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Exploring co-adaptation for public health interventions: insights from a rapid review and interviews

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Abstract

Background Adapting co-creation research processes and/or public health interventions improves the fit between the intervention and population of interest, potentially resulting in more relevant and effective interventions. Mode 2 research approaches (e.g., co-creation, co-production, co-design, community-based participatory research, and participatory action research) can ensure that adaptations fit the socio-cultural and economic contexts. However, an overview of existing practices and how to co-adapt is lacking. This study aimed to provide an overview of the use of co-adaptation in co-creation processes and/or public health interventions.

Methods We conducted a rapid review search on the Health CASCADE co-creation database. Relevant peer-reviewed studies reporting on co-adaptation of public health interventions were identified. A call for case studies via social media and co-authors' snowballing was issued to perform interviews with co-creation researchers gaining insights into how co-adaptation was applied from unpublished studies and practice. Interviews were analysed using template analysis.

Results Fourteen studies addressed various public health issues by co-adapting co-creation processes, intervention activities, communication platforms, monitoring strategies, training components, and materials' language and tone. Most studies lacked detailed reporting on the co-adaptation process, though some provided information on group composition and number, duration, and methods applied. Two out of 14 studies used a framework (i.e., Intervention Mapping Adapt), seven described their adaptation procedure without naming a specific framework, and five did not report any procedures or frameworks. Five of seven case studies used adaptation frameworks (e.g., ADAPT guidance). Interviews provided insights into the co-adaptation process emphasising the importance of contextual fit, integrating prior knowledge, and logging adaptations.

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Conclusions This study is the first introducing the concept of and exploring co-adaptation of co-creation processes and/or public health interventions. It provides details regarding adaptations made, whether and which frameworks were used, and procedures applied to adapt. The findings highlight the need for tailored frameworks for co-adaptation and better reporting of co-adaptation processes.

Keywords Co-creation, Health promotion, Implementation, Modification, Guidelines

Background

Public health interventions often fail to replicate positive effects on health (behaviour) outcomes observed in controlled settings because they do not adequately address the complexity of the real-world contexts [1, 2]. This implementation gap can be bridged through active collaboration with end-users, aligning interventions to diverse contexts and populations while accounting for real world characteristics [3, 4]. Co-creation harnesses the collective intelligence of different stakeholders to collaboratively address real-world challenges across all stages of a project, including development, implementation, and evaluation [5]. Stakeholders can include individuals across micro (e.g., citizens, caregivers, local healthcare providers), meso (e.g., healthcare facility managers, public health practitioners), and macro levels (e.g., policymakers, national healthcare organisations), including the population of interest [6, 7]. Co-creation might help to integrate cultural and contextual insights [8], lead to increased stakeholder commitment and ownership [9, 10] and increased involvement in implementation [11]. This might consequently facilitate the integration of a program into existing structures [8, 12, 13]. Co-creation is situated within Mode 2 research, which focuses on knowledge production in the context of its utilisation through active stakeholder engagement [14]. It includes other participatory approaches such as co-design, co-production, participatory research and Community-Based Participatory Research (CBPR). These terms are often used interchangeably [15, 16], and these approaches share common goals that contribute to an optimised context-fit, and more effective and acceptable interventions. These approaches aim to ensure a rigorous and evidence-informed way of working, continuous evaluation of the co-creation process, foster meaningful stakeholder engagement and collaboration, a shared learning process, contextual knowledge production, and an open, trustful and inclusive dialogue [17]. However, they differ in aspects such as the timing and extent of stakeholder engagement, e.g., whether stakeholders are involved during the design of the intervention (e.g., co-design), design of the implementation strategy (e.g., co-production), in who the stakeholders are (e.g., in CBPR the participants are members of a specific community), and sometimes even in what they aim to achieve (e.g., social change and justice or actual actions) or in the domain in which they were initiated. For consistency, the term co-creation will be used to describe these participatory processes in the current study.

Public health interventions should be implemented on a large scale to reach and benefit a wider range of populations [18]. This necessitates adaptations to various contexts and groups [19]. Adaptations are "intentional modification(s) of an evidence-informed intervention to achieve a better fit between an intervention and a new context" [19]. For co-creation studies, this might entail an adaptation of the co-created intervention and/or the co-creation process through which the intervention was developed. These adaptations may occur during the development phase of the intervention or co-creation process through planned adaptations, or during the implementation as responsive adaptations [19, 20]. The adaptation process involves different steps to increase the fit with specific needs, preferences, and perceptions while ensuring that the core components driving the intervention's effectiveness remain intact, resulting in relevant and effective interventions across different contexts and populations [19]. Adaptations have traditionally been based on low-level input from the new context, often involving researchers collecting information from stakeholders and independently adapting the co-creation process or intervention. However, interventions or co-creation processes have rarely been adapted collaboratively, where stakeholders share decision-making power and actively determine how to adapt the intervention or co-creation process. Applying co-creation to adapt co-creation processes as well as public health interventions is necessary and recommended as it enhances the relevance, appropriateness and possibly effectiveness of co-creation processes and interventions for specific populations.

Despite co-creation and adaptations of public health interventions gaining increased attention, these areas have largely evolved as separate domains. To date, no review has yet explored the use of co-creation for the adaptation of public health interventions, the steps involved in this process, whether and which frameworks were used, or the challenges and facilitators experienced. This gap limits our understanding of how to effectively operationalise co-creation to achieve contextually appropriate adaptations.

Throughout this manuscript, we propose and examine the concept of co-adaptation – a collaborative adaptation process that applies co-creation principles to either

adapt an intervention (co-created or not co-created) to a new context (e.g., a new setting, another population of interest) and/or adapt the co-creation process itself. Definitions applied in this study can be found in Additional file 1. Specifically, this study provides an overview of studies that have utilised co-creation in co-adapting public health interventions and/or co-creation processes. It seeks to illuminate the co-adaptation processes, whether and which frameworks have been used, and practical considerations involved, providing valuable insights for researchers and practitioners aiming to enhance the contextual relevance and effectiveness of public health interventions through co-adaptation.

Methods

This study was produced through the Health CASCADE project, a European-funded project to develop the methodological foundation of evidence-based co-creation [21]. A rapid review was conducted to retrieve published studies describing a co-adaptation process of public health interventions. Since co-adaptation of public health interventions is novel, there is limited published research on these co-adaptation processes. To capture insights of currently unpublished studies, we issued a call for case studies via the social media channels of the Health CASCADE project. Through co-authors' snowballing, co-authors within the Health CASCADE project (including lead researchers and their supervisors) identified researchers known to have conducted co-adaptation studies. These individuals were then contacted and invited to participate in the study. Semi-structured interviews with representatives of the case studies identified were conducted.

Rapid review of published studies

Search strategy

A rapid review search was conducted in the open access Health CASCADE co-creation database [22] to identify relevant peer-reviewed articles using frameworks for co-adapting public health interventions. During a more in-depth exploration of the topic, it became evident that few studies utilised frameworks in the context of co-adaptation. Consequently, we decided to focus on all studies that co-adapted interventions and processes, aiming to gain a comprehensive understanding of how this has been approached so far. Accordingly, we adjusted the inclusion criteria to exclude the framework requirement. The Health CASCADE database is a repository of literature on co-creation, built on PubMed, CINAHL, and all 47 databases within ProQuest [22]. Search terms included co-creation, adaptation, intervention, and public health (see Additional file 2). The search strategy was limited to peer-reviewed articles published in English and was reviewed and approved by all co-authors. All references retrieved from the search on the database, conducted on March 28th 2024, were imported to Zotero [23] and duplication was addressed by one researcher (JB). Unique references were downloaded in RIS format and imported into Rayyan [24]. The search was repeated on December 3rd, 2024, to identify any potential new studies and none were found.

