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# Intervention Mapping Work Book



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# Introduction

This is the Intervention Mapping Work Book. It is an Open Access book, freely available under the [Creative Commons CC-BY-NC-SA license](https://im-wb.com) at <https://im-wb.com>. This book is accompanied by an Exercise Document, which is available as a Google Sheet at <https://im-wb.com/exercise-book>.

## Aim of the workshop

The general aim of the workshop is to practice the steps of the Intervention Mapping protocol in groups in one week. The structure of the workshop is guided by the IM protocol, as described in the book *PLANNING HEALTH PROMOTION PROGRAMS* by Bartholomew et al. (2016). Below, a detailed outline is presented of working with the Intervention Mapping protocol. For each step of the protocol, specific tasks are formulated.

## Preparation

To prepare for the workshop, you can read the following Open Access articles:

- Peters, G.-J. Y. (2014). *A practical guide to effective behavior change: How to identify what to change in the first place*. *European Health Psychologist*, 16(5), 142-155. <https://doi.org/10/ghm799>
- Kok, G. (2014). *A practical guide to effective behavior change: How to apply theory- and evidence-based behavior change methods in an intervention*. *European Health Psychologist*, 16(5), 156-170. <https://doi.org/10/ghm78g>
- Ruiter, R. A. C. & Crutzen, R. (2020). *Core Processes: How to Use Evidence, Theories, and Research in Planning Behavior Change Interventions*. *Frontiers in Public Health* (8) <https://doi.org/10/gb59>
- Kok, G., Gottlieb, N. H., Peters, G.-J. Y., Dolan Mullen, P., Parcel, G. S., Ruiter, R. A. C., Fernández, M. E., Markham, C., & Bartholomew, L. K. (2016). *A taxonomy of behaviour change methods: an Intervention Mapping approach*, *Health Psychology Review*, 10:3, 297-312. <https://doi.org/10/gf2x2w>
- Metz, G., Peters, G. J. Y., & Crutzen, R. (2022). *Acyclic behavior change diagrams: a tool to report and analyze interventions*. *Health Psychology and Behavioral Medicine*, 10(1), 1216–1228. <https://doi.org/10/jp9t>

## Group Work

As a student, you will be performing the tasks in this workbook in workgroups.

To collaborate on the exercises in this book, an exercise document is available as a Google Doc word processor document. Your course instructors may have prepared a version for your group, in which case they will provide the link to you (e.g. in your electronic learning environment). Alternatively, you can copy the standard read-only version that is available at <https://im-wb.com/exercise-book>. Instructions as to how to copy that document are provided in the beginning of the document itself.

In addition to providing a structure for the answers you will produce in this course, the exercise document will also link to a number of Google Sheets that are better suited for specific tasks. For those spreadsheets, the same is true: either your course instructors may have prepared versions for your group (in which case they will provide the links), or you can copy the read-only versions of the spreadsheets.

From the exercise document and the associated spreadsheets, you will make selections of the most important progress points, decisions, justifications, and issues. You will regularly present these in plenary sessions so that you can receive feedback from an IM expert. Whereas the exercise document is highly structured, following the structure of this workbook, *it is up to you to decide what to present and how*. To create these slides, use Google Slides (and store the Google Slides document in your Group Folder) to enable smooth synchronous collaboration and presentation of the results.

By the end of the course period, your group will have gone through all the steps, and you will have a full exercise document as well as a full presentation of the most important points. You will then present this final product - your intervention - for one last round of IM-expert feedback, and time to process that feedback to improve your intervention plans. If the course is graded, the final set of documents (the presentation, the exercise document, and the associated spreadsheets) must be handed in at the end of the course period: details will be provided by your instructor.

## Core processes

In Intervention Mapping, questions are answered using the core processes. These processes are a systematic approach to obtaining answers that are theory- and evidence based, and allow balancing pragmatic considerations such as resource availability (time, funding) with optimizing answer quality and scientific integrity. These are explained in Chapter 1 of the Intervention Mapping book. The Core Processes are:

1. Pose the question(s).
2. Brainstorm potential answers to establish what the planning group already knows and draft a provisional list of answers.
3. Review the scientific literature for answers based on empirical evidence and/or theory.
4. Review applicable theories to expand the potential answers.

5. Assess whether new data are needed, and if so, collect and process these.
6. Develop a semi-definite list of answers.

Note that like most aspects of IM, application of the core processes is iterative; therefore, the semi-definite list produced in the sixth phase can always be revised. To read more about the Core Processes, there is an Open Access article at [doi.org/gb59](https://doi.org/gb59).

In this course, there is no time to comprehensively apply these core processes. Therefore, instead, you will mostly just brainstorm potential answers. You can supplement the brainstorm with the literature that is provided (if any) and quick internet searches. To find scientific articles, use OpenAlex.

OpenAlex is an open source bibliographic database with scientific literature which you can access at [openalex.org](https://openalex.org). For example, this link searches for all articles with “determinants” or “psychosocial correlates” in their title, as well as “condom use”.

Make sure to not spend too much on obtaining the best answers. It is important that you understand which choices you have to make and how you can justify those choices. The quality of the evidence and theory you use is crucial in real life, but not important in this course.

## Citing this book

If you cite this work book, please cite it as:

Peters, G.-J., Oei, N. Y. L., & Ruiter, R. A. C. (2024) Intervention Mapping Work Book. Academy of Behavior Change. <https://doi.org/10/nb6j>



# **Part I**

## **Workbook**

# 1 Step 1

Intervention Mapping guides health promotion planners through the process of program design by means of a series of steps and tasks. It also provides tools and aids to structure and monitor the work during the process: matrices, tables, lists and working documents.

In the 4th edition of the Intervention Mapping textbook (Chapter 4), step 1 includes the following learning objectives and tasks:

- Establish and work with a planning group
- Conduct a needs assessment to create a logic model of the problem
- Describe the context for the intervention, including the population, setting and community
- State program goals.

In this workbook, we will do the same work. However, in the following exercises, we deviate from the structure in the book by splitting up each task into subtasks, which makes it all easier.

In this workbook, we use boxes with different colours to clearly signal types of content:

## Guiding questions

Questions to guide the application of core processes (mostly brainstorming).

## Examples

One or more examples to help you along.

## Products

One or more products, usually to complete in the exercise document, associated spreadsheets, or google sheet/presentation.

Note: the .epub version of this workbook doesn't quite seem to be created properly yet. One problem is that these boxes do not have a color. On that note: if you happen to have expertise in this area and are willing to help out, it would be great if you would get in touch with us. The .pdf version seems ok.

## 1.1 Task: Planning group

To ensure that you comprehensively define your problem, IM starts with a *planning group*, the first task of which is to gather data from multiple sources about the problem and its background. This is to better understand all the facets of the problem, and to estimate the feasibility of possible interventions. Usually this will be a combination of a work group and various advisory groups, consisting of members of the community, including those with the problem, often this is your target group (or for instance when you want to change behavior in children, your target group will be the parents of the at-risk group) and individuals with the relevant expertise. Here, your little group is the planning group, but we also want you to think of who would need to be in the planning group.

### 1.1.1 Core Processes

Who would you ask for your planning group? To help answer this question, brainstorm about questions such as:

#### Guiding questions

- Who represents your target population? (e.g. members of the at-risk group are important participants in a planning group)
- Who are possible environmental agents (e.g. decision makers)?
- Who are the potential program implementers (e.g. the professionals who are going to implement your program)?

### 1.1.2 Examples

#### Examples

We want to increase physical activity in young children, and decrease overweight, but the at-risk group is a bit too young for the planning group, so asking parents (possible target group) is an idea.

- Prevention workers and members of the local health council (decision maker)
- The head of schools (implementers)
- Experts in physical exercise and obesity in children
- You also want people who are critical of your ideas, and who are not convinced about the intervention. They may provide you with good feedback that will eventually improve the intervention.

