

Development of a framework-informed codebook for analyzing qualitative data using i-PARIHS

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Abstract

Background: The terminology and constructs of theories, models, and frameworks (TMFs) can provide a common language that enhances our ability to talk about implementation processes and fosters our ability to synthesize research findings across studies. Use of a deductive codebook based on a TMF can help investigators focus analysis of qualitative data, as well as test and refine the TMF. Although the integrated-Promoting Action on Research Implementation in Health Services (i-PARIHS) framework has been widely utilized in implementations studies, individual studies have had to develop their own codebooks to aid in the analysis of qualitative data because sub-constructs for the Innovation, Recipients, and Context constructs lack definitions and there is no sub-classification of facilitation activities for the Facilitation construct. The lack of a standardized codebook hinders our ability to synthesize research finding across studies. This paper describes a rigorous process of developing a detailed qualitative codebook informed by the i-PARIHS framework.

Methods: A VA Behavioral Health QUERI workgroup conducted a rigorous four-phase process to develop a codebook informed by i-PARIHS. In phase 1, workgroup members reviewed and discussed literature, consulted an organizational scientist, and drafted and refined subcodes and definitions for i-PARIHS constructs. In phase 2, subcodes and definitions were further refined based on feedback from an expert panel. In phase 3, feedback from i-PARIHS developers/experts was incorporated into the codebook. Finally, two studies piloted application of the codebook which informed the final version.

Results: The resulting i-PARIHS-informed codebook includes definitions for the four main constructs of the i-PARIHS framework: Innovation, Recipients, Context, and Facilitation; definitions for subcodes within each main construct; and instructions for the suggested application of individual codes and use of the codebook generally.

Conclusions: The standardized codes and definitions in the codebook can facilitate data exploration, pattern identification, and insight development informed by the i-PARIHS framework. Qualitative analysts can also use them to explore interactions between i-PARIHS constructs, maximize the potential for comparing findings across studies, and support the refinement of the i-PARIHS framework using empirical findings from multiple studies.

Contributions To The Literature

- The i-PARIHS framework is widely utilized in implementation studies to inform data analysis but it does not include well-defined sub-constructs that can be used to code qualitative material.
- This paper presents a qualitative codebook informed by i-PARIHS and describes a rigorous process, including a review by i-PARIHS developers, used to create the codebook.
- The paper demonstrates how this codebook can be used to explore interactions between i-PARIHS constructs, including how facilitation activities address characteristics of the innovation, recipients, and context.

- Use of the i-PARIHS-informed codebook will allow scientists to compare findings across studies, thus advancing our understanding of implementation processes.

Background

Scientists posit that conceptual approaches, i.e., theories, models, and/or frameworks (TMFs), should inform the implementation and evaluation of evidence-based practices and programs [1–4]. TMFs can be used to describe and guide implementation and evaluation processes, including the examination of what influenced outcomes [2, 5–7]. The terminology and constructs of TMFs can provide a common language that enhances our ability to talk about implementation processes and fosters our ability to synthesize research findings across studies [5, 8]. Despite the importance and value of applying TMFs, they are not always utilized or well-described in implementation studies [9]. Failure or suboptimal use of such approaches can hinder implementation success, slow the advancement of implementation science, and ultimately reduce the potential for improving public health [5].

As the study of implementation science has advanced, scholars have developed tools to operationalize TMFs [5, 7]. For example, Stetler et al. (2011) created a guide for applying a revised version of the original Promoting Action in Research Implementation in Health Services (PARIHS) framework [10] to enhance its operationalization [11]. The authors used clear, pragmatic language that focused on measurable behaviors to describe each of the PARIHS elements/sub-elements and provided tool-based practical guidance for the use of the framework. Worksheets and guides for framework application, training, and measures for assessing constructs have been developed to support the operationalization of a number of other TMFs [12, 13]. The measures include quantitative and qualitative resources, such as quantitative surveys and qualitative interview guides and codebooks.

