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Co-production methods in health research

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Chapter 23
Co-production Methods in Health Research

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The Challenge

Successful health innovation requires more than the creation of a new treatment, service, or technology. It also involves gaining an understanding of the needs of the intended recipients or users of the innovation and the environment in which the innovation is going to be introduced. Innovating with the intended users or recipients of new health products is crucial for maximizing the chances of adoption and uptake of new ideas and technologies. Such co-production requires careful planning and facilitation to ensure productive partnerships and involvement of all parties affected by the health innovation. This chapter contains key ideas to help researchers co-produce health innovations with intended recipients or users of new products or services:

- Prerequisites for co-production.
- Determining appropriate user-centered methods.
- Collecting and analyzing the data.
- Integrating results into design.

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Key Ideas

Prerequisites for Co-production

Co-production takes a holistic approach, addressing the needs of the individual as well as the context into which an innovation is going to be introduced. This contrasts with traditional approaches that typically isolate variables of interest and seek to minimize interference from other areas. Specifically, successful co-production requires attention to identifying your co-producers, recognizing the co-producers' expertise, and providing an inclusive environment where everyone's voice can be heard. Various methods can be used to identify the co-producers for each product. One approach is to ask the question "Who will be affected?" and generate a list broken down by groups (e.g., patients and/or service users, their social circle, the staff directly affected, etc.). Another approach is to spend time in the environment that the innovation is targeting. Not only does exploring the environment permit identification of the co-producers, it also provides insight into how the environment functions and key aspects of current practice, which can inform how the new innovation could fit in.

Co-production recognizes that lived experience is as important in health innovation as scientific, medical, or research expertise. Any innovation will only succeed if it is adopted and used. User expertise can illuminate why people do or do not use things as intended (e.g., take their medications as prescribed, carry out recommended activities such as physiotherapy exercises and dietary changes, or use provided devices such as mobility or visual aids). Frontline staff is also expert in understanding challenges to innovation on the ground. For example, a technology that provides video consultations may be rejected by a lonely individual because that individual values the weekly visits from a staff member. Frontline staff can also highlight gaps in their services as well as demands on their services which might make adopting new innovations difficult, e.g., reliable Internet and time for training (Box 23.1).

Box 23.1 Information Users as Experts

A hospital specializing in the treatment and care of older adults offers a memory program to people concerned about their memory. This in-person program provides practice in memory strategies while addressing concerns about memory changes in later life and education about brain-healthy lifestyle choices. However, participation is limited to those who can travel to the hospital. To reach a broader audience, an online version is proposed. Using an iterative co-production process, a team of clinicians, researchers, e-learning experts, and developers work together with older adults to develop and refine the program. Older adults who had completed the program within the previous 12 months co-produce the program interface and the way in which the information in the modules is presented.

A second group of older adults who are new to the program work their way through the online version in their own homes, recording information about

(continued)

Box 23.1 (continued)
all aspects of its usability, accessibility, and enjoyment. The final product consists of interactive learning modules, animations, games, homework assignments, and real-time chats with co-learners that users find easy to use, appealing, and relevant. In terms of replicating the benefits of the original in-person program, the online version is so far producing high levels of user knowledge gain, behavior change, satisfaction, and personal goal attainment.

Successful co-production also requires an inclusive environment where everyone feels able to speak and everyone's contributions are valued. This is particularly important with co-producers who are unfamiliar with research or innovation or who are unfamiliar with giving their opinions in public forums. For example, patient co-producers may feel unsure about what they have to contribute, especially if the innovation relates to technology. Similarly, frontline staff who work directly with patients or service users are rarely asked for their ideas or their suggestions in relation to the services they work in or the people they care for or support. A code of conduct establishing ground rules for communication and interaction, e.g., respecting other people and their opinions and keeping sensitive or personal information confidential, such as personal experiences of patients or staff, can facilitate this (Box 23.2).

Box 23.2 Inclusive Environment
A local government provider of social care wants to redesign its assistive technology (AT) service to increase uptake of the devices it has available. The government provider works with one of the authors to create a daylong interactive workshop to bring together all parties with an interest in AT. This includes people who could benefit from aids for mobility, hearing, vision, and cognition, along with staff in hospital and community settings, housing, and other organizations supporting people using ATs. The workshop is structured and facilitated to ensure that the expertise of all of the participants is heard and is valued. Activities involve looking at factors that influence technology adoption, testing some technologies, and designing an ideal AT service for the local area. The outcome is a set of priorities for the service redesign for the social care provider to use, plus a group of experts to work with in developing it.

The priorities that emerge are (1) the importance of a central hub to support people and signpost additional services; (2) the service that should be for anyone who wants to maintain independence and improve quality of life rather than a medical service just for when people have specific physical needs; and (3) the service and available technologies that should be advertised through a wide variety of media and in a variety of community settings. The group also identifies how it wants to access and adopt assisted living technologies including support from appropriately trained staff, opportunities to use trial technologies in homes, and different payment models including rental and subscriptions.