### 1.1.3 Product

#### ! Products

- List the important groups of stakeholders and other populations, groups, and experts that should be included in your planning group.

## 1.2 Task: Conduct a needs assessment to create a logic model of the problem

Step 1 should lead to answers to a series of questions helping in producing a **logic model of the problem**:

*What is the problem, why is it a problem at all, since when it is a problem and for whom it is a problem, what causes the problem, who needs to be convinced this problem should be solved, who must help solve the problem, and, yes, the problem contains social psychological aspects and should potentially be solvable.*

To answer these questions, IM begins with an analysis of community needs and capabilities. This analysis addresses people's quality of life, health concerns and relevant behavioral and environmental conditions, as well as the community capacities that are potentially useful in improving community health.

Brainstorm about the topic: what do you all already know about the problem? When we say 'brainstorm', we mean that you have to try to address all aspects of the problem. Usually, you ask 'what-where-why-who-for whom' questions to get to the bottom of the problem. We help you out for your first 'brainstorm'. In the box below, we listed a series of questions you can ask yourselves to get started. During your brainstorm, you can use some internet searches to get an idea of all aspects of the chosen problem.

### 1.2.1 Core Processes

Remember that in this course, instead of applying the core processes as they are defined in Intervention Mapping, you should stick to brainstorming, supplemented by the provided literature and quick searches for more scientific literature in OpenAlex.

#### i Guiding questions

- What is the central problem?
- Why is it a problem? Is it a serious problem?
- In what sense is it related to health? Who's health?

- For whom is it a problem (target groups; stakeholders)?
- Which age-group (or more specific group) do you target?
- What behaviors are related to the problem, or cause the problem?
- What are the environmental conditions or conditions that are related to the problem?
- Who are the environmental agents who can control the environmental conditions, and what do they need to do to change those conditions?
- What are the determinants or correlates of the behaviors involved, both for the target population, and for the environmental agents?
- Whose cooperation is necessary to help solve the problem?
- Describe the context: How does the environment directly or indirectly contribute to the problem?
- What are the behaviors of the at-risk group?
- What environmental conditions contribute to the problem (at the interpersonal, organizational, communal and societal level)?
- What would be the best intervention setting?
- Who is the at-risk group?
- Who is the target group (can be the same as the at-risk group)?

### 1.2.2 Examples

### 💡 Examples

Example: We want to promote social distancing in Amsterdam and we want to target the older population.

- At-risk group = 60+ years old citizen
- Behavior at risk group = They do not always keep the proper distance when in the streets
- Target group = 60+ years old citizen
- Environmental conditions = the sidewalks are not wide enough
- Environmental agents = the municipality

Example: We want primary school children to exercise more frequently.

- At-risk group = primary school children
- Behavior at risk group = They play videogames all afternoon.
- Target group = parents
- Environmental conditions = no possibility to play outside
- Environmental agents = heads of schools

### 1.2.3 Product

#### ! Products

- List at least four determinants.
- List at least four environmental conditions.
- Produce a diagram that visualises the logic model of the problem.

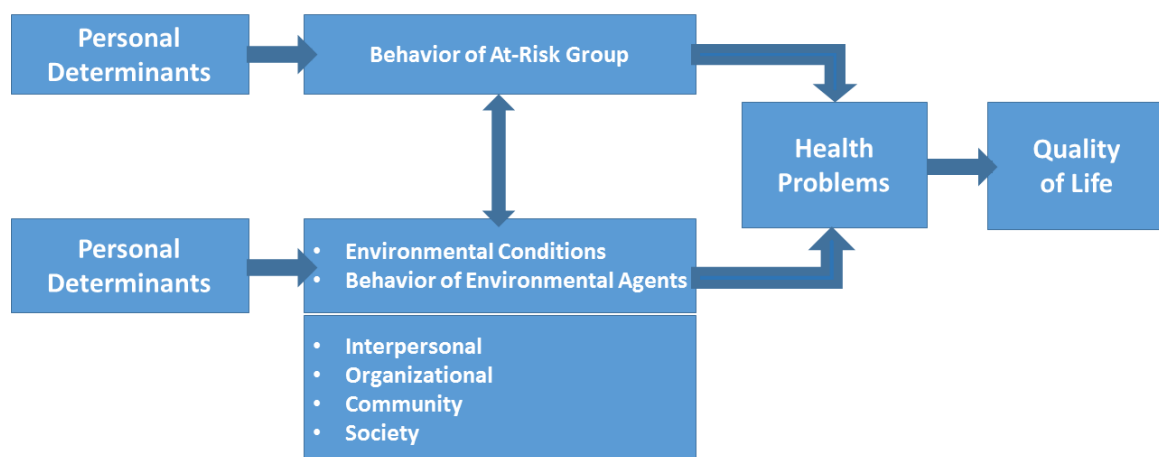


Figure 1.1: Logic model of the problem, see book p. 227.

### 1.3 Task: Describe the context for the intervention, including the population, setting and community

In step 1, you don't only map out the problems and their causes, but you also map out your target population's landscape more generally. Specifically, it's important to identify in which setting the problem occurs (i.e. also aspects that may not play a role for the problem), understand the population (e.g. culture, existing communities, etc), and other assets that you may be able to involve in the intervention later on. This is broadly referred to as the asset assessment. The result is a description of your target population and their surroundings.

This also includes the asset assessment, where you map the specific strengths of the population you want to intervene in. Assets are often mapped for four environment levels: the social environment, the information environment, the policy environment, and the physical environment. Keep in mind that assets are specific characteristics that are not generally true, but specific to your target population (e.g. exceptional infrastructure (physical environment), closely knit community bonds (social environment), a specific social medium that is widely followed (information environment), or good adjustment of policies to local needs (policy environment)).

### 1.4 Task: Stating program goals

Determine your program goals. You prioritize the potential goals on the basis of the needs assessment (see p. 254). This includes deciding what behaviors or environmental conditions are *most relevant* and *most likely to change*.

State in one sentence the expected change of your intervention and its time frame in clear quantifiable terms.

Distinguish the following types of goals:

- Ultimate program goals: these typically involve the quality of life or health of a specific population (the at-risk population)
- Environmental program goals: these are the environmental conditions that you want to change in your program.
- Behavioral program goals: these are the behaviors of the target population you want to change (note that the target population can be different from the at-risk population)

A program always has one or more ultimate goals. The environmental goals and behavioral goals are means to achieve those ultimate goals, but it is possible a program only has environmental goals, or only behavioral goals.<sup>1</sup>

Note that you may want to change behaviors of environmental agents, too. However, in that case, often those *behaviors* are in fact not what is important: instead the environmental

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<sup>1</sup>Note that in step 2, each environmental goal will be analysed and will result in behavioral goals for the environmental agents that have agency over the relevant environmental conditions.

condition that is caused or maintained by their behavior is important. That environmental condition (e.g. a certain norm) is what influences the problem(s) you want to address, so often you are better off specifying you want to change that environmental condition. In step 2, you will identify which behaviors each environmental agent needs to change in order to change the environmental condition.

### 1.4.1 Program Goal

#### **i** Guiding questions

- Which specific target group do we choose?
- What is the current state (e.g. behavior, outcomes)?
- How much behavior change can we expect from our target group?
- How quickly (or in what timeframe) would it be possible to reach that goal? Is this very likely?
- Are effects on relevant health outcomes quantifiable within the chosen relevant and realistic time frame or should we choose a certain behavior or environment?

Note that selecting goals is not a purely theory- and evidence-based decision. It often requires compromises between several interests. For example, there are often political interests. Funders often want to see a certain problem addressed, and may prefer evaluating that problem specifically; or on the other hand, you may collaborate with governmental organisations that want (or don't want) certain outcomes to be selected.

