences, and discussing it with sexual partners. Specific emphasis was devoted to coping with challenges and on ultimately successfully performing the behavior to embed elements of a coping model into the role model stories. After the interviews, stories were written in close collaboration with the interviewees, the intervention owners, and a medical doctor, constantly verifying if all elements in the ABCD were thoroughly addressed. Links to two of the role model stories were placed on the Chlamydia page along with links to the general 'Personal stories' page, which contains all other stories on Chlamydia. All role model stories are available in the Open Science Framework Repository at <https://doi.org/n6s9>.

In a similar vein, Marcos et al. (2024) employed the ABCD approach to map the program theory of a preexisting web-based application designed to support cardiac rehabilitation patients. Additionally, the British sexual health organization Avert utilized ABCDs in their evaluation and optimization of *Be in the KNOW*, a website aimed at enhancing sexual and reproductive health in sub-Saharan Africa, which reached over 13 million people across Africa in 2023. Consistent with the intended benefits of ABCDs described earlier in this section and in Metz et al. (2022), the ABCD analysis of *Be in the KNOW* revealed which parameters for effectiveness of BCPs had been implemented and where there was room for improvement. New elements were introduced (e.g., new quiz content and additional internal links) and changes were made to existing content, such as modifications to the presentation of personal stories. The ABCD also provided a framework for the subsequent evaluation, as it highlighted which determinants had been addressed and would require evaluation (Moore, 2024a,b).

Box 1. Intervention Mapping Step 3: Intervention Design

Building on the matrices of change objectives developed in IM Step 2, IM Step 3 focuses on selecting behavior change methods and translating them into practical applications. Tasks of IM Step 3 include:

Generating program ideas. This begins with creating themes and determining the components, scope, and sequence by incorporating the views of end-users and stakeholders.

Choosing theory- and evidence-based change methods. Use the matrices of change objectives from IM Step 2 to guide the selection. For each determinant, choose behavior change methods that are grounded in theory and evidence (see Kok et al., 2016), and consider the specific change objectives. Keep in mind that methods targeting individual-level determinants can also be applied to influence determinants of individuals who control the environment with their behavior.

Designing practical applications. After selecting behavior change methods, the next step is to choose delivery applications to put these methods into practice. Decisions about the delivery are ideally guided by input from the planning group and based on the perspectives of end-users and stakeholders.

- When translating behavior change methods into practical applications, it is essential to consider the conditions under which each method is most effective—also known as *parameters for effectiveness*.

- The use of ABCDs can support the intervention design by illustrating the causal relationships between the components of the intervention. Furthermore, ABCDs can help guide decisions about updating or adapting interventions when needed.

Discussion

IM Step 3 provides the foundational blueprint for Step 4, where behavior-change methods and their applications are translated into tangible materials and activities. IM Steps 2 and 3 are often considered the most challenging steps of the intervention development process, as they primarily operate at an abstract level, focusing on determinants and behavior-change methods. However, once the outputs of these steps are translated into concrete and tangible intervention components in IM Step 4, intervention developers and stakeholders gain a clearer understanding of the intervention as a whole.

Acyclic Behavior Change Diagrams (ABCDs) play a crucial role in visualizing the causal chain linking IM Steps 2 and 3. They illustrate the theoretical and evidence-based foundation of the intervention, making its development process more transparent and systematic while providing a comprehensive overview of the working mechanisms of the intervention. The use of ABCDs fits particularly well with intervention planning approaches that use logic models (or other similar overviews) of the intended change processes of interventions (Metz, 2024). Such approaches include IM (Bartholomew Eldredge et al., 2016), the Behavior Change Wheel (BCW, Michie et al., 2011), or the Six Steps in Quality Intervention Development (6SQuID, Wight et al., 2015).

Although Intervention Mapping has been recognized as the most comprehensive approach to developing interventions (O’Cathain et al., 2019), it has also faced criticism for being time-consuming (McEachan et al., 2008; Munir et al., 2013; Wight et al., 2015), which makes full adherence to all IM steps and tasks challenging, especially when addressing rapidly evolving health problems. Many researchers and projects operate within strict time constraints and rely on funding from external partners, often involving interdisciplinary collaborations. This adds another layer of complexity as correctly applying IM requires convincing all parties to invest significant effort to understand the problem, behaviors, and relevant determinants to select behavior change methods. This level of comprehensiveness and participatory process may not always align with goals, timelines or expectations of other parties involved.