Codebooks are an important component of the qualitative data analysis process; they facilitate data exploration, pattern identification, and insight development [14]. Use of a deductive codebook based on a TMF or a hybrid inductive-deductive codebook that includes the former as well as additional inductive codes can help investigators focus analysis of qualitative data, as well as test and refine the TMF. Standard operational definitions of constructs and sub-constructs have been developed for several TMFs, including the publicly available codebook created for the Consolidated Framework for Implementation Research (CFIR) [15, 16], a coding manual developed for the Normalisation Process Theory [17], and a list of operationalized definitions for the Exploration, Preparation, Implementation, Sustainment (EPIS) framework [18, 19]. For other TMFs, in the absence of a preexisting codebook, individual studies develop their own codebooks, making it difficult to compare findings across studies using the same TMF and advance generalizable implementation science knowledge.

Integrated-Promoting Action on Research Implementation in Health Services (i-PARIHS) is a widely utilized framework for which there is no common codebook, thus multiple studies have created project specific codebooks to aid in the analysis of qualitative data [20–22]. The i-PARIHS framework specifies four constructs that influence successful implementation: the Innovation; the Recipients of the

innovation; the Context within which the innovation is implemented; and Facilitation of implementation efforts. The characteristics of three of those constructs, the Innovation, the Recipients, and the Context, were identified by framework developers based on theoretical and empirical literature, as well as their own experiences, and are typically considered to be implementation determinants [23]. Recognizing the complexity of implementation processes, i-PARIHS developers suggest that the characteristics of these three constructs also interact [24]. The fourth construct in the framework, Facilitation, is the active ingredient in implementation efforts, interacting with the characteristics of the other three constructs to maximize the potential for implementation success. The i-PARIHS framework and its predecessor, the PARIHS framework, have been widely used in implementation studies to plan and deliver interventions; as an organizing framework for data analysis; and as an evaluation tool to guide study design, data collection, and/or analysis [25–29].

Similar to other TMFs, the i-PARIHS framework needs tools to operationalize it. I-PARIHS developers have focused on creating tools for the practical application of facilitation in implementation efforts [28, 30]. To further develop and refine the evidence base around facilitation as a successful implementation strategy, guidance is needed on how facilitation interventions can be evaluated [31]. Although the Innovation, Recipients, and Context constructs in i-PARIHS have detailed subconstructs, these lack formal definitions [26, 32]. Additionally, the Facilitation construct is under-defined and there is no sub-classification of facilitation activities [32]. Although i-PARIHS has been used to evaluate implementation efforts, this lack of formal definitions hinders efforts to compare findings across studies. Based on their experiences, i-PARIHS developers prescribe particular facilitation activities to address barriers related to sub-constructs. The lack of a sub-classification of these activities prevents us from exploring and testing the range of activities that are utilized in facilitation efforts. This paper describes the rigorous process of developing a detailed qualitative codebook informed by the i-PARIHS framework.

The US Department of Veterans Affairs (VA) Quality Enhancement Research Initiative (QUERI) established in 1998 [33] currently funds more than 40 programs and centers across the US that leverage innovative scientific methods to accelerate evidence into practice and improve the quality and safety of care delivered to veterans. Investigators in one of the original centers, Mental Health QUERI, were funded for a Behavioral Health (BH) QUERI program from 2016 to 2020 to support three primary research projects and an implementation core focused on advancing implementation science by increasing understanding of facilitation and advancing knowledge of team-based care. All three BH QUERI projects planned to utilize the i-PARIHS framework to guide their implementation facilitation strategies, as well as data collection and analysis pertaining to factors determining implementation success. Given the shared conceptual framework and implementation strategy, BH QUERI represented a unique opportunity to use common measures and methods to examine the effectiveness of facilitation across interventions, sites, and varying levels of facilitation. Additionally, i-PARIHS developers Gill Harvey and Alison Kitson invited BH QUERI investigators to form a collaboration for purposes of knowledge sharing and advancing the study of facilitation. In May 2017, Dr. Kitson traveled to the US to meet with the BH QUERI team. In the process of discussing how BH QUERI might aggregate qualitative data on facilitation collected across multiple projects, meeting attendees decided that a common or standard codebook informed by the i-PARIHS

framework was needed so that findings could be compared across projects. The BH QUERI team took responsibility for developing the codebook. Below we describe the process of codebook development.