Simultaneously, there are methodological considerations: can that problem be measured well? What effect size would you expect, and is that sample size reasonable? Other considerations are theoretical: how quickly do you expect that a potential outcome can change if your intervention is successful? This is often combined with pragmatic considerations (e.g. how long will you have for the evaluation), and sometimes activist considerations play a role, too (e.g. you might collaborate with a volunteer foundation that prioritizes certain outcomes to enhance visibility).

Finally, in the goal, include both the present state (the 'baseline') as well as the desired result.

### 1.4.2 Examples

#### **i** Examples

Reaching the 60+ population is more difficult, and they are physically slower, so although they are the at-risk group, we now choose the younger adults as target group. To do this in the entire city is not feasible, so we focus at one busy street. To set our goals too far in the future would be useless, so we want fast implementation and fast results. The program goal would therefore be *to increase social distancing of adults*



*under 30 from 60% to 80% on the sidewalk in the Kalverstraat in Amsterdam within 2 weeks.*

- We wanted primary school children to exercise more frequently. We chose the following program goals:
  - *to increase physical activity in children between 6 and 10 from an average of by 26 minutes per week to 52 minutes per week and to decrease weight in the overweight children from an average of 72kg to 65kg, following 2 years of our intervention at the schools in Amsterdam-Noord.*
  - *to decrease weight in the overweight children between 6 and 10 from an average of 72kg to 65kg, following 2 years of our intervention at the schools in Amsterdam-Noord.*

Note that we separated increasing activity and decreasing weight. Here we might picked the parents as the target group (we need them to bring the children to the extracurricular gymnastic classes) or the heads of schools in Amsterdam-Noord (who need to implement our intervention program at their school). By the way: the program goals should be feasible! Our examples might not be that feasible, but at least we focused at a specific age group of children in a specific area (Amsterdam-Noord), instead of ‘all children in the world’.

### 1.4.3 Products

Although “in real life”, it is quite possible to not have any behavioral program goals, when working with this workbook, you *must* select a target group (which can be either the at-risk group or a different population) and a behavioral goal.

#### ! Products

- List the ultimate program goal(s).
- List the environmental program goal(s), if any.
- List the behavioral program goal(s).

## 2 Step 2

In step 1, the focus was on the problem and the corresponding problematic behaviors. However, when you want people to do something differently, you have to be able to recommend a course of action to replace the undesirable behavior or to increase healthy behaviors: you want to *change behavior*. IM experts call this “the Flip”. Step 2 starts with this “Flip”.

In the 4th edition of the Intervention Mapping textbook, step 2 is discussed in Chapter 5, where the following learning objectives and tasks are discussed:

- State expected outcomes for behavior and environment
- Specify performance objectives for behavioral and environmental outcomes
- Select determinants for behavioral and environmental outcomes
- Construct matrices of change objectes
- Create a logic model of change

In this workbook, we still do the same work. However, the following exercises deviate from the structure in the textbook, as it is easier to split up each task into subtasks.

There is a lecture with step 3, which starts with step 2, at <https://youtu.be/OoFM5dBSjVU?si=PtuKd3giN1WTamBc>, with part two at [https://youtu.be/u5UG55AiFpg?si=t6Xk9Q\\_bPzR5xYFU](https://youtu.be/u5UG55AiFpg?si=t6Xk9Q_bPzR5xYFU).

### 2.1 The Flip

In Step 1, your focus was on understanding the problem at hand. However, successful behavior change means you have to support a desired behavior, not so much discourage an undesired behavior. Therefore, Step 2 of Intervention Mapping starts with The Flip: a deliberate shift in perspective from the problem to the solution. From this point forward, your work in Step 1 serves as a background against which you map what should change to accomplish the program goals with which you concluded Step 1. In *some* cases, determinants identified in Step 1 may make a reappearance in an inverted form (e.g. in Step 1, “low self-efficacy” may have been identified as a factor contributing to the problem; in Step 2, this may be reflected in identification of “self-efficacy” as a relevant determinant and an objective to increase self-efficacy). However, after The Flip often the assumed determinant structure changes, with some determinants disappearing, others being added, and some being changed.

### 2.1.1 List target group

First, you decide on the target group (the population whose behavior your program should change). This can be the at-risk group, but it is also possible that your intervention will have to target another group. For instance, when your at-risk group is “new-born baby’s” your target group will likely be the parents, or GP’s.

### 2.1.2 Define the target behavior

Second, you define the target behavior. This is the desirable behavior of the target group: what should they do exactly?

### 2.1.3 List environmental conditions

Third, list the environmental conditions you want to realise. Similar to the target behavior, this should be the desirable state.

*Note that in step 1 environmental program goals are not always specified. In that case, you also do not specify environmental conditions here yet (but you may still end up specifying environmental conditions below).*

Environmental conditions typically resolve or mitigate barriers your target population may encounter. Make sure you do not fall into the trap of including “potential interventions” here.

#### Examples

In many situations (but not all), examples of “wrong” environmental conditions are:

- The school does not provide enough education
- Or, formulated flipped into the desirable state: the school provides adequate education
- Parents (or peers, colleagues) do not discuss subject X enough

These are problematic because you’re sneakily thinking about interventions you might want to implement. However, if you start thinking about interventions/solutions already in this phase, you will narrow your perspective and become biased, prohibiting you from attaining a full understanding of the situation.

In addition, realize that environmental conditions are typically things that could come out of an interview with a target population member. Because of this, they are often not the absence of something (people rarely experience the absence of something as a barrier).

## 2.2 Identify sub-behaviors/performance objectives

Target behaviors are often very broadly defined (see the examples below). It is therefore important to identify the *sub-behaviors* that make up the target behaviors. These ultimately being objectives you want to achieve with your intervention, In Intervention Mapping, these sub-behaviors are called Performance Objectives.

### Guiding questions

To identify the performance objectives for your target behavior, ask yourself the following question: “What do the people have to do to perform this target behavior?”

Formulate performance objectives in a way that includes the target group and that makes them measurable and that describes action, for example in the form of a statement like “[target population] [sub-behavior]”, such as “Women recovering from breast cancer register at their local gym”.

A major mistake is to formulate performance objectives as determinants, for example, by expressing skills or knowledge. For example, “X should be able to do Y”. That statement does not describe the performance of an action; it describes a prerequisite for performance of an action. A performance objective should be: “X does Y”.

A useful guideline is that if all performance objectives, as you formulated them, are true, the target behavior should by definition be performed. For example, if the statements “University students consistently carry condoms” and “University students consistently use condoms when engaging in sex” are true, you know that the target behavior “condom use” is achieved. That is, assuming these two performance objectives exhaustively cover the target behavior!

### Examples

For example, when the target behavior is “washing hands”, valid sub-behaviors/performance objectives are:

1. Use soap
2. Wash hands at least 20 secs
3. Clean thoroughly (also the wrists, and under the nails)
4. Use paper towel to dry hands
5. Use paper towel to close the watertap

For example, when you like to promote condom use (health promoting behavior), you want people to plan condom use.

1. Plan to purchase condoms
2. Go to the store and buy condoms
3. Use condoms

### Products

- List the performance objectives that comprise the target behavior.

“In real life”, if you did not select a target group and target behavior in The Flip, you do not select performance objectives here yet. Also note that even if in another situation, you do not select a target population and a target behavior, you will still select performance objectives for your environmental agent(s). The concept is quite central to Intervention Mapping.

## 2.3 Identify environmental conditions and environmental agents

In this section, you merge two lists:

1. All environmental conditions that you listed in The Flip; and
2. All environmental conditions for the performance objectives.

### Guiding questions

For each performance objective, specific environmental conditions may be relevant. To identify these think about what could be barriers hindering each performance objectives, and what could facilitate them?

