Co-creation in public health research

Co-creation is an approach for developing a product (e.g., interventions or tools), in collaboration with stakeholders from a specific context, with the aim of solving a specific problem in that specific context. It can be applied in various ways within research project. This document describes two practical examples on how it can be applied in the context of a public health related intervention.

Co-creation in the SUPREME NUDGE Project

Summary

In Supreme Nudge we used a 'cyclical' co-creation methodology for the co-creation of intervention designs, aimed at real-world implementation. This co-creation took form of a collaboration between the researcher(s) and stakeholders from the intended implementation context: supermarket staff, supporting staff, and managers. By going through this process, designs were developed and evaluated, and potential implementation challenges were identified and addressed, which strengthened ownership and support among relevant stakeholders. The case described here is based on a previous publication by Middel et al.[1]

Purpose

The purpose of this tool is to facilitate (public health) researchers in designing interventions that are tailored to a specific implementation context, in collaboration with stakeholders from that context, in order to increase ownership of the intervention among these stakeholders, and strengthen implementation feasibility and fidelity.

This method is **not** meant for evaluating the effectiveness or impact of specific intervention strategies (for which purpose we would recommend a Reflexive Monitoring in Action approach). Stakeholders participating in the co-creation process may provide input on what they perceive as effective or impactful intervention strategies, but such input should be validated through appropriate research methods (e.g., controlled experiments).

The Method

The cyclical co-creation method is based on the Design Research Cycle.[2] It consists of a series of sequential cycles, with each cycle consisting of three steps.

Step 1: Theorize
Each cycle starts with the researchers gathering relevant information and insights, to identify ideas, directions, or adjustments for the intervention design.

In the first cycle, such knowledge is primarily gathered from external sources, (e.g., other studies, literature, or pilot experiments into the effectiveness of certain intervention designs) and should be focussed on deciding on the (evidence based) strategies around which the intervention will be designed (e.g., pricing strategies, choice architecture, nudging).

In subsequent cycles, this information is gained from the feedback of collaborating stakeholders (e.g., information regarding the intended context, and how the intervention would fit within it). External sources can still play a role, for example when a change in the chosen strategy is deemed necessary (which needs to be decided), or the appearance of new relevant knowledge (which may disagree with previous design choices).

Step 2: Build
Based on the knowledge and decisions gathered through theorization, the researcher develops or iterates upon their intervention design 'prototypes'.

In the first cycle, the researcher should focus on developing at least one design prototype for each intervention strategy that they want to utilise (possibly combining strategies in one design prototype). At this stage, these prototypes can be as simple as a general idea (e.g., "we want to increase the in-store prices of unhealthy foods").

In subsequent cycles, design prototypes are meant to be iterations on the prototypes from the previous cycle, incorporating new knowledge and decisions. With each cycle, these prototypes should also be developed further towards readiness for implementation. Depending on the intervention, this can involve the development of physical or digital mock-ups, detailed plans, and details on the implementation of the intervention, such as scripts outlining activities, responsibilities, time-planning, and financial aspects. Occasionally, new knowledge or decisions (e.g., a novel strategy that the researcher wants to apply) can necessitate the introduction of a new design prototype in later cycles, in which case the trajectory is started anew for this specific prototype, possibly at increased speed.

If the process goes as planned, a number of suitable prototypes are identified, and further developed to for the context. In the unlikely event that none of the prototypes are considered suitable for further development, new ones can be proposed and developed, starting the process anew.

Step 3: Evaluate
This step introduces the co-creation element. The prototypes developed in the preceding build step are presented to relevant stakeholders from the implementation context. With these stakeholders, the prototypes are evaluated from the perspective of their implementation in the implementation context. This is done through qualitative methods, such as individual or group interviews, or workshops. In early stages, individual or group interviews may be most practical, whereas in later cycles, when prototypes have become more complex, and the nuances of their implementation become more relevant, discussions with a broader group of stakeholders will be recommended. Generally, it is advised to include a wide range of stakeholders in each cycle, as this increases the chances of identifying potential problems and solutions, as well as generating broad support and ownership of the prototype.

Progressing through Cycles

The aim is that each cycle results into the intervention design becoming more developed and tailored to the implementation context. The number of cycles is variable, and should ideally be determined by the progress made in selecting and developing the prototypes. Once a clear selection has been made, and these prototypes have been developed to the point of being

suitable for implementation, a final evaluation step, with as broad a range of relevant stakeholders as possible, is recommended, as a final check.