Inclusion criteria

Peer-reviewed empirical articles written in English were included if they met the following criteria: (1) adapted a co-creation process and/or intervention with a public health focus, (2) used co-creation or another approach included in Mode 2 research (i.e., co-design, co-production, participatory research, and collaborative research), and (3) adhered to the study's definitions of adaptation and co-creation, as mentioned in the introduction, and public health, defined as "all organised 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" [25]. For inclusion, articles were not required to provide these exact definitions, but the research needed to align with these concepts.

Screening and data extraction

All retrieved articles were divided in four sets, each set was screened by two researchers independently (OEO and JB/GRL/LRD, MVo and JB, GRL and LRD, QA and JB/GRL/LRD) performing a double-blinded title and abstract screening. Conflicts were resolved through discussion or involvement of a third reviewer (MGG, GC, MVe, TA, LSB, or BD). Lead researchers (JB, GRL, LRD) then performed a double-blinded full-text screening, resolving conflicts through discussion and consensus. Data extraction components were determined during a co-working event in June 2023 involving researchers from several European universities with different experiences and expertise related to co-creation. Input from this co-working event was processed by the lead researchers (JB, GRL, LRD) and extraction tables were created in a Microsoft Word template. Data being extracted for both the original as well as the adapted intervention included intervention name, public health issue, target population, country, implementation intervention components, and whether the intervention was evaluated. Data being extracted for both the original as well as the adapted co-creation process included length of the process, number, minutes, and frequency of sessions and methods. Data being extracted especially on adaptation included its reason, frameworks and steps used.

Data were extracted by JB, GRL, and LRD. To provide a comprehensive overview, original intervention data

were retrieved from the original study if authors referred to the original study in the included article. Evaluation design was included as an extraction criterion because Moore and colleagues [19] emphasised the importance of reviewing evaluation designs for both the original and adapted interventions to ensure the original intervention's adaptability.

Interviews to explore unpublished case studies

To complement review findings, gather in-depth insights into critical aspects of the process of co-adaptation and to collect recommendations for future research we conducted semi-structured online interviews with researchers involved in co-adaptation processes as main project leaders between August and November 2023, after conducting the rapid review search in March 2023. Semi-structured interviews aimed (1) to collect experiences in co-adaptation processes, and (2) to formulate recommendations for future co-adaptation studies. We developed an interview guide (see Additional file 3), including questions about frameworks, steps, and models used to guide the co-adaptation process, activities undertaken during the co-adaptation process, experiences of pitfalls and successes and recommendations for future researchers. Since the actual co-adaptation process was underreported in the articles included in the rapid review, the interviews focused on topics providing more insight into the co-adaptation process itself. Since the included case studies were unpublished, all interviewees read the manuscript before it was submitted to the journal to ensure that included details about their projects would not pose any issues for them when publishing their own work. All interviewees provided written approval for publishing the details about their project stated in the manuscript.

Inclusion criteria

Unpublished case studies were included if they co-adapted a co-creation process and/or intervention with a public health focus. To verify whether the studies adhered to this criterion and the definitions of adaptation, co-creation, and public health, one of the lead researchers (JB, GRL, or LRD) contacted the interviewee via email to request detailed information about the study and the co-adaptation process. If case studies adhered to the abovementioned definitions, they were selected for the interview study.

Analysis

Interviews were recorded and transcribed verbatim. Lead researchers conducted a template analysis, a generic style of thematic analysis offering flexibility while using a hierarchical coding template [26, 27], meaning that researchers organised data into different levels using a main theme and corresponding subthemes. This approach centres on developing a coding template that can be adjusted to the study's needs, without requiring strict separation between descriptive and interpretive themes [26]. Analyses were conducted in Microsoft Word using the comments feature. To analyse the interviews, lead researchers applied the six procedural steps of template analysis [26]. Initially, researchers familiarised themselves with the data by reading or listening to the transcripts. Secondly, they performed preliminary coding on a subset of the data using a priori themes based on the interview questions to highlight significant transcript segments. Thirdly, they organised themes that emerged during step two into meaningful clusters, establishing relationships between clusters. In the fourth step, they developed an initial coding template and subsequently refined this template in the fifth step to include additional data beyond the initial subset. Finally, they completed the coding template and applied this template to all interview transcripts. The final analysis coding template can be found in Additional file 4. For this analysis, the epistemological position is contextual constructivist, since lead researchers mutually checked their interpretation of the data while developing the template.

Results

Rapid review of published studies

The PRISMA flowchart [28] (Fig. 1) provides an overview of the study selection process. In total, 14 articles were included [20, 29–41], of which two [32, 33] were related to the same research project. Baydala and colleagues assessed the effectiveness of the co-adapted intervention [32] and also examined the co-adaptation process [33]. Both articles were included as they provide information about the co-adaptation process. Given that both studies involved the same intervention context and adaptations, they are treated as a single entry in the reporting of study details below. The primary reason for excluding articles was that they did not align with our definition of co-creation. Additional reasons for exclusion included no public health focus, and not adhering to our definition of adaptation, as the terms adaptation and refinement are sometimes used interchangeably.

Study characteristics

The included articles addressed various public health issues including HIV/AIDS prevention, drug and alcohol abuse, mHealth for medication adherence, obesity prevention, and mental health. These interventions targeted diverse populations such as South African adolescents, Latin children in the USA, American Indian youth, Aboriginal youth, Canadian Inuit youth, rural community residents, people with impaired mobility, African American and Hispanic adults in the USA, and psychiatric patients in Brazil.

