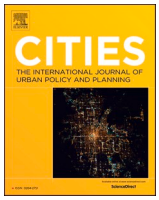
Cities 169 (2026) 106569

Contents lists available at ScienceDirect

Cities

journal homepage: www.elsevier.com/locate/cities



"Challenging but worth it!": The purpose of participatory research in urban health, an evaluation and derived framework

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ARTICLE INFO

Keywords:
Public engagement
Environmental health
Citizen science
Review
Model
Indicators

ABSTRACT

Participatory approaches are becoming paramount to harness the relationship between researchers, government, industry, and civil society to inform programs and policies. However, variability in implementation and limited standardized reporting hinder the systematic evaluation of their effectiveness. This study characterizes participatory methodologies in urban health research and proposes a framework for evaluating and reporting such approaches. Using an explanatory sequential design, this study evaluated 20 participatory pilot studies from the Urban Health Cluster (Horizon 2020 European Commission Programme), combining survey data and semi-structured interviews with project leads. The analysis identified four primary purposes for participatory methods: to assess health-environment correlations; raise awareness; co-create interventions; and assess health-related effects. Case studies exemplify each of these purposes. Findings informed a "purpose framework" nested within a theory-of-change model, which clarifies the rationale behind participatory approaches and maps their processes and intended impacts. The framework includes indicators for purpose, stakeholder involvement, participation mechanisms, facilitators, challenges, expected outcomes, and evaluation strategies, reported across all 20 projects. Public authorities (90 %) and civil society (85 %) are the most frequently engaged stakeholders, typically involved during project identification and deployment. Engagement was facilitated by shared motivation to address local needs, while long-term commitment posed challenges. Our results highlight the limited use of theory-of-change models in current practice and the value of structured frameworks for enhancing the reproducibility and transformative impact of participatory urban health research. The proposed framework can help align participatory methods with a theory of change and foster more effective urban health transformations.

1. Introduction

Urban health is a transdisciplinary and intersectoral field where multiple theoretical and methodological approaches are deployed to study the pathways between urban environment features and human health and develop effective health-promoting urban interventions (Galea & Vlahov, 2005; Kim et al., 2022). Although different disciplinary approaches co-exist in the current research and practice of urban health, it is arguable that their common final goal is to impact health and sustainability outcomes by transforming urban environments and human behaviours (Crane et al., 2021; Grant et al., 2017). Nevertheless, there is an implementation gap between the existing evidence and the existing policies and programs (Kim et al., 2022; Oliver et al., 2014). The limited translation of scientific knowledge into actionable policies has driven the rise of participatory urban governance -an approach that integrates health governance, multisectoral action, and civic engagement (Mesa-Vieira et al., 2023). Strengthening collaboration among researchers, policymakers, and communities is expected to help overcome the fragmented efforts that hinder effective implementation (Carroll-Scott, 2020; Crane et al., 2021). In this line, the use of

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https://doi.org/10.1016/j.cities.2025.106569
Received 15 October 2024; Received in revised form 7 May 2025; Accepted 4 October 2025
Available online 17 October 2025

participatory methodologies is gaining a role in urban transformation interventions for its potential to bring together multiple components and stakeholders, co-creating and testing interventions tailored to real-world contexts (Leask et al., 2019). These approaches are intended to harness local knowledge to identify key elements within physical and social urban environments that influence health outcomes, and enhance trust in decision-making (Carroll-Scott, 2020; Crane et al., 2021; Rosas et al., 2022). However, the impact of these participatory strategies is often underreported in scientific literature, underscoring the need for documentation and dissemination of outcomes (Mesa-Vieira et al., 2023; Ward et al., 2022).

Participatory research is an umbrella term encompassing designs, methods, models, and frameworks that involve stakeholders who belong to or represent the interests of the target population (i.e., end-users) (Vaughn & Jacquez, 2020). In the urban health field, participatory approaches are deemed to facilitate purposeful dialogue across diverse sectors (e.g., urban planning, public health, environmental epidemiology, transport), and include vulnerable populations in disentangling how the unequal spatial and social distribution of urban environment features translate into health outcomes among different population groups (Froeling et al., 2021; Pedersen et al., 2022). The heuristic of participatory approaches is to go beyond knowledge generation and foster the input of multiple stakeholders to support decision-making for the development of synergistic interventions and policies, maximizing the potential outcomes (Crane et al., 2021). Although participatory approaches can empower stakeholders to develop urban health strategies tailored to their circumstances, each city's progress in transforming urban environments and human behaviours will vary depending on its current context, urgent priorities, and concerted actions among stakeholders (Crane et al., 2021; Geekiyanage et al., 2021).

Urban health stakeholders are increasingly embracing participatory and collaborative processes to co-produce knowledge, provide locally situated solutions, drive urban transformation, and reduce health inequities (Mesa-Vieira et al., 2023; Pedersen et al., 2022). The engagement of stakeholders in the development of health-promoting interventions and policies is thought to increase understanding of exposures, risks, barriers, and enabling factors that influence health behaviour, adherence, and effectiveness (e.g., physical, mental, and social health outcomes) (Commodore et al., 2017; Leask et al., 2019). Therefore, the goals of participatory research include performing socially relevant research informed by real-world contexts, results that can be more effectively translated into community settings and policy practice, and improved research quality by integrating diverse expertise and knowledge (Brunton et al., 2017). Altogether, this can enable processes of data-driven governance, local capacity building, advocacy, and action change (Mesa-Vieira et al., 2023). However, to date, the evidence on the effectiveness of participatory methods is limited. Baseline situations, outcomes and/or impacts relative to the implementation of participatory urban health strategies have been rarely reported in the scientific literature (Mesa-Vieira et al., 2023; Ward et al., 2022; Wehn et al., 2021a).

Given the variability in researchers' experiences with participatory methods and the limited standardized reporting in the literature, there is a growing need to expand evidence on the effectiveness and nuances of these processes (Froeling et al., 2021; Mesa-Vieira et al., 2023; Somerwill & Wehn, 2022; Ward et al., 2022). This study aims to characterize the use of participatory methodologies in urban health research, addressing challenges and lessons learned, and to propose a framework for evaluating and reporting urban health participatory projects. Urban health research typically uses a theoretical framework to explain how the urban context influences health, guiding research questions and findings (Galea et al., 2005; Galea & Vlahov, 2005). In this context, participatory methods can be directed by a framework that clarifies participatory processes and outcomes. A theory of change outlines the pathway through which an intervention or project leads to a desired outcome, mapping the steps, processes, and causal relationships between inputs, activities, outputs, outcomes, and impacts (Cassetti & Paredes-Carbonell, 2020). We propose a "purpose framework" within a theory-of-change scheme to capture the rationale behind participatory approaches (purpose), outline the processes (stakeholders, mechanisms, facilitators, challenges), and identify potential urban health transformations enabled through the participatory approach (outcomes, evaluation). We propose a set of indicators to monitor participatory processes based on this framework. To this end, we review six projects from the European Urban Health Cluster, funded under the Horizon 2020 SC1-BHC-29-2020 topic, "Innovative actions for improving urban health and wellbeing - addressing environment, climate, and socioeconomic factors".

1.1. A conceptual background

Researchers across various disciplines have a long history of collaborating with non-academic stakeholders in participatory research (Vaughn & Jacquez, 2020). Different tools and structured activities are used to facilitate participation, shared decision-making, and mutual learning. In this sense, the process of engaging stakeholders in each step of the research process can be almost unique to each project. In the last decade, in both urban development and public health, "participatory approaches" have been increasingly used to build partnerships with stakeholders with insider knowledge and lived experience (Geekiyanage et al., 2021).

Authors reviewing public engagement in public health and civic engagement have described the way that stakeholders are engaged as a continuum with increased involvement, impact, trust, and communication flow (Brunton et al., 2017; Vaughn & Jacquez, 2020). In general, the continuum ranges from academic/expert-driven research/intervention (i.e., experts provide communities with information) to shared decision-making between academics/experts and community partners (i.e. co-creation processes) (International Association for Public Participation, n.d.; Haklay, 2013; Shirk et al., 2012). Whereby highly participatory strategies with a focus on community-driven research and social transformation impacts are more explicit to the right of the continuum (Table 1).

Although the continuum would suggest that different mechanisms of participation are more empowering than others, there is no prescription for the "right" way to do participatory research (Leask et al., 2019). On one extreme, there can be models with a "utilitarian perspective" where the expert opinion is seeking more acceptable and effective interventions with improved service use and outcomes. On the opposite side, "social justice" models are more responsive to community needs, seeking the empowerment and development of the community itself (Brunton et al., 2017). Each engagement type has its purpose. According to the needs and goals of the research, decisions must be made about what is most important and which methods and tools will produce the desired level of participation and maximize the potential for real-world impact (Geekiyanage et al., 2021; Pedersen et al., 2022). We used the taxonomies of public engagement reported in the literature (Table 1) as a foundation for this study.