Example Application

This method was applied in the SUPREME NUDGE project, in order to co-create a number of health-promotion strategies, which would be applied in a number of real-world supermarkets.[1] Below we will briefly describe the process, which is also illustrated below in **Figure 1**.

Cycle 1

We purposefully sampled ten participants from various backgrounds at the central management of the supermarket organisation, based on their relevance to the intervention ideas. Participants were interviewed alone, or in pairs (in case of similar/connected background). Sampling was concluded when all relevant stakeholder groups at the central-management level had been engaged at least once. We focussed on central management in the first cycle, as these actors have the broadest view of the organisation and are the primary decision-makers.

We conducted one-hour interviews with the participants. Interviews first explored the general context of the participant and the organisation, by discussing their work and important connections. Following a general exploration of the participant's perspectives on unhealthy dietary behaviours, and the role of supermarkets in relation to this problem, participants were introduced to several broad ideas for health-promotion interventions, and asked to reflect on the feasibility, acceptability, and effectiveness of these ideas. Follow-up questions explored the underlying reasons and sought solutions or improvements.

Cycle 2-X

We engaged twelve key decision-makers in the central management of the supermarket organisation, in groups of 3-5 participants. Participants were proposed by an internal contact-person as the appropriate decision-makers. Instead, repeated discussions with these key decision-makers were held until specific intervention designs selected and mutually considered acceptable in their design.

With these participants, we conducted one-hour group-discussions, in which prototypes (including planning, example images, implementation strategies, etc.) of the interventions were presented to the participants. Based on these prototypes, the feasibility and potential risks of each intervention were discussed, agreements were made on certain design characteristics, and solutions to perceived risks or problems were sought. After each group discussion, the prototypes were developed further.

In parallel, we sampled seventeen managers and private owners of affiliated stores, based on suggestions from an internal contact-person. Each of these managers or owners was engaged in a separate one-hour interview.

In these interviews, participants were presented with a summary of various interventions, as a discussion piece. Participant were asked to share their thoughts on these interventions. We explored the feasibility of implementing each intervention in participants' stores, and their perceived effectiveness in promoting healthier choices. When an intervention was viewed as

unfeasible or ineffective, the problem and solutions would be explored. Finally, participants were asked if they had any additional suggestions for interventions. Between interviews, the summarized interventions, removing interventions were developed further, based on the received input, and adding new ideas. Based on the combined output of these discussions, a selection was made of interventions to develop further, and boundaries for this development.

Final Cycle
The final selection of interventions was developed in an extensive summary for each intervention, including details on planning and implementation. These summaries would be evaluated one final time in this cycle.

We purposefully sampled twelve participants to represent departments involved in the (future) implementation of evaluated interventions. Three interventionists (alongside authors) from the SUPREME NUDGE project participated as intervention experts, and group leaders.

The participants were engaged in a workshop. First, participants were divided into groups, and would discuss a sub selection of the interventions. Groups composition and the sub selection of interventions were chosen in advance to keep the discussions as relevant as possible to real-world usage of the interventions (e.g., stakeholders who worked on pricing would discuss price-related interventions). The groups utilised ranking exercises to identify the most feasible and impactful interventions, and explore points for improvement. Afterwards, each group would present their findings plenary to the other groups, in order to give the other participants, the opportunity to provide additional feedback. Based on these presentations and plenary discussion, a final set of recommendations would be made regarding which interventions should be developed and implemented, and what should be the final points for improvement on these interventions.
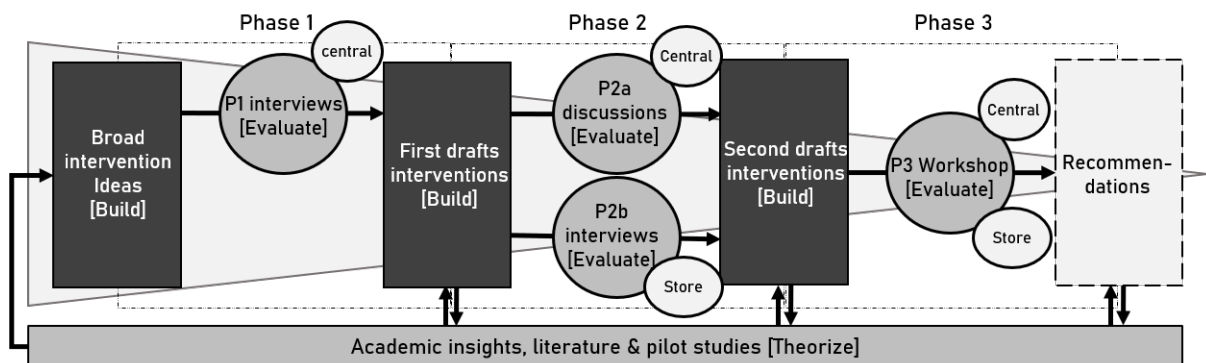
Figure 1. A schematic overview of the co-creation process, as conducted in the SUPREME NUDGE project. Phase 1 contained cycle 1, phase 2 contained numerous parallel and sequential cycles, whereas phase 3 contained the final cycle.

