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From theory to design: Bringing the intervention to life

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Abstract

Step 4 of the Intervention Mapping (IM) protocol, known as Program Production, emphasizes translating a carefully planned program into a practical, effective, real-world intervention. A program's success can be compromised by deviations from its core principles, poor contextual adaptation, or ineffective implementation planning. We outline key considerations for intervention planners for step 4 of the IM protocol, including early engagement with participants and implementers to ensure relevant and respectful interventions. Recommendations include refining program structure, creating and pre-testing draft materials, leveraging existing resources, and enlisting expert design support. Interventions should remain aligned with theoretical principles, feasible within available resources, and culturally grounded to reflect the values, beliefs, and lived experiences of the target population.

Key words: Intervention mapping, behaviour change, program production, cultural adaptation

Introduction

In planning behaviour change interventions, Step 4 of the Intervention Mapping (IM) protocol, Program Production, details the creative translation of the program planning done thus far into the actual intervention with its components, materials and activities. So far in the IM process, the planning group followed steps 1-3 including 1) identifying the problem and what needs to change, 2) formulating detailed change objectives, which are developed by combining performance objectives (what we want the target group to do) with determinants (factors influencing those behaviours) which help define exactly what needs to change in order to achieve the desired behaviour, and 3) selecting theory-based change methods and translating them into appropriate, practical applications to accomplish change objectives formulated. This process guided the program's development, shaping its themes, components, and implementation sequence (Bartholomew Eldredge et al., 2016; Kok, 2014). For all intents and purposes, at this stage of the process, the planning group should have a well-developed program that considers the comprehensive theory and the careful, evidence-based planning invested. However, a well-developed program does not necessarily translate into an effective one when implemented in real-world settings. This may be due to 1) deviating from the core principles and elements of the program established in prior IM steps, 2) inadequate translation for the specific context and setting in which the intervention will be implemented, or 3) poor implementation planning. Therefore, step 4 requires collaboration with experts and the active involvement of the target population and implementers while developing, testing content, and completing materials to ensure a theory-driven, practical, and culturally relevant approach (Box 1).

Box 1: Step 4 of Intervention Mapping: Producing Program Components & Materials

Practical Guide:	**1. Engage Participants and Implementers Early**	- Consult your target population and the implementers to ensure that interventions are relevant and respectful. - Stay grounded in earlier outputs: program goals, change objectives, and theoretical methods.
	2. Refine the Program Structure and Organization	- Finalize the scope, sequence, and delivery methods of intervention components. - Ensure all components align logically with performance and change objectives
	3. Develop Drafts of Messages, Materials, and Protocols	- Define the purpose, audience, and usage context of each material. - Determine the formats needed: videos, brochures, scripts, digital apps, etc.

Box 1: Step 4 of Intervention Mapping:
Producing Program Components &
Materials

		- Explore existing resources before creating new ones.
		- Consider feasibility and plan for resource management.
	4. Pre-test and Refine Materials	- Create initial drafts and scripts for all components.
		- Foster iterative collaboration between the planning group and design and production teams.
		- Test materials with a sample of the target population.
		- Gather feedback on clarity, tone, relevance, and usability.
		- Revise and finalize based on findings from pre-testing.
	5. Final Production	- Oversee final production to ensure materials are packaged appropriately and are accessible.
Key Consideration	**Enlisting Expert Design Support:** *To help translate complex content into clear, engaging, accessible, and culturally appropriate program materials*	- Collaborate with writers, graphic designers, videographers, developers, and other creative professionals to bring program content to life.
		- Clearly define roles, expectations, and deliverables.
		- Design, production, and communication professionals are essential in making the intervention engaging, accessible, and usable across various literacy levels and platforms.
	Ensuring Alignment with Established Theoretical Principles: *To ensure fidelity to program theory and core behaviour change goals.*	- Designers should be briefed about the theory-driven components to ensure materials reinforce key constructs.
		- Ensure the structure effectively incorporates behavior change theories and methods identified earlier.
	Feasibility and Resource Management: *To ensure the intervention can be delivered consistently and at scale.*	- Design the program structure to work within real-world constraints (e.g., available time, budget, staff capacity) to support scalability
		- Keep content simple to deliver, cost-effective to produce, and easily adapted or updated if needed.
	Designing Culturally Grounded Interventions: *To align the intervention with the target population's values, beliefs, context, and experiences, thereby facilitating understanding, trust, uptake, and impact.*	- Ensure that program materials reflect the language, norms, values, and lived experiences of the target population. Use cultural consultation or co-design approaches whenever possible.
		- Use narratives, visuals, and examples that reflect the target population's daily realities, and avoid generic messaging.

