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Navigating process evaluation in co-creation: a Health CASCADE scoping review of used frameworks and assessed components

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ABSTRACT

Background Co-creation is seen as a way to ensure all relevant needs and perspectives are included and to increase its potential for beneficial effects and uptake process evaluation is crucial. However, existing process evaluation frameworks have been built on practices characterised by top-down developed and implemented interventions and may be limited in capturing essential elements of co-creation. This study aims to provide a review of studies planning and/or conducting a process evaluation of public health interventions adopting a co-creation approach and aims to derive assessed process evaluation components, used frameworks and insights into formative and/or participatory evaluation.

Methods We searched for studies on Scopus and the Health CASCADE Co-Creation Database. Co-authors performed a concept-mapping exercise to create a set of overarching dimensions for clustering the identified process evaluation components.

Results 54 studies were included. Conceptualisation of process evaluation included in studies concerned intervention implementation, outcome evaluation, mechanisms of impact, context and the co-creation process. 22 studies (40%) referenced ten existing process evaluation or evaluation frameworks and most referenced were the frameworks developed by Moore *et al* (14%), Saunders *et al* (5%), Steckler and Linnan (5%) and Nielsen and Randall (5%).

38 process evaluation components were identified, with a focus on participation (48%), context (40%), the experience of co-creators (29%), impact (29%), satisfaction (25%) and fidelity (24%).

13 studies (24%) conducted formative evaluation, 37 (68%) conducted summative evaluation and 2 studies (3%) conducted participatory evaluation.

Conclusion The broad spectrum of process evaluation components addressed in co-creation studies, covering both the evaluation of the co-creation process and the intervention implementation, highlights the need for a process evaluation tailored to co-creation studies. This work provides an overview of process evaluation components, clustered in dimensions and reflections which researchers and practitioners can use to plan a process evaluation of a co-creation process and intervention.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ There is a growing recognition of the value of process evaluation.
⇒ The absence of process evaluation frameworks built to suit the context of co-creation makes it unclear whether they are adequate for this specific context.

WHAT THIS STUDY ADDS

⇒ The results demonstrate a fragmented interpretation of process evaluation in the context of co-creation.
⇒ Most assessed process evaluation components relate to participation, context, experience of co-creators, impact, satisfaction and fidelity.
⇒ The majority of studies do not reference existing process evaluation frameworks, with the UK Medical Research Council Guidance being the most referenced framework.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ The study highlights the need to enhance existing process evaluation frameworks with additional characteristics and components relevant to co-creation.
⇒ The study suggests considering both the co-creation process and intervention implementation as interventions and conducting process evaluations for each.
⇒ The study recommends the use of formative evaluation.

INTRODUCTION

Co-creation is advocated as a means to develop solutions (e.g., an intervention to improve public health) which meet the needs and wishes of the population of interest and other relevant stakeholders, by embracing a

collaborative approach of innovative problem-solving. This approach includes the involvement of a wide range of stakeholders throughout all phases of a project,[1] from identifying or defining the problem to the project's concluding stages[2] to co-create effective and sustainable solutions that align with the needs and preferences of all relevant stakeholders.[3] It has been considered a promising approach to increase the effectiveness and impact of public health interventions and to contribute to the closing of the implementation gap,[4] particularly valuable in the context of marginalised communities.[4 5]

However, co-creation risks tokenistic and ineffective applications without a rigorous methodology.

Process evaluation especially has been regarded as crucial to contextualise, explain and increase the science behind public health interventions.[6] Its understanding has evolved over time. In its early stage, it primarily involved the assessment of implementation through the analysis of quantitative process indicators for interpreting the results obtained from effectiveness studies. Later, there was increased recognition of the need for qualitative research alongside trials to place greater value on the context, acceptability of an intervention and implementation issues.[7] This understanding of process evaluation is exemplified by the framework of Saunders *et al*,[8] which focuses on capturing the intervention implementation aspects, such as fidelity to the protocol, the number of intervention activities implemented and topics intended covered, attendance rates, recruitment procedures and contextual factors that may have affected the intervention implementation.

Since 2010, process evaluation expanded its scope to include the exploration of mechanisms of impact. For instance, through the British Medical Research Council (MRC) guidance,[9] authors propose understanding process evaluation as a way to not only report on intervention implementation but also as an opportunity to explore elements that may help to explain how a certain impact has been achieved. Process evaluation is described by the MRC guidance and recent studies as a way to assess fidelity and quality of implementation, clarify causal mechanisms and identify contextual factors associated with variation in outcomes.[10–12] It is defined to be applicable and valuable to the stages of intervention development and implementation.[9]

Applied to co-creation, an evaluation of the process is crucial both at the development stage (ie, co-creating the intervention) and at the implementation stage (ie, implementing the co-created intervention). At both stages, a process evaluation can serve as a way to identify areas of improvement, ensure that the diverse perspectives and contributions of stakeholders are meaningfully integrated and that co-creators are experiencing a sense of joint ownership.[13] It allows for the co-creation efforts to evolve and become more effective in addressing public health issues by meeting the needs and wishes of the communities and individuals involved.[13] Despite being crucial to ensure a meaningful practice and an

evidence-based assessment of the co-creation process and developed solution/intervention, no process evaluation framework has yet been designed explicitly for the context of co-creation. Being co-creation an underused yet emerging approach in public health,[1 3 14] we observe a lack of evaluation frameworks that account for essential aspects in the co-creation process[15] and that align with the most recent literature on co-created public health interventions.[16] Despite being crucial to ensure a meaningful practice and an evidence-based assessment of the co-creation process and developed solution/intervention, no process evaluation framework has yet been designed explicitly for the context of co-creation.

For this reason, this review aims to explore how process evaluation is conceptualised, planned for and conducted in the context of co-creation, by providing an overview of process evaluation conceptualisations, used evaluation frameworks and components assessed at both the stages of development and implementation. It represents the background and exploratory work on the ways in which process evaluation is conducted in co-creation projects that will serve us to publish recommendations in our follow-up study.

Furthermore, several studies applying a co-creation approach have highlighted the importance of ensuring stakeholders' perceptions and experience of the process are captured and guiding the intervention itself and/or adjustments and adaptation during the co-creation.[17 18] This type of formative evaluation has been previously regarded as valuable in the context of co-creation and participatory research approaches.[18–20] Hence, this review additionally aims to explore the extent to which included studies had planned for or conducted a formative evaluation, and, therefore, conducted, analysed or reported back evaluation results during the process to provide feedback to the co-creators and/or research team to adapt or improve the process.[21]

Finally, as engagement with the population of interest and stakeholders in co-creation processes is assumed to be happening throughout,[2] in this study, we are interested in exploring the extent to which included studies planned for or conducted a participatory evaluation as part of the process evaluation. Participatory evaluation is described as a type of evaluation approach in which stakeholders are involved in the design of the evaluation, the data analysis or reporting.[22]

Overall, this study seeks to provide a review of studies planning and/or conducting a process evaluation of public health interventions adopting a co-creation approach and aims to derive assessed process evaluation components, used evaluation frameworks and to assess the extent to which studies conducted formative and/or participatory evaluation.

METHODS

This research was conducted in two parts. First, we conducted a scoping review to identify frameworks and

components used in the evaluation of a co-creation process and implementation of the related co-created interventions. Then, concept mapping[23] was applied to identify a set of overarching dimensions to cluster the identified components.

Search strategy

This scoping review followed the PRISMA-ScR (Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews) guidelines.[24]

We searched the Health CASCADE and SCOPUS databases with the same search strategy of including co-creat* OR co-creat* AND process AND evaluation. The Health CASCADE database is a recently published open-access database including peer-reviewed articles about co-creation across various fields.[1] It was produced within the Health CASCADE project, a European-funded project aiming to develop the methodological foundation of evidence-based co-creation.[25] The search on both databases was conducted with no time or language limitations. Following the database search, articles were exported into a CSV file to remove duplicates in Excel. The articles were then imported and screened in Rayyan.

Process of selection

All studies were doubled-screened by several reviewers at title and abstract (GRL, JdB, KG, DMA, LM and SC) and at full-text (GRL, JdB, KG, DMA, QA, TA, MV and MG-G) and irrelevant studies were removed against the agreed set of criteria. Differences of opinion regarding inclusion or exclusion were resolved by discussion and reaching consensus and, if not applicable, by the involvement of a third reviewer (GRL, JdB, KG, DMA, QA, TA, MV and MG-G).

Eligibility criteria

In line with the recommendations of Levac *et al*,[26] the criteria for study inclusion were refined through iterative discussion among the research team. Articles were included if they complied with the definition of co-creation intended as 'an evidence-based methodology for the development, implementation and evaluation of innovations through continuous, open collaboration, interactional knowledge production and shared decision-making among key stakeholders, directed at improving public health'.[27]

We included studies that explicitly mentioned planning or conducting a process evaluation of (a) the co-creation process at any of the intervention/project stages (eg, the engagement with relevant stakeholders in the needs analysis; intervention development) and/or (b) the implementation of the co-created interventions (eg, how the co-created intervention was carried out and received, and examining its fidelity, quality and acceptability). Included studies related to the public health field, defined as all organised measures (whether public or private) to prevent disease, promote health and prolong life among the population as a whole.[28] All studies included had to

be empirical studies, that is, gathering data based on experience, observations or experimentation.[29]

Full inclusion criteria for title and abstract screening and full text can be found in online supplemental file 1.