Importantly, among participatory methodologies, citizen science is increasingly being used to give a meaningful role to the public in the generation of new knowledge, partially due to the use of information communication technologies (ICT) tools as enablers of the process (King et al., 2019; Rosas et al., 2022; Wehn et al., 2021a). In the field of environmental health, the use of low-cost open-source sensing technologies is fostering the proliferation of citizen science projects to address issues identified by communities that are disproportionately exposed to environmental hazards (e.g., poor air quality, industrial water, and soil contamination), at the same time underlining the relevance of capturing both perceived and objective exposure, integrating qualitative and quantitative data (Froeling et al., 2021) and leveraging data analytics for policy co-creation (Arundel et al., n.d.).

Table 1
Taxonomies of public engagement.

Study	Field	The participation continuum ⟷		
Brunton et al., 2017 (Brunton et al., 2017)	Public health	1) Normative need. Communities do not participate in the design of the intervention and the theory of change for engaging communities focuses on communicative and implementation competence. Peers or laypeople deliver the intervention.	2) Local adaptation. The need is usually identified by people outside the community but the theory of change includes specific community engagement to better align the intervention to the community's needs and preferences.	3) Felt need. The community identifies its own needs and plays a collaborative role in designing the intervention. The theory of change is about empowering communities to mobilize themselves and make changes to their social and environmental locales.
International Association for Public Participation (IAP2) 2018 (International Association for Public Participation, n.d.)	Civic engagement	1) Inform. Information is provided to help communities understand complex topics. 2) Consult. Consultations to obtain public feedback.	3) Involve. Working with the public to ensure that public concerns and aspirations are understood and considered. 4) Collaborate. Partnerships to develop alternatives and preferred solutions.	5) Empower. Decisions made by stakeholders are implemented into practice.
Leask et al., 2019 (Leask et al., 2019)	Public health intervention design	1) Traditional top-down. Academic researchers make decisions, "one size fits all" intervention.	2) Co-creation. Multiple stakeholders involved in tailoring the intervention through a co-learning process.	3) Meta-design. End-users make decisions, and interventions tailored to end-user by end-user.
Shirk et al., 2012 (Shirk et al., 2012)	Citizen Science	1) Contributory. Citizen scientists are only involved in data collection	2) Collaborative. Citizen scientists are involved in data analysis and interpretation	3) Co-created. Citizen scientists are involved in problem definition, and translating research findings into public health impact
King et al., 2019 (King et al., 2019)	Citizen Science	1) For the people. Individuals contribute with biological samples or other personal health information	2) With the people. The public can actively participate in a standardized data collection process	3) By the people. Community members are involved in all phases of the research process, including data-driven community action.
Froeling et al., 2021 (Froeling et al., 2021)	Citizen science	1) Participation. Citizens become subjects in a study and primarily provide data	2)Engagement. Citizens and researchers exchange knowledge and communication in public deliberation and community outreach activities.	3) Involvement. Active role of citizens in scientific governance, taking part in as many research steps as possible.
Haklay, 2013 (Haklay, 2013)	Citizen science	1) Crowdsourcing. Citizens as sensors, volunteered computing	2) Distributed intelligence. Citizens as basic interpreters, volunteered thinking. 3)Participatory science. Participation in problem definition and data collection.	4) Extreme citizen science. Collaborative science, problem definition, data collection and analysis

2. Methods

2.1. Study design

This study employed a mixed-methods approach to review 20 participatory projects conducted in 19 pilot cities within the Urban Health Cluster, funded under the Horizon 2020 (H2020) European Framework Programme: "SC1-BHC-29-2020: Innovative actions for improving urban health and wellbeing addressing environment, climate, and socioeconomic factors" (European Commission, n.d.). The European Urban Health Cluster's internal Working Group "Participatory approaches to urban health" invited project leads from all projects via email to participate (Table 2). An explanatory sequential design was employed to integrate quantitative and qualitative methods and provide a comprehensive representation of participatory processes across pilot cities. The study began with a survey to identify and quantify participatory process characteristics, followed by interviews to explore their nuances. The framework was developed through an iterative process. The initial draft was prepared during the survey design phase and refined after analysing survey and interview results.

2.2. Quantitative component

The literature review informed the design of the online survey, structured according to a theory-of-change scheme (e.g., purpose, process, outcomes). The survey aimed to characterize and quantify participatory methods used in each pilot city within the Urban Health Cluster. It incorporated both open-ended and multiple-choice questions, with response options grounded in the literature (Table 3) (Ficorilli et al., 2021; Kocman et al., 2023; Passani et al., 2022; Wehn et al., 2021b). The survey covered the characteristics of the pilot project (aim, setting, duration), characteristics of the participatory approach (purpose, stakeholders, engagement pathways, communication channels, stakeholders' participation in each phase of the project, and main participatory activities); drivers and challenges to the participatory approach (logistics, ethical issues); expected outcomes and impacts of the participatory approach (measurable outcomes, number of stakeholders engaged; impact evaluation strategies) (Appendix A).

Quantitative data were analysed using descriptive statistics (e.g., frequencies), while open-ended questions were thematically analysed following a grounded theory approach (Charmaz & Belgrave, 2015) that allowed the identification of emerging categories: the diverse purposes, facilitators, challenges, and expected outcomes.

2.3. Qualitative component

To validate and refine the framework categories, the survey was complemented by semi-structured interviews with project leads from three pilot cities. Each interview lasted approximately one hour, was audio-recorded, and transcribed for analysis. The interviews explored the context and motivations behind participatory approaches, participation mechanisms, expected outcomes, and experienced challenges (Appendix B). Thematic analysis was conducted based on the theory-of-change categories, offering deeper insights into city-specific experiences (e.g., purpose, process, outcomes).

2.4. Framework development

The framework was developed through an iterative process. The initial draft was prepared during the survey design phase, based on the literature review. Further versions were refined after analysing the results of the survey and interviews, respectively. The refined framework was applied to all 20 projects and shared with project leads for validation, with their feedback incorporated into the final version.

Table 2
Urban Health Cluster projects and pilot cities.

Urban Health Project	Urban health problem	Project aim	Pilot cities
eMOTIONAL Cities	Limited scientific evidence on how the natural and built urban environment shapes the neural system underlying human cognitive and emotional processing in different vulnerable groups (e.g., according to gender, age, and mental health). Evidence is needed to foster more inclusive urban design resulting in better individual health and well-being.	To measure citizens' psychophysiological responses when exposed to different urban environments and map neurobiological reactivity through time and space as the urban landscape changes.	Copenhagen Lisbon London Michigan
ENLIGHTENme	Limited scientific evidence about indoor and outdoor lighting impacts on human health and well-being – particularly for people over the age of 65 and other vulnerable groups.	To collect evidence about indoor and outdoor lighting impacts on the health and well-being of people over the age of 65 and inform urban lighting policies.	Amsterdam Bologna Tartu
HEART	Limited urban planning mechanisms to include health and well-being as a key planning criterion and implementation mechanism based on Blue-Green-Solutions.	To evaluate health outcomes of nature-based solutions (blue-green spaces) and promote use of the renovated green spaces	Aarhus Attica Belgrado
RECETAS	Reduced quality of life among adults suffering from loneliness in socio-economically deprived urban areas.	To co-create a nature-based social prescribing menu with end-users; and evaluate its effectiveness to reduce perceived loneliness in older adults.	Barcelona Cuenca Helsinki Marseille Melbourne Prague
URBANOME	Limited evidence on environmental health determinants, the spatial distribution of these in the city, and the social distribution of their impact among different population groups.	To promote urban health, well-being, and liveability, through systematically integrating health concerns in urban policies and the activities of urban citizens, following the approach of the "Urban Living Lab".	Aarhus Aberdeen Athens Ljubljana Madrid Milan Montpellier Stuttgart Thessaloniki
WELLBASED	Limited evidence on energy poverty in urban contexts and its health-related effects.	To design, implement, and evaluate a comprehensive urban programme to significantly reduce energy poverty and its effects on the citizens' health and wellbeing, built on evidence-based approaches in six pilot cities.	Budapest Edirne Jelgava Heerlen Leeds Valencia

Table 3
Components of the Urban Health Cluster Survey.