Methods

All authors were members of a workgroup that planned and conducted a rigorous four-phase process to develop the codebook. MJR, KD, SL, and JS are BH QUERI investigators with expertise in implementation science (including implementation facilitation and the i-PARIHS framework) and qualitative methods. BS is a research assistant who had previous experience in using the original PARIHS framework in qualitative data analysis. Accepting the four i-PARIHS constructs as top-level codes, in Phase 1, we identified preliminary subcodes for each of the constructs and developed subcode definitions and instructions for their use. In Phase 2, we conducted an iterative expert panel process to obtain feedback from other BH QUERI investigators who had expertise in qualitative methodology and i-PARIHS. In Phase 3, we sought feedback from i-PARIHS developers/experts; and in Phase 4, we piloted the application of the codebook in two studies. See Fig. 1 for a summary of the tasks within each phase. Below we describe these phases in detail.

Phase 1: Preliminary Codebook Development (September 2017 – November 2018)

Innovation, Recipients, and Context Subcodes

For the Innovation, Recipients, and Context constructs, workgroup members adopted i-PARIHS construct characteristics [30] as the initial subcodes for each construct. Throughout the process of developing subcode definitions (described below), we assessed each subcode and decided whether to include it in the codebook or recommend excluding it. We also evaluated whether the subcode label clearly represented the construct characteristic; as needed, we modified the subcode label to ensure clarity. We assessed, based on literature and our expertise, whether additional subcodes were needed. Because there was significant overlap between the characteristics of the Recipient and Context constructs, we sought consultation from an organizational science and qualitative methodology expert to help us identify context subcodes and differentiate between Context and Recipient subcodes.

One or two workgroup members were responsible for drafting the initial definition and coding instructions for each subcode based on descriptions of the construct characteristic in core materials [30, 31, 34], literature related to theories that informed i-PARIHS developers' understanding of the characteristic, and other relevant literature when further clarification was needed. All other workgroup members individually reviewed drafted material and provided feedback. The member responsible incorporated feedback and, if needed, reviewed additional literature and modified the definition and/or instructions. Workgroup members then reviewed and discussed the second iteration and suggested additional edits, if appropriate. The workgroup leader, MJR, incorporated these suggestions, as well as the consultant's suggestions for context subcode definitions and coding instructions, and finalized the preliminary

definition and instructions. See Additional File 1 for a list of literature reviewed in the development process.

Facilitation Activity Subcodes

Because i-PARIHS developers assert that facilitators activate implementation by assessing and responding to the Innovation, Recipients, and Context [30], we chose to focus subcodes for the Facilitation construct on activities that facilitators perform. We leveraged previous work conducted by BH QUERI investigators over an eight-year period that resulted in the identification and description of 32 implementation facilitation activities [35]. The workgroup reviewed and adopted this list of activities as the subcodes for this construct and further refined the previously developed descriptions of facilitation activities. Because of the large number of specific facilitation activity subcodes, we also clustered these subcodes to create higher level codes to enable a more expedited analysis with the option to pursue more detailed sub-coding within specific clusters.

Phase 2: Expert Panel Review (September 2018 – February 2019)

We recruited eight other BH QUERI investigators who had expertise in implementation science (average of 7.8 years) and qualitative methodology (average of 12.6 years) to serve on an expert panel. Panel members rated their knowledge of the i-PARIHS framework on a scale from 1–5 (poor to excellent) and reported a median rating of 4 (very good). We conducted the expert panel review process in 3 cycles. In cycle 1, the panel reviewed and provided feedback on subcodes for the Innovation construct. In cycle 2, they reviewed and provided feedback on Facilitation Activity subcodes, and in cycle 3, on Context and Recipients subcodes. Each cycle was completed in two rounds.

In round 1 of each cycle, we provided the panel with a document containing a) information about the development process; b) codebook material including construct subcodes, definitions, and coding instructions; c) workgroup recommendations for combining, modifying, and excluding subcodes; and d) questions for additional feedback. The document also provided instructions for the review process, asking panel members to 1) evaluate codebook material for clarity and comprehensiveness; 2) evaluate workgroup recommendations for changes and/or additions to i-PARIHS construct characteristics; and 3) provide written feedback, including recommendations for edits to codebook material. MJR reviewed round 1 feedback and contacted panel members individually, as needed, to clarify their recommendations. MJR and KLD then determined what material could be revised and finalized based upon round 1 results vs. material that would require further panel discussion in round 2, and updated the codebook accordingly.