Data extraction

A template was developed in Excel to facilitate the extraction of information about included articles (see online supplemental file 2) and include data related to the definition of process evaluation, if applicable; frameworks used to guide the evaluation, if applicable; process evaluation components and on whether included articles conducted a formative evaluation[21] or a participatory evaluation.[22] We also extracted information related to the components assessed as part of the process evaluation. All data were independently extracted by two reviewers (GRL, JdB, KG, DMA, QA, TA, MV and JRZR), and, in case of discrepancies, MG-G and GRL were involved, and consensus was reached for the final extraction.

Data analysis

To synthesise research findings related to the identified components, the extracted components were clustered by the first author (GRL) according to similarities. For instance, if we encountered components that were extracted and labelled as 'facilitation', we clustered these together with any related components that shared a similar thematic element, such as 'facilitation of patients' involvement'. In case of uncertainty, the last author (MG-G) was consulted.

In order to synthesise the identified components into a visually accessible format and to provide a structure to the results, we aimed to delineate a set of dimensions encompassing all individual components. To do so, all co-authors participated in three iteration rounds of consensus-making. First, to identify overall dimensions, co-authors were invited to independently group components and assign a name to each cluster via the online programme Trello.com. Each cluster would represent a dimension. Second, during an in-person meeting, using all dimensions that were drafted individually as a base, co-authors, as a group, sought consensus on a set of final dimensions.

Once dimensions were set, co-authors were asked individually to sort all components into the identified dimensions via the same online programme. We set a consensus threshold, which required that more than 50% of the co-authors must agree on the placement of each component within a specific dimension. More than 50% agreement was obtained for all sorted components.

RESULTS

By reviewing and analysing included studies, this review provides an overview of how process evaluation was conceptualised and conducted in co-creation projects. It achieves this by describing included studies, frameworks used and any adaptations made to those frameworks and
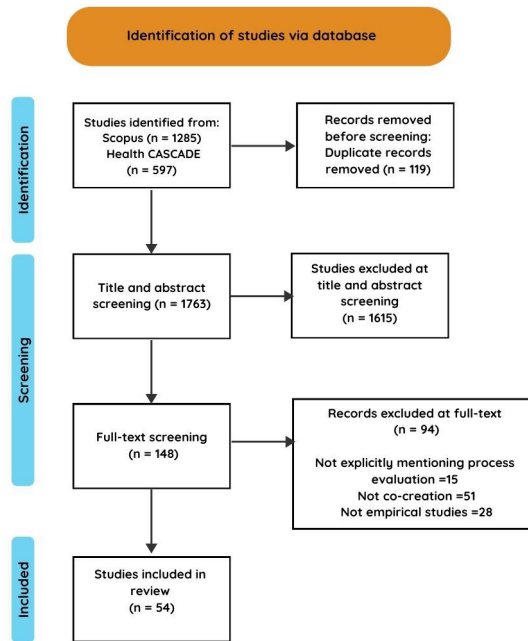
Figure 1 PRISMA-ScR flow.

reporting on the assessed process evaluation components.

From the original total hit of 1882 articles, 119 duplicates were removed and 1615 were excluded at title and abstract screening. 79 articles were excluded after the full-text screening, resulting in the inclusion of 54 studies. The PRISMA extension for scoping review guidelines has been used to present the screening process (figure 1).

Overview of included studies

Online supplemental file 3 shows the included studies and details about the authors, publishing year, the country in which the study was set and specifies whether the study applied formative evaluation and/or participatory evaluation. The majority of included studies were conducted in the USA (18%), followed by Canada (7%), the Netherlands (5%) and the UK (4%), with the rest spread across various countries, each representing 1%–3% of the total. Studies primarily focused on obesity prevention (7%) and mental health (4%). Other topics included nutrition, physical activity, workplace wellness and various public health issues such as HIV prevention, breast cancer, drug use, occupational health and more (1%–3% of the total).

All included studies were published between 2002 and 2022. There was an increase in publications between 2003 and 2017, with a peak of eight in 2016 and seven in 2017. Subsequently, from 2018 onward, there has been a continued growth in publications.

Formative and participatory evaluation

13 studies (24%) conducted formative evaluation during either the co-creation process or the intervention's implementation and 37 (68%) conducted process evaluation after the intervention's implementation (ie, summative evaluation). Two studies conducted a participatory evaluation (3%) while the remaining (97%) did not.

When it comes to formative evaluation, several authors identified potential implementation barriers and facilitators to support future adaptations or iterations of the intervention implementation.[30–35] In some studies, the research team asked participants to reflect on perceptions related to the participants' engagement[36] or expectations,[37] to adapt, if redeemed as necessary, the following intervention's sessions, such as workshops and/or activities.[36 38]

Two studies conducted participatory evaluation in different forms. Gibbons et al[39] reported that, when presenting to the group, interested partners iteratively shared their thoughts, concerns and suggestions regarding the findings and the interpretation of the findings. More comprehensively, Harper et al[33] engaged with community representatives right from the planning of the process evaluation up to the choice of evaluation methods and strategies, in accordance with both community sensitivity and scientific rigour, up to the interpretation of findings.

Process evaluation conceptualisation

24 studies (44%) did not explicitly define process evaluation. 30 studies (56%) included an explicit definition of process evaluation within the manuscript, whether it was by referencing an existing study or by providing a definition themselves. Definitions of process evaluation provided by the included studies are available in online supplemental file 4, including extracted quotes.

The manner in which process evaluation aims were described across studies provides insights into how the conceptualisation of process evaluation varied across studies. While the evaluation of intervention implementation is taken into account by the majority of the studies, several authors focused on other elements, including outcome-related evaluation,[33 35 40 41] mechanisms driving impact,[34 42–53] the contextual factors at play[42 43 47 49 54–56] and the co-creation process.[31 37–41 48 49 51 54 57–59]

Several studies referred to process evaluation as the monitoring and reporting of intervention implementation and delivery. In these instances, process evaluation strives to paint 'a clear, descriptive picture of the quality of the programme elements being put into place and what is taking place as the programme proceeds'.[58 60] Parker et al,[61] for instance, used process evaluation to gauge the extent, fidelity and quality of the intervention implementation. Similarly, Sormunen et al described process evaluation as 'a process through which to report on structure and activities of the programme or intervention'.[50]

Four authors included an evaluation of outcomes as part of their process evaluation, defining this in several ways, including as a process in which you may analyse the 'outcomes of the process used in the intervention'[40] and 'as a way to establish whether the partnership and project activities have been as intended and resulted in the expected outputs'.[41] Magnusson et al described process

evaluation as the procedure which 'will monitor the processes in terms of reaching the intended outcome'[35] while Harper *et al* described process evaluation's goal as 'to clarify anticipated outcome goals and criteria used in outcome evaluations that measure a programme's relevance and accomplishments'.[33]

Authors in the included studies have also aimed to comprehend impact mechanisms as part of their process evaluation[34 42–53]. Studies conducted by Steckler and Linnan[62] described process evaluation as the mechanisms that shed light on why some interventions produced the intended results, and why others did not. Studies citing Moore *et al*[9] stressed the importance of examining the nature of what was implemented in practice and understanding the context around the intervention outcomes to inform future programmes. In this light, process evaluation is said to allow 'to draw inferences about future applicability in the current setting and about generalisability and transferability to other settings'.[63] Anselma *et al*,[64] among others, stressed process evaluations should help to gain a deeper understanding of the more and less effective elements of interventions, as well as facilitators and barriers to the intervention's maintenance/sustainability.

The intention to capture mechanisms of impact ties in with the evaluation of contextual implementation barriers and facilitators. To try to capture mechanisms of impact, studies stressed the relevance of assessing contextual factors that may be influencing the co-creation process and intervention. Gathering insights about the intervention's context, as part of the process evaluation, is seen as a way to 'understand how and why the programmes work, and under what conditions'.[46] Similarly, Palmer *et al*,[65] citing Glasgow *et al*[66], described the process as the capturing of information about emerging barriers and facilitators to change implementation and to identify contextual (organisational and environmental) factors that affect the intervention.

Lastly, several studies refer to an evaluation of the co-creation process and related aspects when describing process evaluation.[31 37–41 48 49 51 54 57–59] Fusari *et al*,[43] for instance, highlighted the use of process evaluation as a way to learn about the engagement mechanisms of participants and stakeholders to unveil insights around impact mechanisms that may be necessary for scale-up. Tolma *et al*[58] included the intention, as part of their process evaluation, to evaluate stakeholders' reactions, such as, for instance, 'the level of participation among intended recipients to the programme and reactions of the intended recipients to the programme'.[58] Greer *et al*[40] and Anselma *et al*[64] included the assessment of enabled capacity building and empowerment as a result of the engagement and as part of their process evaluation.