### Examples

- Target behavior: handwashing at work
  - Environmental condition = Soap is available in every bathroom at work
  - Environmental agent = the boss (the boss is at the organisational level)
  - Environmental agents' target behavior = the boss provides soap
    - \* Performance objective 1: the boss buys soap
    - \* Performance objective 2: the boss tasks employee to regularly refill soap containers
- Target behavior: condom use in gay sauna
  - Environmental condition: Sauna visitor is welcomed in a non-judgmental fashion towards using condoms in the sauna
  - Performance objective 1: Sauna employees receive customers in a non-judgmental fashion and have an empathic attitude (interpersonal level)
  - Performance objective 2: Sauna owner buys condoms (organisational level)

### Products

- List all potentially relevant environmental conditions.
- For each environmental condition, list the corresponding environmental agent(s).
- For each agent, list their environmental level (i.e. the interpersonal level, the organizational level, and the community / societal level).

## 2.4 Identify environmental agent (sub-)behaviors

Environmental agents (the people, groups, or organisations that have the agency to control one or more environmental conditions) control their corresponding environmental conditions through their behavior.

To achieve the environmental conditions you aim for, you need to identify what those environmental agents need to do. Similar as for target groups, this means identifying the constituent performance objectives (sub-behaviors).

### 2.4.1 Target behaviors

In many cases, environmental agents will be involved in work you yourself are unfamiliar with, so a good specification of the target behaviors is sometimes not straightforward. Fortunately, broad definitions are acceptable at the target behavior level.

### 2.4.2 Sub-behaviors / performance objectives

Because target behaviors for environmental agents are broadly defined, intervening on them requires specification. You specify them by formulating sub-behaviors or performance objectives. So, repeat what you did for the target group, but do it now for the environmental agents' target behaviors.

#### Guiding questions

To find out the performance objectives for the environmental conditions, ask yourself the following question: “What does the environmental agent *need to do* to accomplish the changes in environmental condition?”

#### Examples

- Environmental condition = hand hygiene resources are available for employees
  - Environmental agent = employer
  - Target behavior of environmental agent = “make hand hygiene resources available”.

- This target behavior is accomplished through the following performance objectives:
  - \* employer adjusts budgets for purchasing soap, towels, etc
  - \* employer task somebody with ensuring full soap dispensers
- Environmental condition = people keep 1.5 meter distance in a small street
  - Environmental agent = municipality
  - Target behavior of environmental agent = “clearly indicate with signs that people should keep distance”
    - \* Performance objective = municipality orders the placing of signs (organisational level)

### ! Products

- List the target behavior for each environmental agent
- List the performance object for each target behavior

## 2.5 Identify determinants and sub-determinants

If you get to this point, you mapped out the more concrete parts of the intervention. You should next get a clear idea of what the world should look like: what do you think the environment of the important groups in your situation should look like, and how should everybody in those groups behave (at-risk group, the target group, and/or one or more environmental agents)?

To achieve these even more tangible goals, people shall actually have to change their behavior. The behavior of the at-risk group and the target group is directly relevant to your intervention, and the behavior of the environmental agents is instrumental to achieving the environmental conditions.

Roughly speaking, people’s behavior is a consequence of their environments and their psychology. You have identified the relevant environmental influences and processed them above as environmental conditions, which yielded environmental agents and their behaviors (and potentially, more environmental conditions). That means that at this point, only psychology remains.

There are many theories that explain why people behave like they do. Each theory is designed for a specific purpose: some deal with habitual behavior, some with health behavior, some with reasoned behavior, and some with impulsive behavior. These theories postulate constructs to describe aspects of the human psychology that, according to the relevant theory, contribute to determining behavior. In the context of behavior change, constructs that are theoretically assumed to predict behavior are called *determinants*.

Determinants are generally defined at a general level. For instance, attitude, knowledge, habits, perceived norms, self-efficacy, willingness, self-identity, and risk perception are all

determinants. Such general definitions are useful when studying human behavior over a variety of populations and behaviors, but the generic level of definition provides no guidance for intervention development. For an overview of determinants, see Psychological Construct Repository at <https://psycore.one>.

In an intervention, you don't target "attitude" or "knowledge": you communicate about specific facts or list specific advantages or disadvantages. Therefore, when developing a behavior change intervention, the most important thing is identifying the more specifically defined sub-determinants.<sup>1</sup> You identify the relevant sub-determinants and determinants for each performance objective in two steps: listing, en selecting.

### 2.5.1 Long-list sub-determinants and determinants

First, you establish a long list by simply including everything that might be important. Normally, you do this for every performance objective - for the target behavior of your target population, but also for the target behavior of each environmental agent. In real IM life you use all core processes and thus should look at theories, literature (e.g. meta-analyses), do your own experimental studies, or qualitative research, or do all of them. However, in this workbook, just select one environmental agent.

#### Guiding questions

- Brainstorm and use literature and behavioral theories (see chapter 2 of the book) to compile a long list of determinants for the individuals' target behavior and for the environmental agent(s).

#### Examples

Target behavior individual = hand washing

- Sub-determinants of the individuals' target behavior:
  - expectations regarding effectiveness of hand washing (belongs to determinant attitude);
  - degree to which hand washing is automated (belongs to determinant habit);

Environmental agent = employer

- Sub-determinants regarding hand washing:
  - belief that hand washing will reduce work production (belongs to determinant attitude);
  - belief that illness will reduce work production (belongs to determinant attitude);

---

<sup>1</sup>Note that it is also crucial to know the corresponding overarching determinants - you will need that information in step 3.



- the perception that promoting hand washing is approved of by other employers (belongs to determinant perceived norms)

Environmental agent = Gay sauna owner

Target behavior = promoting safe sex in his sauna

- Sub-determinants regarding safe sex:
  - expectation that more customers will come when free lube is provided (belongs to determinant attitude);
  - potential false belief: the belief that provision of free lube will result in substantial spillage which entails the risk of people slipping (belongs to determinant attitude)

Target behavior individuals = keeping distance from each other in the busy street

- Sub-determinants regarding social distancing:
  - belief that becoming ill sooner than later is a positive thing because ICU's might be full in two months (belongs to determinant attitude);
  - expectation that one's immune system is strong enough (belongs to determinant attitude);
  - the perception that elderly people in the streets are especially at risk (belongs to determinant **personal norms** or moral norms)

### ! Products

- Create a long list of potential (sub-)determinants in the spreadsheet linked to from the Google doc (complete columns A-E).

## 2.5.2 Select, defer, or forgo sub-determinants and determinants

Second, you go through the list and you select those (sub-)determinants and determinants you wish to keep for your intervention. There are three potential actions at this point:

1. *Select a (sub-)determinant*: you will retain this (sub-)determinant for step 3, to target it with your intervention.
2. *Defer a (sub-)determinant*: you lack the resources to (also) target this (sub-)determinant in this intervention. You think that this (sub-)determinant is important (and changeable), but you keep it for potential future iterations of your intervention.
3. *Forgo a (sub-)determinant*: you decide that the (sub-)determinant is probably not so important for the target behavior; or that it is important, but not changeable with the means you have available or can conceivably secure in the future.

Select from your list the most relevant determinants for your intervention that are important - *they contribute significantly to the behavior (0, +, or ++)*, and that are *changeable* - *they*

can be changed with the available methods (0, +, or ++). Consult the literature and your common sense to make these decisions.

### Guiding questions

- Read ‘Rating importance of determinants’, IM Book, pp. 306-308.
- Decide for each determinant whether to select, defer, or forgo it, based on information about the determinants’ associations to (proxies of) behavior in the case of the population (e.g., your target group or an environmental agent), and information about the changeability of the determinants, for example based on psychological theory.