In round 2 of each cycle, we provided the panel with a document containing a) codebook material that we had been unable to finalize, b) panel members' recommendations from round 1, c) if appropriate, additional material from the literature, and d) instructions for this round of the review process. Panel members individually reviewed this material and then met together by phone to discuss and provide verbal feedback to MJR. MJR incorporated most of their feedback. MJR and KLD reviewed and came to

consensus on feedback that merited further discussion and incorporated this feedback to finalize the preliminary codebook.

Phase 3: i-PARIHS Developers Review (February – July 2019)

To further refine the codebook, we obtained feedback from i-PARIHS framework developers, Drs. Gill Harvey and Alison Kitson, and Dr. Sarah Hunter, a post-doctoral research fellow who was leading a team of researchers to develop tools and resources to support the use of the framework in research and clinical practice. We provided these experts with a draft of the codebook and workgroup lead MJR met with them by phone to orient them to the codebook, describe the workgroup's development process, and ask them to review and provide feedback on the codebook as a whole and the subcodes, definitions, and coding instructions. The experts individually reviewed the codebook and then met face-to-face to discuss and synthesize their comments and recommendations into a single document, which they provided to the workgroup. MJR and KLD reviewed their comments and came to consensus on final changes to the codebook.

Phase 4: Codebook Piloting (July 2019 – April 2021)

We piloted the application of the codebook in data collected for two BH QUERI research projects, both informed by the i-PARIHS framework. In one project, facilitators had supported implementation of measurement-based care (MBC) in VA primary care clinics [36]. In the other project, facilitators had supported implementation of the Collaborative Care Model in VA-based outpatient mental health teams, called Behavioral Health Interdisciplinary Program (BHIP) teams [37].

MBC project investigators piloted the codebook on qualitative data collected for multiple study components. In total, the pilot included application of all Innovation and Recipients codes and clustered Context and Facilitation Activities subcodes to transcripts for 28 individual and 11 group interviews, as well as 122 site-level debriefing note documents. The analysis team top-coded all documents using the qualitative data analysis software program, Atlas.ti 8. They then sub-coded data for each construct either by reviewing and summarizing top level data in a Word document organized by subcodes, or by sub-coding in Atlas.ti, extracting the coded text, and then summarizing data for each subcode. Finally, they compiled subcode summaries in an Excel document to create a matrix across data sources for each subcode, enabling them to explore similarities and differences across sites as well as interactions between facilitation activities and site characteristics. The analysis team included MJR, KLD, and BNS.

BHIP project investigators piloted the codebook during a secondary analysis of data collected from 31 BHIP providers at nine VA medical centers to understand providers' perceptions of and experiences with implementation of the Collaborative Care Model. The goal of the secondary analysis was to examine implementation barriers and facilitators through the lens of the i-PARIHS framework. They applied codes to interview transcripts for the Innovation, Recipients, and Context constructs, excluding subcodes that were not relevant for their specific Collaborative Care Model implementation effort. For the Context construct, they used the same set of clustered context subcodes MBC investigators had applied. Their

data sources did not include information about facilitation activities, so the Facilitation activity codes were not used. They applied the top-level construct codes to interview transcripts using NVIVO 12 software and created quote reports for each construct. They then summarized coded text by relevant subcodes for the four PARIHS constructs in a Word document. Because they had previously coded the same dataset by Collaborative Care Model elements [38], they also examined cross-coding between Collaborative Care Model and i-PARIHS codes/subcodes. The analysis team included JLS, KLD, and another BH QUERI investigator who had served on the expert panel.

After the codebook piloting process was complete for both projects, the analysis teams met to discuss what they had learned that might inform the final version of the codebook. In advance of this meeting, they were asked to review the codes and definitions and consider how they had applied them, whether there were codes they struggled with understanding or applying, whether they edited code definitions, and whether additional instructions are needed for using the codes. They were also asked to provide feedback about the usability of the codebook, advantages and disadvantages to using it, and how we might improve it. We then edited codebook instructions based on their feedback.

Results

After the preliminary development of the codebook (Phase 1), each phase of the development process informed revisions to the results of the previous phase. We thus describe below the results of all four phases for each of the i-PARIHS constructs and to the Codebook more generally.