Determining Appropriate User-Centered Assessment Method(s)

Determining what people want or need is a common first task in co-production. Many different needs elicitation and user-centered assessment methods have been developed by psychologists, sociologists, user experience experts, interface developers, computer scientists, human factors experts, and others. A recent review identified 18 different methods for needs elicitation. These include cultural probes, think-aloud protocol, technology interaction, and paper prototyping.

Similarly, a wide range of qualitative and quantitative methods are available for user evaluations, which are frequently combined in mixed methods studies. Conventional examples for collecting qualitative data include surveys, interviews, card sorting techniques, and observational and think-aloud methods. Methods for collecting quantitative data involve metrics and validated measures such as self-report and observational measures, visual acuity measurement, and cognitive assessment metrics. However, not all methods are equally well suited for all evaluation purposes or for all potential audiences, particularly older adults or people with disabilities. In addition, it is not always obvious which methods would be optimal for a specific stakeholder group. Across all fields, innovators tend to favor methods they learned during training or have used before without necessarily considering whether the method is a good fit for their particular evaluation strategy. Sometimes existing methods can be modified, but in other cases, individuals may be excluded because they cannot participate in a particular methodology. In some situations, user-centered assessment may be avoided altogether because it is perceived as too difficult or time-consuming. On the positive side, newer methods such as participatory design, idea jams, and design jams are being developed and introduced to tackle these limitations and extend user participation in co-production.

This raises the question: How can a developer or designer know which method to choose and how it best fits with their target users? Most user-centered method descriptions do not provide a guide to what users are required to be able to do to participate in them, nor ways to assess the fit of the method with either the evaluation strategy or user characteristics. Using the four main human capability categories: vision, hearing, cognition and mobility, Roy, Neumann, and Fels (2017) have developed NICKEL, a needs elicitation methods selection tool to assist designers in determining appropriate methods using four main human capability categories: vision, hearing, cognition, and mobility. Designers estimate the capabilities that they think their potential users will have and then enter them in NICKEL and receive a recommendation for possible methods (http://tungsten-training.com). For example, hearing capabilities can be *hearing*, *hard of hearing*, or *deaf* (see example in Box 23.3). While this is only one way of assessing appropriate methods, it asks designers to consider who their co-producers will be and what abilities their co-producers possess. It also challenges the notion that all methods can work with everyone.

Box 23.3 Determining the Appropriate User-Centered Assessment Method(s)
A designer wants to include deaf users who speak a signed language in a usability evaluation for a new Web application. However, typical usability methods such as think-aloud protocol and answering questions on a questionnaire are not conducive to sign language. Think-aloud protocol requires that a user work through a set of typical tasks with a technology and talk about what they are thinking in real time. Signed language users talk with their hands, face, and body; thus, they cannot use a computer interface (e.g., typing or using a touch pad or mouse) while talking. Online questionnaire tools do not allow for video-based questions instead of text. Signed language users often have weak text-based skills and cannot fully understand or express themselves with text. This dilemma requires a new method that allows signed language users to test the Web application and provide feedback in real time. The gestural think-aloud protocol (Roberts & Fels, 2006) was developed and disseminated for this purpose. Deaf users can work with an interface and sign in real time. A signed language interpreter can simultaneously provide live interpretation for hearing developers or designers.

Analyzing Co-production Data

Gathering and analyzing co-production data generally employs a mixed methods approach, using both quantitative and qualitative data collection and analysis methods. Quantitative analysis methods usually refer to statistical procedures, while qualitative methods involve finding patterns, commonalities, or anomalies in verbal, visual, or text data provided by people.

Quantitative data. It is often difficult to recruit sufficient numbers of participants who fit specific selection criteria. This means that relatively small numbers of individuals (small *n*) are often involved in co-production, and the sample does not meet the assumptions of parametric or regression statistical analyses. However, there are multiple statistical and qualitative analysis methods dedicated to small *n* designs, e.g., Norman (2010). For example, a case study methodology can be used (Meyer, 2001), where one or a specific group of people (series of case studies) is studied and reported on in-depth. Nonparametric statistics such as the Mann-Whitney *U* test or the Kruskal-Wallis test are suitable when non-normal distributions and/or small sample sizes are used. There is considerable research on the use and procedures for nonparametric statistics going back to Siegel (1957). Another common quantitative approach for small sampled studies is repeated measures or *within-participants* design wherein each participant carries out multiple tasks or parts of a study. With repeated measures there can be a learning effect or influence from completing multiple parts of the same study; thus the statistical analyses must account for this possibility. Repeated measures ANOVA or the nonparametric Friedman's test is commonly used to analyze data collected from within-participants studies. When there are a sufficient number of participants, the statistics can be more complicated but also more powerful in generalizing the results to a larger

population. Parametric tests of difference, such as Student's *t*-test and analysis of variance (ANOVA), factor analysis and regression statistics, and multivariate statistics such as structured equation modelling, are common approaches.