### Examples

Here are links with examples of determinant selection based on importance and changeability:

- Cannabis use: <https://www.healthpsychologybulletin.com/articles/10.5334/hpb.18/>
- Eating behavior: <https://www.sciencedirect.com/science/article/abs/pii/S0195666320300672>
- Using a high dose of MDMA: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5508122/>

### Products

- Process each sub-determinant listed in the spreadsheet doc and select, defer, or forgo each (sub-)determinant (complete columns F and G)

## 2.6 Select environmental conditions (and so, agents), and sub-behaviors and sub-determinants

Out of the long list of potentially important stuff, decide which you select. If you do not select something, you can either defer (retain for potential later intervention) or forgo (eliminate, e.g. because it’s irrelevant).

### Examples

Selection based on how important stuff is for the behavior (relevance; usually correlational evidence) and how easy it is to change something (sadly, this is too often just anecdotal evidence; sometimes for determinants meta-analyses or systematic reviews)

## ! Products

- List your decisions regarding environmental conditions and agents

## 2.7 Produce Matrices of Change Objectives

Matrices of change objectives are generally made for each level of intervention planning:

- Individual
- Interpersonal
- Organizational
- Community
- Societal

Change objectives are the specific goals of your intervention. Change objectives literally state what should change at the individual levels, or what should change among environmental agents. A change objective is a sub-determinant that you selected from the long list, but reformulated. You formulate change objectives according to similar principles as you applied for performance objectives. Change Objectives are statements that, when true, mean that the corresponding sub-determinant has been achieved. The idea is that while sub-determinants express a psychological state or process, change objectives are formulated to be measurable (**‘SMART’**).

SMART refers to:

- **Specific:** Define your change objectives as specific as possible: e.g., what should change in the target group and/or the environment in order to deal with or reduce the health-related problem. What should change, among whom?
- **Measurable:** Can you measure the change (objectives)?
- **Achievable:** Are the change objectives you set achievable and attainable?
- **Realistic:** Can you realistically achieve the objectives with the resources you have?
- **Time:** Within what period will you achieve your change goals?

## i Guiding questions

For change objective at the individual level ask: *“What do people need to learn with regard to the determinant to do the performance objective?”*

- For example, for a change objective regarding self-efficacy, you might ask: *“What do people need to learn with regard to self-efficacy to carry a condom?”*

For environmental level change objectives you might ask: *“What do agents need to*

*learn with regard to the determinant in order to do the performance objective?”*

- For a change objective regarding social norms in the community you might thus ask: *“What do people in the community need to learn in order for the person to keep a social distance in a busy street?”*

Formulate change objectives in a way that makes them **measurable** by using active verbs such as “shows”, “indicates”, “demonstrates” etc; see page 317 of the IM book for examples of active verbs (4th ed.: Table 5.10, p. 317).

Note that (sub-)determinants that you decided to defer or forgo are *not* included in your Matrix of Change Objectives.

### Examples

**Background Step 2:** IM change objectives have to be specified explaining *who and what will change as a result of the intervention*.

- the *individual level of change*, e.g., “adolescents express confidence regarding negotiating condom use with a sexual partner”
- the *organizational level change*, e.g., “sauna owners acknowledge the advantages of condom distribution in the sauna”
- or the *community level change*, e.g., “community leaders approve of extracurricular physical workouts in school buildings”.

Sometimes formulating change objectives is relatively straightforward, for example when the sub-determinant is an expectation (i.e., the expectation that moderating one’s alcohol use has the benefit of feeling more fit the following day can be formulated as a change objective as “... explains that moderating alcohol use makes one feel more fit the following morning”.

Sometimes, it is harder to see which behavior forms evidence of having successfully changed the sub-determinant. For habits, for example, this behavior should be evidence that a cue-response association has been changed or created. For example, concerning dental hygiene, a cue-response association that you may want to establish is the response to use dental sticks after a meal. The cue, then, is finishing the meal. A change objective corresponding to this sub-determinant could be “... reports that finishing a meal prompts getting a dental stick from their bag”.

The Matrix of Change Objectives is structured as follows:

- Each row corresponds to a performance objective;
- Each column corresponds to a determinant;
- Each cell contains all change objectives for that performance objectives and determinant.

Note that some cells will contain multiple change objectives, and some cells will be empty, because not all determinants are important for all performance objectives.

### ! Products

- Produce a Matrix of Change Objectives for each target behavior (for the target group and for each environmental agent).

## 2.8 Start on the logic model of change

The logic model of change is a model showing how you expect your intervention to work. These logic models can be easily produced using Acyclic Behavior Change Diagrams (ABCD).

To produce the ABCDs, you first fill in the ABCD matrix. The ABCD matrix is a table into which you copypaste (in columns 4, 5, 6 and 7) the information in your Matrix of Change Objectives. This ABCD matrix is then used to produce the ABCD itself.

Open the Matrix of Change Objectives that you just produced, and open the empty ABCD matrix provided in the Google document. Then, copy the following cells from the Matrix of Change Objectives spreadsheet to the ABCD matrix spreadsheet:

- Cell A1 lists the target behavior: copy it to cell G2, and then duplicate it to the cells in column G for every row you end up filling in the ABCD matrix.
- The row headers (column A) contain the performance objectives (the sub-behaviors). Copy these to column F of the ABCD matrix.
- The column headers (row 1) contain the determinants. You will eventually copy these to column E of the ABCD matrix (but see the next bullet).
- In the cells, the Matrix of Change Objectives contains the Change Objectives themselves. These are sub-determinants that have been rephrased conform the specific guidelines for Change Objective phrasing. Each of these sub-determinants/Change Objectives has its own line in the ABCD matrix. The sub-determinant/Change Objective itself is in column D of that row. Note that the Matrix of Change Objectives can have multiple Change Objectives in one cell. Some cells in your Matrix of Change Objectives may thus end up corresponding to multiple rows in your ABCD matrix, because in your ABCD matrix, it is crucial that each sub-determinant/Change Objective has its own line.
- After you copy-pasted all sub-determinants/Change Objectives into column D of the ABCD matrix, verify that every row also has the corresponding determinant in column E, the corresponding sub-behavior/performance objective in column F, and the corresponding target behavior in column G.

You will fill in columns A, B, and C in step 3.