Frameworks used
Eight studies (14%)[42 43 47 49 54–56] cited evaluation or process evaluation frameworks developed by Moore *et al*,[9] three studies (5%)[62 48 51 58 62] cited Steckler and Linnan,[62]

three (5%)[35 67 68] cited Saunders *et al*,[8] three (5%)[63 69 70] cited Nielsen and Randall;[55] two studies (3%)[40 71] cited Greer *et al*,[40] and two (3%)[64 65] citied Glasgow *et al*,[66] one study (1%)[34] cited Damschroder *et al*[72], one study (1%)[73] Nielsen and Abildgaard,[74] one study (1%)[59] Rowe and Frewer[75] and one study (1%)[76] Grant *et al*.[77]

Table 1 presents, in order of highest to lowest number of cited times, details of the frameworks that were used in the included studies to guide the process evaluation, including the modifications to the original framework.

Most studies adapted frameworks to include evaluation elements that refer to the co-creation process and related experience, perceptions with the implementation intervention and co-creation process.[59 64 67 67] Additions to the MRC guidance[9] included evaluation elements related to the participants' experience of engaging in the co-creation process and/or intervention implementation. To the MRC guidance, Cedstrand *et al*[55] integrated Nielsen and Randal's framework,[69] while Fusari *et al*[43] included the use of the logic model.

To Nielsen and Randall's framework,[69] Yeary *et al*[51] included the assessment of acceptability and satisfaction with the intervention components and awareness of the intervention, while Tolma *et al*[58] further looked into barriers to intervention maintenance. Yeary *et al*[51] also added evaluation elements related to the acceptability of intervention components (satisfaction) and the intervention reach (awareness of the intervention).

Dimensions
Figure 2 presents a visual representation of identified process evaluation components clustered in overarching dimensions.

Process evaluation dimensions
Each dimension and component may apply to both the co-creation process and the implementation of the intervention.

'Delivery' components measured the degree to which the co-creation process and/or intervention implementation was delivered as intended. It includes the reporting of the number of co-creation and/or intervention sessions (e.g., workshops) delivered, the number of participants involved, etc and reports on changes concerning the original protocol. The dimension of 'delivery' encompasses the following process evaluation components: delivery, dose delivered, adherence, adaptation, dose received, exposure and fidelity.

'Participation' includes components assessing the extent to which individuals or groups have engaged with and participated in the co-creation process and/or implemented intervention. It included components measuring the level of involvement and active engagement of the population of interest and/or end-users during the co-creation process and/or in the intervention, including the self-perceived degree of shared ownership and commitment. The latter may be observed and reported by facilitators and/or reported by participants. The dimension of

Table 1 Frameworks used in studies to guide process evaluation

Authors	Year	Title	Times cited	Original components of the framework	Modifications made by study
Moore et al[9]	2015	Process Evaluation of Complex Interventions: Medical Research Council Guidance	8	▸ Context: 　– Contextual factors that shape theories of how the intervention works; 　– Contextual factors that affect implementation, intervention mechanisms and outcomes; 　– Causal mechanisms present within the context which act to sustain the status quo, or potentiate effects. ▸ Implementation: 　– Implementation process (how delivery is achieved); 　– What is delivered: Fidelity, dose, adaptations, reach. ▸ Mechanisms of impact: 　– Participants responses to and interactions with the intervention; 　– Mediators; 　– Unexpected pathways and consequences.	McMaughan et al[54] and Geelen et al[42] looked at the participants' and stakeholders' perceptions and experience with implemented interventions. Cedstrand et al[55] integrated Nielsen and Randal's components of readiness for change and available support from managers. Fusari et al[43] incorporated the logic model's steps, that is, needs, evidence, input, activities, outputs, outcomes and impact.
Steckler and Linnan[62]	2002	Process Evaluation for Public Health Interventions and Research	3	▸ Context; ▸ Reach; ▸ Dose given; ▸ Dose received; ▸ Fidelity; ▸ Implementation; ▸ Recruitment.	Yeary et al[51] also assessed the acceptability of intervention components (satisfaction). Tolma et al[58] add the evaluation of barriers to maintenance.
Saunders et al[8]	2005	Developing a process-evaluation plan for assessing health promotion programme implementation: a how-to guide	3	▸ Fidelity; ▸ Dose delivered; ▸ Dose received; ▸ Reach; ▸ Recruitment; ▸ Context.	Dean et al[67] further included the assessment of the experiences of the target population's participation in the intervention.
Nielsen and Randall[69]	2012	Framework for Evaluating Organizational-level Interventions	3	▸ Context: 　– Omnibus context, that is, the general intervention and implementation setting; 　– Discrete context; that is, specific events that may have influenced the effects of the intervention. ▸ Intervention: 　– Initiation; 　– Intervention activities: risk assessment, action plans; 　– Implementation strategy: drivers of change, participation, support from senior; management, middle managers, consultants, communication and information. ▸ Mental models: 　– Mental models; 　– Readiness for change; 　– Perceptions of intervention activities; 　– Changes in mental models.	Cedstrand et al[55] further incorporated this framework with elements from Moore et al related to the intervention implementation, that is, fidelity, dose and reach. Lelie et al[70] further investigated reach, tailoring and exposure. As part of context, explores the role of culture. Schelvis et al[63] further looked into reach, satisfaction, targeting, delivery, exposure, culture and conditions.
Greer et al[71]	2016	Peer Engagement and Evaluation Project (PEEP)	2	▸ Supportive environment; ▸ Equitable participation; ▸ Capacity building and empowerment; ▸ Improved programming and policy.	

Continued

Table 1 Continued

Authors	Year	Title	Times cited	Original components of the framework	Modifications made by study
Glasgow et al[66]	1999	RE-AIM	2	▶ Reach ▶ Effectiveness ▶ Adoption ▶ Implementation ▶ Maintenance	Anselma et al[53] further included the perceived effects on children's participation and their experiences with the collaboration and communication during the intervention.
Damschroder et al[72]	2009	The Consolidated Framework for Implementation Research based on user feedback	1	▶ Innovation characteristics; ▶ Outer setting ▶ Inner setting ▶ Individual characteristics ▶ Implementation process	Morgan et al[34] to their evaluation added the category of Innovation Sustainability, within which they include a feasibility evaluation.
Nielsen and Abildgaard[74]	2013	Organisational interventions: a research-based framework for the evaluation of both process and effects	1	▶ Change mechanisms (organisational actors' mental models and behaviours) ▶ Initiation ▶ Screening ▶ Action planning ▶ Implementation ▶ Context	
Rowe and Frewer[75]	2000	Public participation methods: a framework for evaluation.	1	▶ Resource accessibility ▶ Task definition ▶ Structured decision-making ▶ Cost-effectiveness	Dyer et al[59] added several components related to the evaluation of the cocreation process.
Grant et al[77]	2013	Process evaluations for cluster-randomised trials of complex interventions: a proposed framework for design and reporting	1	▶ Processes involving clusters ▶ Recruitment of clusters; Delivery to clusters; Response of clusters Process involving target population ▶ Recruitment and reach of individuals; Delivery to individuals; Response of individuals ▶ Maintenance ▶ Theory ▶ Context	Beckerman-Hsu et al[76] further explored adherence (content, reach, frequency, duration), adaptations (additions, deletions, modifications) and details on the quality of intervention delivery, participant responsiveness, barriers and facilitators to implementation.

'participation' encompasses the following process evaluation components: participation, motivation, retention, facilitation, methods, partnership and recruitment.

'Experience' captures components measuring and assessing the subjective perception and evaluation of co-creation process and/or the implementation of the intervention by the individuals or groups who participated in it. It includes the assessment of (a) the experience related to the co-creation process and/or (b) the overall experience and involvement with the intervention implementation and actions. The dimension of 'experience' encompasses the following process evaluation components: acceptability, expectations, perceptions and satisfaction.

'Context' relates to components that are intended to examine the broader social, cultural, economic and political factors which create the system that can impact the success or failure of the intervention. The purpose of evaluating context might be to (a) understand the systemic factors which have influenced the public health issue that matters, (b) help ensure that the co-creation process and intervention is appropriately tailored to the specific context in which it is being implemented and (c) understand which environmental factors have had an impact on the co-creation process or intervention implementation. The dimension of 'context' encompasses the following process evaluation components: mapping, context, feasibility, readiness for change, support and resources.

'Maintenance' includes components that assessed the extent to which the intervention outcomes and/or

Figure 2 Overview of dimensions and components identified through included studies.

relationship formed during the co-creation process and/or implementation of the intervention are being maintained. The dimension of 'maintenance' encompasses the following process evaluation components: maintenance, retention and future organisation.

'Impact' relates to components assessing the extent to which the co-creation process and/or implementation of the intervention has achieved one or more of its desired outcome(s) and its overall impact, including, for example, empowerment, self-reported or reported attitudes and/or changes towards the targeted health behaviour, self-perceived increase of well-being, awareness and satisfaction related to the participation in the process. The dimension of 'impact' encompasses the following process evaluation components: mechanisms of impact, impact, adoption, empowerment, capacity building, knowledge integration and evidence, communication, policy change and reach.