Analytical category	Operationalization in data collection instrument
Purpose of the participatory approach	Open-ended questions regarding the aim of the project, motivation for including a participatory approach, and stakeholders involved.
Mechanisms of participation	Multiple-choice questions about the level of participation of the stakeholders in each study phase and research activities. Answer options were based on Kocman et al. (Kocman et al., 2023) Four phases of a participatory urban health project: 1) Identification (identification of civic concerns, research question, and community building strategies), 2) Design (design of data collection protocol, data collection tools, and governance protocol), 3) Deployment (data collection campaign, data analysis, impact assessment), 4) Action (dissemination of findings, advocacy for policy impact, and mobilization to ensure project's legacy). Open-ended questions to describe main participatory activities.
Expected outcomes of the participatory approach	Multiple-choice questions about expected tangible outcomes of the participatory approach. Answer options were based on (Passani et al., 2022; Wehn et al., 2021b)), who propose five dimensions to characterize potential outcomes of participatory projects: scientific (e.g., knowledge resources), social (e.g., community building and empowerment), economic (e.g., impact on employment, income, and revenue generation), political (e.g., Impact on policy process, political participation) and environmental (e.g., ecosystem, air quality, health).
Challenges to participatory research	Open-ended questions about facilitators, issues, and lessons learned; and multiple-choice questions about ethical challenges (answer options based on (Ficorilli et al., 2021)).
Evaluation strategies	Open-ended questions about strategies to evaluate the participatory approach

The authors conducted a reflective analysis of the study findings, leading to the development of participation performance indicators. These indicators synthesized insights gained throughout the research. Conceptualized as lessons learned, the indicators address gaps identified in the findings of this study and aim to enhance future monitoring and reporting of participatory processes. The indicators are intended to guide the application of the "purpose framework" and provide qualitative criteria to characterize the participatory processes following the rationale of the participation continuum.

3. Results

Within the Urban Health Cluster, project leads from 21 pilot studies completed the online survey. One response was excluded from the analysis since it reported not using any participatory approach. Project leads from three pilot studies participated in semi-structured interviews.

The evaluation revealed trends in participatory urban health projects and outlined a framework to characterize participatory methods' purpose, the involved stakeholders, mechanisms for participation, facilitators and challenges, expected outcomes, and evaluation strategies. As in a theory-of-change scheme, the categories comprised in the framework characterize the underlying rationale (i.e., purpose), describe the process (i.e., stakeholders, mechanisms, facilitators, and challenges), and identify the potential urban health transformation enabled through the participatory approach (i.e., outcomes, evaluation). Table 4 presents the framework derived and used to characterize the projects. The following sections of the paper describe the evaluation findings for each category in the framework. Table 6 presents an overview of all the evaluated UHC projects using the proposed framework.

The research topics examined in the projects include the neurobiological reactivity towards the natural and built urban environment, the

Table 4
Framework for reporting participatory urban health approaches.

Purpose	Stakeholders	Mechanisms for participation	Facilitators and challenges	Outcomes	Evaluation
Why is the participatory approach needed? (Specify main purpose)	Who are the involved stakeholders? (Specify number per category)	How are the stakeholders participating? (Specify per study phase and describe the activities)	What factors influence the participation of the stakeholders? (Specify main factors)	What are the primary outcomes of the participatory approach? (Specify targeted outcome)	What is the strategy to assess the participatory approach? (Explain the outcome of the evaluation)
1) Gather evidence on urban health correlations 2) Raise awareness of environmental health 3) Gather evidence on urban health correlations and co-create urban health intervention 4) Co-design urban health intervention and assess health-related effects	1) Civil society (e.g., lay citizens, NGOs) 2) Government 3) Researchers 4) Industry	1) Identification -Identification of civic concerns -Research question -Community-building strategies 2) Design -Design of data collection protocol - Design of data collection tools -Design of intervention protocol 3) Deployment -Data collection campaign -Data analysis -Impact assessment 4)Action -Dissemination of findings -Advocacy for policy impact -Mobilization to ensure the project's legacy	1) Facilitators (e.g., local relevance, sense of belonging, well-being benefits, know-how, ownership) 2) Challenges (e.g., conflict, limited commitment, time, and/or trust) 3) Ethical challenges (e.g., personal data management, review board procedures)	1) Evidence on urban health correlations 2) Public engagement and awareness 3) Evidence that informs urban health-related policies 4) Co-created urban health interventions	1) Process evaluation 2) Impact evaluation

health-related impacts of indoor and outdoor lighting, the health-related effects of the natural-based, blue-green solutions, the health outcomes of social prescription of nature-based activities in urban contexts, the spatial distribution of environmental health determinants in the city and the social distribution of their impact, and the health-related effects of energy poverty in urban contexts.

3.1. Purpose of the participatory approach

This category refers to the rationale for including participatory methods in the study design. In the reviewed pilot projects, four purposes were identified: 1) to gather evidence on urban health correlations (e.g., to collect data with stakeholders) (35 %; $n = 7$), 2) to raise awareness of environmental health (e.g., communicating risks and mitigation strategies) (15 %; $n = 3$), 3) to gather evidence on urban health correlations and to co-create an urban health intervention (15 % n = 3), 4) to co-design an urban health intervention and assess health-related effects (35 %; n = 7) (Fig. 1). The two latter refer to engaging stakeholders in co-designing an urban health strategy or program, whether it is oriented by the results of a previous assessment of health outcomes or co-created for the assessment of further health-related outcomes.

The case-based analysis drawn from the semi-structured interviews allowed for capturing the rationale and methodological nuances in more detail. Table 5 presents how each project enables mechanisms for the different stakeholders to participate in the research and how the urban health research outcomes might be related to the purpose but are not exclusive across them. Table 6 presents in detail each case study.

3.1.1. Gather evidence on urban health correlations

In the case of Lisbon, the study was designed as a data-driven project to assess correlations between urban structure and mental health through the spatial analysis of mental disorders prevalence, prescription of antidepressant and anxiolytic drugs, social media-based sentiment analysis, index of green areas, air pollution, and urban form features. Upon identifying the urban hotspots, the researchers decided to include a participatory approach to engage policymakers and residents in co-designing neuro-aesthetics experiments and testing potential impacts through virtual reality tools. The researchers will compare the empirical knowledge between urban planners and residents about the kind of emotions and feelings that certain urban structure features can foster, and compare the results from the neurobiological reactivity. The study is expected to provide evidence of brain activity and physiological response to urban features, and the differences between these data and the empirical knowledge from the stakeholders. Altogether, the study will provide evidence to improve neurobiological reactivity to urban form among vulnerable populations in hotspot areas. The researchers expect that the participatory approach will raise awareness of the potential of urban form design to trigger positive emotions and improve well-being. This should encourage stakeholders to use the evidence to design the urban form and to involve citizens in the design process. So far, the stakeholders have stressed the relevance of the participatory approach to identify current and future problems and provide "road maps" to study and tackle them.

"This is wishful thinking. This will demand some changes in how they work. And so, I'm not certain that it's going to be something they will implement right away. But they are very interested and every time that we ask them to collaborate, to have a meeting to present results, sometimes it's even them that get in touch with us and ask, how is it going? Do you already have some results from this area or that area?" (Lisbon, project lead).

3.1.2. Raise awareness of environmental health risks

In the case of Valencia's pilot project, 350 households are participating in a randomized controlled trial to assess the impact of an urban programme aimed at reducing energy poverty and its effects on health and well-being. The residents participating in the intervention group are acquiring tools and skills to reduce their energy bills and improve their health. The intervention comprises an energy kit, on-site energy audit, optimization of the bills (assistance to apply for subsidies or discounts on their energy bill), "healthy lifestyle" workshops, and a photovoice