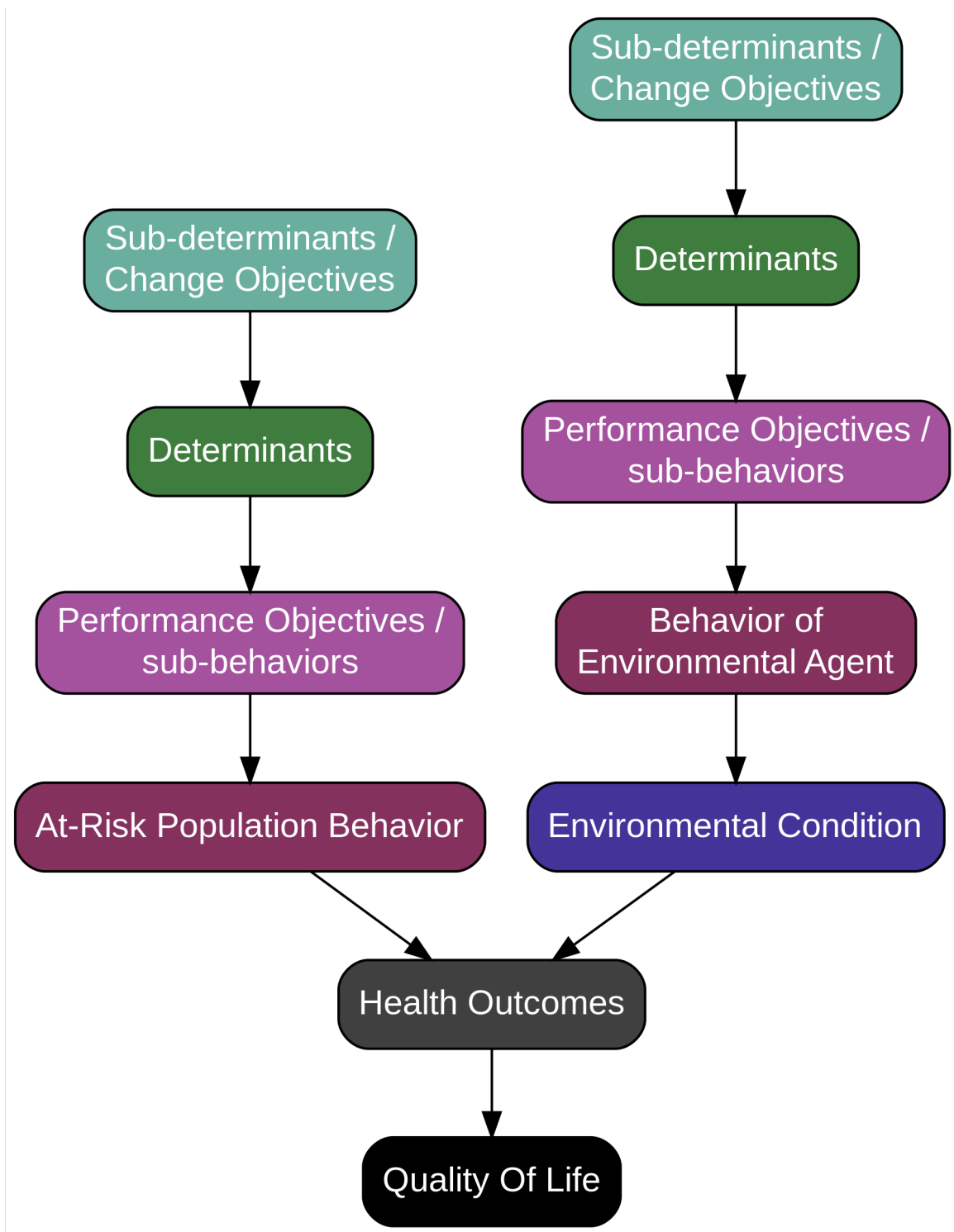


Figure 2.1: Logic model of Behavior

## 3 Step 3

You produced a matrix of change objectives and you started on the Acyclic Behavior Change Diagram (ABCD; the logic model of change) in the previous step. In step 3, you complete this ABCD by filling in the three leftmost columns. You will then wrap all this together into one coherent intervention by producing a program theme, designating each application to one or more program components, and deciding on the components' sequence and the program scope.

In the 4th edition of the Intervention Mapping textbook, step 3 is discussed in Chapter 6, where the following learning objectives and tasks are discussed:

- Generate program themes, components, scope, and sequence
- Choose theory- and evidence-based change methods
- Select or design practical applications to deliver change methods

Pages 345-364 of the fourth edition of the IM book cover these tasks and give some examples. In this workbook, we still do the same work. However, the following exercises deviate from the structure in the textbook, as it is easier to split up each task into subtasks.

### 3.1 Select methods and applications

Column D of your ABCD matrix contains the complete list of aspects of the psychology of the relevant target group (e.g. your intervention's target group, or an environmental agent, or an implementer, see Step 5). Each sub-determinant/Change Objective must be targeted by at least one application in your final intervention.

Therefore, it is best to start by thinking about which methods and applications you want to use. This depends on what is available in your intervention: if the intervention contains interactive elements, other methods are available than if you have to work with mailings or bill boards (letters/mailings or bill boards are cheaper, and can be more accessible, than other channels).

Deciding on your methods and applications is an iterative process, and you can approach it from both directions: either you start thinking from which theoretical methods you want to use, and then think about how to apply them; or you can start thinking about what your intervention will look like (the application) and then decide which methods are suited for those applications.

The important thing is that for every Change Objective in column D of your ABCD matrix, you specify which method you will use to target it in column A; how you will apply that

method in column C; and how, in that application, you will implement that method's parameters for effectiveness in column B.

If you target a Change Objective with multiple applications and/or methods, copy its row, in such manner that you end up with an ABCD matrix where every row lists exactly one structural-causal chain.

Use the determinants in column E to select the methods (the tables referred to above are organised per determinants).

#### Guiding questions

- Study Tables 6.5 to 6.18 in Chapter 6 (pages 345-433 of the 4th edition of the IM book) or the tables in the supplementary materials available at <https://osf.io/ng3xh>.
- Select theoretical methods for your Change Objectives. If you are unable to identify methods but able to identify applications, ask yourself – why would it work? The answer will lead you to a method.
- Complete columns A, B, and C of your ABCD matrix.
- Do this both for the ABCD matrix of the target group and for one environmental agent. Note that for environmental agents, different methods exist depending on their environmental level.

#### Examples

As you will see in the 2 examples, every ABCD matrix looks different. So, do not immediately think you did something wrong if it is not entirely similar to the examples.

- A list of student-produced ABCD matrices for different behaviors is available at <https://im-wb.com/abcd-examples>
- A simple ABCD matrix for refraining from using a high dose of MDMA is available [here](#)

#### Products

- Produce a full ABCD matrix and the corresponding diagram.

## 3.2 Themes, components, scope and sequence

The Acyclic Behavior Change Diagram you produced is the blueprint for your intervention. However, it still is far from a coherent whole. It should still be tied together into a coherent intervention.

To achieve this, you need to *organize the applications* (column C from your ABCD matrix) into components. Next, you decide on *the sequence*; the order in which the components will



be presented, and decide on *the scope* of each component (e.g., are there topics that should not be addressed?).

You also need a theme. You can think of the theme as the ‘face’ or ‘corporate identity’ of your intervention. How do you “call” your intervention and present it to your target group and to implementers?

#### Guiding questions

- Generate ideas about possible themes, components, the scope and sequence of the program (see page 355 in the book)

#### Examples

- This is really the moment to be creative together! Of course you could find themes on the internet of well-known interventions, which might inspire you, but first seeing other examples might be creativity-crippling and turn you into a copy-cat. We therefore will not give you any examples.

#### Products

- Complete the table in the “Themes, components, scope and sequence” section in the google document.