Process evaluation components

Among the most evaluated components are participation (26, 48%), context (22, 40%) and experience of co-creators (16, 29%), together with impact (16, 29%), satisfaction (14, 25%) and fidelity (13, 24%). Descriptions of each component are explicated below. Other components, in order of frequency of use, include the following: recruitment, reach, dose delivered, readiness for change, delivery, empowerment, motivation, dose received, support, capacity building, perceptions, maintenance, facilitation, communication, adherence, feasibility, exposure, adoption, adaptation, knowledge integration and evidence, resources, future organisation, policy-change, partnership, methods, expectations, acceptability and retention.

We describe below the most evaluated components (>23%), namely participation, context and experience of co-creators, impact, satisfaction and fidelity. A description of all components, as intended by the authors of the included studies, including the frequency of use, can be found in online supplemental file 5.

Participation

26 studies assessed participation as part of their process evaluation, including the extent to which individuals or groups who were the target of the intervention engage with and participate in the co-creation process and/or implementation of the intervention. Studies assessed the nature and degree of participation,[37 78–80] and more specifically, whether it was voluntary, that is, the extent to which there was a voluntary shift of responsibilities from providers to users[80] or equitable, ensuring all experiences were listened to, respected and represented at the table.[30 45 71 81] Some assessed the extent to which there was continued or early engagement of communities throughout the process,[45 59 78 82] including whether the objectives were set out and agreed by stakeholders at the start of the process,[45] whether they had the chance and time to discuss and continuously revise the action

plans[30 73] or whether participants agreed they were targeting the most important problems in the intervention.[73 83]

Studies also specifically measured the participants' involvement in decision-making,[82] participants' feelings regarding the transparency of the process[82] occurrence of joint actions to meet community needs,[60] the extent to which participants feel joint ownership[63] or shared responsibility for the intervention.[70] Studies also assessed the perspectives of participants on the process[70 84] and, specifically, as to whether they have felt involved in the intervention,[63] have established a trustful and open relationship with the working team[45 85] and how they perceived the impact or accomplishment of the engagement process.[39] Clark and Laing[86] assessed the value of knowledge of exchange while participating. den Broeder *et al*[87] looked at perceived factors facilitating or hindering the development of consensus and perceptions of the level of perceived consensus and actual consensus.

Other studies evaluated the benefits and barriers[39 88 89] and implementation determinants related to the engagement process.[79] Kelly and Van Vlaenderen[78] focused on assessing the degree to which the communicative problematics of participation have been identified and dealt with in a project. Dennehy *et al*[90] used Lundy's Model of Participation,[91] to operationalise participation, focusing on the evaluation of perceptions related to the creation of an inclusive and safe space for children, facilitation, extent to which their views are listened to and acted on.

Context

22 studies reported an assessment of context as part of their process evaluation examining the broader social, cultural, economic and political factors impacting the success or failure of the intervention in a specific context.

Studies mostly evaluated the contextual factors that might impact or have impacted the intervention planning and implementation.[42 51 67 68 73] A wide range of approaches to the definition of context were used. Reeve *et al*[49] assessed context as the larger social, political and economic environment that may influence the implementation of an intervention. Igel *et al*[47] included the evaluation of existing social, health and environmental issues while Schelvis *et al*[92] explored the organisational and the environmental characteristics that affect the intervention. Tolma *et al*[58] reviewed aspects related to the larger social, political and economic environment and Gensby *et al*[46] highlighted the importance of considering the political-administrative context in which rehabilitation programmes are practised. Robertson *et al*[56] focused on broader community and environmental factors, such as socioeconomic considerations and community participation.

Studies explored implementation barriers and enablers,[31 45 58 93 94] some focusing specifically on existing organisational structures, professional values or sociopolitical context that enable successful implementation,[95 96] environmental factors,[30] resources available[52 56] or events

that occurred and influenced the content of the execution of the action plan.[63] Beckerman-Hsu et al[76] also specifically looked at moderators and the extent to which their role impacts implementation.

Authors have also mapped the characteristics and distribution of a specific population or health issue in a particular geographical area. Authors identified, analysed and considered the systematic representation of relevant stakeholders,[45 96] aimed to clarify context, processes and activities,[96] to understand the community[85] and to identify the contextual and procedural drivers of any wanted change.[57]

Experience

16 studies evaluated the experience of participants and assessed the subjective perception of individuals or groups who participated in the co-creation process and/or intervention implementation. The majority of the studies[48 54–59] assessed overall experience and involvement with the implemented intervention and actions while others[31 55 60] evaluated how the participants specifically experienced the participatory process, or the coordination and collaboration in the process.[59]

Impact

16 studies assessed impact-related measures related to the extent to which the intervention had achieved one or more of its desired outcome(s) and its overall impact. This included evaluating the impact of the intervention on the collaborative and equitable involvement of its members,[97] patient health and well-being,[98] employee engagement and participation in work,[99] line manager attitudes and actions,[92] and personal impact on advisory group members.[90]

Reeve et al[49] evaluated patients' perceptions of the overall impact they perceived as a result of taking part in the intervention. Heggdal et al[98] specifically reported on whether the intervention had the intended effect on patient health and well-being and whether the intervention had prompted individuals to be more active or had led to changes in their health behaviours.[83 84 92]

Others have evaluated the institutional and organisational changes taking place among and beyond the group of participants[57 92 99] and outcomes that were a result of the engagement process between several parties involved.[61 79 100] Chrisman et al[60] assessed the concrete achievements of the intervention, such as the number of publications, programmes, evaluations and grants that have been produced.

Some studies focused on evaluating mechanisms of impact and examined how the intervention produced its intended outcomes. Some studies aimed to identify the specific causal mechanisms or pathways that linked the intervention to the observed changes in health-related behaviours, health outcomes or other targeted outcomes[42 47] and one study specifically looked at factors and mechanisms which contributed to citizen participation and intersectoral collaboration.[101]

Satisfaction

14 studies assessed the level of satisfaction among the participants and/or end-users who received or participated in a co-creation process and/or public health intervention. The evaluation of satisfaction was assessed through the overall intervention, its design and implementation, partnership, research process, products, team building process and dialogues, as well as the progress of the co-creation group.

Satisfaction was evaluated in various aspects of the intervention, such as the overall intervention,[50 63 67 84 97 102] design and implementation[102] and more specifically, the partnership,[97] the research process,[97] products[97] or team building process[102] and dialogue[103] and the progress of the co-creation group.[84] Some studies assessed satisfaction with specific stages of the process, including satisfaction with the needs assessment phase and the developed action plan.[63] Lelie et al[70] registered satisfaction with the appropriateness of tools and materials, intervention activities and intervention approach. Schelvis et al[92] aimed to capture satisfaction levels with the participatory process.

Fidelity

Fidelity was assessed in thirteen studies and refers to the process of measuring and assessing the extent to which an intervention was delivered as intended, according to the original programme design or protocol. Studies evaluated fidelity by determining whether the intervention was implemented consistently and faithfully across different settings and to identify any variations or adaptations that may have been made during implementation.[32 42 46 51 55 58 61 63 67 68 92 104]

DISCUSSION

Broadening the scope of process evaluation for co-creation

The increased number of publications on process evaluations of co-creation projects included in the current review not only indicates a growing interest in the field but also a recognition of its potential benefits and relevance. However, the field of process evaluation in co-creation is to be researched further. As previous reviews recommend,[105 106] it is yet to be understood why process evaluation frameworks are so scarcely applied. The results from the current review align with those of two separate reviews on the use of process evaluation by Lazo-Porras et al[105] and Liu et al[106] in chronic and neglected tropical diseases in low-income and middle-income countries and in primary care interventions addressing chronic disease. Both studies indicate a low percentage of included studies that reference existing frameworks in process evaluation (12% and 31%, respectively). Among recommendations for the use of process evaluation in the study by Lazo-Porras et al,[105] was to standardise reporting to ensure consistency and comparability among studies.

Echoing the above-mentioned results and recommendation, the results of this review highlight the importance of addressing the need for a standardised process

evaluation specifically designed for co-creation. Such evaluation should capture essential co-creation elements as part of the co-creation process as well as part of the implementation of the co-created solution. An evaluation of the co-creation process would need the inclusion of specific elements, such as an assessment of the active collaboration with the stakeholders, the experience, facilitation and levels of participation. The process evaluation carried out by the included study by Dyer *et al*[59] illustrates this by focusing in-depth on an evaluation of the engagement and participation of co-creators in the co-creation and implementation process. Authors include valuable evaluation elements which relate to the following aspects: (a) the early engagement of communities in the process; (b) identification, analysis and systematic representation of relevant stakeholders; (c) clear objectives set out and agreed by stakeholders at the start of the process; (d) continued engagement of communities throughout process; (e) relevant methods chosen and tailored to the context, (f) participants and level of engagement; (e) highly skilled facilitation of the process; (f) integration of local and scientific knowledge; (g) open and meaningful information exchange and interaction with face to face; (h) transparency, trust and fairness; (i) equality among stakeholders and (l) the competent management throughout process.