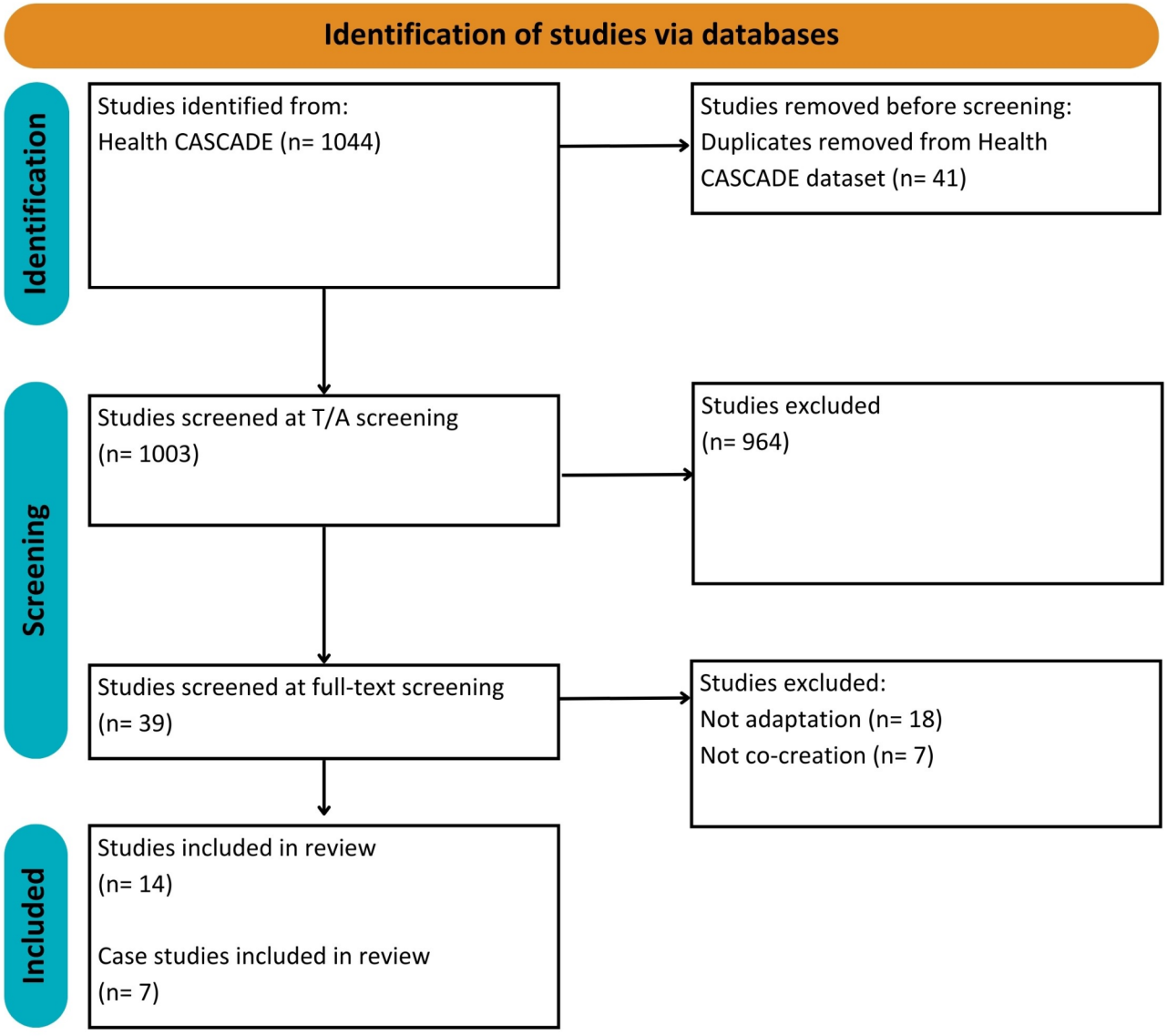

Fig. 1 PRISMA flowchart study selection process [28]

Three studies evaluated original interventions using randomised control trials [20, 31–33], while four used other types of effectiveness evaluations, such as quasi-experimental and one-group pre-test post-test design [34, 37, 39, 40]. Six studies did not mention any details related to the evaluation of the original intervention [29, 30, 35, 36, 38, 41].

Ten included studies did not mention an evaluation related to the adapted intervention [20, 30, 31, 34–38, 40, 41]. Both Aventin and colleagues [29] and Baydala and colleagues [32] mentioned the planning for feasibility testing and a randomised controlled trial, while Baydala and colleagues [33] included considerations for feasibility evaluation, effectiveness evaluation, and qualitative data collection. One study [39] included plans for evaluating the effect of the adapted intervention using a randomised controlled trial. Study characteristics can be found in Table 1.

Co-adaptations of public health interventions

Reasons for co-adaptation are listed in Table 1, including, for instance, wanting to adapt the intervention to the setting or population, adding a theoretical paradigm to the intervention or including a more participatory approach. Seven studies adapted secondary aims of the original intervention [20, 29, 34, 35, 38, 40, 41]. All 13 studies adapted intervention components or activities from the original intervention, such as educational, promotional and/or recreational activities or new formats of workshops and meetings [20, 29, 31–33, 35, 39, 40].

Studies additionally reported on the adaptation of several implementation strategies from the original

Table 1 Overview of characteristics of included studies

First author, year	Original name of the intervention (adapted name)	Public health issue	Reasons for adaptation	Mode of adaptation (Fig. 2)	Adaptations		Target population		Evaluation planned or performed		Country	
					What was adapted?	How it was adapted?	Original intervention	Adapted intervention	Original intervention	Adapted intervention	Original intervention	Adapted intervention
Aventin et al. 2021	If I were Jack (same name)	Unintended pregnancy and avoidance of HIV/STIs	Wanting to bring evidence of effective interventions into new settings	Mode 6	- Interaction video drama uses local actors and is filmed in local areas - All materials are adapted to the local context - Lesotho materials are amended to account for criminalisation of abortion - Activities increase focus on gender, inequalities, contextual sex, and substance abuse - Activities mention local barriers to condom/ contraception use and misconceptions about these - Activity added on transactional sex - Activity added on the dangers of unsafe abortion in both countries - Activity added on LGTBQ + adolescents - Homework activity replaced with and individual activity to help young people to safely identify an older trusted adult that they could speak to about sexual and reproductive health - Parent/ caregiver activity amended to address local concerns - Parent/ caregiver materials refer to sexual and reproductive health education rather than relationships and sexuality education - All online activities are coupled with paper versions for those with no internet access - All activities refer to sexual and reproductive health rather than sex or sexuality as this is more taboo	Establishment of separate adolescent, community, and expert project advisory groups in each country. Involvement of adolescent and adult focus group participants. Adaptation took 8 months, 12 focus groups were held, 8 with adolescents and 4 with adults, every focus group lasted 2–3 h	Boys aged between 14–15, but can also be delivered to girls	Adolescents in Lesotho, Maseru district and South Africa, peri-urban informal settlement of Khayelitsha	Not reported in included article	Feasibility test and randomised controlled trial	United Kingdom	South Africa and Lesotho
Baldwin et al. 2021	The Teen Intervention Project (same name)	Alcohol and abuse problems in adolescents	Adaptation for American Indians tribes	Mode 3	- Intervention training manual was translated according to local language, cultural practices, and symbolism	A board representing local stakeholders was engaged in the co-adaptation process	6th to 12th graders in the United States	American Indian Youth	Not reported in included article	Not reported in included article	United States (different tribal sites)	United States (different tribal sites)
Bardosh et al. 2017	WelTel (same name)	mHealth for medication adherence	Adaptation for Canadian and Kenyan health system	Mode 3	- More versatile text - Weekly texts to patients - Web-based platform that provides access to patient action plans - Centralised-server system - Offline platform for deployment in remote regions	They do not report on how stakeholders were engaged in the co-adaptation process	Several populations, e.g. HIV, tuberculosis, asthma, etc. patients in Kenya	Several populations, e.g. HIV, tuberculosis, asthma, etc. patients in Kenya and Canada	Randomised controlled trial	Not reported in included article	Kenya	Kenya and Canada

Table 1 (continued)

First author, year	Original name of the intervention (adapted name)	Public health issue	Reasons for adaptation	Mode of adaptation (Fig. 2)	Adaptations		Target population		Evaluation planned or performed		Country	
					What was adapted?	How it was adapted?	Original intervention	Adapted intervention	Original intervention	Adapted intervention	Original intervention	Adapted intervention
Bay-dala et al. 2009; 2014	The Life Skills Training Program (same name)	Drug and alcohol abuse	Adaptation to Aboriginal youth and communities	Mode 6	- The programme was renamed - Lessons translated to Isga language - Boosters translated to Isga language - Add a naming ceremony to lesson programme - Module plans were expanded to allow time for a cultural activity or ceremony during each lesson to connect the original programme to the teaching of the Nakota Sioux - Culturally appropriate images were made by an artist and students - All modules were adapted to include new local graphic design - Activity on healing the worried mind was added - A 3-day workshop before implementation for all community members - A 2-day training of a certified Life Skills Training trainer about the content of the programme and how to deliver it	Co-adaptations were made involving the Alexis Working Committee (representatives from the Alexis Nakota Sioux Nation and of the UofA school of public health and Faculties of Medicine, Arts, and Extension) and the Adaptations Committee (community members and school personnel). Adaptation took 7 months with weekly contact moments. Methods used with the committees: consensus-based decision-making model	Students in elementary and middle school	Aboriginal youth and communities	Randomised controlled trial	Feasibility evaluation of designed intervention, effectiveness evaluation and qualitative data collection	United States	Canada
Betts et al. 2018	Diabetes Prevention Program Group Lifestyle Balance - DPP GLB (Group Lifestyle Balance Program Adapted for individuals with impaired mobility - GLB AIM)	Obesity prevention and impaired mobility	Integration of Social Cognitive Theory and Prevention and Cognitive Behavioural Therapy and new target population	Mode 6	- Monthly meetings instead of weekly - Arm-based activity trackers - Mobile applications to self-monitor diet and physical activity - Creation of a Facebook group - Invited caregivers to attend programme sessions for participants - Language and examples in materials were made more "disability friendly" - Added sessions on cooking, group-based problem solving and planning activity to address emergent barriers - Revising content on physical activity to address accessibility issues, including focus on enhancing motivation and self-efficacy	An advisory board (health professionals and individuals representing community-based disability organisations) was established and met once in person, afterwards they continued with remote working groups to make planned adaptations. The principal investigator, co-investigators and interventionists met on a monthly basis to discuss barriers and devise responsive adaptations to address them.	People with obesity	People with impaired mobility	Randomised controlled trial	Not reported in included article	Developed in the United States (broad population, not location-specific)	United States (Dallas)