Enlisting Expert Design Support

Up until Step 3 of the IM process, the planning group typically comprises behavioural scientists, program managers, researchers, representatives from these at-risk groups, and individuals who have knowledge of the target populations, community members, as well as professionals and experts from related organizations. At this stage of the process, these individuals are usually focused on evidence and other scientific principles, working in controlled research settings (Bartholomew Eldredge et al., 2016). However, as the planning moves into Step 4, which involves the creation of appropriate creative materials and activities, the involvement of creative or technical design expertise becomes increasingly important. Expertise in design is essential for the appeal, usability, and effectiveness of the intervention. The integration of design expertise will not only enhance the aesthetic and functional aspects of the intervention but also ensure that it aligns with the needs and preferences of the target population, as guided by the preliminary

work the planning group conducted in developing the intervention (Balderman, 1996; Bartholomew Eldredge et al., 2016; Kok, 2014).

For instance, when developing an intervention that will be delivered through a mobile phone application, it's crucial to work with developers who specialise in mobile applications to ensure a user-friendly design that enhances user engagement and guarantees the software's efficiency and dependability (Bhimanapati et al., 2024). However, it is also important to consider the user experience, which is more than how the application works; it is how it feels and looks to the user. An application that is technically functional but is visually unappealing and difficult to navigate will not retain users well (Bhimanapati et al., 2024). Engaging someone with user experience and interface design expertise is also essential in developing an aesthetically pleasing interface. These professionals focus on features like layout, colours, fonts, and other design features. Therefore, a well-designed mobile phone application has a good user interface design that facilitates user interaction and helps to achieve the goals of the application. Hence, it is important that both technical knowledge and creative planning are involved in the creation of a product and an intervention that is not only effective but also appealing to the eye (Bhimanapati et al., 2024; Lienhard and Legner, 2017).

Likewise, the development of key messages for target audiences in communication campaigns or any similar interventions is critical, and individuals trained in communication strategy play a crucial role (Abraham and Kools, 2012). They ensure that the key messages are important to the target group and deal with the issues that prevent change in behaviour. It also helps to gain a better understanding of the possible implementation challenges during the development of the intervention if these professionals are involved. They can identify the practical difficulties, for instance, resource constraints, technological infrastructure, and the characteristics of the users that may limit the effectiveness of the intervention. The planning group can therefore be able to support the development of efficient interventions when translating theory-based behaviour change methods into practice by including this technical expertise. This will help to ensure that they are aligned in the thinking around the design and also provide opportunities for the planners to ensure the core theoretical principles, change methods and practical applications established during the intervention development are maintained (Abraham and Kools, 2012; Bartholomew Eldredge et al., 2016; Kok, 2014).

Ensuring Alignment with Established Theoretical Principles

Step 4 requires the planning group to ensure that the core theoretical basis of the intervention which was determined in steps 1-3 of the IM process is maintained during production. As development moves from the controlled research environment to real-world settings where the intervention will be implemented, getting creative professionals on the planning group as discussed above, is not without its challenges. They have their own processes and thinking around designing interventions. According to the IM approach, ensuring that the design of the intervention materials and activities are engaging and relevant to the context and setting of the target population also requires fidelity to the theoretical methods and practical application strategies established in prior steps of the development process. Adhering to theoretical principles during the design process is not likely to be top of mind for creative designers and the resulting disconnect could lead to interventions that fail to achieve their intended objectives (Bartholomew Eldredge et al., 2016; Fernandez et al., 2019).

Therefore, it is important that creative professionals receive clear instructions or specifications (the brief) at the outset of their involvement, and that there is consultation with the planning group at regular intervals during the design process. Their preliminary concepts or designs should be presented to the rest of the planning group, who should provide detailed feedback, and only when consensus has been reached can they refine the designs or proceed to pretest the materials produced.