Most importantly, this review has surfaced a growing trend of bringing the co-creation process into the conceptualisation of process evaluation.[31 37–41 48 49 51 54 57–59] Studies have done this by incorporating co-creation elements in existing process evaluation frameworks,[59 64 67 67] including an assessment of experience[34 48 49 54–56 70 107 108] and components related to participation.[25 30 37 39 45 60 63 70 71 78 80 81 85 87] Placing value on the co-creation process and its evaluation might entail having to consider the co-creation process an intervention in itself, with its own impacts and process evaluation. An evaluation of the co-creation process might be crucial as strictly linked to the implementation of the co-created solution. Equally valuing the process of co-creation and intervention implementation may enable us to grasp a more complete picture and to explore the relation between the process which co-created the solution (e.g., intervention) and the implementation of the solution/intervention itself.

Participatory evaluation and formative evaluation

Despite participatory evaluation being considered a potentially recurring approach to process evaluation, very few studies have done so (3%). We speculated that this could be attributed to potential challenges associated with its implementation, including the additional time it may require from participants and the possibility that it may not be perceived as highly significant by the studies that have included it. More guidance might be needed on how to conduct participatory evaluation in a way that is relevant to the stakeholders and adherent to co-creation principles. One first step might be, as done in the included study by Anselma *et al*,[53] to share the effect

and process evaluation plan and ask the population of interest, in this case children, to reflect on the proposed measures and to suggest potential additional evaluation outcomes or methods.

13 studies (24%) have been found to adopt a formative evaluation approach. Formative evaluation has been thought useful for the identification and resolution of potential issues that could hinder the intervention's implementation and/or related solution development[109] and as an opportunity to explore whether the intervention is addressing a significant need, using ongoing input for short-term adjustments and to detect and adjust, if needed, to unanticipated events and local adaptations.[109]

Formative evaluation, especially in the context of co-creation, has been considered valuable when pinpointing the population of interest and stakeholders' feedback regarding the co-creation process, the implementation and tailoring implementation strategies.[19 20] It may be particularly significant as a way to gauge stakeholders' active participation and ensure their perspectives are comprehensively captured and integrated into the intervention and ensure a successful intervention[18–20] and allow for the intervention implementation fine-tuning, ensure it is closely aligning with stakeholders' insights, feedback and concerns.[35]

Formative evaluation may be considered a characteristic inherent to co-creation, as the process is considered highly iterative.[13] This inherent iteration nature built within co-creation might represent a challenge when it comes to the evaluation of fidelity. A challenge might be faced if formative evaluation is either not reported, as this usually happens more informally, or avoided altogether, particularly in the case of well-controlled randomised trials, which may typically refrain from postapproval alterations.[109] As co-creation adopts an approach which is receptive to stakeholders' context and feedback, the intervention should not solely be reporting adherence to predetermined steps but also valuing and adapting, when possible, to the lived experience, knowledge and values of the co-creators.

To be able to measure the extent to which formative evaluation activities exert influence on the implementation, thoroughly reporting modifications becomes essential. It is, therefore important, in this respect, that the intention of formative evaluation is explicated and reasons for and applied modifications are reported, including why and how formative was collected, used, by whom and to what extent it was integrated in the modifications.[109]

Recommendations for future research

Through a search of the published literature, this is the first scoping review of process evaluations planned or conducted in the context of co-creation for public health. Findings from this study lead to several implications for the field of process evaluation for co-creation.

First, the incorporation of extra elements into existing process evaluation frameworks and focus on process evaluation components related to the co-creation

process, such as experience, participation and satisfaction, suggests that the existing process evaluation frameworks may fall short in comprehensively evaluating the co-creation process. It is important also to recognise, as expressed throughout the manuscript, the importance authors have placed on components related to context and mechanisms of impact.

Second, placing a focus on the co-creation process may necessitate valuing the co-creation process as an intervention in itself. Equally, valuing both the co-creation process and the intervention implementation as distinct interventions and conducting process evaluations for both may help to provide a more comprehensive picture of co-creation.

Third, the high percentage of use of formative evaluation throughout included studies may suggest that this is key to the context of co-creation processes and may help account for the iterative nature of the approach and adapting the co-creation process and intervention to the co-creators' lived experience, knowledge and values. Conversely, the limited use of participatory evaluation by included studies may suggest either a lack of relevance or constraints in its practical implementation. This scoping review is conducted as part of the Health CASCADE project and findings will be used to inform the development of further guidance on planning and evaluating co-creation for public health. The authors involved in the guidance development will expand on components identified, recommend methods for evaluation and include practical examples to support researchers and practitioners.

How to use this review?

We see this review as serving three distinctive objectives. First, to provide an overview of existing conceptualisations related to process evaluation and frameworks used to guide the planning of process evaluation for co-creation. Second, to identify process evaluation components that previous studies took into account, to get a sense of what was valued as part of their planned or conducted process evaluation of co-creation. Lastly, the review seeks to facilitate reflection on process evaluation components that researchers and practitioners could consider when planning for the process evaluation of co-creation in the field of public health.

Study limitations

First, the framework modifications detailed in table 1 stem from our subjective understanding of the components and may not have been explicitly reported as modifications in the included studies. Second, each identified process evaluation component described in online supplemental file 5 is presented as described by the authors of the included studies. No modifications have been made to the clustering and description of identified process evaluation components to portray accurately what had been done and how components were intended by the included authors. Finally, even though

a >50% agreement sorting rule was set, some co-authors expressed the difficulty in placing individual components into one dimension as they felt some could have related to several dimensions.

For the reasons expressed above, it should be noted that review findings should not be seen as a source of expert advice on process evaluation, but rather considered as a synthesis of current practice which can help reflect on the planning for process evaluation in the context of co-creation. Furthermore, while almost all the co-authors found most process evaluation components to be applicable and relevant to both stages, some shared the challenge of thinking of the components without categorising them into the (a) co-creation process and (b) implementation of co-created solution/intervention. For the development of the process evaluation framework for co-creation planned as a follow-up study, although we anticipate some overlaps, we will explicitly refer to these two stages distinctively.

Lastly, it should be noted that authors used their discretion to determine inclusion or exclusion, based on their own judgement and consensus between reviewers. Hence, the decision on whether studies complied with the set definition of co-creation reviewers on the reviewers' own perceptions. Reviewers included studies if they perceived them as complying with the definition of co-creation, which was based on the reviewers' own perceptions. Any inconsistencies were discussed with the involvement of a third reviewer and, if needed, discussed with a broader group of reviewers for alignment.

CONCLUSION

This study offers an overview of process evaluation frameworks and components reported in studies conducting process evaluation of co-creation in public health. Results show a pluralistic understanding of process evaluation, which varies according to authors and refers to process evaluation concepts related to intervention implementation, outcome evaluation, mechanisms of impact, context and the co-creation process.

Alongside standard process evaluation components that relate to the intervention's implementation, attention has been placed, by authors of included studies, on process evaluation components related to participation, context, experience of co-creators, together with impact, satisfaction and fidelity. The study, overall, encourages the adoption of a holistic perspective to process evaluation, encompassing elements that allow for an enriched understanding of the process and for a comprehensive evaluation and replication of effective and meaningful interventions. By highlighting important gaps in the field, the findings also serve to inform future methodological work and guidance development on process evaluation and

can be used as guidance when planning for process evaluation.

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Navigating Process Evaluation in Co-creation: A Health CASCADE Scoping Review of Utilized Frameworks and Assessed Components
Screening manual

Definitions

Process evaluation: studies that explicitly mentioned planning or conducting a process evaluation of (a) the co-creation process at any of the intervention/project stages (e.g. the engagement with relevant stakeholders in the needs analysis; intervention development, implementation or evaluation) and/or (b) the intervention implementation (e.g., including how the intervention was carried out, fidelity, quality, etc.).

Co-creation is defined as: "an evidence-based methodology for the development, implementation and evaluation of innovations through continuous, open collaboration, interactional knowledge production and shared decision-making among key stakeholders, directed at improving public health" (Messiha 2021, pg. 5). Please strictly apply definition, i.e., consider the presence of elements highlighted in yellow.

Public health: related to the public health field, defined as all organised measures (whether public or private) to prevent disease, promote health, and prolong life among the population as a whole (22).

Inclusion/exclusion criteria

Process evaluation related criteria

1. We will include studies that have conducted the process evaluation of:

    (a) the co-creation process at any of the intervention/project stage (i.e., the involvement of relevant stakeholders in the needs analysis stage; the process of collaborating with the population of interest, etc.) and/or

    (b) the intervention itself (e.g., including how the intervention was carried out, fidelity, quality, etc.).

2. Include papers only if process evaluation has been explicitly mentioned to be evaluated/assessed in the paper.

3. Do not include if the paper is describing a participatory evaluation, but not referring to any process evaluation. I.e. if they describe how they have set up the participatory evaluation (who they contacted, how were they involved, etc.), but they don't say anything about how they would evaluate/have evaluated the co-creation process OR how they would evaluate/have evaluated the co-created product.

4. Include papers describing/evaluating the process how the partnership with co-creators developed and assessing whether this has been successful or not.

Co-creation related criteria

5. Co-creation as defined above.

6. Our search strategy only includes "co-creat" so only the dataset includes papers where authors have regarded as co-created. If you encounter papers referring to co-development and co-design but you believe these were not part of an overall co-creation process, please exclude.

Field of paper

7. Only include papers related to the public health field. We define public health according to WHO's definition: "Public health refers to all organized measures (whether public or private) to prevent disease, promote health, and prolong life among the population as a whole. Its activities aim to provide conditions in which people can be healthy and focus on entire populations, not on individual patients or diseases."