Table 1 (continued)

First author, year	Original name of the intervention (adapted name)	Public health issue	Reasons for adaptation	Mode of adaptation (Fig. 2)	Adaptations		Target population		Evaluation planned or performed		Country	
					What was adapted?	How it was adapted?	Original intervention	Adapted intervention	Original intervention	Adapted intervention	Original intervention	Adapted intervention
De-Camp et al. 2021	Active and Healthy Families – AHF (same name)	Obesity weight management	To meet further community goals and priorities by adding community-based delivery	Mode 6	- Group education sessions - Development of implementation protocols that incorporated implementation strategies reflective of the emerging immigrant community context - Co-facilitation model - Discussion of community/ structural level facilitators and barriers to behaviour change in addition to immigration - Problem solving during coaching to develop strategies to mitigate community/ structural level barriers - Target insurance reimbursement as community-based service/ programme	A stakeholder network was established for the co-adaptation process and consisted of four subcommittees (patient engagement subcommittee, community engagement subcommittee, healthcare delivery subcommittee, research subcommittee) and a steering committee. The co-adaptation process lasted 20 months. The patient engagement subcommittee met 4 times, the community engagement subcommittee met 6 times, the healthcare delivery subcommittee met 5 times, the research subcommittee met on a weekly basis and the steering committee met 4 times. Methods used: photovoice, creating problem statements, making difficulty and importance matrices, qualitative interviews, group ideation, and brainstorming	Latinx families, specifically children aged 5–12	Latinx families	Effectiveness evaluation	Qualitative evaluation	Developed in the United States for immigrant Latin families (not location-specific)	United States (Baltimore)
Etter et al. 2019	ACCESS Open Minds (same name)	Mental health	To adapt to different context and include additional theoretical stance	Mode 6	- Youth workers need to connect with all youth in the community - Youth workers facilitate youth events and activities - Integrate activities with intervention activities of other programmes - Building relationships with the healthcare system outside the community - Encourage discussions about mental health by hosting family nights and support groups - Youth workers help to navigate youth and their families to care and other appropriate services	An elder who understood the culture was involved in the co-adaptation process	Youth in Canada	Youth of Inuit community of Ulukhaktok, Canada	Not reported in included article	Not reported in included article	Canada (different Inuit communities)	Canada (Inuit community of Ulukhaktok)
Norr et al. 2006	World Health Organization's (WHO) primary health care (PHC) model (same name)	HIV/AIDS prevention	Adaptation to rural context and wish to include further target population	Mode 6	- Rural examples were added - Specific sessions for health workers were added about antiretroviral drug treatment, the implementation of universal precautions, ethical behaviour, and teaching HIV prevention to clients and families	Several different sessions were held iteratively, first with the rural health workers, then with adults to further adapt the program	Urban communities in Malawi	Rural communities in Malawi	Not reported in included article	Not reported in included article	Developed by the WHO for broader population (not location-specific)	Malawi

Table 1 (continued)

First author, year	Original name of the intervention (adapted name)	Public health issue	Reasons for adaptation	Mode of adaptation (Fig. 2)	Adaptations		Target population		Evaluation planned or performed		Country	
					What was adapted?	How it was adapted?	Original intervention	Adapted intervention	Original intervention	Adapted intervention	Original intervention	Adapted intervention
Ruggiero et al. 2011	Diabetes Prevention Program's (DPP) clinic-based lifestyle intervention (Making the Connection (¡Conéctate! - MTC)	Diabetes prevention	Translation to Hispanic context	Mode 6	- Programme was tailored to the Latino community by providing culturally specific information on diabetes risk and culturally relevant and language appropriate programme and supplementary materials - Culturally appropriate materials were a recipe book, National Diabetes Education Program materials - Provision of self-monitoring tools - Walking was emphasised as a community-based strategy for physical activity - Programme was delivered for free and in small groups	Not reported in included article	African American adult population	Hispanics in the United States	Effectiveness evaluation	One-group pre-test post-test design	Developed in the United States (broad population, not location-specific)	United States (Chicago)
Tumiel-Berhalter et al. 2011	Good For The Neighborhood (same name)	Health disparities	Creating a tailored intervention	Mode 3	- Different activities - Transportation to events - Address non-health issues such as employment and crime	Formative evaluation was used to make adaptations to the programme. Community partners and participants were asked to provide feedback	Developed for undeserved communities	Citizens within four specific United States underserved communities	Not reported in included article	Not reported in included article	Developed in the United States (broad population, not location-specific)	United States (West and East Side of Buffalo, City of Niagara Falls, Seneca Nations of Indians)
Wainberg et al. 2007	No original name but references to six interventions (PRISSMA, Projeto Interdisciplinar do Sexualidade, Saúde Mental e Aids—Interdisciplinary Project in Sexuality, Mental Health, and AIDS)	HIV prevention	There are no HIV prevention programs targeting psychiatric patients in Brazil	Mode 6	- Manuals translated to Portuguese - Add cultural relevant content - Module on assertive communication and triggers of unsafe sex was expanded with stigma related to having a mental illness, and potential impact of beliefs on risk and on the importance of social responsibility in maintaining sexual health - Peer education system - Verbal message delivery strategies - Role plays replaced with nonverbal communication exercises - Adding skill building exercises	Stakeholder groups involved in the co-adaptation process were: (1) the research team, American and Brazilian investigators, (2) the Community Advisory Board, community leaders, patient advocates, other members f the broader community, (3) ethnography patients, patients, and hospital staff, (4) the intervention adaptation working group, mental health care providers. Each stakeholder group had clearly delineated roles, tasks, and goals. Only the research team interacted with all the other stakeholder groups. Three 3-day workshops were conducted over a duration of 2 months to adapt the intervention	Psychiatric patients	Psychiatric patients in Brazil	It states that all six interventions used for co-adaptation were proven to be effective	Randomised controlled trial	United States	Brazil

Table 1 (continued)

First author, year	Original name of the intervention (adapted name)	Public health issue	Reasons for adaptation	Mode of adaptation (Fig. 2)	Adaptations		Target population		Evaluation planned or performed		Country	
					What was adapted?	How it was adapted?	Original intervention	Adapted intervention	Original intervention	Adapted intervention	Original intervention	Adapted intervention
Whitney et al. 2017	The South Side Diabetes Project (SSDP) (same name)	Diabetes prevention	Increasing impact of previous intervention	Mode 6	- Biblical scripture was added to educational slides - Class presentations were added - On goal- setting worksheets biblical scripture was added - Group discussions about the role of faith in health promotion activities - Opening and closing classes with group prayer - Culturally tailored testimonials	Two focus groups of approximately 60 min with African Americans with diabetes were held to inform the adaptation. Adaptations were made in collaboration with the local church. The intervention team included physicians, religious scholars, church leaders, clinical researchers, public health experts, diabetes educators, and persons with diabetes	Low-income African Americans	Low-income African American neighbourhoods in Chicago	States that only preliminary studies have been done on effectiveness of Diabetes Empowerment Program (DEP)	Not reported in included article	United States (Chicago)	United States (Chicago but in a church setting)
Yeary et al. 2017	Evidence-based diabetes self-management education - DSME (same name)	Diabetes self-management education	Adaptation for the Marshallese	Mode 6	- Cultural components of the seven key components were changed - Education about fibre and non-starchy vegetable intake - Put emphasis on the intake of complex carbohydrates - Incorporation of fruits as daily snack using fruit the Marshallese community is familiar with - Adding Marshallese's spiritual beliefs - Focus on physical activities that are consistent with the Marshallese's cultural beliefs and practices - Using analogies involving natural elements of the Marshall Islands - Education about Western medicine and continued medication - Emotional expressiveness and trust-building activities to facilitate conversations about stress and coping - Preference of oral communication over written communication	A Curriculum Adaptation Team was established including academic researchers, community members, and clinical experts. An Advisory Board provided ongoing input in the co-adaptation of the curriculum, also consisting of academic researchers, community members, and clinical experts. Curriculum co-adaptation was achieved through weekly meeting of 3 half-day planning sessions that took place over 7 months.	People with diabetes	People with diabetes	Not reported in included article	Not reported in included article	United States	Republic of Marshall Islands