Innovation

Because the characteristics of the Innovation construct were well described and/or grounded in theory in the core materials, subcode labels were based on characteristics identified by i-PARIHS developers with one exception. Based on literature and our experience, in Phase 1 we identified complexity as an important innovation characteristic and added a *Complexity* subcode to the codebook. In Phases 2 and 3, the expert panel and i-PARIHS developers concurred. Additionally, the observable results characteristic was initially subsumed under the *Relative advantage* subcode because of the strong overlap between them [15]. However, based on Phase 3 feedback from i-PARIHS developers, we included *Observable results* as a distinct subcode. Definitions of the Innovation subcodes were modified throughout all phases of development (see Table 1).

Table 1

i-PARIHS Innovation characteristics, Innovation subcodes, and definitions

Characteristics of the Innovation[30]	Innovation Subcodes	Innovation Subcode Definitions
Underlying knowledge sources	Evidence: Research/published guidelines	Presence or absence of findings from quantitative, qualitative, or mixed methods studies, as well as literature reviews, that show the efficacy, effectiveness, or other evidence for the innovation (e.g., its utility or acceptability). Also includes discussion about published guideline recommendations.
	Evidence: Clinical experience	Presence or absence of professional knowledge of or experience with the innovation which is embedded in or based upon clinical practice and is often tacit and intuitive.
	Evidence: Patient needs, preferences, and experiences	Presence or absence of patients' personal knowledge of and experiences with an innovation, including current or previous experiences with the innovation, the extent to which the innovation met/meets their needs and preferences.
	Evidence: Local practice information	Presence or absence of sources of evidence related to the innovation from the context of care, including, but not limited to, audit and performance data, report cards, progress reports, fidelity ratings, quality improvement and program evaluation data, and financial data/implications.
Clarity	Clarity	Degree to which the innovation is understood, including specifics of what components of the innovation must be implemented (for fidelity) and/or what can be adapted or changed.
Degree of fit	Degree of fit	Extent to which the innovation is compatible with 1) the values and norms of individuals implementing the innovation and/or 2) the existing practices and operations of the setting, including workflows, processes, roles, policies, etc.
Degree of novelty	Degree of novelty	Extent to which the innovation or components of the innovation is/are new to or different from individuals' current thinking, ways of relating to and interacting with each other, or practice.
Usability	Usability	Degree of ease or difficulty with which the innovation can be, is, or was adopted and/or used, including the accessibility and availability of information/tools/guides regarding how to adopt/use the innovation.
Relative advantage	Relative advantage	Comparison of the innovation with an existing program, practice, or alternative solution and the degree to which one is perceived and/or objectively observed to be more advantageous than the other in meeting patient, clinical, and/or organizational goals and needs.
Trialability	Trialability	Whether the innovation can be or has been tested (or experimented with) on a small scale, including discussion about whether it is possible or not possible to conduct a pilot.

¹Subcode added during the Codebook development process

Characteristics of the Innovation[30]	Innovation Subcodes	Innovation Subcode Definitions
Observable results	Observable results	Degree to which positive results/benefits of an innovation are directly observable/visible.
N/A	Complexity ¹	Ways in which the innovation itself is simple or complicated. Discussion may be about the number of innovation components and/or interaction between them, the number and difficulty of behaviors that those delivering or receiving the innovation must perform, the number of groups or organizational levels targeted by the innovation, and/or the number and variability of outcomes.
¹ Subcode added during the Codebook development process		

Recipients

There were several challenges to identifying subcodes for the Recipients construct. Although the Innovation and Context constructs were part of the original PARIHS framework, the Recipients construct was new in i-PARIHS and not as well defined conceptually as the others had been. Also, the Recipients construct includes both individuals and teams, making it harder to differentiate some Recipient characteristics from characteristics of the Context. We thus made a number of modifications to subcode labels initially named after the characteristics of recipients identified by developers (see Table 2 for i-PARIHS characteristics of Recipients and final subcodes for this construct). First, although i-PARIHS identified motivation, values and beliefs, and goals as distinct Recipient characteristics, we felt it would be hard to parse these out in qualitative material. We therefore opted to combine these characteristics into one subcode, *Personal attributes*. Second, we felt that time, resources, and support and existing networks were characteristics of the context and should not be included as subcodes for the Recipients construct; expert panel members concurred. However, based on i-PARIHS developers' feedback, we included subcodes for these two characteristics but modified the labels to focus on how the presence or absence of these characteristics affect recipients. Third, at the recommendation of the expert panel, we added the word autonomy to the *Power and authority* subcode label to differentiate the ability to influence the actions of others from recipients' own actions. Fourth, we excluded local opinion leaders as a subcode because this characteristic delineates a change agent role that may not be applicable for a specific implementation effort, and other types of change agents (e.g., champions, QI team) may be involved. In the codebook, we suggest that subcodes be added for local change agents if capturing change agent roles is important for a study. Finally, during the piloting process, we added a subcode for *General attitude* to account for statements study participants made about what they thought or felt about the innovation. Definitions of the Recipients subcodes were modified across the phases of development (see Table 2).