Practical reflections
Based on our practical experiences with the described co-creation methodology, we have several reflections on its use:
- In our example, a section of the relevant stakeholders was not included in the first phase. In hindsight this may have limited the exploration of ideas, as a number of important

perspectives were missed. Ideally, all relevant stakeholder groups should be involved from the start.

- In our example, phase 2 consisted of several parallel cycles, aimed at different stakeholder groups. This allowed us to tailor the development of prototypes to the aspects of these prototypes relevant to these stakeholders specifically. However, it is also important that frequent connections are made between such parallel trajectories, so that the developed ideas do not drift apart. We accomplished this by having the same researcher be involved in both trajectories. Alternatively, both trajectories can be led by different researchers, who would frequently coordinate and compare received input.
- In the final cycle it may pay off to include a number of individuals who have previously been uninvolved in the process. Due to the frequent interactions with certain stakeholders, 'blindness' may emerge towards the drawbacks or shortcomings of certain prototypes. Including a fresh perspective as a final check can help avoid such issues.
- Although the goal is to develop broadly supported prototypes, it may happen that individuals are strongly opposed to a specific idea, despite otherwise broad support. In such cases it is important to consider whether such opposition is a result of shortcomings which are only apparent through their unique perspective, or if more personal factors (e.g., beliefs, preferences) are involved. The first case should be acted upon, in order to avoid problems during implementation, whereas the second would require a judgement of the feasibility of changing or dropping the point of opposition, the feasibility of resolving the issue through communication with the opposed party, and/or the feasibility of proceeding without their support for this idea.

Co-creation in the BENEFIT project

Summary

In the BENEFIT project, a user-centred design approach, inspired by the CeHRes roadmap for eHealth development, was implemented to ensure alignment with stakeholders and the context.[3] This framework emphasizes continuous evaluation and adaptation of the eHealth product throughout the developmental process. As can be seen in the CeHRes roadmap (Figure 1) co-creation is essential in this process. In the BENEFIT study, co-creation was performed through usability testing with stakeholders; through heuristic evaluation with professionals, and by using a think-aloud method with patients.[4]

Purpose

In the BENEFIT project, we used the user-centred design approach of the CeHRes roadmap for eHealth development to ensure that our patient digital platform, also known as the digital Personal Health Environment (PHE), aligns well with stakeholders and the context, with the aim of improving future adoption and implementation.

Method: CeHRes Roadmap

The CeHRes roadmap is a framework for holistic eHealth technology development, emphasizing flexibility and constant evaluation throughout the process. It suggests that evaluation should be ongoing, starting at the beginning of the developmental phase (**Figure**

2). The idea is to assess and adapt each product to fit the context, stakeholders, and previous results. Taking inspiration from this framework, we implemented the suggested iterative design to develop and improve our BENEFIT PHE.
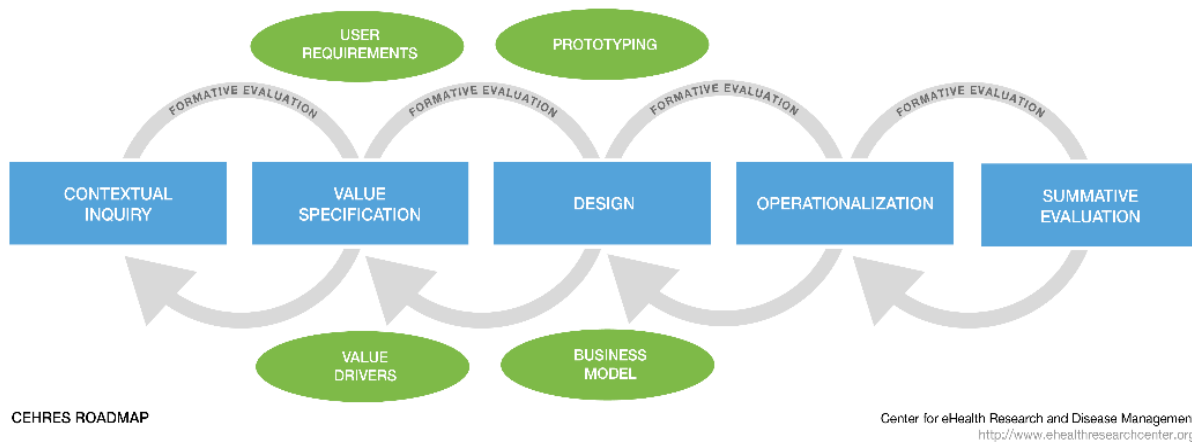
Figure 2. The CeHRes Roadmap for eHealth technology development, with various formative evaluations represent different iterative cycles, and in this 'practical example,' they illustrate the development process.