Table 2 Frameworks and steps for adaptation

Study	Adaptation steps reported in study
Aventin et al. 2021	Step 1: Conduct needs assessment, including: a) Consult with adolescent, adult, and expert advisory groups b) Conduct systematic review: determinants of condom use among adolescents in Southern Africa c) Conduct focus groups adolescents d) Conduct focus groups adults e) Collate findings from systematic review and focus groups f) Develop logic model of the problem
	Step 2: Conduct Intervention Mapping exercise, including: a) Specify changes to intervention goals b) Specify changes to intervention determinants, objectives, input, and activities and outcomes c) Specify changes to underpinning theory and delivery methods d) Draft intervention theory of change model e) Draft intervention adaptation, adaption, implementation and evaluation plans f) Consult with advisory group members
	Step 3: Plan for adaptation, implementation and evaluation, including: a) Collate feedback from advisory groups b) Finalise interventions goals, objectives, outcomes, and theory of change model c) Finalise intervention adaptation plan d) Finalise intervention implementation plan e) Finalise intervention evaluation plan
Baydala et al. 2009; 2014	Step 1. Review and cultural adaptation of program
	Step 2: Delivery of the adapted program
	Step 3: Evaluation
Betts et al. 2018	Step 1: Planned adaptation
	Step 2: Responsive adaptation
	Step 3: Evaluation
De Camp et al. 2021	Step 1: Assessing fit between evidence-based intervention and implementation context using 4 guiding questions
	Step 2: Multimodal strategy to answer guiding questions
	Step 3: Research staff use meeting notes to generate summaries
	Step 4: Steering Committee uses summaries to plan adaptations
	Step 5: Proposed adaptations shared with subcommittees and refined based on feedback
	Step 6: Final synthesis generated using intervention function/form concept
Etter et al. 2019	Step 1: Training was conducted through a series of conversations between youth workers (recruited before) and training staff
	Step 2: Subsequent discussions on how the components of the training might fit into the way of living in the community
Norr et al. 2006	Step 1: Establishing relationships with rural health centers/communities
	Step 2: Qualitative interviews to collect information on how to adapt to rural health workers' context
	Step 3: Research team analyses results of step 2 to tailor the original (urban) intervention to the needs of rural health workers
	Step 4: Intervention is scaled (more centers, more health workers), after having received this intervention, they are offered to be trained
	Step 5: Intervention is made available in targeted villages to every adult who wants to participate
	Step 6: Community meetings to share results from qualitative interviews from phase 1, aim here is to adapt the intervention to youth

Table 2 (continued)

Study	Adaptation steps reported in study
Ruggiero et al. 2011	Step 1: Screening Step 2: Community translation of intervention
Wainberg et al. 2007	Step 1: Optimizing fidelity, including: a) Establishing and training a cohesive bicultural research team b) Identifying efficacious interventions c) Identifying common content areas and message delivery strategies Step 2: Optimizing fit, including: a) Creating a culturally informed and cohesive research team b) Fostering local collaboration and acceptability c) Eliciting HIV- related needs and risk contexts of the target population d) Identify local cultural principles relevant to HIV prevention Step 3: Balancing fidelity and fit, including: a) Creating and training an intervention adaptation workgroup and culturally translating efficacious interventions b) Building consensus and completing adaptation through experiential workshops. This includes 1: review, evaluate, determine adaptations of messages and delivery strategies, 2: consolidate and refine content, message delivery strategies and materials, 3: consolidate sessions and flow of the intervention Step 4: Pilot testing and refining, including: a) Training intervention facilitators to pilot the sessions b) Piloting and refining intervention sessions c) Approving and manualizing the intervention

intervention, for instance, communication platforms used in intervention implementation ($n = 3$) [20, 31, 35] and new tracking devices and strategies to monitor the intervention's implementation ($n = 4$) [20, 34, 37, 41]. Baydala and colleagues [32, 33] added training components and Whitney and colleagues [40] included additional materials, workshops, and training days to guide the intervention implementation.

Ten studies [20, 30–35, 37, 39–41] reported on contextual modifications to align with the new population of interest or context, including, for instance, the addition of biblical scriptures ($n = 1$) [40], language modifications that reflected Aboriginal youth culture ($n = 1$) [30] or included disability-friendly language ($n = 1$). Three studies reported translating the original intervention's promotional and educational materials to local language [30–33] and three adapted the original intervention name to reflect the new setting and/or target population [20, 37, 39]. Adaptations made in the different studies can be found in Table 1.

Co-adaptation process

Only two studies [20, 34] reported extensively about the co-adaptation process, while the remaining eleven studies reported on only a few aspects of the co-adaptation process [29–33, 35–41]. Betts and colleagues [20] reported on details of specific co-adaptation objectives, duration, modality or location of each of the co-adaptation sessions, methods involved and extent to which the target population representatives and stakeholders were involved. They described setting up an advisory board of relevant stakeholders which directed and participated in making planned content and reviewed final versions of all sessions. Similarly, DeCamp and colleagues [34] reported on the co-adaptation objectives, number and duration of each session, composition of stakeholders involved, and methods used during the co-adaptation process, which included photovoice, creating problem statements, making difficulty and importance matrices, qualitative interviews, group ideation and brainstorming.

Only Betts and colleagues [20] explicitly referred to planned versus responsive types of adaptations. They described, in line with the definitions we used throughout this study, planned adaptations as the modifications they made prior to the intervention and responsive adaptations as modifications made during the course of intervention delivery. In the latter phase, specifically, Betts and colleagues [20] assessed stakeholders' engagement and barriers to program adherence and adjusted corresponding adaptations to the remaining sessions.

Aventin and colleagues [29] reported on a few aspects of the co-adaptation process, including the type and number of stakeholders engaged (i.e., a project advisory group, including local stakeholders, community members, and representatives of population of interest), the number and duration of sessions (i.e., $n = 12$ focus groups lasting 2–3 h in each intervention country), phases of co-adaptation (i.e., planning and adaptation phase) and time period of co-adaptation (i.e., eight months). Wainberg and colleagues [39] described some aspects of the co-adaptation process, including the type and number of stakeholders engaged (i.e., research team, the community advisory board, patients, hospital staff, intervention adaptation work group), the number of sessions (i.e., three-day workshops) and duration of the process (i.e., two months).

While all studies reported on the use of adaptation in a co-creative manner, and therefore included in our review, some included minimal information on the co-adaptation process [30–33, 35–38, 40, 41]. Among them, Baydala and colleagues [32, 33] included brief information on the period over which the group met, the composition of the co-adaptation groups and some consideration of their roles. Yeary and colleagues [41] briefly described the type and number of stakeholders engaged, number and duration of sessions, and time period of co-adaptation.

Frameworks and steps reported to guide co-adaptation

Only two studies stated the use of existing frameworks to guide the adaptation [29, 34], both referring to the use of the Intervention Mapping Adapt [42]. Both studies included an initial needs assessment, identification of the evidence-based intervention, and assessment fit and plan for adaptation. However, both studies mentioned the relevance and importance of considering the explicit integration of stakeholder engagement into the existing Intervention Mapping Adapt framework.