Table 2

I-PARIHS Recipients characteristics, Recipients subcodes, and subcode definitions

Characteristics of Recipients [30]	Recipients Subcodes	Recipients Subcode Definitions
Motivation Values and beliefs Goals	Personal attributes ¹	Personal traits or characteristics of any recipient(s). This can include tolerance of ambiguity, general intellectual ability, motivation to change, values, goals, competence, innovativeness, seniority or tenure, learning style, being self-aware, reliable, other personality traits, etc.
Skills and knowledge	Skills and knowledge	What recipients know and understand about the innovation and/or whether recipients have the ability/expertise to perform the tasks required for implementation.
Time, resources, support	How time, resources, and support affect recipients ²	How the presence or absence of sufficient time, resources and support is affecting/affected by the ability of a specific recipient (individual or team) to implement or receive the innovation.
Collaboration and teamwork	Collaboration and teamwork	Group processes and team-related issues, including presence or absence of interprofessional collaboration, communication, and teamwork within teams, between teams and managers, and/or between individuals who work together toward a common goal; team building activities; areas of disagreement/conflict between team members or stakeholder groups; and available conflict management/resolution strategies.
³ Existing networks	How existing networks affect recipients ²	How formal or informal networks and/or relationships is affecting/affected the ability and/or motivation of a specific recipient (individual or team) to implement or receive the innovation. Networks/relationships may be professional, task-related, or social and may occur at any level or across levels of the context. Examples of formal networks/relationships include memberships, listservs, communities of practice, learning communities, learning collaboratives, practice-based research networks, etc. Examples of informal networks/relationships include social practices such as getting together with colleagues for lunch; regular hallway conversations with certain colleagues; friendships; "huddles" among clinical providers/teams; etc.

¹Motivation, Values and beliefs, and Goals characteristics of Recipients combined under the subcode label Personal attitudes

²Names of Recipients characteristics modified for sub-code label

³Subcode added during the development process

⁴Recipients characteristic excluded as a subcode

Characteristics of Recipients [30]	Recipients Subcodes	Recipients Subcode Definitions
Power and authority	Power, authority, and autonomy ²	The capacity or ability of an individual or team to direct or influence their own actions and/or the actions of others. Power and/or authority may be derived from organizational role (e.g., leadership), professional role (e.g., physician, nurse, etc.), expertise, relationships to powerful others, and/or ability to offer or deny rewards or use the threat of force to gain compliance.
Presence of boundaries	Presence of boundaries	Experience with boundaries between groups (e.g., professions/occupations, work units, service lines, roles) that influence implementation. Examples include discussion about the lack of communication between primary care and mental health providers and how clinicians' scopes of practice or discipline/unit-specific restrictions limit provision of/access to services.
N/A	General attitude ³	How the interview participant thinks or feels about the innovation generally, e.g., that they like it or don't like it, it is helpful, or they enjoy using it.
Local opinion leaders ⁴	N/A	
¹ Motivation, Values and beliefs, and Goals characteristics of Recipients combined under the subcode label Personal attitudes		
² Names of Recipients characteristics modified for sub-code label		
³ Subcode added during the development process		
⁴ Recipients characteristic excluded as a subcode		