Example Application

In this practical example, we will explore how an iterative process involving co-creation with various stakeholders, using usability testing techniques like heuristics evaluation and the think-aloud method, is essential during the eHealth development's design phase to ensure the technology aligns with user needs and preferences.

Step 1: development of a patient journey

In the BENEFIT project, a patient journey was developed in collaboration with healthcare professionals from the care setting and researchers. This journey contains the entire intervention process for the PHE, which includes activities such as completing lifestyle questionnaires and monitoring blood pressure values.

Step 2: Expert Evaluation in BENEFIT

The evaluation of the PHE customer journey was conducted with the expertise of behaviour change and medical care experts. The experts, known as evaluators, used a set of rules (called heuristics) to check how easy it is for people to use the PHE platform and find any issues with how it is designed. This evaluation aimed to compare the design of the PHE customer journey with established guidelines (heuristics) for user interface design. User interface design includes arranging and organizing a system or platform for a user-friendly experience. This process is particularly useful when resources and time are limited, as it allows us to detect significant user problems early on.[5] Many of these heuristics were developed using Jakob Nielsen's 10 usability principles, which are based on human behaviour, psychology, and information processing.[5,6] These guidelines cover a range of user-friendly interface designs, as illustrated in **Figure 3**.

10 Usability Heuristics

Visibility of System Status	Match Between System & the Real World	User Control & Freedom	Consistency & Standards	Error Prevention
Recognition Rather than Recall	Flexibility & Efficiency of Use	Aesthetic & Minimalist Design	Help Users Recognize, Diagnose & Recover from Errors	Help & Documentation

Interaction Design Foundation
interaction-design.org
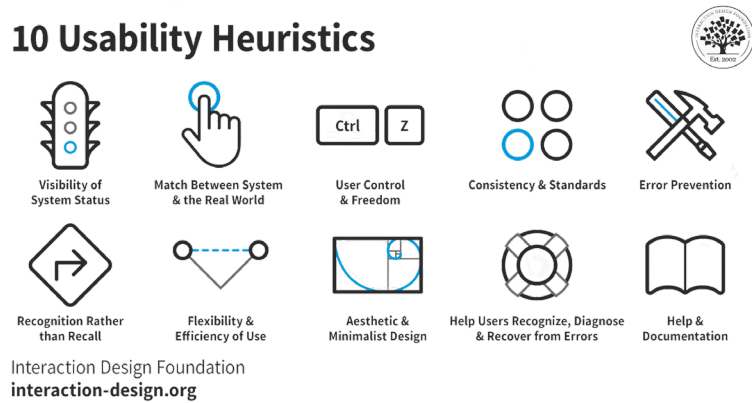
Figure 3. Jakob's Ten Usability Heuristics. Interaction Design Foundation, 2022, CC BY-SA 4.0

The evaluation process included seven participants who were highly educated in behaviour change and medical care. They were tasked with completing an online questionnaire prepared by the research team. Throughout the evaluation, they engaged with the various stages of the PHE BENEFIT customer journey (**Appendix A**). Participants were required to provide feedback on each page using an online assessment form, participating in activities like page exploration and goal setting while evaluating the PHE based on various criteria. For each criterion, participants rated issues on a scale from 0 (no usability problem) to 4 (a critical usability issue, requiring immediate fixes). Additionally, they were asked to explain the issues and provide suggestions for resolutions.

The results of the heuristic evaluation were presented verbally to the team members in a session, and they brainstormed about the results. Then, the team members gathered to identify which "found problems" could be addressed in the short term. What issues require more data, and what issues should be prioritized in the next usability test?