In applying the IM process during the development of MyDESMOND, a digital self-management program for type 2 diabetes, Hadjiconstantinou et al. (2020) reported in detail the application of step 4 in the IM process. The planning group focused on enhancing content and design in step 4 of IM. Collaboration among a multidisciplinary team, design experts, and patient and public involvement (PPI) representatives adapted key components of the in-person DESMOND program to a digital format. A web designer ensured technical feasibility and user-centered design while PPI representatives provided feedback on clarity, navigation, and cultural relevance. The design incorporated interactive features, including goal-setting tools, health trackers, and discussion forums, which integrated behavior change techniques (BCTs) and theoretical models such as the Health Action Process Approach (HAPA) and the COM-B model. Communication specialists and diabetes educators ensured that language and visuals were clinically accurate and accessible. Core contributions included addressing mobile app interface issues, BCT integration, and conducting iterative end-user usability testing. This collaborative, theory-based approach led to an intervention that was both evidence-informed and user-friendly. The majority of users (92%) reported that it provided clear information, 82% stated they would recommend it to others, and many found the content relatable. The intervention achieved strong user engagement outcomes, with 56% of users retained after one month and 17.6% remaining active after one year—figures that compare favourably with similar interventions (Barker et al., 2023).

Feasibility and Effective Resource Management

Program production must take into account the availability of resources, the stakeholders' concerns and the context in which the intervention is to take place to ensure effectiveness during implementation (Racine et al., 2023). Planners need to consider factors such as funding, staffing, timing and equipment that may affect the feasibility of implementation (Fernandez et al., 2019; Jones et al., 2016). An example of an intervention that fell short due to feasibility and resource management challenges—among other issues including considerations around behavioural science principles, is in-person Directly Observed Therapy (DOT) for Tuberculosis (TB) treatment (World Health Organization, 2017; Sagbakken et al., 2013). This approach was adopted by many national TB programs to ensure adherence to TB treatment by making healthcare workers or trained community members observe patients take their medication. Its objectives were to avoid drug resistance, enhance treatment success, decrease transmission and offer the patient support through counselling and education. Furthermore, it established systematic adherence monitoring and allowed health providers to intervene whenever necessary. All of which were sensible and imperative to patient outcomes and TB control (World Health Organization, 2010). Nevertheless, despite its effectiveness, DOT was found to be costly as it involved frequent patient-provider contact and coordination of complex logistics. This has led to its decline in many national TB programs,

which has resulted in shifting to more patient-centred and decentralized adherence models like Video Directly Observed Therapy (vDOT) and community-based models (World Health Organization, 2017).

In the current landscape, Artificial Intelligence (AI) has increasingly been used to deliver interactive voice-based patient-facing interventions such as counselling or patient consultations (Miner et al., 2017; Olawade et al., 2023). This approach offers an attractive solution, especially in high disease-burden settings with constrained human resources for health (HRH) (Guo and Li, 2018). However, key practical considerations such as development and implementation costs, limitations in infrastructure, and the need to ensure the quality and accuracy of AI-generated content must be carefully addressed. The feasibility of scale-up of such interventions in lower-resource public health settings may be a challenge, as healthcare budgets need to prioritise essential services over potentially costly AI integration. When planners are thinking about incorporating AI into their intervention implementation strategies in real-world settings, it is vital to tackle all elements related to feasibility and efficient resource management within the environment where the implementation will occur to ensure effectiveness and sustainability. Additionally, AI-generated content should undergo ongoing review to ensure its quality and accuracy. However, the technology is still evolving and may become more affordable, which would make them more feasible at scale in future (Jacob et al., 2025).

IM guides planners to take a participatory approach in the planning and development process to ensure feasibility at an early stage. This approach enables the identification of potential barriers such as cost, infrastructure limitations and workforce capacity for potential implementers and target populations and also assesses potential barriers and facilitators to implementation. Interventions are therefore developed with resource considerations in mind, to increase the probability of sustainable and effective implementation (Bartholomew Eldredge et al., 2016; Kok, 2014).

Designing Culturally Grounded Interventions

At this stage of the intervention development process, though the creative translation is the focus, planners should ensure that the cultural appropriateness, comprehensibility, and appeal to the users of the materials, activities, protocols and messages used in the intervention are ensured. These factors are important to consider to enhance the feasibility and acceptability of the intervention for the target population and its feasibility of implementation in their context (Bartholomew Eldredge et al., 2016). IM underscores the importance of ensuring that interventions are culturally grounded. When considering this from the two levels of surface and deep structure, surface structure deals with the visible and easily identifiable elements of a community including language, symbols and familiar settings so that interventions are culturally meaningful to the target population. On the other hand, deep structure looks at the causes of behaviour from a historical, social, psychological, and environmental perspective of the affected community (Bartholomew Eldredge et al., 2016; Resnicow et al., 1999).