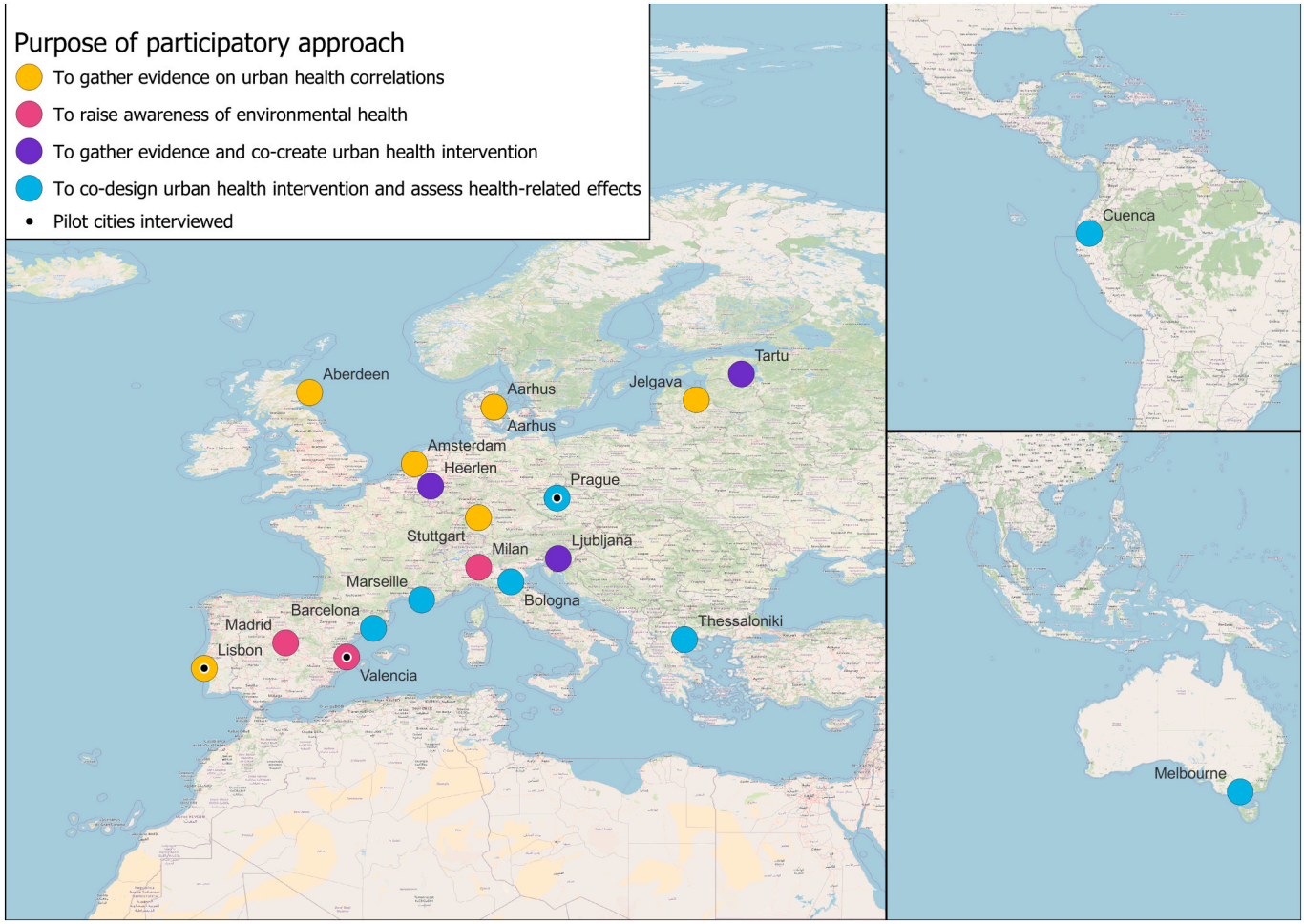

Fig. 1. Purpose of the participatory approach in the pilot cities from the Urban Health Cluster.

exposition where the citizens illustrate how they experience that energy poverty affects their health. During the course of the project, the researchers have expanded some components to respond to citizens' requests. These include teaching residents to monitor environmental parameters in their homes and establishing collaboration with other stakeholders who can help to address residents' needs (e.g., express house renovation). The overall goal of this project is to raise awareness about the impact of lack of energy on health, promote the right to adequate energy and invite policymakers to integrate the project findings into policies and programs.

"We are monitoring the humidity, the temperature, and the CO2 levels in the house. When we went to check the devices, many participants told us 'We would like to have this data', which is great that someone is interested in learning the temperature of the house. So, we incorporated that into our visits. So, when we visited them in month six, we showed them the results of the home sensor (…) So let's say we listen to participants' needs and we try to, among our possibilities, look for other partners that are working on participants' needs when we cannot reach our budget, let's say it's beyond our possibilities." (Valencia, project lead).

3.1.3. Gather evidence on urban health correlations and co-create urban health intervention

Ljubljana's Urban Living Lab is using a citizen science approach to evaluate the potential effects of "green cycle paths" to reduce urban cyclists' exposure to environmental stressors. The stakeholders participate in the evaluation of the urban stressors that affect bike commuters, and the co-creation of strategies to reduce exposure. During the data collection campaign, the bike users use sensor devices for the detection of air and noise pollution in combination with physical activity trackers. They collect the environmental data for two weeks using sensors in "conventional" and "greener less polluted" routes and provide individual biological samples. In addition, they will participate in workshops to co-analyze the data and co-create strategies with other stakeholders to reduce personal exposure to stressors. The project is expected to contribute with evidence on urban cyclists' exposure to stressors (air pollution and noise), the potential health-related effects, and co-created strategies (e.g., promoting the choice for green cycle paths, and influencing urban planning to promote green cycle paths) (Rubio et al., 2025).

3.1.4. Co-design urban health intervention and assess health-related effects

Prague's pilot project co-created a social prescribing program, called Friends in Nature, offering social and cultural activities in green urban spaces to older adults (Coll-Planas et al., 2024). The study is being evaluated by a randomized controlled trial and process evaluation to assess the effectiveness of the nature-based social prescribing program to reduce loneliness. By involving an expert municipal organization and the older adult population to co-design the nature-based social prescribing menu, the study is raising interest in participation as an approach to increase social inclusion and the use of non-pharmaceutical approaches and urban green spaces to improve health. Importantly, during the course of the project, the perceived need to provide the control group with the intervention has encouraged finding stakeholders willing to collaborate in the delivery of the program after the conclusion

Table 5
Purposes for the participatory approach.

Purpose	Description	Outcome	Case study
Gather evidence on urban health correlations	The engagement of stakeholders is aimed at collecting data and/or assessing correlations between the urban environment and human health outcomes.	Evidence on urban health correlations	Emotional cities -Lisbon The study assesses the psychophysiological responses to different urban environments and compares stakeholders' empirical knowledge of neurobiological reactivity to the urban landscape (e.g., policymakers vs. residents). The project seeks to identify features of inclusive urban design that result in better individual health and well-being, especially for vulnerable populations (e.g. mental health patients).
Raise awareness of environmental health	The stakeholders' engagement is aimed at communicating environmental health risks and mitigation strategies.	Public engagement and awareness	Wellbased - Valencia. The study is an impact assessment of an urban programme designed to raise awareness and reduce energy poverty and its effects on the citizens' health and well-being. The project seeks to influence policymakers to promote the right to energy based on acknowledging that lack of energy affects people's health.
Gather evidence on urban health correlations and co-create urban health intervention	The engagement of stakeholders is aimed at producing evidence on the relationships between the urban environment and human health outcomes and based on this evidence, co-create an urban health strategy.	Evidence that informs urban health-related policies	Urbanome – Ljubljana The study engages bike commuters 1) to wear sensors to evaluate their exposure to environmental pollution and potential health-related effects, and 2) to co-create strategies to reduce bike users' exposure to environmental stressors. The project seeks to improve bike users' environmental health literacy through the use of environmental sensors; and foster the co-creation of strategies that promote the choice for green cycle paths.
Co-design urban health intervention and assess health-related effects	The public engagement is aimed at co-designing an urban health intervention and assessing further health-related outcomes.	Co-created urban health interventions	Recetas – Prague The study co-created a nature-based social prescribing menu with older adults; and is evaluating its effectiveness in reducing loneliness and improving health outcomes among the users. The project seeks to promote the uptake of an effective program to reduce loneliness and increase the use of nature-based urban places, specifically, through the adoption and implementation of the program at the national level through the healthcare system and digital platforms.

of the study. Similarly, upon evaluating the effectiveness, the expected outcome of the project is the adoption and implementation of the programme at the national level through the healthcare system (Litt et al., 2024).

"In the Czech context, very often participation is seen as something that is more like icing on the cake, you know, just a little nice detail that you add. But until recently it was not usually considered something that is meant to be a fundamental part of projects that are in politics or research. And, in our cultural background, it's not very common to have a high level of participation. So, this could also be a source of inspiration and good practice for some future projects, because we believe that public involvement and participation will tend to be reinforced and supported." (Prague, project lead).

3.2. Stakeholder reach and engagement

This category comprises the multiple actors from the quadruple helix structure for multi-stakeholder collaborations, which include citizens (or civil society representatives), researchers (or academic partners), industry and government actors (Wehn et al., 2021a). Regarding the stakeholders involved in the participatory activities, public authorities (90 %) and civil society (85 %) are the most frequently engaged in the projects.

The pilot cities vary in scope of stakeholders' engagement, six projects aim to engage less than 100 stakeholders, ten projects between 100 and 300 stakeholders, two projects between 300 and 1350, and two projects have not determined a specific number. Regarding the policymakers' engagement, nine projects aim to engage 10 or fewer, eight projects have not defined any specific target number or expect to engage as many as possible, and three projects aim for 11 to 30 policymakers.

Working with existing community-based organizations was reported as the main pathway for engaging stakeholders, including decision-makers and experts working in the private and public sectors of the area of interest, and establishing links with the local community (leaders and lay citizens). Phone calls (60 %), mailing lists (55 %), and social media (40 %) are the main communication channels with stakeholders. Strategies to follow up include personal communication (20 %), workshops (20 %), and written reports (15 %). Nevertheless, 35 % reported being unsure about the upcoming strategies for follow-up.

3.3. Mechanisms for participation

The category refers to the different tools and structured activities used to facilitate participation in each phase of the study. The research activities where participation was mostly enabled were the identification of civic concerns (80 %), community-building strategies (65 %), and data collection campaigns (60 %). In contrast, the activities where participation was less enabled were data analysis (80 %), design of data collection tools (70 %), and design of data collection protocol (65 %). There is uncertainty reported regarding the participation that will be enabled for the dissemination, advocacy, and legacy of the project results (Fig. 2). "Workshops" and "community meetings with stakeholders" were the most common mechanisms for stakeholders to participate in the scientific process.