Team members from both the research and private sectors collaborated in various sessions to develop new ideas based on the heuristic evaluation results and converted them into prototypes, i.e. a 'clickable demo'. These prototypes were used to gather input from the stakeholder group of "patient users."

Step 3: Think aloud method in BENEFIT
Using semi-structured interviews, a 'think aloud method' was performed with CVD patients following cardiac rehabilitation. Participants were given a clickable demo of the technology and asked to use it according to their preferences. While using it, they were instructed to express their thoughts about what they saw, their actions within the application, and the reasons behind their choices. This was done through a series of short tasks. The think-aloud sessions lasted for one hour and were conducted in a comfortable setting in a in cardiac rehabilitation centre to ensure that the participants felt at ease.

The think-aloud method, provides direct insight into users' thought processes and reasons behind their actions, allowing for a deeper understanding of their experiences. The 'think aloud' method often uncovers specific usability issues and user preferences, allowing for more targeted improvements compared to the broader feedback from heuristic evaluation.

A summary of the main positive points experienced by the participants and areas that could be improved was created based on recorded verbal statements and observation notes. Using this feedback, the technology was further refined and underwent beta testing.

Practical reflections

Based on our practical experiences with the described co-creation methodology, we have several reflections on its use:

- Feedback Management: Handling feedback from co-creation can be challenging, especially when time and team backgrounds vary. Ensuring clear communication and common priorities between the research and ICT teams is crucial.
- Iterative Design: While iterative design takes time, it is an investment to ensure technology is user-friendly. Planning for iteration from the project's start, even in grant proposals, is essential.
- User Fatigue: Involving fewer users in co-creation can prevent research fatigue. Running multiple tests is key as usability engineering aims to improve design, not just identify flaws, reducing user exhaustion.
- Usability Testing: Choosing the right usability testing method is vital. The think-aloud method requires strong verbal and literacy skills, which should be considered when selecting this approach.

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Appendix A. PHE BENEFIT customer journey

BENEFIT CUSTOMER JOURNEY

BENEFIT CORE ATTRIBUTE

CUSTOMER GOALS

CUSTOMER RESPONSES

RECEIVING CONTINUED SUPPORT
STEP 01
"I experienced a cardiac incident. My mortality became salient to me and I became anxious. Close supervision during cardiac rehabilitation eased my mind, yet, within 3 months, the program will end. Luckily, continued support is offered through a Personal Health Platform (PHE)."

EHEALTH PLATFORM

"Wow, this is an one-stop-shop for eHealth interventions! It is a relief to finally receive long-term support."

NEED FOR SIMPLICITY
STEP 02
"I'll try it out, at least something is offered and it sounds like the platform has many options. But, I'm over 60 years old and don't know much of this technology. It may not be the right support for me."

GUIDANCE ECOACH

"With the guidance from the digital coach it is very easy to start."

IN CHARGE OF MY LIFESTYLE
STEP 03
"The eCoach introduces herself and tells me to fill out a questionnaire regarding my health, wellbeing and healthy living. The platform gives me insights into how I'm currently doing and it tells me to eat more healthily. Yet, I prefer to work on my distress, so, I will set a goal to relax more."

SMART GOALS & MONITORING

"This online approach is new to me and I'm a bit anxious, but also motivated to continue."

WORKING ON MY HEALTH
STEP 04
"Based on the questionnaire results and my goal, the eCoach suggests fitting support-tools. I think I'll select this application. I download it on my smartphone and allow data exchange to the platform, so that my caregivers automatically receive information on my use and status."

TRAINING & DATA EXCHANGE

"I like this fully tailored support and training very much."

MAINTAINING MOTIVATION
STEP 05
"Whenever I work on my healthy lifestyle, I receive virtual points that I can exchange for discounts on healthy products or services. Sometimes they include positive messages such as praise."

REWARD PROGRAM & PRAISE

"That is a nice bonus! Maybe I am going to buy that healthy cookbook for new inspiration."

PROGRAM ADHERENCE
STEP 06
"A weekly notification reminds me to reflect on my progress. If I do not respond, my eCoach asks me whether I still actively engage in the intervention, what my progress is, and what facilitating and hindering conditions I encountered. This program really makes sure I live healthily."

REMINDERS & COUNSELING

"This really gives me the support I need. Investing in a healthy lifestyle is difficult, but I am trying my best!"