From a surface culture perspective, the presentation and delivery approach of content in a training program are crucial for ensuring relevance within a given context. The format, language, and setting of these materials must align with the target audience's environment to enhance engagement and effectiveness. For instance, a key training method the Thusa-Thuso motivational interviewing (MI) counselling training program for lay HIV counsellors in the primary healthcare system of South Africa employs is demonstration modelling videos for improving MI skills (Mokhele et al., 2020). The intervention development group considered using existing training materials. However, upon review of the available videos were found to be inappropriate for the local context. Many focused on issues such as substance use and addiction, for which MI was originally developed. Others addressed weight management, nutrition, and lifestyle changes (Miller and Rollnick, 2023, 2002). While relevant in some healthcare settings, these were not the primary focus of the Thusa-Thuso program. Additionally, the individuals featured in these videos did not reflect the demographics of South African lay counsellors or their clients. The settings were also unrealistic, often depicting structured counselling sessions in psychologists' offices, with clients seated on couches while counsellors took detailed notes on a notepad or patient file. These scenarios were far removed from the realities of busy public healthcare facilities. To improve contextual relevance and acceptability, the intervention development group developed custom training videos in local languages, featuring counsellors and clients who resembled the target audience. The videos were recorded in settings mirroring typical interactions within South Africa's primary healthcare system. Developed in consultation with an intervention development group that included the target population and implementers, these videos were more realistic and contextually appropriate. This alignment with real-world practice enhanced their applicability and increased the likelihood of successful implementation (Mokhele et al., 2020, 2024, 2019, 2022; Onoya et al., 2022).

An example of the need to take deep and surface cultural considerations in intervention development can be seen in Voluntary Medical male circumcision (VMMC) programs in the Eastern Cape province in South Africa. Surface adaptations like local language messaging and community endorsements need to be accompanied by deep structure considerations of aligning traditional initiation practices. One cannot overlook the deeply rooted cultural significance of masculinity in traditional male circumcision in the Xhosa community when developing a medical male circumcision program targeting males for HIV prevention (Nyembezi et al., 2016). Therefore, if one is going to introduce medical male circumcision without going through cultural gatekeepers, then there is a likelihood of resistance. Involving traditional leaders, traditional nurses, and other stakeholders in the traditional initiation practice during intervention development helps ensure that VMMC programs are both effective and culturally accepted by the community (Coast et al., 2014; Marston et al., 2016; Ngoma et al., 2024; Nyembezi et al., 2016).

In the recent review of The planning group for the video-based mobile app titled "Undetectable and You" which incorporates the "Undetectable = Untransmittable" (U=U) message through testimonials from people living with HIV (PLHIV) and their partners into HIV counseling in South Africa, applied similar collaborative process among expert participants in the planning group included experts and key stakeholders, such as U=U and ART stakeholders, PLHIV, healthcare providers, civil society representatives, and audiovisual specialists. The planning group guided the work of the audiovisual specialists who produced the videos and developed the app for the intervention, which ensured the intervention's messaging, materials, and delivery remained true to the conceptual framework for the intervention and ensured alignment with the contextual and scientific foundations of the intervention and formative evidence from earlier IM steps (1-3) (Sineke et al., 2024). This careful collaborative planning, rooted in the latest scientific and contextual understanding, ensured the intervention's usability and potential for widespread implementation. Positive results from the app's pilot trial revealed increased U=U knowledge, improved retention in care, and

enhanced viral suppression among participants exposed to the interventions compared to those in the control arm (Bor et al., 2024; Sineke et al., 2024).

Conclusion

A program that is well developed does not necessarily translate into effective intervention, and assuming that success is guaranteed by the work completed in Steps 1-3 of the IM protocol is a recipe for failure. Step 4 is critical in moving from planning to practical application of the theory in the real world by defining the process of producing actual, practical program materials, components and activities based on theory. It guarantees that the program is still logical and can be easily implemented in practice by linking the materials to the determinants and change objectives defined in the course of earlier steps of development. This ensures that the intervention remains relevant, feasible, and sustainable throughout this process by maintaining a participatory approach and being grounded in theory. Finally, Step 4 defines the planning process as the generation of tangible, innovative resources that are necessary for the effective implementation and maintenance of the program.

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