3.4. Facilitators and challenges to participatory methods

The category aims to highlight the factors influencing the development of the participatory methods in the study. Among the reviewed projects, the understanding and motivation to address local needs seem to facilitate the engagement of stakeholders to collaborate in the project and uptake its results (e.g., inform policies, and foster community ownership of the intervention). Similarly, the sense of belonging to a

Table 6
Urban Health Cluster-Project overview.

Pilot city (Urban Health Programme)	Objective	Purpose of participatory approach (specific area)	Stakeholders	Mechanisms for participation	Facilitators and Challenges	Outcomes	Evaluation of the participatory approach
Aarhus (HEART)	To evaluate health outcomes of nature-based solutions (blue-green spaces) and promote the use of the renovated green spaces.	Gather evidence on urban health correlations (Blue-green spaces)	Lay citizens (n = 100–300) Public authorities (n = tbd) Doctors in hospitals, regional planning medical authorities	Identification, Action: Workshops at healthcare facilities Deployment: Clinical studies involving environmental and health monitoring (sensors on site, wearables, clinical visits).	F: not stated C: engagement of participants	Evidence on urban health correlations Evidence that informs urban health-related policies *The results will inform on the health outcomes of nature-based solutions and promote the use of renovated green spaces through urban planning methodologies.*	Not stated
Aarhus (URBANOME)	Study mobility behaviours, health outcomes, and changes towards more healthy routes and modes of mobility.	Gather evidence on urban health correlations (mobility patterns)	Lay citizens (n = 20–30) Public authorities (n = 3–5)	Identification, Deployment: Interviews with experts; In-situ data collection; interviews and focus groups	F: Academia, municipality, neighborhood collaboration C: Long-term commitment of participants	Evidence on urban health correlations *The results will inform about mobility practices and changes towards healthy routes.*	Impact evaluation (Ethnographic approach, Individual-level indicators)
Aberdeen (URBANOME)	To evaluate the impact on well-being of the eBike hire scheme and inform transportation and urban well-being strategies.	Gather evidence on urban health correlations (Urban cycling)	Lay citizens (n = tbd) Public authorities (n = tbd)	Identification, Deployment: Intervention co-design with stakeholders; data collection with end-users; workshops	F: the project's credibility to influence policy development, design, and delivery. C: Engagement of participants	Evidence that informs urban health-related policies *The results will inform transportation policies and urban well-being strategies about access to active transportation measures.*	Process evaluation (Ethnographic approach)
Amsterdam (ENLIGHTENme)	To evaluate health-related effects of the public lighting system in a low SES neighborhood.	Gather evidence on urban health correlations (Urban lighting system)	Lay citizens (n = 250) Public authorities (n = 5–10)	Identification, Action: Co-design workshops	F: Cross-sectoral collaboration (Academia, municipality and neighborhood) C: Citizens' lack of institutional trust	Public engagement and awareness *The results will inform on the health-related effects of lightning among residents of a low SES neighborhood.*	Not stated
Barcelona (RECETAS)	To co-create the nature-based social prescribing menu "Friends in Nature", and evaluate its effectiveness to reduce loneliness and increase health-related quality of life.	Co-design urban health intervention and assess health-related effects (Nature-based social prescribing)	Research subjects (n = 316) Local healthcare professionals (n = 300) Public authorities (n = 30)	Identification, Design, Deployment, Action: Co-design workshops	F: Relevant topic, partners with shared goal and motivation C: Local networking takes time.	Co-created urban health intervention *The outcome will be a co-created and evaluated menu of nature-based social prescribing to alleviate loneliness in older adults.*	Impact evaluation (Quantitative individual-level indicators for social impacts)
Bologna (ENLIGHTENme)	Co-design a public lighting system and assess health-related effects of public lightning in circadian rhythm.	Co-design urban health intervention and assess health-related effects (Urban lighting system)	Lay citizens (n = 40) Public authorities (n = 6)	Identification: Co-design techniques (i.e., mood board and planning for real needs) Action: Satisfaction assessment workshop	F: Engagement of local community leaders C: attitudes towards the participatory approach can hinder its deployment.	Co-created urban health intervention. *The outcome will be a public lighting system co-designed with the local stakeholders.*	Process evaluation (Sociological qualitative approach)
Cuenca (RECETAS)	To co-create a nature-based social prescribing menu with end-users; evaluate its effectiveness in reducing	Co-design urban health intervention and assess health-related effects (Nature-based social prescribing)	Lay citizens (n = 60); Public authorities (n = 5)	Identification, Design, Deployment, Action: Co-design workshops	F: Relevant topic, trained researchers in participatory research	Co-created urban health intervention *The outcome will be a co-created and evaluated menu of nature-based social*	Process evaluation; impact evaluation (mixed methods)

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Table 6 (*continued*)

Pilot city (Urban Health Programme)	Objective	Purpose of participatory approach (specific area)	Stakeholders	Mechanisms for participation	Facilitators and Challenges	Outcomes	Evaluation of the participatory approach
	perceived loneliness in older adults; and build local capacity.				C: Follow up on limited resources	*prescribing to alleviate loneliness in older adults.*	
Heerlen (WELLBASED)	To evaluate health-related effects of energy poverty.	Gather evidence on urban health correlations and to co-create urban health strategy (energy)	Academia (n = 7) Public authorities (n = 2)	Identification, Design, Deployment, Action: Health-cafes, Collective image classification.	F: building trust and openness with stakeholders. C: Personal data management.	Evidence that informs urban health-related policies *The results will provide evidence to support policymaking for a comprehensive approach to poverty reduction.*	Not stated
Jelgava (WELLBASED)	Evaluate the health-related effects of energy poverty.	Gather evidence on urban health correlations (energy)	Lay citizens (*n* = 150) Public authorities (n = 1)	Identification: Social support department	F: Not stated C: Engagement of participants	Evidence on urban health correlations *The results will inform about correlations between urban populations' health outcomes and energy use habits.*	Not stated
Lisbon (EMOTIONAL CITIES)	Assess correlations between urban structure and mental health and co-design experiments to map neurobiological reactivity as the urban landscape changes.	Gather evidence on urban health correlations (urban structure)	Lay citizens (*n* = 200) Private entities (n = 7) Public authorities (n = 6)	Identification: Mapping workshop with stakeholders Deployment: Co-creation of experiments using sensors and virtual reality tools. Action: Workshop with policymakers	F: Open communication through every stage C: Ethics committee procedures.	Evidence on urban health correlations Evidence that informs urban health-related policies *The results will inform about gaps between urban design perception among city-makers and residents, and the mental health-related effects, providing evidence to improve neurobiological reactivity to urban form among vulnerable populations in hotspot areas.*	Not stated
Ljubljana (URBANOME)	Assess bike commuters' exposure to environmental stressors, the health-related effects, and co-create strategies to reduce exposure to environmental stressors for bike commuters	Gather evidence on urban health correlations and to co-create urban health intervention (Urban cycling)	Lay citizens (n = 250) Public authorities (n = 3)	Identification, Design, Deployment, Action: Workshops with stakeholders; data collection with end-users (personal environmental sensors)	F: Open communication through every stage C: Citizen science logistics; Evidence uptake in policy-making	Public engagement and awareness Co-created urban health intervention *The outcomes will include increased environmental health literacy and health-protective behaviours among bike users, and influencing urban planning measures to promote green cycle paths.*	Process evaluation; impact evaluation (Ethnographic approach; Individual-level indicators)
Madrid (URBANOME)	To promote alternative mobility patterns around urban school areas that reduce exposure to air pollution and improve air quality.	Raise awareness of environmental health risks (usability of mobility patterns in school areas)	Lay citizens (n = 100) Public authorities (*n* = 1)	Identification, Design, Deployment: Co-creation activities in the Urban Living Lab and awareness activities at Primary schools using environmental sensors.	F: Understanding of local concerns. C: Schools' time availability.	Public engagement and awareness *The results will include changes in mobility patterns around urban school areas (e.g., promotion of bike lanes, safe routes, green spaces) and increased awareness about air pollution exposure and health-related effects in school environments.*	Impact evaluation (Individual-level indicators and ethnographic approach)
Marseille (RECETAS)	To evaluate nature-based social prescribing effectiveness to	Co-design urban health intervention and assess health-related effects	Lay citizens (n = 100)	Identification, Action: Workshops with stakeholders	F: Immediate well-being benefit	Public engagement and awareness	Impact evaluation (Quantitative individual-level

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Table 6 (*continued*)