Date	First author's last name and year	DOI	Is the paper referring to a **definition of process evaluation**? *(yes/no)*	Are they conducting **a formative evaluation**? *(yes/no)*	Was the **process evaluation participatory**? *(yes/no)*

Name the component	**Description of component**

Author(s)	Year	Public health topic/issue	Country	Guiding framework* *Frameworks are further described in Table 2	Formative evaluation	Participatory evaluation
Anselma et al. (28)	2019	Physical activity and dietary behaviour with children	The Netherlands	Glasgow et al. (29)	-	-
Bauermeister et al. (30)	2017	HIV/STI program	United States of America	-	-	Yes
Beckerman-Hsu et al. (31)	2020	Obesity prevention in low-income preschool children	United States of America	Grant et al. (32)	-	-
Berge et al. (33)	2017	Childhood obesity prevention	United States of America	-	-	-
Brooks et al. (34)	2019	Service user in mental health care planning	The United Kingdom	-	-	-
Brussoni et al. (35)	2012	Injury surveillance	Canada	-	-	-
Cameron et al. (36)	2019	Workplace alcohol prevention	Australia	-	-	-
Cedstrand et al. (37)	2020	Workplace wellness in the construction industry	Sweden	Moore et al. (9), Nielsen and Randall (38)	-	-
Chrisman et al. (39)	2002	Disease control and prevention	United States of America	-	-	-
De Bock (40)	2010	Physical activity in preschools	Germany	-	-	-
De Rosis et al. (41)	2020	Promotion of healthy living targeting adolescents	Italy	-	-	-
Dean et al. (42)	2022	Nutrition and dietary behaviour in children	The United Kingdom	Saunders et al. (8)	-	-
Den Broeder et al. (43)	2016	Health impact assessment	The Netherlands	-	-	-
Dixon-Ibarra et al. (44)	2016	Physical Activity Health Promotion	United States of America	-	Yes	-

Dyer et al. (45)	2014	Community-based natural resource management	Zambia/Democratic Republic of Congo/Mozambique	Rowe and Frewer (46)	-	-
Edwards and Highuchi (47)	2018	Improving long-term care	Canada	-	-	-
Elinder et al. (48)	2012	Obesity prevention	Sweden	-	-	-
Frable et al. (49)	2006	Obesity prevention with low-income families	United States of America	-	-	-
Fusari et al. (50)	2020	After stroke rehabilitation	The United Kingdom	Moore et al. (9)	Yes	-
Geelen et al. (51)	2020	Physical activity during hospitalisation	Netherlands	Moore et al. (9)	-	-
Gensby et al. (52)	2018	Occupational rehabilitation	Norway	-	Yes	-
Gibbons et al. (53)	2016	Health disparities	United States of America	-	-	Yes
Greer et al. (54)	2018	Drug use	Canada	Greer et al. (55)	-	-
Greer et al. (55)	2016	Harm reduction and substance use	Canada	Greer et al. (55)	-	-
Gupta et al. (56)	2015	Work ability among industrial workers	Denmark	Nielsen and Abildgaard (38)	-	-
Gupta et al. (56)	2017	Physical activity of industrial workers	Denmark	-	-	-
Harper (57)	2003	HIV prevention	United States of America	-	Yes	Yes
Hassenforder et al. (58)	2016	Pollution and depletion of freshwater resources	Uganda	-	-	-
Heggdal et al. (59)	2021	Self-management of chronic illness	Norway	-	-	-
Hetherington et al. (60)	2017	Sanitation and hygiene	Tanzania	-	-	-
Hinckson et al. (61)	2017	Healthier community environments	New Zealand	Linnan & Steckler (62)	-	-
Igel et al. (63)	2017	Health promotion in socially deprived neighbourhoods	Germany	Moore et al. (9)	-	-

Keller et al. (64)	2022	Workplace wellness for people with chronic diseases	United States of America	-	-	-
Kelly et al. (65)	2017	Breast cancer	United States of America	-	Yes	-
Kteily-Hawa et al. (66)	2019	Peer leader training for sexual health	Canada	-	Yes	-
Lelie et al. (67)	2022	Workplace health promotion in occupational settings	The Netherlands	Nielsen and Randall (38)	-	-
Magnusson et al. (68)	2014	Healthy weight in children	Sweden	Saunders et al. (8)	Yes	-
Marinescu et al. (69)	2013	Health disparities	United States of America	-	Yes	-
McMaughan et al. (70)	2021	Home health assessment for children with disabilities	United States of America	Moore et al. (9)	-	-
Morgan et al. (71)	2019	Dementia care in rural locations	Canada	Damschroder et al. (13)	Yes	-
Muvuka et al. (72)	2020	Mental health literacy to tackle depression	United States of America	-	-	-
Nomura et al. (73)	2009	Dementia and cognitive rehabilitation	Japan	-	-	-
Palmer et al. (74)	2015	Community mental health setting	Canada	Glasgow et al. (29)	-	-
Parker et al. (75)	2003	Asthma	United States of America	-	Yes	-
Plumb et al. (76)	2004	Breast cancer research	United States of America	-	Yes	-
Reeve et al. (77)	2016	Primary mental health care	The United Kingdom	-	Yes	-
Reininger et al. (78)	2010	Obesity prevention	United States of America and Mexico	-	-	-
Robertson et al. (79)	2018	Physical activity for men	Ireland	Moore et al. (9)	-	-

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Schelvis et al. (80)	2016	Occupational health in schools	The Netherlands	Nielsen and Randall (38)	-	-
Shahmanesh et al. (81)	2021	HIV prevention for adolescents and youth	South Africa	-	Yes	-
Sormunen et al. (82)	2011	Health promotion in elementary schools	Finland	-	-	-
Tolma et al. (83)	2009	Community development to address health issues	United States of America	Linnan and Steckler (62)	-	-
Wilcox et al. (84)	2010	Physical activity and dietary habits	United States of America	Saunders et al. (8)	-	-
Yeary et al. (85)	2015	Weight loss maintenance and obesity prevention	United States of America	Linnan and Steckler (62)	-	-

Supplementary File 3: Process evaluation definitions

Study included	Process evaluation definition
No explicit description of process evaluation within manuscript	
(26,29,37,39,51,55,56,62,69,77)	Does not provide any explicit description of process evaluation in the manuscript.
(31,33,36,38,44,45,49,52,63,80)	Does not provide any explicit description of process evaluation in the manuscript but references existing process evaluation studies to identify evaluation components.
Explicit description within manuscript referencing existing process evaluation framework or evaluation study	
(35,79)	Cite Green and Kauter et al (15), process evaluation gives "a clear, descriptive picture of the quality of the program elements being put into place and what is taking place as the program proceeds". Tolma et al. emphasises process evaluation "must evaluate all program inputs (e.g., program goals and objectives, resources allocated), implementation activities (e.g., staff performance, events sponsored), and stakeholder reaction (e.g., level of participation among intended recipients to the program and reactions of the intended recipients to the program".
(32,46,47,59,75,83)	Cite Moore et al., describing process evaluation as the examination of "the implementation, mechanisms of impact and the context". Igel et al. suggest, "process evaluations are important in examining the nature of what was implemented in practice, helping interpret context around intervention outcomes, and therefore informing future programs". For Anselma et al. process evaluation should "help to gain a deeper understanding of the more and less effective elements of actions, as well as facilitators and barriers for sustainable implementation". By referring Moore et al., Fusari et al. believe process evaluation at the feasibility stage can help "to understand how the trial design and intervention could be optimised ahead of an RCT. They also conduct in parallel an independent process evaluation to learn about usage and engagement mechanisms of participants and stakeholders to provide information for implementation fidelity and impact mechanisms necessary for scale-up".
(70)	Cite Glasgow et al. and describe process evaluation's main as the "capturing of information about emerging barriers and facilitators to change implementation and to identify contextual (organisational and environmental) factors that affect the intervention".

(64)	Reference Saunders et al. and describe process evaluation as the procedure which "will monitor the processes in terms of reaching the intended outcome".
(57,81)	Both cite Linnan and Steckler and report that process evaluation can shed light on why some interventions produced the intended results, and why others did not, and provide valuable insights. They state that a comprehensive process evaluation ensures that the program's operations, implementation, and service delivery are thoroughly documented. Process data may also be used to help interpret study findings and identify program elements that were more or less effective.
(40)	Cite Valente (16) say process evaluation offers insight into whether the program is successful within the community and allows for program planners to make post implementation modifications before larger effectiveness studies.
(71)	CiteIsrael et al. (17) describe process evaluation's aim as to determine the extent, fidelity, and quality of intervention implementation. Process evaluation focuses on examining how an outcome is achieved, e.g., the internal dynamics of program operations.
(51)	Cite Greer et al. describe process evaluation's aim to analyse the intentions, strategies employed, and outcomes of the process utilised in the project and discuss the implications for capacity building and empowerment among the peer researchers.
(54)	Emphasise the importance of the means rather than the results and looks at aspects such as fairness, information exchange, group process, and procedures (Chess and Purcell, 1999).
(60)	Citeboth Butterfoss et al. (18) process evaluation was used to examine the stakeholders' perceptions of their level of involvement by exploring their expectations from the project, commitment to project and its activities, and perspectives on the role of stakeholders in the project. Process evaluation was seen as a way to establish whether the partnership and project activities have been as intended and resulted in the expected outputs.
(78)	Process evaluation addresses both the structure and activities of the program or intervention, concerning the physical setting or procedure, as well as the behavior of the participants. Process evaluation is important step in validating the study between the intervention and the outcomes (Bliss and Emshoff, 2002), and avoiding Type III error (Linnan and Steckler, 2002; Lohrmann, 2006).
(53)	By citing Linney and Wendersman (19) authors express that process evaluation helps inform ways in which programs can be modified and better implemented in order to allocate an agency's resources more efficiently and ensure that the specific needs of the target population are truly met. In addition, process evaluations clarify anticipated outcome goals and criteria used in outcome evaluations that measure a program's relevance and accomplishments.
(97)	By citing Oakley et al. (20) they state that process evaluation helps interpret the intervention's outcomes, while also shedding light on successes and failures of an intervention and highlighting parts of the intervention that should be improved in replication study. It allows to draw inferences about future applicability in the current setting and about generalizability and transferability to other settings.