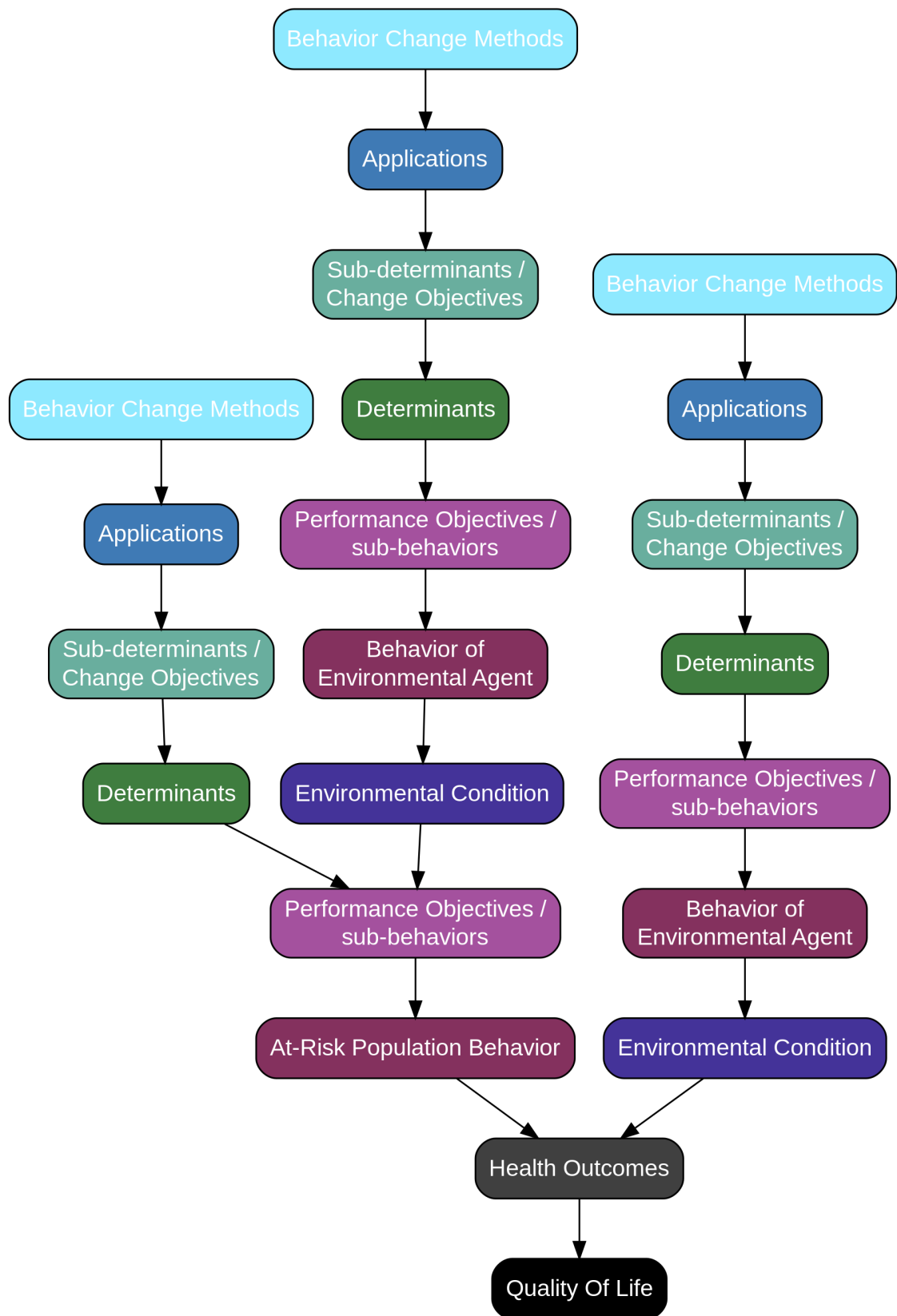


Figure 3.1: Logic Model of Change

## 4 Step 4

### 4.1 Program production

- Read IM book on Program production (pp. 435-476) as a preparation.

### 4.2 Program plan

- Your program plan needs a good structure. You first organize the methods and applications of choice in a program plan that describes who must do what and when, considering available channels and the delivery systems. The program structure should describe the following:
  - the themes (general organizing constructs) (p.356)
  - the scope of the program (the breadth and amount of the program) (p. 358)
  - the sequence (the order) of program activities (p. 358)
  - the delivery vehicles/channels (questions are: what, when, where, how much, how often?) (p. 359)
  - The book emphasizes cultural relevance (p. 438), but when you are a Development and Health psychology student, you might need to be aware of age-relevant issues and developmental stages.

### 4.3 Program materials

Program materials should support your program, and logically follow from the change objectives that you have formulated in step 2, and the methods and applications that were chosen in step 3. The program should reach the intended at-risk population or target group, and the environmental agents, so the **delivery context or setting** are important to consider.

- Prepare plans for program materials: Create specifications and working documents.

- Working documents express the themes and messages of the materials. Points to consider: type of application, length, feasibility, salience, production qualities, design, clarity, etc).

Specify the necessary creative resources (program producers) so that you can produce the applications.

Remember that you have to collaborate with experts in different professions and that you are the only expert aware of the parameters of the methods; check the (step 3) applications for parameters!

#### 💡 Examples

Example format for program material plans:

Program Components	Description	Producers
Poster	The poster to hang in the billboards.	Production Company Name X
Website frontend	The interface that end users of the website are exposed to.	Webdesign Company Y

Note that especially the “Description” should normally be considerably more extensive.

#### ! Products

- Produce program material plans.

## 4.4 Draft messages, materials and protocols

Once you have an overview of the program components, you start drafting these components. This is described in the IM book on pages 456-464.

## 4.5 Pretest, refine, and produce materials.

- How would you pretest the program applications and materials?
  - Pretest materials on members of the target population and professionals
  - Evaluate the results
  - Anticipate implementation before you finalize the applications and program
  - Check: Are all your change objectives still in the final program?

Of course you will not be able to do all these things in this workshop but in real life IM you shall have to take these steps too.

This is described in the IM book on pages 464-468.

# 5 Step 5

## 5.1 Planning program adoption and implementation

- See Chapter 8 of the book on step 5.

Step 5 is about how to implement the program: *Who has to do what to keep the program up and running*. You want the program that you have developed to be used widely, you want it to be used the way you intended it to be used and you hope it will be used for quite some time. It is therefore very important that potential program users, or implementers, are actually aware of the existence of the program, are motivated to use it, understand how to use it, etc. Consequently, you will have to repeat all the IM steps, but now aimed at the program users (who are now your target group).

So, start step 1 again, with identifying potential *adopters and implementers*.

Then, adapt your planning group (re-evaluate who should be in there), etc.

### Examples

Example of more exercise for young children at schools:

- Who executes your programme or intervention?
  - Our intervention for young overweight children will be adopted by parents and teachers.
- How will they know that our intervention exists?
  - Head of schools should inform them.

Example for social distancing in the Kalverstraat:

- Who executes your programme or intervention?
  - The shopkeepers will adopt our intervention.
- How will they know that our intervention exists?
  - The municipality should inform them.

## **Part II**

# **Appendices and references**

## 6 References

Bartholomew Eldredge, L. K., C. M. Markham, R. A. C. Ruiter, M. E. Fernàndez, G Kok, and G. S. Parcel. 2016. *Planning Health Promotion Programs: An Intervention Mapping Approach*. San Francisco: Jossey-Bass.



## 7 Glossary

In the definitions in this glossary, terms that refer to concepts that are defined elsewhere in the glossary are printed in *italic*.

### 7.1 General terms from psychology

**Behavior** Behavior is often defined as muscle activity. In Intervention Mapping, behavior is defined a bit more broadly and can include decisions people take. Behaviors are always processes that take place over time. Although the duration can be brief (e.g. for decisions), you can always identify a time when a behavior was not yet engaged in and a time after people have engaged in the behavior. This is very different from determinants, which describe a psychological state, not a process (although an exception is that determinants can sometimes describe the desired manner in which a psychological process should unfold).

**Construct** In psychology, a construct is usually a hypothesized psychological variable or process. Construct definitions describe which aspects of human psychology comprise that construct. Some examples of psychological constructs are attitude, positive affect, working memory, extraversion, depression, stress, executive functioning, self-regulation, planning, sadness, habit, intrinsic motivation, and risk perception. Constructs are generally not natural kinds: they do not exist in the world as discrete, modular things that exist regardless of what humans think about them. Water ( $H_2O$ ) is a natural kind (all molecules consisting of two hydrogen atoms and one oxygen atom is water, and vice versa), but “attitude” does not exist independently of our definitions. Because these constructs don’t exist as such, different psychological theories often capture the same psychological aspects but ‘slice’ human psychology differently. Those aspects of human psychology corresponding to the representation of the potential negative consequences of engaging in drinking large quantities of beer are defined as part of risk perception by some theories; outcome expectation by other theories; and attitude by other theories.