Pilot city (Urban Health Programme)	Objective	Purpose of participatory approach (specific area)	Stakeholders	Mechanisms for participation	Facilitators and Challenges	Outcomes	Evaluation of the participatory approach
	reduce loneliness and increase health-related quality of life.	(Nature-based social prescribing)	Public authorities (n = tbd)		C: long-term engagement of participants; disagreements among stakeholders	*The outcome will be an intervention based on local engagement.*	indicators for social impacts)
Melbourne (RECETAS)	To co-create the best possible model tailored to meet end-users needs and test nature-based activities to reduce loneliness.	Co-design urban health intervention and assess health-related effects (Nature-based social prescribing)	Lay citizens (*n* = 50) Public authorities (n = tbd)	Identification: Community meetings	F: Locally relevant project C: Long-term commitment of participants. "Slowing down and patience."	Co-created urban health intervention *The outcome will be an intervention based on local engagement.*	Not stated
Milan (URBANOME)	To increase the pedestrian areas in front of the schools and improve the safety of the public space available to pupils (e.g., exposure to traffic).	Raise awareness of environmental health risks (Public space)	Lay citizens (n = 200–300) Public authorities/ institutions (n = 15)	Identification, Deployment: Open public call, Co-creation of intervention; Sensor monitoring campaign; practice theory (interviews, questionnaires, participant observation).	F: Community ownership of the urban intervention; commitment of stakeholders C: Long-term commitment of participants	Public engagement and awareness Co-created urban health intervention *The outcomes will include increased pedestrian areas in front of the schools, raising awareness of the space outside schools as a healthy environment, and co-creating a methodological framework to monitor the health and well-being aspects of an urban intervention.*	Impact evaluation (social impact and wellbeing through ethnographic approach)
Prague (RECETAS)	To explore how nature-based therapies can contribute to alleviating loneliness and improve people's lives in cities.	Co-design urban health intervention and assess health-related effects (Nature-based social prescribing)	Lay citizens (n = 60) Public authorities (n = tbd)	Identification, Deployment, Action: Well-being and nature workshops with stakeholders	F: Participation as a novelty, partners with a shared goal and motivation C: Adapting the study design to participants' needs.	Co-created urban health intervention *The outcomes will include new relations among participants, increased awareness among general practitioners and experts about social prescribing, and a co-created menu of nature-based social prescribing to alleviate loneliness in older adults ready to be used in the healthcare system through a digital platform.*	Impact evaluation (Individual-level indicators)
Stuttgart (URBANOME)	Assess the effect of the "Superblock" urban intervention to reduce traffic, improve environmental health parameters and increase opportunities for pedestrians and bike users to enjoy public space.	Gather evidence on urban health correlations (public space; mobility)	Lay citizens (*n*≥ 100) Public authorities (n = 5)	Identification, Deployment, Action: Interviews, community meetings, environmental sensors campaign.	F: community-led initiative and public authorities' intertest. C: Open communication; engagement of participants, and medical data security.	Evidence on urban health correlations Public engagement and awareness *The results will inform about the Superblock's effects on livability indicators (*e.g.*, traffic, environmental health) and promote the involvement of citizens in scientific and civic participation.*	Impact evaluation (Ethnographic approach, impact assessment)
Tartu (ENLIGHTENme)	Study the health-related effects of light among people over the age of 65 and create a decision support system for urban lighting policies.	Gather evidence on urban health correlations and to co-create urban health intervention (Urban lighting system)	Lay citizens (n = 50–100) Public authorities (n = tbd)	Identification: Co-design workshops	F: Inclusion and participation as a novelty. C: Engagement of older adults. "People are surprised, that we ask their opinion and don't believe that their opinion matters."	Co-created urban health intervention *The outcome will be a decision support system that includes residents' perceived needs.*	Not stated

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Table 6 (*continued*)

Pilot city (Urban Health Programme)	Objective	Purpose of participatory approach (specific area)	Stakeholders	Mechanisms for participation	Facilitators and Challenges	Outcomes	Evaluation of the participatory approach
Thessaloniki (URBANOME)	Co-create cross-sector initiatives that can inform urban design and policymaking that maximize the health and well-being of the citizens.	Co-design urban health intervention and assess health-related effects (specify area)	Lay citizens, Academia and Public authorities (n = 1350)	Identification, Design, Deployment, Action: Social media outreach campaign, Intervention co-design with stakeholders; data collection with end-users (sensor campaigns and mapping of urban stressors); further workshops	F: Relevant topic, need to inform policy-making C: Engagement of participants.	Evidence that informs urban health-related policies *The results will inform urban design policies to include health-promoting components that maximize impact on the well-being of the citizens.*	Impact evaluation (Policy-level indicators)
Valencia (WELLBASED)	To design, implement, and evaluate a comprehensive urban programme to significantly reduce energy poverty and its effects on the citizens' health and wellbeing.	Raise awareness of environmental health risks (energy)	Households (intervention n = 130; control = 177) Public authorities (n = tbd)	Identification, Action: Citizen School for the Right to Energy (citizens training and empowerment to make more efficient use of energy at home, and adopt healthy lifestyles)	F: Partnering with community organizations to offer incentives and workshops that build trust and leverage the sense of community. C: Long-term commitment.	Public engagement and awareness Co-created urban health intervention *The outcomes will include promoting the right to energy and reducing energy poverty and its effects on the citizens' health and well-being.*	Impact evaluation (Individual-level indicators)

Fig. 2. Stakeholders' participation in research activities among the UHC projects.

community, and the immediate well-being benefit that can be experienced through participating, can facilitate undertaking the project as a shared goal. The know-how of the researchers facilitating the participatory activities was highlighted as a driver to ensure open communication, transparency, and a clear understanding of aims.

Participants' engagement and long-term commitment were the most reported challenges. Other challenges include limited time availability, institutional trust, and stakeholder disagreements. Some project leads mentioned a lack of knowledge regarding project topics among partners, resistance to the participatory approach, limited resources to follow up, and possible conflicting issues in the project areas. Collaborating with public institutions from the health sector and tailoring more thoughtful approaches to participants were mentioned as strategies to overcome the challenges: small groups, clear agenda, dynamic facilitation methods, attention to local needs, developing trust and ownership; diversifying recruitment strategies; keeping participants interested through regular events, updates and feedback; systematic communication strategies.

The most reported ethical challenges were related to personal data management (stakeholders' transference of personal data for the recruitment, participants' provision of sensitive personal data, data security challenges) and consent forms and procedures. Difficulties in returning information to participants and general distrust were also mentioned. The implementation of protocols to protect sensitive private information and defining roles for ethical responsibility among partners were adopted solutions.

3.5. Outcomes

This category is aimed at characterizing potential outcomes stemming from the participatory approach. The expected tangible outputs of the participatory approach, like the stated purposes of the projects, include 1) evidence on urban health correlations (e.g., causal relationships between urban environment features and health behaviours/outcomes), 2) public engagement and awareness concerning an urban health topic, 3) evidence that informs urban health-related policies (e.g., metrics and strategies linking health and transport, urban design, energy poverty), and 4) co-created urban health interventions (e.g., designing and implementing urban health programs). However, these are not exclusive to each type of purpose and the projects can include one or more of these outcomes.

The survey results revealed that participatory approaches undertaken in the pilot cities are expected to mainly have scientific (70 %), social (70 %), and political (60 %) impacts, whereas economic impacts are less expected (Fig. 3). The project leads expect that the participatory approach would mostly contribute to increasing citizens' access to new knowledge and know-how (80 %), social inclusion (75 %), social interactions (75 %), sense of community (70 %), civic engagement (65 %), pro-environmental ways of thinking (65 %), and to change or inform new policies (65 %). Seventy percent of the project leads believe that the participatory approach will contribute to the knowledge-transfer process for the uptake of evidence to inform policy and urban interventions.

3.6. Evaluation strategies

The category refers to the strategies used to assess the participatory approach. The potential outcomes of the participatory approach can be assessed in terms of process or effects. The reported evaluation strategies in the reviewed projects include quantitative indicators and individual-level outcomes (25 %), mixed-methods outcomes' evaluation (20 %), mixed-methods impact assessment (10 %), and qualitative process evaluation (10 %). Nevertheless, some projects reported not having specified a strategy yet (35 %).

Regarding the mixed-methods approach to integrate outcomes of the participatory component to other project outcomes, 50 % reported not having determined a technique yet, 40 % reported using an integration technique for quantitative and qualitative data, and 10 % mentioned integrating the participatory component data to the overall qualitative data of the project.

3.7. Participation performance indicators

To operationalize the purpose framework and track the performance of the participatory processes, we propose sixteen non-numeric indicators (Table 7). They are organized into the same framework domains intended for project leads or reviewers to qualitatively characterize the participatory process as detailed as they wish. The criteria are deliberately descriptive, as it is important to acknowledge that each participatory approach has specific objectives and expected outcomes. For instance, a project aimed at raising awareness might choose an informational approach when interacting with policymakers, whereas a co-

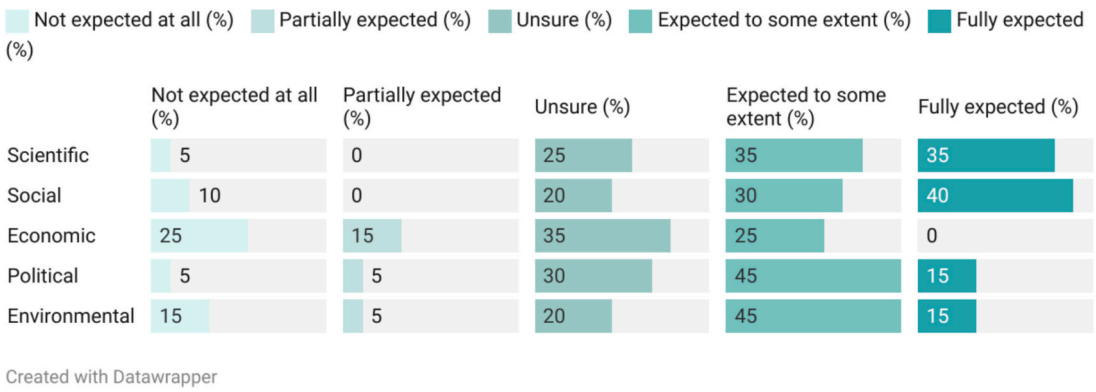

Fig. 3. Potential impact dimensions among the UHC projects.

creation project might develop a collaborative approach and tailor digital tools to support active contribution.