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Own explicit description provided by authors, with no referencing to existing framework or study	
(48)	"The process evaluation's aim is identifying potential causal mechanisms and detail the intervention context to understand how and why occupational rehabilitation programs work, and under what conditions".
(74)	"Process evaluation strategies gather information from the community to provide solid evidence for how to modify the campaign to best meet audience expectations".
(73)	"Describe what was delivered, how and why; in order to support the interpretation of emerging outcome data".
(68)	"A process evaluation was conducted to determine the extent to which the project plan was developed and executed according to intervention's guidelines".
(67)	"To inform the development and implementation of a rural PHC intervention, and identify barriers and facilitators to developing, implementing, and sustaining the intervention in a rural PHC team".
(72)	"To assess the research partnerships as well as the strengths and weaknesses of the grant program. Specific areas of investigation included the roles of the research partners, the nature of their involvement in the study, suggestions for improving the funding mechanism, and lessons learned to ensure strong community and academic researcher collaborations in the future".
(65)	The process evaluation aims to provide project partners and the funder with information on the development and implementation of interventions at different stages and the functioning of the partnership".
(66)	Process evaluation highlights community members' experiences.
(61)	Process evaluation is a type of evaluation which focuses on operations and implementation and which presents an opportunity for reflection and learning about participatory processes and to help to clarify the roles and expectations of collaborators.
(49)	A process evaluation was conducted to understand the attitudes, perceptions, beliefs, impact of and satisfaction with the engagement process used to conduct the work.
(30)	Process evaluation aimed to explore the impact of the intervention's produced products.
(41)	Process evaluation focuses on assessing community engagement and giving context to outcome-based evaluation.

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Name and Description and Frequency of use
Participation – assessed in 26 studies
Twenty-six studies assessed participation as part of their process evaluation, including the extent to which individuals or groups who are the target of the intervention engage with and participate in the co-creation process and/or intervention's implementation. Studies assessed the nature and degree of participation (1–4), and more specifically, whether it is voluntary, i.e. the extent to which there was a voluntary shift of responsibilities from providers to users (4) or equitable, ensuring all experiences are listened to, respected and represented at the table (5–8). Some assessed the extent to which there is continued or early engagement of communities throughout the process (1,5,9,10), including whether the objectives were set out and agreed by stakeholders at the start of the process (5), whether they had the chance and time to discuss and continuously revise the action plans (7,11) or whether participants agreed they were targeting the most important problems in the intervention (11,12). Studies also specifically measured the participants' involvement in decision-making (9), participants' feelings regarding the transparency of the process (9) occurrence of joint actions to meet community needs (13), the extent to which participants feel joint ownership (14) or shared responsibility for the intervention (15). Studies also assessed the perspectives of participants on the process (15,16) and, specifically, as to whether they have felt involved in the intervention (14), have established a trustful and open relationship with the working team (5,17) and how they perceived the impact or accomplishment of the engagement process (18). Clark et al. (19) assessed the value of knowledge of exchange while participating. Den Broeder et al. (20) looked at perceived factors facilitating or hindering the development of consensus and perceptions of the level of perceived consensus and actual consensus. Other studies evaluated the benefits and barriers (18,21,22) and implementation determinants related to the engagement process (3). Kelly et al. (1) focused on assessing the degree to which the communicative problematics of participation have been identified and dealt with in a project. Dennehy et al. (23) used Lundy's Model of Participation (24), to operationalise participation, focusing on the evaluation of perceptions related to the creation of an inclusive and safe space for children, facilitation, extent to which their views are listened to and acted upon.
Context – assessed in 22 studies
Twenty-two studies reported an assessment of context as part of their process evaluation examining the broader social, cultural, economic, and political factors impacting the success or failure of the intervention in a specific context. Studies mostly evaluated the contextual factors that might impact or have impacted the intervention planning and implementation (11,25–28). However, there is a wide range of approaches to the definition of context that impact the translatability of the findings. Reeve et al. (29) assessed context as the larger social, political, and economic environment that may influence the implementation of an intervention. Igel et al. (30) included the evaluation of existing social, health, and environmental issues, while Schelvis et al. (31) explored the organisational and the environmental characteristics that affect the intervention. Tolma et al. (32) reviewed aspects related to the larger social, political, and economic environment and Gensby et al. (33) highlighted the

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importance of considering the political-administrative context in which rehabilitation programs are practised. Robertson et al. (34) focused on broader community and environmental factors, such as socioeconomic considerations and community participation.

Studies explored implementation barriers and enablers (5,32,35–37), some focusing specifically on existing organisational structures, professional values or socio-political context that enable successful implementation (38,39), environmental factors (7), resources available (34,40) or events that occurred and influenced the content of the execution of the action plan (14). Beckerman-Hsu et al. (41), also specifically looked at moderators and the extent to which their role impacts implementation.

Authors have also mapped the characteristics and distribution of a specific population or health issue in a particular geographical area. Authors identified, analysed and considered the systematic representation of relevant stakeholders (5,39), aimed to clarify context, processes and activities (39), to understand the community (17) and to identify the contextual and procedural drivers of any wanted change (42).

Experience – assessed in 16 studies

Sixteen studies evaluated the experience of participants and assessed the subjective perception of individuals or groups who participated in the co-creation process and/or intervention implementation. The majority of the studies (48,54–59) assessed overall experience and involvement with the implemented intervention and actions, while others (31,55,60) evaluated how the participants specifically experienced the participatory process, or the coordination and collaboration in the process (59).

Impact – assessed in 16 studies

Sixteen studies assessed impact-related measures related to the extent to which the intervention had achieved one or more of its desired outcome(s) and its overall impact. This included evaluating the impact of the intervention on the collaborative and equitable involvement of its members (43), patient health and well-being (44), employee engagement and participation in work (45), line manager attitudes and actions (31), and personal impact on advisory group members (23).

Reeve et al. (29) evaluated patients' perceptions of the overall impact they perceived as a result of taking part in the intervention. Heggdal et al. (44) specifically reported on whether the intervention had the intended effect on patient health and well-being and whether the intervention had prompted individuals to be more active or had led to changes in their health behaviours (12,16,31).

Chrisman et al. (13) assessed the concrete achievements of the intervention, such as the number of publications, programs, evaluations, and grants that have been produced. Others have evaluated the institutional and organisational changes taking place among and beyond the group of participants (31,42,45) and outcomes that were a result of the engagement process between several parties involved (3,46,47).

Some studies focused on evaluating mechanisms of impact and examined how the intervention produced its intended outcomes. Some studies aimed to identify the specific causal mechanisms or pathways that linked the intervention to the observed changes in health-related behaviours, health outcomes, or other targeted outcomes (25,30) and one study specifically looked at factors and mechanisms which contributed to citizen participation and intersectoral collaboration (48).

Satisfaction – assessed in 14 studies

Fourteen studies assessed the level of satisfaction among the individuals or populations who received or participated in a public health intervention. The evaluation of satisfaction was assessed through the overall

intervention, its design, and implementation, partnership, research process, products, team building process, and dialogues, as well as the progress of the co-creation group.

Satisfaction was be evaluated in various aspects of the intervention, such as the overall intervention (14,16,26,43,49,50), design and implementation (50) and more specifically, the partnership (43), the research process (43), products (43), or team building process (50) and dialogue (51) and the progress of the co-creation group (16). Some studies assessed satisfaction with specific stages of the process, including satisfaction with the needs assessment phase and the developed action plan (14). Lelie et al. (15) registered satisfaction with the appropriateness of tools and materials, intervention activities and intervention approach. Schelvis et al. (31) aimed to capture satisfaction levels with the participatory process.

Fidelity – assessed in 13 studies

Fidelity was assessed in thirteen studies and refers to the process of measuring and assessing the extent to which an intervention was delivered as intended, according to the original program design or protocol. Studies evaluated fidelity by determining whether the intervention was implemented consistently and faithfully across different settings and to identify any variations or adaptations that may have been made during implementation (14,25–28,31–33,47,52–54).