**Determinant** In behavior change science, a determinant (also called behavioral determinant or psycho-social determinant) is a modifiable psychological construct that is hypothesized to cause behavior (or contribute to causing behavior) by at least one theory. From this general definition, it follows that determinants can in principle describe psychological processes, but they almost always describe psychological states, or dimensions along which a set of states are organized, instead. For example, a determinant of behavior is an attitude: people can have a very positive attitude, a mildly

positive attitude, or a negative attitude. This state is assumed to (partially) determine their behavior. Like constructs, determinants can be defined on a spectrum from very generic to very specific. “General self-efficacy” is a very generically defined construct; self-efficacy as applied to a given target behavior is more specific; and somebody’s expectation that a certain barrier will prohibit them from engaging in a given target behavior is even more specific. All three are determinants; but along this spectrum, there is a point where determinants are so specifically defined that they become sufficiently concrete to communicate about them in an intervention, and determinants that are so specific are called *subdeterminants*. For example, general and specific self-efficacy are abstract, generic determinants: but the expectation that condoms can be obtained for free is very specific and concrete. The latter relates to the potential barrier that condoms are expensive, and this *subdeterminant* can directly inform intervention efforts.

**Logic model** A logic model is a diagram that visualizes (theoretical, empirically derived, or hypothetical) relationships between concepts. Those concepts can be pretty much anything, such as constructs (e.g. attitude, intention, stress), mechanisms, processes or behaviors (e.g. goal setting, doing the dishes, buying a beer), or other aspects of the natural world (e.g. the weather, the state of the environment, whether it’s day or night). The relationships, too, can be pretty much anything, such as causal relationships (one thing causing another) or structural relationships (such as one thing being made up of other things). Some specific types of logic models exist, such as Directed Acyclic Graphs (DAGs; used to reason about causal inference in psychological science and other sciences), Acyclic Behavior Change Diagrams (used to represent the causal and structural assumptions underlying a behavior change intervention), the PRECEDE diagram (used to represent the results of a needs assessment), and a COMPLECS overview (also used to represent the results of a needs assessment).

**Theory** A theory is an explanation of a bit of the world. Theories in the social sciences often hypothesize (and then define) one or more (e.g., psychological) constructs and then describe how they relate to each other. For example, the Intervention Mapping book lists a series of theories that explain human behavior. Theories are by definition constrained to small parts of reality. For example, the Reasoned Action Approach explicitly explains reasoned action (and so makes no effort to explain habitual behavior; note, though, that reasoned is often not rational); the Health Belief Model explains how health beliefs influence health behavior; the Common Sense Model of Illness explains how lay people think about illness; etc. This clear delineation is a feature of theories, not a bug - and this is why in applied research and in behavior change intervention development, it is almost always necessary to adopt an eclectic approach and combine multiple theories.

## 7.2 Intervention Mapping terms

**Change Objective** Change Objectives are *subdeterminants* that have been formulated according to a specific set of guidelines. This means that they have to describe a behav-

ior that, if the corresponding target individual performs it, provides evidence that in the target individual's psychology, the corresponding subdeterminant has the desired state. For example, the subdeterminant "the expectation that using a condom prevents HIV", a subdeterminant that is an instance of overarching determinant "instrumental attitude belief expectation" can be reformulated into "an adolescent explains how condom use prevents HIV". Note that Change Objectives are representations of the corresponding subdeterminant - even though they are formulated as behaviors, the behavioral component is purely instrumental to facilitate formulating the Change Objective in a way that lends itself to measurement. Change Objectives, therefore, are psychological constructs (very specific psychological constructs, just like the subdeterminants that they express), not behaviors or performance objectives.

**Environmental Agent** Environmental agents (sometimes called environmental actors) are people or groups of people that have agency over one or more environmental conditions. They are often decision makers or similarly central stakeholders, such as school or hospital boards, teachers, or nurses. Environmental agents often exist on one or several environmental levels.

**Environmental Condition** An environmental condition is an aspect of the environment of the target population, of an environmental agent, or of an implementer. Environmental conditions usually describe a state of the world, for example, "condoms are freely available", "there are many facilities for exercise", or "sufficient healthy options are on offer in the school cafeteria". Environmental conditions are under the control of environmental agents.

**Environmental Level** An environmental level is the level at which an environmental agent exists. These levels determine which methods are available for targeting those agents. Usually, the levels that are distinguished are the individual level (i.e. not an 'environmental' level), the interpersonal level (e.g. peers or family), the organizational level (e.g. a hospital or school), the community level (e.g. a church or social organization), and society level (e.g. local or national government), and the global level (e.g. the WHO, the UN, etc).

**Performance Objective** A performance objective is a sub-behavior. The concept is used to get more fine-grained insights into the determinants and environmental conditions that together predict a behavior. For example, if you want to promote condom use, people will have to acquire condoms, discuss condoms with their partner, and appropriately use the condoms. These three sub-behaviors have different determinants and environmental conditions, some of which more easily escape notice when not considering behavior at the more specific sub-behavior level. Performance Objectives (POs) are called Performance Objectives, because, like Change Objectives, they have been selected as objectives to intervene on (i.e. as sub-goals). In other words, a target behavior may consist of more sub-behaviors than are selected as intervention targets, and in that case there are fewer POs than sub-behaviors.

## 7.3 Non-IM behavior change terms

This section mostly lists additional terms related to tools created by Crutzens & Peters.

**ABCD** An Acyclic Behavior Change Diagram is to step 3 of IM what a Matrix of Change Objectives is to step 2: it succinctly illustrates which

**Aspect of the human psyche** An aspect of the human psyche is a raw expression of somebody's psyche (e.g. "I really hate broccoli!" or "At that party, everybody was drinking cocktails."). Aspects can be categorized into specific psychological constructs (e.g. into (sub)determinants). Aspects can be identified, for example, in qualitative data such as interviews transcripts, or from information provided by experts or target population members in the planning group.

**COMPLECS** COMPLECS is a recursive acronym for COMPLECS Organises Multiple Players & Linked Environments using Connected Specifications. When developing a behavior change intervention, it is first necessary to obtain a comprehensive in-depth understanding of the problem. For example, the Intervention Mapping protocol dedicated the first step, the Needs Assessment, to this endeavour. In this phase, maintaining an overview can be challenging, as all the myriad aspects of reality that are, or may be, relevant are collected and related to each other.

**CIBER plot** A Confidence Interval-Based Estimation of Relevance plot is a visualization to help select (sub-)determinants to intervene on. It shows two estimates that are important: each (sub-)determinant's univariate distribution (the mean as well as individual participants' scores) as well as each (sub-)determinant's association to behavior or a proxy of behavior (e.g. intention or an intermediate determinant). COMPLECS was developed to help to keep an overview during this process. It allows adding new information in a piece-wise manner, and then combines everything into one visualisation.

**MAP** A Map of Aspects of the Psyche (MAP) shows all psychological *aspects* that may cause a target behavior. It is used as a tool to produce a long-list of sub-determinants from which then change objectives are selected.

**Sub-determinant** A sub-determinant is an *aspect* that has been categorized as a specific psychological construct (i.e. a determinant). *Determinants* are psychological *constructs* that cause behavior (as specified in at least one theory). Psychological constructs can be defined on various levels of specificity: "intelligence" or "personality" are very broadly defines constructs, whereas "attitude" is more specific, and "risk perception" even more specific. On this general-specific-dimension, there are no default or optimal levels of specificity. However, there is a point where definitions become sufficiently specific and contextually embedded that it becomes possible to express the related psychological content verbally or visually. Determinants (i.e. psychological constructs) that are defined with that level of specificity are called sub-determinants. These are important to distinguish in behavior change science and practice because behavior change interventions can never target determinants - they can only target sub-determinants, since the stimuli that form the intervention (e.g. texts, images,

videos) must necessarily be concrete and specific. Therefore, a required step in intervention development is identifying the sub-determinants that need to be targeted. In Intervention Mapping, those sub-determinants that are selected as intervention targets are then formulated as Change Objectives by following a specific set of guidelines.