Seven studies [20, 32, 33, 35–37, 39] reported on the steps used to co-adapt public health interventions but did not state the use of a framework. Aventin and colleagues [29] described the steps of conducting a needs assessment, mapping the intervention, and finalising adaptation, implementation, and evaluation plans. Baydala and colleagues [32, 33] included the steps of reviewing and culturally adapting the program before delivery and evaluation. Betts and colleagues [20] incorporated planned and responsive adaptations, while DeCamp and colleagues [34] included assessing fit to planning adaptations based on feedback. Wainberg and colleagues [39] reported on the steps of assessing cultural fit including team collaboration, training, and pilot testing. The remaining five studies [30, 31, 38, 40, 41] did not report on frameworks used nor used a stepwise approach. Frameworks and steps for adaptation are displayed in Table 2.

Interviews to explore unpublished case studies

Through our call for case studies and snowballing approach, we identified seven unpublished studies in which co-adaptation was applied to a co-creation process and/or a public health intervention. Case studies were conducted in different countries, involved different target groups, and a variety of public health issues. Seven semi-structured interviews were conducted with one individual who was or previously had been engaged in these co-adaptation studies. Results show that different modes of co-adaption were applied in the case studies. Two case studies aimed to co-adapt the co-creation process with new interventions being developed (Chic@s en Acción and The Workplace Health Study). Five case studies aimed to co-adapt an intervention (either originally co-created or non-co-created) through a co-creation process (Weekday WOW factor, Are You Daydreaming?, Team Baby, ECHO-COPD, Diet and Physical Activity Intervention). Planned and responsive adaptations occurred in different phases, i.e., during the adapted co-creation process or during the development and implementation of the intervention. For example, planned adaptations during the co-adaptation process included changing co-creation methods based on a context analysis, responsive adaptations during the co-adaptation process included shifting activities via sessions based on stakeholders' feedback, planned adaptations during the development of an intervention included to fit intervention components to the specific context, and responsive adaptations during the implementation of an intervention included changing implementation strategies based on stakeholders' feedback. Additional file 5 provides an overview of the included studies describing reasons for adaptation and how co-adaptation was conducted. Themes emerged from these interviews were context, continuous feedback for responsive adaptations, knowledge integration, challenges when adapting, frameworks used, and recommendations for co-adaptation.

Context

Interviewees underscored that understanding the new context and how it differs from the previous context is of utmost importance. In the co-adaptation of an mHealth application to another population of interest, awareness of differences between the old and new population of interest influenced how the solution was designed: *"There are differences in the quality of care that migrants have compared to the native population because of challenges with the language and also awareness of what is possible or where they can get care and things like that".* This also applied to the co-adaptation of a school-based nutrition and physical activity intervention, in which differences in resources between both schools shaped the design of the intervention components: *"... it might be tempting to think that all schools need the same components... you have to co-create with them to find out what are exactly the needs of the people".*

In a project co-adapting a co-creation process to three different Small and Medium-sized Enterprises, organisational culture was identified as a significant contextual influence on how to co-adapt: *"I find that a very important one in adapting your co-creation process is figuring out the culture of your group, of your company".* Similarly, in another project that co-adapted and transferred a Youth-centred Participatory Action Research (YPAR) process to a different country, cultural differences were mentioned as a crucial factor to consider: *"I do think that there is a cultural difference in the openness to participatory approaches between the Netherlands and Spain. I think in the Netherlands this has evolved a little bit further already and in Spain it seems that the children and the teachers are less used to the idea of working together in a participatory way".* While some cultural contexts may be more readily prepared to embrace co-creation, others may require additional effort and preparation to adopt such approaches.

Interviewees also mentioned the importance of carefully reconsidering whether facilitators from the original context still have a good fit with the group participants in the new context: *"It could go really well or maybe it doesn't, because the facilitator's not having as much connection with the [new] group for whatever reason".*

Continuous feedback for responsive adaptations

Continuous feedback from stakeholders was collected throughout the respective research projects, prompting ongoing reflections on improving the co-adaptation process or the implementation of the co-adapted intervention. This feedback was particularly important for guiding subsequent responsive adaptations: *"We asked them [co-adaptors in a project which aimed to adapt the co-creation process] to fill in a form on what they thought was needed in the upcoming workshops, what was missing, what we needed to do to reach our end goal, our solution, and actions to get there. Additionally, also how they're feeling about the workshops, if they're feeling involved, if they feel it's useful. This feedback would go into adapting next workshops"*. In another study, continuous feedback shaped how activities were adapted, i.e., responsive adaptations during the implementation of the intervention: "*We gathered continuous feedback through questionnaires (...), we captured some information about why people came [to the daytime discos for the elderly] and why they enjoyed it and [it] seemed to be meeting some of the problem areas".*

Knowledge integration

The importance of integrating knowledge from previous co-creation studies into the co-adaptation was mentioned several times by different interviewees: *"So, my initial adaptations and learning was from this project [another co-creation project that was undertaken previously]".* Similarly, another interviewee mentioned: "*We should take learnings that might not have been published yet, but that we know of from the experts and integrate that into the [current study] so that we* are able to *implement it from the start".* Another interviewee mentioned that a previous intervention guided the process of co-adaptation of the new intervention: *"I'm not starting from scratch, I already have an idea from the first one [intervention] to be a guide on the questions to ask".* The need to integrate new knowledge emerging during co-adaptation processes was raised as well: *"If it's the same composition [of participants] and if the previous co-creators join, that will end in the same place [the co-adapted intervention will be too similar to the original intervention], so that's not optimal. It definitely involves different co-creators".*

Moreover, interviewees mentioned that it was especially important to be familiar with the specific original intervention and/or process that they were planning to co-adapt. This included reaching out to the researchers who were part of the original process and/or intervention. For example, one interviewee highlighted that: *"It's really good to get familiar with the original intervention and not only how it was delivered, but also how it was developed. And then also talk to the previous co-creators or previous facilitators [if the intervention was initially co-created] because their context can vary but it's adaptation, it's not a new intervention, so you can get tons of ideas or different practical skills from the facilitators [who facilitated the original co-creation process or implemented the original intervention]".*

Interviewees indicated that when co-adapting without sufficient knowledge of the original intervention and/or process, core elements might be overlooked, which may lead to less effective or even negative results: *"These adaptations might also have negative outcomes or consequences because you're maybe skipping elements or changing elements that had a specific purpose, or (…) a certain part of the process [if initially co-created] is not carried out as intended. And all these [changes] could potentially have negative outcomes".*

Challenges when co-adapting

One challenge mentioned was that co-adaptation might not be as participatory since it is not started from scratch, but builds up on an existing process or intervention, or because time during co-adaptation processes is often limited as compared to regular co-creation processes. For example, during co-creation processes to adapt an intervention, concerns were raised about whether facilitators' familiarity with the original intervention might unintentionally guide participants into a certain direction, instead of fully addressing their unique needs: *"There was the danger of push[ing] them [the students] into a certain direction [during the co-creation process], because I knew how the original intervention looked like".* Moreover, it was indicated that stakeholders who were part of the co-adaptation process had also been part of the original co-creation process and *"already [knew] what the intervention [looked] like, heavily limit[ing] their creativity (…)".* Including someone in the process who was familiar with the original intervention *"helps to break the preconceptions of the co-adaptors who attended the previous workshop [to develop the original intervention]"* and helped to overcome this challenge. Co-adapting public health interventions rather than developing them from scratch, led to shortened co-creation processes, which in turn created time pressure that sometimes reduced participation and limited co-creativity: "*Sometimes sessions were not as co-creative [or participatory] as we wanted because we really had to make decisions, there was no other time to do it".*

Moreover, interviewees mentioned that planning and preparing co-adaptation processes requires the engagement of different stakeholders, including those from the original as well as the new context, which was considered an additional challenge: *"I would say that adapting the protocol would involve a lot of expertise from different advisors, which you would need to consult. And I think one of the challenges is to be able to bring all these advisors together (…)".*