Reach – assessed in 11 studies

Reach, was assessed within process evaluation by eleven studies, assessing the extent to which a program, intervention, or campaign had successfully reached its intended audience or target population. The purpose of evaluating reach was to determine whether the program had effectively reached the people who it was designed to serve or influence (14,15,26–29,31,32,35,53,55).

Recruitment – assessed in 8 studies

Eight studies evaluated recruitment and referred to the process of assessing the effectiveness of a recruitment strategy and its outcomes. One aspect of evaluating recruitment was assessing the procedures used to interest workers and participants and identifying reasons for non-participation (31). Two studies (27,46) explored potential barriers to participation and how to improve recruitment strategies while others (4,26,28,32) evaluated the effectiveness of recruitment strategies at the individual, organisational, or community levels. As part of recruitment, three studies reported on the characteristics of individuals who participated in the intervention (4,33,56).

Dose delivered– assessed in 7 studies

Six studies assessed the dose delivered by referring to the extent to which the intervention components or services were delivered as intended. The majority of studies (26–29,32,53) sought to understand to what extent the intervention components were delivered. In Schelvis et al. (31), facilitators reflected on how many steps of the participatory process were delivered by the facilitator.

Readiness for change – assessed in 6 studies

Six studies assessed readiness for change and looked at the degree to which individuals or organisations were prepared to adopt and implement new interventions or changes in behaviour (14,15,31,39,53,57).

Delivery – assessed in 10 studies

Ten studies looked at how closely the intervention was implemented according to the intended plan (25,35,55) and received by the participants as intended (25,27). Studies investigated intervention delivery (58) and quality of the intervention delivery (41) and aimed to detect whether there have been changes in program delivery during the intervention period (33). Some authors focused on assessing the degree to which the

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activities were implemented as intended and achieved the desired outcomes (21,33,46,56). Schelvis et al. (14) explored whether the action plan was implemented by implementors in the way it was intended by the delivery team while Svartengren et al. (45) looked at delivery by assessing specifically the extent to which the intervention was implementation as intended by the facilitators.

Empowerment – assessed in 5 studies

Five authors included an evaluation of empowerment as part of their process evaluation and referred to assessing the extent to which an intervention had achieved its goal of empowering individuals or communities.

Anselma et al. (59) focused on how the involvement of children in decision-making and community change influenced their health behaviour and empowerment while Poland et al. (8) planned to evaluate the ability of the project team to provide an empowering environment for youth to accomplish goals. Kteily-Haw et al. (60) assessed the extent to which knowledge was acquired about the subject matter and the personal growth that derived from engagement in the process. Nomura et al. (61) assessed empowerment at the individual, community and group levels. Chrisman et al.'s (62) assessment of empowerment included the community's ability to understand and control social forces for improvement and finds the group's belief in the capability to succeed in future actions to be the indicator of it.

Motivation - assessed in 5 studies

Five studies assessed underlying motivations of individuals for engaging in various activities. Most studies looked at motivations for engagement (4,16,23). Svartengren & Helmann et al. (45) also identified incentives that influenced the decision to join the project while Kelly et al. (63) assessed reasons for members to stay engaged in the process throughout.

Dose received - assessed in 5 studies

Five studies evaluated the extent to which the target population received the intended components of the intervention. Yeary et al. (27) assessed the extent to which participants were engaged in the intervention and both Yearly et al. (27) and Dean et al. (26) extended to which sessions were completed and received by participants.

Wilcox et al. (28) explored to what extent training and follow up activities prepare participants to carry out the post-intervention activities. Tolma et al. (32) plan to evaluate dose delivered as the extent to which the participants engaged with the intervention, while Reeve et al. (29) gathered participants' perceptions of service received.

Communication – assessed in 5

The evaluation of communication in selected studies included the assessment of whether information about an intervention or project has been effectively conveyed to the intended audience. It involved measuring how well the message was understood and received by the recipients, as well as identifying potential barriers or gaps in communication.

Schelvis et al. (31) focused on the manner in which the project was communicated to the participants, including specifically assessing whether the project was effectively communicated to employees at the start, as well as whether the results of each step were communicated to the participants. Hatfield et al. (57) set to understand the extent to which the message successfully reached diverse community segments, while Gibbons et al. (18) assessed askes participants their perceptions regarding the best means of increasing awareness of the project. Harper et al. (64) focused on specifically monitoring program promotion and outreach as part of their process

evaluation analysis and Ham et al. (9) degree to which information about the intervention was made available to stakeholders and the public (9).

Support – assessed in 4 studies

Four studies assessed the level of assistance and guidance provided by management and other stakeholders to ensure the successful implementation of an intervention or process. Studies evaluated the existence of a supportive environment (65), the intervention support activities provided (56), and support received within the organisational settings, by the managerial (53), senior, and middle management support (14).

Capacity building – assessed in 4 studies

Four studies evaluated the extent to which a public health intervention has built the capacity of individuals, organisations, or communities to deliver or sustain the intervention. Capacity building was referred to as the capacity increase overtime and empowerment (6), skill enhancement (64) and processes in place with the intention to train staff (7,39).

Perceptions – assessed in 4 studies

Four studies examined how various stakeholders perceived the intervention, including participants, providers, and other key individuals involved in the implementation and delivery of the intervention (14,31,37,60).

Maintenance – assessed in 4 studies

Four studies assessed the extent to which the intervention outcomes and/or collaborative relationships formed during the intervention implementation were maintained. Some authors focused on an evaluation of whether, and if so, to what degree, the program components were followed (55,58), including the log of workshop attendance (46), and whether the partnership formed during the program was sustained over time (35). Tolma et al. (32) focused on asking the following questions: a) what do we do to keep participants involved?; b) what makes people keep coming to the meetings? and c) what do we do that get people at each meeting?.

Facilitation - assessed in 4 studies

Four studies looked at evaluating the nature, type and quality of facilitation (5,9,19,41).

Adoption – assessed in 4 studies

With the evaluation of adaptation, studies assessed the extent to which individuals, organisations, or communities decided to adopt and implement a new behaviour or practice promoted by the intervention (35,55,56,58).

Adherence – assessed in 3 studies

Evaluation of adherence in public health interventions was intended by some authors as the adherence to the original plan, by others as adherence to health advice and solution and adherence to guiding principles.

Beckerman-Hs et al. (41) looked at adherence levels to the elements of content, duration, frequency and reach, and more specifically adherence to guidelines, the extent to which components were fulfilled, balanced representation, meetings structure, and community member commitment to sustain the intervention. Falletta et al. (43) explored the extent to which the program adhered to referenced principles of community-based research approaches (CBPR) while Cedstrand et al. (53) aimed to investigate barriers and facilitators related to participant's adherence.

Feasibility – assessed in 3 studies

Supplementary Material

Studies assessed the assessment of the practicality and potential for successful implementation of an intervention in a particular setting (66,67), while Berge et al. (50), looked specifically at whether the feasibility of CBPR methods to carry out the intended activities.
Exposure – assessed in 3 studies
Three studies evaluated the extent to which the target population is exposed to the components of the intervention (14,15,31).
Knowledge integration and evidence - assessed in 3 studies
Knowledge had been assessed as part of their process evaluation by Cameron et al. (5), which explored the level to which there has been an integration of local and scientific knowledge and by Greer et al. (65) looking at the origin and nature of the underlying constructs of evidence. Greer et al. (65) aimed to understand how evidence informed the protocol development, analysis, and outputs of the intervention and assessing the evidence of progress or opportunities for improvement, such as knowledge translation and sharing of findings, peer-facilitated data collection, collaborative data analysis, and diverse knowledge translation.
Partnership - assessed in 3 studies
The evaluation of partnership involved assessing the effectiveness of collaborations between organisations, agencies, and individuals in achieving common goals (36,43) or assessing the social bonds and networks of interpersonal and interinstitutional links among stakeholders (62).
Resources - assessed in 2 studies
The evaluation of resources in studies involved assessing the adequacy and availability of resources required for implementing the intervention. Schelvis et al. (14) focused on whether the organisation had the capacity to implement the action plan while Cameron et al. (5) wonder whether the resources were adequate to enable all participants to take part in the program activities.
Future organisation - assessed in 2 studies
Evaluation of the future organisation referred to the studies' intention to collect suggestions for the future organisation of the intervention (16) and future projects or issues on which the collaboration should focus (18).
Policy-change - assessed in 2 studies
The assessment of policy/procedure change involved the evaluation of the impact of changes to policies and procedures (13,65).
Methods - assessed in 2 studies
In selected studies, the evaluation of methods involved assessing the appropriateness and effectiveness of the methods used to identify the target population (5,65).
Expectations - assessed in 2 studies
Two studies evaluated the expectations of stakeholders regarding the intervention and the extent to which these have been met (2) and in regards to participation in the co-creation group (16).
Acceptability - assessed in 2 studies

Supplemental material

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Two studies evaluated acceptability evaluation, referring to the extent to which the intervention was perceived as suitable, agreeable, and satisfactory by the target population or stakeholders (58,66).

Retention - assessed in 2 studies

Evaluation of retention involved assessing the factors that influence the continued participation of stakeholders in the planning process (32), including the log of workshop attendance (46).