The purpose domain assesses participants' engagement with data, from passive (self-reported data) to active (interaction with tools) and uptake (initiating health-promoting initiatives). The stakeholder domain assesses the extent to which socioeconomic status (SES) criteria are considered and balanced in recruitment efforts, and the efforts made to include underrepresented or vulnerable populations, ranging from basic to proactive. In the "Mechanisms" domain, the interaction with stakeholders is graded from informational to collaborative; the development and use of tools are categorized from standard non-tailored tools to purpose-built; and participatory-driven policy-making is assessed from being neglected to actively practiced.

The outcomes domain examines the sustainability of the participatory process in terms of having no foresight for sustainability, to active training of participants to ensure the continuity of the process; likewise, participants' motivation and capacity to sustain the participatory process is rated from minimal to highly motivated. Lastly, the evaluation domain assesses the degree to which participants' feedback is incorporated to track project impacts over time.

4. Discussion

This study revealed trends in participatory urban health projects and outlined a framework to characterize participatory methods' purpose, the involved stakeholders, mechanisms for participation, facilitators, challenges, expected outcomes, and evaluation strategies. Most pilot projects use participatory methods to assess the causal relationships between the urban environment and health outcomes and develop context-specific interventions with the collaboration of public authorities and civil society. Their participation mostly encompasses the "identification" and "deployment" phases of the projects. The understanding of local needs and the motivation to work on a topic of relevance seem to facilitate the engagement of stakeholders, whereas the long-term commitment can be a challenging aspect. Overall, the participatory approaches are intended to harness the causal relationships between the urban environment and human health outcomes. However, the results suggest the limited use of a theory-of-change framework to systematically evaluate the potential participatory-led urban health transformation.

The framework proposed in this study aligns with Leask et al. (Leask et al., 2019) reporting guidelines for participatory approaches in public health research, covering the planning, conducting, evaluating, and reporting phases of a project. In addition, our framework contributes with categories that can help to theorize what form of participation can work best to achieve a desired urban health outcome. The categories built from the evaluation findings represent a contribution to characterizing potential urban health participatory models and enhancing their systematic and reproducible conceptualization, deployment, and evaluation. These results contribute to addressing the gap identified in previous reviews regarding the lack of methods to evaluate stakeholders' engagement (Mesa-Vieira et al., 2023; Ward et al., 2022) and do a scientific synthesis of participatory projects and their sustainability (Finger et al., 2023).

The findings showed that most of the pilot cities from the European Urban Health Cluster are using participatory approaches and come to these approaches from diverse disciplines and scientific ambitions. The predominant purpose is to evidence and harness the relationships between the urban environment and human health outcomes. Recent reviews have found the growing interest and expansion of participatory governance in public health (Mesa-Vieira et al., 2023) and urban planning (Geekiyanage et al., 2021) research and practice. To different extents, participatory processes are expected to influence the uptake of the research findings among policymakers and/or lay citizens, principally. However, indicators and systematic evidence to evaluate them are limited (Mesa-Vieira et al., 2023; Rosas et al., 2022). Our findings underscore the expected social and political impacts of the participatory processes, and our framework of categories ranging from the purpose to the evaluation can help to clarify the targets and pathway. The framework proposed in this study can help to theorize (hence, evaluate) different processes of social and political change enabled through the engagement of stakeholders in the different phases of urban health research. As stated in previous reviews, it is important to explicit the rationale for choosing participatory methods and tools in each phase (Geekiyanage et al., 2021). It is key to systematically conceptualize, deploy, and evaluate participatory methods tailored to each relevant purpose and phase of the project (e.g. fit-to-purpose participation tools).

Stakeholders from the government and civil society are the main participants in the Cluster projects, and their participation mostly encompasses "identification" and "deployment" activities (e.g., identifying civic concerns, and collecting data). However, specific activities to engage the stakeholders in the "action" phase were not frequently reported. This is in line with previous literature reviews that have reported that participatory methods in urban development have been mainly used in the "pre-design" phase to inform and consult citizens and have stressed the need for mechanisms of participation in the post-development phases of the projects (Geekiyanage et al., 2021). The case-based analysis included in this evaluation revealed the significant efforts the projects make to develop participatory processes and prolong the commitment of stakeholders to promote the legacy and ownership of the project. The engagement of stakeholders, although challenging, was often stressed as relevant to enhance the understanding of current and future problems and to orient socially relevant systematic production of scientific evidence. Nevertheless, the progress in implementing and transforming policies, environments, and behaviours depends on the urban context. Participatory approaches should be agile to respond to local conditions, including incorporating local citizens in the design and delivery of processes and practices. Especially, as reported in some

Table 7
Participation performance indicators (PPI).

Framework domain	Participation performance indicator (PPI)	Description	Qualitative criteria
Purpose	1. Participatory approach purpose	Defines the primary goals of the participatory approach.	☐ Gather evidence on urban health correlations ☐ Raise awareness of environmental health ☐ Gather evidence on urban health correlations and co-create urban health intervention ☐ Co-design urban health intervention and assess health related effects
	2. Participants' engagement with data	Defines participants' engagement with data.	☐ Passive: Participants allow collocation of devices or contribute with self-reported data (e.g., Questionnaire, charting, mapping) ☐ Active: Participants use and interact with assessment tools (e.g., apps, devices) ☐ Uptake: Participants initiate health-promoting initiatives
Stakeholders reach	3. Quadruple helix engagement	Evaluates the involvement of key stakeholders following the quadruple helix engagement model.	☐ Civil society (e.g., lay citizens, community-based organizations, non-governmental organizations) ☐ Government or public authorities ☐ Researchers ☐ Industry
	4. Inclusion of Social groups	Assesses efforts made to include underrepresented or vulnerable populations.	☐ Basic: No additional effort to recruit less represented/vulnerable groups (elderly, disabled, etc.) ☐ Proactive: Efforts made to include less represented/vulnerable groups
	5. Representativeness of Socioeconomic status (SES)	Assesses the extent to which SES criteria are considered and balanced in recruitment efforts.	☐ General: No inclusion of SES criteria or checking ☐ Aware: SES data collected, no active balancing ☐ Proactive: Active recruitment and/or balancing of underrepresented SES
Mechanisms for participation	6. Phases with active participation enabled	Identifies the project phases where active participation is enabled.	☐ Identification (i.e., identification of civic concerns, research question, recruitment/community-building process) ☐ Design (i.e., design of data collection protocol, design of data collection tools, design of intervention protocol) ☐ Deployment (i.e., data collection campaign, data analysis, impact assessment) ☐ Action (i.e., dissemination of findings, advocacy for policy impact, mobilization to ensure the project's legacy)
	7. Interaction with participants (individual level)	Evaluates interaction with study participants.	☐ Informational: one-way communication (emails, social media) ☐ Consultative: two-way communication (correspondence, phone calls, direct presentations) ☐ Collaborative: workshops, focus groups, multi-stakeholder interactions
	8. Interaction with stakeholders (community-level)	Evaluates interaction with community-level stakeholders.	☐ Informational: informational newsletters, updates on project progress via website or social media ☐ Consultative: feedback surveys, consultations, regular update meetings ☐ Collaborative: participatory planning, stakeholder advisory groups, joint decision-making committees
	9. Interaction with policymakers (policy-level)	Evaluates interaction with policymakers.	☐ Informational: policy briefs, official reports, webinars ☐ Consultative: meetings for feedback and discussion, policy roundtables, direct correspondence ☐ Collaborative: co-creation workshops for policy development, continuous dialogue forums, policy innovation labs
	10. Tools to support participation	Differentiates between standard and purpose-built tools tailored for engagement.	☐ Standard: Acquired or built non-tailored tools, primarily using standard one-way mechanisms, e.g., email, social media, questionnaires, polls, feedback options in apps. ☐ Tailored: Developed purpose-built tools, e.g., two-way platforms and communication channels, active communication between participants-researchers-stakeholders
	11. Participatory-driven policy-making	Assesses the extent of participants' influence on project results' uptake.	☐ Neglected: No contact between participants and policymakers; No uptake of findings into decision-making/policy ☐ Responsive: Limited participation in the delivery of results to policymakers; Positive reaction of policy-makers, some uptake observed ☐ Collaborative: Active participation in the delivery of results to policymakers; Policy uptake evident and encouraged
Outcomes	12. Primary outcomes of participatory approach	Defines the primary outcomes of participatory approaches.	☐ Evidence on urban health correlations ☐ Public engagement and awareness ☐ Evidence that informs urban health-related policies ☐ Co-created urban health interventions
	13. Sustainability of the participatory process	Assesses mechanisms in place to ensure the continuity of participatory efforts beyond project completion.	☐ Absent: No sustainability foreseen or communicated with participants and other stakeholders ☐ Partial: sustainability mechanisms in place, but scarce initiative to sustain the participatory process ☐ Active: skill training for participants to sustain the participatory process
	14. Participatory-driven sustainability	Assesses participants' motivation and capacity to sustain the participatory process independently.	☐ Minimal: Participants are not motivated to keep the project going