Another challenge related to IM and the use of ABCDs, is that intervention developers may not be as familiar as behavioral scientists with behavior change theory, methods, and taxonomies used for logic models and ABCDs. In the ABCD Shiny App, users manually enter BCPs, corresponding conditions, and targeted determinants, which requires an understanding of how these are related. Ways to improve user support have been proposed (Metz, 2024), for example by integrating behavior change taxonomies into the app. This would enable the app to make suggestions based on user input. For example, when a user adds a determinant, the app could suggest BCPs that target that determinant (e.g., guided practice or planning coping responses to target self-efficacy; (Kok et al., 2016). In addition, the app could offer sample descriptions of sub-determinants based on the chosen determinant, which developers would only need to specify (e.g., ‘express confidence in the ability to...’ for self-efficacy). It is expected that this extension will integrate ABCDs more seamlessly into intervention development and make them more accessible to those without a behavioral science background (Metz, 2024).

Recommendations for health psychology scholars

When translating behavior change methods into practical applications, health psychology scholars can consider several factors to maximize the effectiveness and relevance of their interventions. A thoughtful approach to selecting, adapting, and applying methods can ensure that interventions are both theoretically sound and practically impactful. Below are key considerations that can guide this process:

1. Leveraging Behavior Change Taxonomies

Existing taxonomies of behavior change methods and techniques provide guidance for matching determinants with appropriate behavior change methods. The taxonomy by Kok et al. (2016) is designed for the systematic development of behavior change programs. A defining characteristic of Kok et al.’s taxonomy is its focus on parameters for effectiveness, defined as “*the conditions that must be satisfied in practical applications for the method to be effective*” (Kok et al., 2016, p. 301). For example, the behavior change method of ‘modeling’ requires adherence to specific parameters for effectiveness, such as ensuring that individuals can identify with the model and possess sufficient self-efficacy and skills (Bartholomew Eldredge et al., 2016, p. 377).

2. Use of Core Processes

Core Processes, a six-step approach, can guide program developers to find answers to the questions in the development of an intervention, using expert knowledge, theories, and empirical evidence (Ruiter and Crutzen, 2020). The six steps of Core Processes involve: 1) posing questions, 2) brainstorming answers, 3) reviewing evidence, 4) finding theoretical support, 5) identifying and addressing the need for new research, and 6) finalizing and evaluating the list of possible answers (Ruiter and Crutzen, 2020). In particular, for Step 3 of Intervention Mapping, Core Processes can offer structured guidance on the selection and adaptation of behavior change methods by using evidence, conducting new research to bridge knowledge gaps, and consulting end-users and stakeholders. By following this structured approach, developers can ensure that the selected methods are not only theoretically appropriate but also practically feasible and contextually aligned. Further information on Core Processes can be found in another contribution within this special issue (Crutzen and Nalukwago, 2025) .

3. Incorporating Cultural and Contextual Insights

Insights from Step 1 of Intervention Mapping, which involve conducting a thorough cultural analysis and asset assessment, are crucial when translating behavior change methods into practical applications (Bartholomew Eldredge et al., 2016). Cultural analysis ensures that interventions align with the values, norms, and beliefs of the target population, while asset assessment identifies available resources within the environment. By integrating these insights, program developers can tailor interventions to enhance their acceptability and effectiveness. Both cultural considerations and asset assessment play a role in guiding decisions about practical applications, ultimately contributing to the overall impact of the interventions.

4. Instead of reinventing the wheel, reverse engineering

The plethora of interventions developed over the years raises issues related to implementation, maintenance, and ongoing evaluation, as intervention content, such as videos or web content, can quickly become outdated due to technical and scientific advances. The resulting need for continuous monitoring of the use and impact of interventions means that updates, whether changes or additions, are often required. A well-developed intervention based on the first three steps of IM can facilitate this process, as the Logic Model of Change, such as one represented in an ABCD, can provide a framework for evaluation and can be updated when developing new intervention content. If the Logic Model of Change of a thoroughly developed intervention has become obsolete or missing, it is advisable to follow a reverse engineering approach, as suggested by Marcos et al. (2024) and Metz et al. (2023), to create a new Logic Model of Change in collaboration with the intervention developers.

Concluding remarks

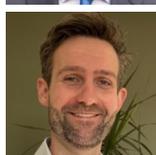
This piece provides an overview of Step 3 of Intervention Mapping (IM) for developing and adapting behavior change interventions. The key tasks of IM Step 3 include: (1) generating program ideas, (2) selecting behavior change methods, and (3) translating these methods into practical applications while ensuring they meet parameters for effectiveness. We also explain Acyclic Behavior Change Diagrams (ABCDs) and their role in IM Step 3 through real-world examples. Finally, we discuss the challenges encountered when applying IM and offer recommendations for health scholars to enhance the effectiveness of interventions.

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