Frameworks used

Five out of the seven interviewees referred to the use of frameworks, namely the Generic Statistical Business Process Model (GSBPM) [43], Intervention Mapping (IM) [42], the Person-Environment-Occupation-Performance model (PEOP) [44], a combination of the Model for understanding Adaptations Impact (MADI) [45], ADAPT guidance [19], and Framework for Reporting Adaptations and Modifications to Evidence-based interventions (FRAME) [46], the PRODUCES (PRoblem, Objective, Design, (end-) Users, Co-creators, Evaluation, Scalability) framework [9], and the Health CASCADE draft evidence-based co-creation guideline [47]. Frameworks were mainly used to structure the co-adaptation (e.g., GSBPM, PRODUCES), and ensure an evidence-based outcome of the co-adapted intervention (e.g., IM). Some interviewees indicated having chosen the framework primarily because they were familiar with it *("This is the framework that underpins everything that I do, so it's almost automatic"*), but they also mentioned flexibility and structured nature of the framework as reasons

for use. However, they wished for the framework to better align with co-adaptation or participatory approaches in general and mentioned that some frameworks were somewhat vague when it came to co-adaptation. Moreover, one interviewee mentioned the need for frameworks that offer structure, while avoiding rigidity to preserve the bottom-up approach of co-adaptation: *"How structural can you get, because we are all about flexibility and context(.) Can you make a framework and put examples that won't fit back into boxes? Suddenly you have all the same co-creation processes, starting from the same base, which might not work for everyone, which might not be great for all contexts".*

Recommendations for co-adaptation

Interviewee recommendations are presented in Additional file 6. In summary, interviewees recommended to: (1) perform a context analysis before starting the process, i.e., carefully comparing the context where the original co-creation and intervention was implemented to the new context, (2) engage different stakeholders at an early stage in the co-adaptation process (including stakeholders from both the original and the new context), (3) keep a logbook to track different adaptations and take these learnings into new adaptations, (4) be transparent about general aims of the co-adaptation and the fact that it is not something that is started from scratch, (5) continuously reflect on co-adaptations to allow responsive adaptations.

Discussion

This study explored the co-adaptation of interventions and co-creation processes in public health through findings from a rapid review and interviews with co-creation researchers. Co-adaptation was approached differently across the studies included in the rapid review and interview studies, highlighting the diverse nature of the process and the challenges involved when reviewing co-adaptation. To capture this, we created Fig. 2, which visualises various modes of adaptation, i.e., approaches to adapting co-creation processes and/or interventions. At this point, we specifically want to mention the co-adaptation of co-creation processes. While this might seem logical to tailor the process to stakeholder's needs, this has often been done by researchers without engaging stakeholders. Therefore, there is little guidance on how to do this, and little information on how this has been approached. However, co-adaptation of the co-creation process might deepen stakeholder engagement and ensure transparency, which is essential for trust building [17]. Moreover, co-adaptation of co-creation processes might increase in importance as public health research shifts more towards Mode 2 research [48]. If researchers cannot identify an intervention that meets the criteria for adaptation outlined in the ADAPT guidance [19] and lack the resources to co-create one from scratch, they might instead choose to co-adapt a co-creation process, which could lead to an effective new intervention.

Knowledge integration

Interview results highlight the importance of integrating prior knowledge on processes for effective co-adaptation. Interviewees mostly referred to experiential knowledge of stakeholders or researchers, who had been engaged in the original co-creation process, or were engaged in or knowledgeable about the new context. This relates to findings of the rapid review, which revealed a lack of detailed reporting in the literature, with many studies lacking an adequate description of the development and context of the original interventions or the specific adaptations made to fit new contexts. This lack of detail could result from journal word limits or a general underestimation of the importance of reporting such details [49]. In response to these gaps, we emphasise the need for thorough documentation of the co-adaptation process (e.g., methods used during the co-adaptation process) and the co-adapted intervention (e.g., intervention components that were adapted). This documentation should at least include what was adapted, why, and how. This would facilitate researchers' ability to use existing knowledge on how co-adaptation worked in practice, providing valuable insights to better plan and implement future co-adaptation efforts. In cases where the original intervention's context or development details are missing, developers of the original intervention should be contacted for further information, for example by holding online meetings in cases when researchers and key stakeholders engaged in the original intervention are not located near the co-adaptation team [19]. To enhance co-adaptation processes, the establishment of advisory boards or adaptation teams can facilitate the integration of prior knowledge throughout the adaptation process.

Reporting and integrating prior knowledge into the co-adaptation can also ensure that the effectiveness of the original intervention is maintained, as its active ingredients, i.e., the mechanisms by which they achieve their outcomes, can be identified. Researchers should draw on the effect and process evaluations of the original intervention to ensure that these mechanisms are preserved during adaptation, considering elements like delivery, experience, context, maintenance, impact, and participation [50]. The process evaluation can concern the implementation process as well as the co-creation process itself. Moreover, the CORE Fidelity method [51] has been proposed as a method for defining core elements of an intervention, while maintaining flexibility in implementation, and also highlights the importance to gather and integrate prior knowledge. Core elements