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Table 7 (*continued*)

Framework domain	Participation performance indicator (PPI)	Description	Qualitative criteria
			☐ Motivated: Highly motivated participants with clear aspirations for community leading and engagement in terms of sustainability; snowball effect for community leadership
Evaluation	15. Evaluation strategies for participation outcomes	Examines how participation outcomes are assessed.	☐ Process evaluation: Mostly qualitative approach to document and assess the participatory process and identify areas of improvement. ☐ Impact evaluation: Mostly quantitative or mixed-methods approach to assess the effectiveness of participation in achieving its intended objectives.
	16. Participatory evaluation	Examines how participants' feedback is incorporated to track impacts (e.g. behaviour change) over time.	☐ Neglected: Little to no feedback from participants in terms of behaviour/individual decision-making changes; don't expect more ☐ Responsive: Active gauging of participants' perceived impacts (individual and community level), some changes shown, more expected ☐ Transformative: Established and implemented protocols for fostering and following behaviour change over time; already have numerous examples and expect more

projects, working in low socioeconomic areas requires intense work to build trust (and conditions to maintain it) towards authorities and collaborative approaches (Carroll-Scott, 2020).

This evaluation shows that participatory processes bridge two key areas in urban health research: knowledge generation and ownership (e.g., who has the new knowledge), and decision-making for transformational change (e.g., how it is used). Engaging stakeholders in using ICT tools for data collection and co-analysis democratizes science, enhances digital and environmental health literacy, and builds local capacity to drive systemic change (Arundel et al., n.d.). However, successful stakeholder engagement in health-related projects relies on researchers' abilities to facilitate collaboration, address local concerns, build trust, and leverage partnerships in the long-term (Ward et al., 2022). Therefore, active communication, such as sharing interim results and future steps, is crucial for building credibility and influencing policy development and community empowerment (Carroll-Scott, 2020). In this sense, engaging diverse stakeholders throughout various stages challenges the traditional "participation continuum," extending the transformative power of participatory approaches beyond specific participation types. To a different extent, the participatory projects help create evidence, raise awareness, foster behaviour change, and enable cooperation for implementing and scaling up programs (Finger et al., 2023).

Kim et al. (Kim et al., 2022)proposed a categorization of urban health approaches based on the differences in how the approaches view and conceptualize priority issues and the beliefs on the best methodologies and instruments to research and address those issues. According to their proposed categories (Kim et al., 2022), all the projects reviewed in this study fit into the "urban health science" since they are aimed at producing evidence on the relationships between the urban environment and human health outcomes to develop effective interventions and policies. All the projects can also be categorized as "healthy built environments" given their advocacy for the integration of health in the practice of spatial planning. The areas of urban intervention include urban form, public lighting systems, blue-green spaces, health systems, cycle paths, school areas, and energy. Most of the pilot projects can also be categorized as "health social movements" (Kim et al., 2022), since their participatory approach focuses on health equity and social empowerment for urban governance (e.g. ENLIGHTENme-Bologna, Tartu; RECETAS- Barcelona, Cuenca, Melbourne, Prague; URBANOME-Ljubljana, Madrid, Milan, Thessaloniki; WELLBASED- Heerlen, Valencia). Few pilot cities undertake the "medical-industrial city" approach (Kim et al., 2022) by emphasizing the application of technology to the urban infrastructure to monitor or change disease, risk factors, and behaviour of individuals (e.g., HEART-Aarhus).

Nevertheless, the absence of a robust theory of change in many of the evaluated projects highlights the need for more comprehensive evaluation strategies to better understand and measure the impact of participatory methods on urban health outcomes. Although the reviewed projects expect to produce evidence that influences citizens' behaviours, changes policies and urban structures, we found few projects with specific plans to systematically document, analyze and report the results of the participatory approach (Santos-Tapia et al., 2023). As previous authors have pointed out (Rosas et al., 2022; Somerwill & Wehn, 2022), some strategies that could be used are interviews with stakeholders, individual-level behaviour change assessment, programme impact evaluation, and follow-up of ripple effects with each of the involved groups of stakeholders (Rubio et al., 2022). Data analytics from digital tools enabling participation (Arundel et al., n.d.) and performance indicators can work to monitor participatory projects. Nevertheless, the follow-up efforts should consider different periods enabling capturing short-, mid-, and long-term impacts at the individual, community, and city levels.

4.1. Study limitations and strengths

This study presents limitations that should be considered when interpreting the findings. Firstly, the sample size of 20 pilot studies, while providing valuable insights, may not fully capture the diversity of participatory methodologies used globally across different urban health research experiences. However, the integration of quantitative findings with qualitative insights provided a comprehensive representation of participatory processes across pilot cities. The framework and indicators we propose can continue to be adapted by studies in other regions. The selection of projects funded under the Horizon 2020 European Commission Programme introduces a selection bias, as these projects could have different characteristics compared to those funded by other sources or in other regions. However, the study remains highly relevant across the European region. Although the reliance on self-reported data through surveys and interviews may be subject to social desirability bias and inaccuracies in recall, our empirical findings have undergone rigorous validation and refinement through iterative feedback from project leads and co-authors. Furthermore, the reviewed projects are still ongoing and further evaluation of their participatory processes and outcomes should be followed up over time. Pilot cities serve as learning environments, allowing for the transfer of insights and best practices across diverse urban contexts, and encouraging the formulation of new hypotheses and future research directions. Future research should aim to include more varied samples, longer monitoring periods, and standardized evaluation frameworks.

4.2. Policy implications

The European Commission emphasizes the alignment of research and

innovation with societal values through inclusive participatory approaches. The framework and indicators developed in this study aid in the systematic reporting and evaluation of urban health participatory projects and align with the European Commission's ambitions to ensure research outcomes are socially impactful. The adaptation of this framework and indicators in future studies can help to address evidence gaps. The participation performance indicators can serve as a practical tool for project leads to monitor and evaluate their participatory processes.

5. Conclusion

Overall, the European Urban Health Cluster is producing evidence on the causal relationships between urban environment and human health outcomes and developing context-specific interventions. This evaluation revealed that while the report of participatory processes in standardized models is not possible, the use of a framework that can guide the report of key aspects can contribute to enhancing systematicity and reproducibility without neglecting or restricting the creativity and flexibility of the projects to their context. This study acknowledges the multiple efforts researchers are making to tailor relevant methodological participatory approaches. The proposed framework promotes the use of a theory of change to tailor participatory methods and enhance their transformative impact. Implementing such frameworks can help describe participatory-led urban health transformations and potentially lead to more impactful and sustainable urban health solutions, ultimately improving public health outcomes across diverse urban settings.

CRediT authorship contribution statement

María Alejandra Rubio: Writing – original draft, Methodology, Investigation, Formal analysis, Data curation. **Rok Novak:** Writing – review & editing, Funding acquisition, Data curation. **Laura Hidalgo:** Visualization, Investigation, Writing – review & editing. **Jill Litt:** Writing – review & editing, Methodology, Investigation, Funding acquisition, Conceptualization. **Don Slater:** Writing – review & editing, Methodology, Funding acquisition, Conceptualization. **David Kocman:** Conceptualization, Investigation, Writing – review & editing, Data curation, Funding acquisition, Methodology.

Funding

The European Urban Health Cluster is funded by the European Commission. This work was supported by the Horizon 2020 Framework Programme (grant No. 945307 (eMOTIONAL cities), No. 945238 (ENLIGHTENme), No. 945105 (HEART), No. 945095 (RECETAS), No. 945391 (URBANOME), No. 945097 (WELLBASED)) and the P1–0143 programme "Cycling of substances in the environment, mass balances, modelling of environmental processes and risk assessment", funded by the Slovenian Research Agency.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

We extend our sincere thanks to the project leads of the pilot cities for contributing with their insights and experience. We thank them for their comments on the manuscript. We appreciate the valuable and active participation of stakeholders in each of the pilot cities of the Urban Health Cluster. Thank you for your openness, commitment, and collaboration.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.cities.2025.106569.

Data availability

Data will be made available on request.

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