Evaluating the usability and utility of products is a common purpose of product innovation assessment that can occur at different steps of the design process. Usability testing is utilized to identify problems or issues with a product or tool from a user's perspective in the areas of learnability, usefulness, efficiency, effectiveness, satisfaction, accessibility, and ease of use (Bevan, Carter, & Harker, 2015). Utility testing is used to determine the effectiveness of the functionality with users (Rogers, Sharp, & Preece, 2011). As the main purpose of these types of evaluation is to identify problems, statistical significance is not that useful. It has been proposed that having between 3 and 16 evaluators (users) is sufficient to identify 90% of usability problems (Molich & Nielsen, 1990). To find the remaining 10% requires many more evaluators. Graphical techniques and frequency diagrams provide ways of visualizing how many participants found any one problem and/or issue (or set of related problems) and can assist in assigning priority to those problems and the ordering of resolutions to those problems. However, it is important not to dismiss usability issues or problems or ideas identified or contributed by a single user and/or evaluator, as they can unearth more obscure but critical functionality or design ideas.

Qualitative. There are numerous approaches for analyzing qualitative data, but selecting the best method can be confusing. It is important to keep in mind the purpose of collecting the qualitative data and what is needed from it. If the purpose is to find meaning or to generate a theory about a specific problem or set of problems, then grounded theory can be useful (Glaser, 2017). If the purpose is to identify or confirm a common set of themes among what people have said or written during a study, then methods such as thematic or content analysis are helpful (Miles, Huberman, & Saldaña, 2014). If the interest is in finding how often specific words or phrases appear in written, spoken, or signed works and/or how often specific words or phrases appear close together, discourse analysis may be the best approach (Gee, 2014). Useful software includes NVivo and QDA Miner for textual analysis and Noldus Observer™ for video analysis.

This very brief description demonstrates the many possible methods available to analyze co-production data, and there is no right or wrong way. Definitive statements about general patterns of most of the population necessitate large quantities of data and fairly sophisticated statistical analyses. However, problem or issue identification requires less data. Mixed methods allow the richness and messiness of human commentary, opinions, behavior, and thoughts to complement more objective and focused, but limited in scope, sets of numbers. This can then help to answer questions not only about *What?* but also *Why?*.

Integrating Results into Design

The tenets of user-centered design hold that user needs and user data must be incorporated into product designs or revisions from the very beginning of product innovation. Planning for the time and resources required for ongoing user testing is

essential and necessary at the specification step, to avoid expensive retrofits or product acceptance failure due to usability issues. However, product developers, management, and marketers do not necessarily accept or understand the relationship between having users involved early in the design process and the final product's use, performance, and adoption. User evaluation can increase the time to market and/or cost of developing a specific product. In addition, the product development team may have little or no experience in capturing and integrating user-based information into products. This highlights the importance of building capacity in the team, e.g., iterative prototyping, working with users, and mixed methods. An archive of all data including audio and video recordings, sketches, made objects, or photographs should be maintained to assist designers and developers in understanding user feedback and input in context.

Product Innovation Pathway Model

Co-production is essentially a mind-set for innovation. The approaches introduced in this chapter are intended to assist in thinking about how to work with users of products and services to co-create products and services that will fit into their lives (Table 23.1).

Table 23.1 Product innovation pathway (PIP) model—co-production methods

PIP level	PIP description	Key activities
1	Innovative ideas	In co-production, innovative ideas can come from anyone. Bring together researchers, developers, and people with direct experience of an issue to identify problems, opportunities, and potential solutions in workshops, knowledge cafés, and informal interviews. Take time to do a scan and jointly evaluate ideas and solutions from elsewhere, e.g., other application areas or countries
2	Planning	Forward plan your co-production activities. Think about the types of interactions and activities you will engage in, the purpose of these interactions and activities, their duration and frequency, the types of data to be collected, and how these will be analyzed
3	Development	Co-production develops as ideas are fleshed out, prototyped, and iteratively tested. This can be achieved with one dedicated group of users or testing each version with new users to see how they respond *cold* to the latest changes. Video recording is a great tool for capturing user reactions and exploration
4	Testing in real-world environment	Conduct co-creation into the context in which an innovation is going to be used. This can be a person's home, workplace, school, sports venue, transport, etc. real-world testing takes out all the potential obstacles to an innovation being successfully deployed
5	Outcomes and impact	Start by identifying: What does success look like? In the memory program described in Box 23.1, success is a fully interactive Web-based program that offers the same benefits to users as the face-to-face original. This will enable you to plan out a series of co-production activities to get you to where you want to be

Learning More

To find out more about the co-production methods mentioned in this chapter, please access the TUNGSTEN website (http://tungsten-training.com/). For further information about using the co-production methods, please contact the authors.

Key Messages

- Co-production starts with the intended users or recipients to ensure innovations are adopted, not rejected nor abandoned.
- Users and/or recipients are experts about their situation and are equal in the process.
- Create an environment where everyone's voice can be heard.
- Think carefully about what you want to gain from co-production.
- Review different co-production methods to identify the right one(s) for your purpose.
- Don't be afraid to try new approaches.
- Co-production data and analysis can be useful in demonstrating the technique and justifying design.

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