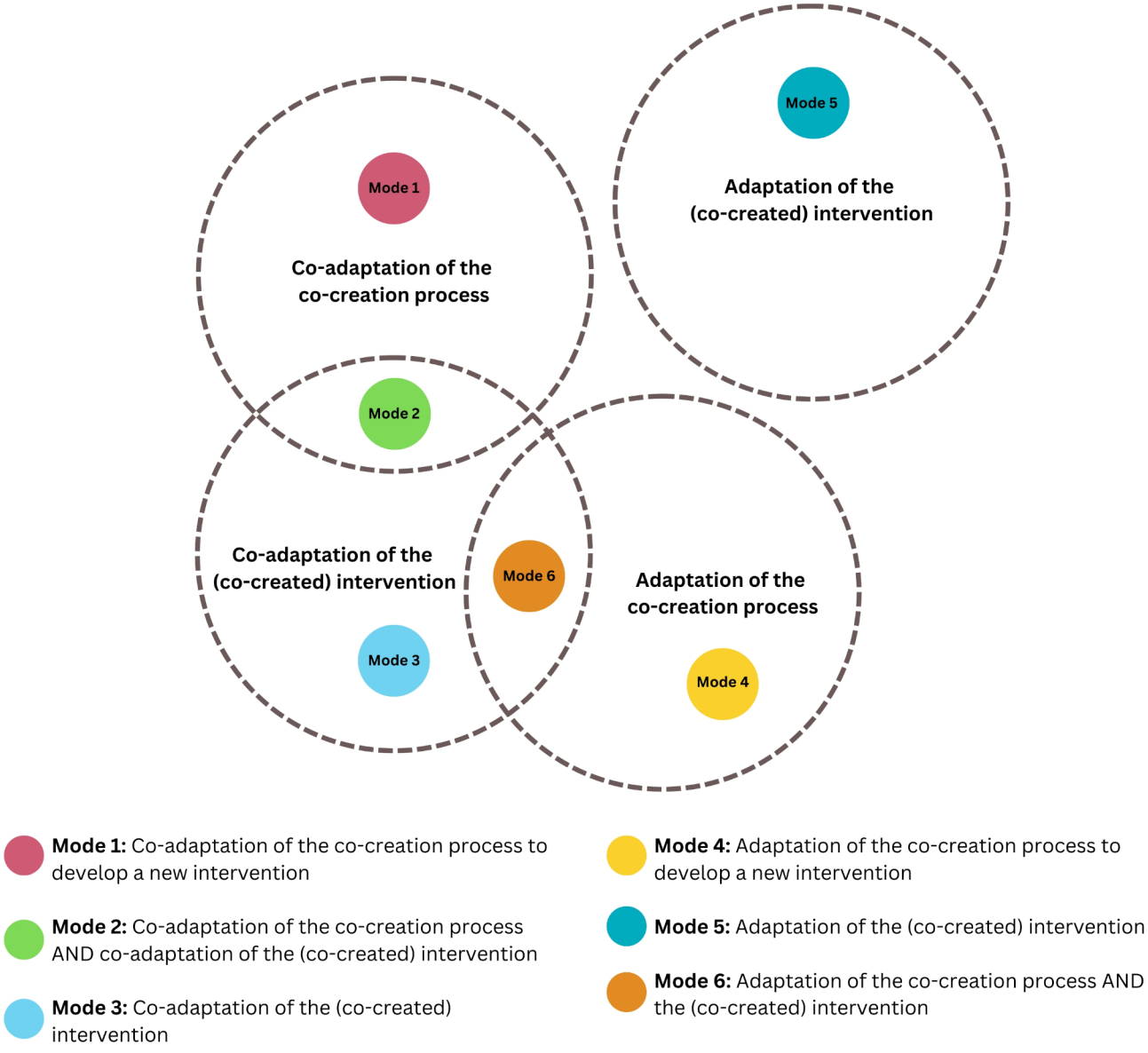

Fig. 2 Modes of adaptation

in an obesity screening intervention might, for example, be an alert popping up on the computer screen, while the appropriate timing of this reminder popping up might differ between contexts [52]. Using an example from one of the interview studies, a core element might be the use of social comparison between adolescents who engage in a healthy sleep intervention, while this might happen via an app-based class competition or via a paper-based class competition, depending on digital literacy of the adolescents. A critical challenge that is specific to co-adaptation lies in preserving these core components while adhering to principles of shared decision-making and stakeholder ownership in the co-adaptation process. This tension, highlighted by interviewees, emphasises the need for transparency—reflected in one of the dimensions of co-creation (open, trustful, and inclusive dialogue) brought forward by Messiha and colleagues [17]. Transparency about what constitutes core components versus adaptable peripheral elements from the outset, for example by co-adapting not only the intervention but also the co-creation process, can help manage expectations and foster collaborative decision-making. Furthermore, effective

methods for adapting periphery components can support this process. By maintaining open communication and shared understanding, researchers can strike a balance between fidelity to core elements and the adaptability required for contextual relevance.

Readiness for co-creation and contextual fit

Interview results also highlight the importance of assessing and fostering readiness for co-creation in both the original and adaptation contexts. Readiness encompasses stakeholders' motivation, context-fit, and the capacities required for implementation. Variations in readiness can be attributed to cultural differences, such as where a country is positioned on the dimension of power distance (i.e., the degree to which power imbalances are accepted in a specific culture), which may influence the willingness or ability of stakeholders to engage in co-creation [53]. As mentioned by stakeholders from the Chic@s en Acción project, in a culture in which power distances are accepted to a greater extent (e.g., Spain) there might be less readiness for co-creation, which at its core, strives for a more equal distribution of power, than in a country where power distances are less accepted (e.g., the Netherlands).

In cases where readiness is low, stakeholders - particularly researchers - may require training to meaningfully engage communities. During these trainings, power dynamics, treating community members as co-researchers, and building long-term, trust-based relationships should be addressed. Ethical practices, guided by community priorities, are paramount to ensure that community voices are heard and that their input shapes both the process and outcomes of co-adaptation [54]. Additionally, aligning projects with community priorities and emphasising capacity building can foster mutual benefits.

Frameworks for co-adaptation

The rapid review found that most researchers structured their co-adaptation processes using step-based approaches rather than established frameworks. Interviews revealed that researchers often modified or combined existing frameworks to tailor them to the unique demands of co-adaptation. These findings suggest that current frameworks may not fully address the needs of researchers in this field. Future research should therefore investigate the existing literature on co-adaptation more broadly to identify relevant guidelines, barriers, and facilitators. This would provide a more comprehensive understanding of current practices and inform the development of structured, adaptable frameworks for co-adaptation.

Recommendations and broader implications

While further research is needed to provide concrete recommendations for frameworks for co-adaptation, our findings highlight several key steps to consider when co-adapting an intervention or a co-creation process. A first step is conducting a context analysis. Similarities and differences between the original and adapting contexts, including cultural factors such as power distance acceptance should be assessed. This analysis can help determine whether additional support is required during the planning phase to prepare the adaptation context for its role. Second, researchers involved in the original intervention should be engaged to incorporate their expertise, if not already done during the planning stage. This collaboration should focus on identifying the intervention's core components, distinguishing them from peripheral, adaptable elements. Third, the adaptable components should be addressed together with stakeholders, i.e., peripheral components should be adapted while ensuring that the core ingredients that drive the intervention's effectiveness are maintained. During this process, essential principles or dimensions of co-creation should be integrated. Fourth, researchers should acknowledge that many challenges encountered in co-adaptation also apply to co-creation in general. As co-creation underpins co-adaptation methodologies, it is advisable to begin by consulting established co-creation guidelines (e.g., co-creation dimensions) and aligning these with adaptation frameworks. By following these steps, researchers can adapt existing interventions more efficiently and effectively. This approach allows for high-quality adaptations that account for stakeholders' needs and contextual factors, optimizing resource use while maintaining the integrity and impact of the original intervention.

Strengths and limitations

A notable strength of this study is the combination of a broad and exploratory rapid review with qualitative interviews. This dual approach provides a comprehensive overview of co-adaptation practices in the literature while enabling an in-depth exploration of critical aspects of the co-adaptation process and offering recommendations for future co-adaptation efforts.

However, the study has some limitations. Firstly, the rapid review was limited to the Health CASCADE co-creation database, potentially excluding other relevant studies. Despite this limitation, the use of this pre-screened database enhanced the efficiency of the review process. Secondly, the interviews were based on only seven case studies, which may not fully capture the diversity of perspectives and experiences in co-adaptation. Additionally, data extraction was performed by the lead researchers, introducing potential subjectivity into the process.

Conclusion

This study synthesises findings from a rapid review and interviews to explore the co-adaptation of co-creation processes and public health interventions. Stakeholder engagement emerged as a critical factor for ensuring contextual relevance and cultural sensitivity in co-adaptation. However, the lack of detailed reporting on co-adaptation processes in the literature hampers transparency and replicability. We recommend prioritising the integration of prior knowledge and ensuring contextual fit as essentials for successful co-adaptation. By combining co-creation methodologies with systematic adaptation practices, public health interventions can become more accessible, culturally relevant, and resource-efficient [55], thereby enhancing their potential impact on diverse populations.

Abbreviations

PRISMA	Preferred Reporting Items for Systematic reviews and Meta-Analyses
HIV	Human Immunodeficiency Virus
STI	Sexually Transmitted Infections
DPP GLB	Diabetes Prevention Program Group Lifestyle Balance
GLB AIM	Group Lifestyle Balance Program Adapted for individuals with impaired mobility
AHF	Active and Healthy Families
WHO	World Health Organisation
PHC	Primary Health Care model
PRISSMA	Projeto Interdisciplinar do Sexualidade, Saúde Mental e Aids
SSDP	The South Side Diabetes Project
DSME	Evidence-based diabetes self-management education - DSME
SME	Small and Medium-sized Enterprises
Y-PAR	Youth-centred Participatory Action Research (Y-PAR)
GSBPM	Generic Statistical Business Process Model
IM	Intervention Mapping
PEOP	Person-Environment-Occupation-Performance model
MADI	Model for understanding Adaptations Impact
PRODUCES	PRoblem, Objective, Design, (end-) Users, Co-creators, Evaluation, Scalability

Supplementary Information

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Supplementary Material 1

Supplementary Material 2

Supplementary Material 3

Supplementary Material 4

Supplementary Material 5

Supplementary Material 6

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Author contributions

JB, GRL, and LRD developed the conceptual ideas, screened title, abstract, and full texts, performed and analysed interviews, and drafted the paper. JB, GRL, and LRD contributed equally to this manuscript. OEO, MVo, and QA screened title and abstract and provided input on the manuscript. MGG, GC, MVe, TA, LSB, and BD supported the development of conceptual ideas, the analysis and paper drafting. All authors read and approved the final manuscript.

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Data availability

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

Ethical approval was granted with code 2122003 by the Ethics Committee of the faculty of Psychology, Education and Sport Sciences at Blanquerna – Ramon Llull University. Written informed consent was obtained from all interview participants who were not co-authors.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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