Context

There were also a number of challenges to identifying subcodes for the Context construct. First, i-PARIHS developers identified characteristics of context as unique to particular levels (e.g., policy drivers and priorities are considered characteristics of the outer context). However, we found that most characteristics of context can/might occur across organizational levels (e.g., local policies and priorities in the inner context might also impact implementation). To address this challenge, we developed two sets of context subcodes, one for characteristics of context and the other for levels of the implementation context (e.g., local, organizational; see Additional file 2 for the full codebook). To develop the context characteristics subcodes, we combined those delineated by the developers if they were similar in content but broken out into different organizational levels. For example, we combined i-PARIHS's formal and informal leadership support (a characteristic of the inner/local context) and leadership and senior management support (a characteristic of the inner/organizational context) into a single *Leadership support* subcode (see Table 3 for i-PARIHS characteristics of Context and final subcodes for this construct). In the codebook, we recommend that characteristics of context be cross-coded with the level(s) at which they occur. For

example, to code discussion of the influence of a broad organizational policy affecting multiple units in a large healthcare organization, coders would apply both the *Policies and priorities* code for the characteristic of the context and the *Inner/Organizational* code to identify the level of context.

Table 3
i-PARIHS Context characteristics, Context subcodes, and definitions

Characteristics of Context by Level [30]	Context Subcodes	Context Subcode Definitions
<p>Inner/Local: Formal and Informal Leadership Support</p> <p>Inner/Organizational: Leadership and Senior Management Support</p>	<p>Leadership Support</p>	<p>Characteristics or behaviors of formal or informal leaders that either support or interfere with the implementation or sustainment of the innovation. This could include discussion of leadership style, relationship building, role modeling, educating, planning-organizing-aligning, and communicating, encouraging, empowering, and/or concrete support, e.g., protected time, space, resources, training, etc. Alternatively, discussion may be about how leaders fail to provide such support or exhibit negative attitudes/behaviors toward innovation implementation/sustainment.</p>
<p>Inner/Local: Culture</p> <p>Inner/Organizational: Culture</p>	<p>Culture and climate¹</p>	<p>Culture of the organization or organizational unit, including prevailing norms, values, beliefs, meanings, understandings, philosophies, way of life, and assumptions. Also includes discussion about the current climate of the organization or organizational unit, e.g., staff empowerment, morale, attitudes, job satisfaction, burnout, etc., as well as the degree of stability/instability of the environment in which implementation is occurring/will occur.</p>
<p>Inner/Local: Past experiences w/ innovation/change</p> <p>Inner/Organizational: History of Innovations and change</p>	<p>History of innovation and change</p>	<p>How the organization or organizational unit has historically experienced, undertaken, and responded to past change initiatives and/or innovations.</p>
<p>Inner/Local: Evaluation and Feedback processes</p>	<p>Evaluation, monitoring, and feedback¹</p>	<p>How the organization or organizational unit collects, assesses, monitors and disseminates data/information about clinical processes and outcomes, economic outcomes, user experiences, clinical performance, etc. Also includes discussion about data sources (e.g., data dashboards, medical records) and ways in which results are fed back to and used by individuals, teams, and services (e.g., through presentations and/or formal reports). This information may be used, e.g., to understand current ways of working or to improve processes.</p>

¹Context characteristics modified for sub-code label

²Subcode added during the development process

³Context characteristic excluded as a subcode

Characteristics of Context by Level [30]	Context Subcodes	Context Subcode Definitions
<p>Inner/Organizational: Organizational Priorities</p> <p>Outer: Policy Drivers and Priorities and Regulatory Frameworks</p>	<p>Policies and priorities¹ (includes mandates)</p>	<p>Organizational policies, policy drivers, mandates, and/or priorities; whether/how these are related to/support/hinder the innovation and/or its implementation; and the changes required. Policies are the decisions, plans, and actions that an organization, organizational unit, state or country take to achieve specific goals. They include statements of what needs to happen and how (e.g., legislation enacted by a government, regulations or rules issued to carry out the intent of laws or of regulatory bodies, regulatory frameworks or models for enacting regulations, and organizational policies and procedures). Policy drivers are forces that influence policy decisions, e.g., serious problems, i.e., high rates of suicide; legal or ethical concerns, i.e., lack of equity; and crisis events, i.e., hurricanes and forest fires. Mandates are formal orders/commands/requirements and may be a component of written policies. Organizational priorities are identified areas of focus, e.g., improving access to care and reducing medical errors in healthcare settings.</p>
<p>Inner/Organizational: Learning Networks</p> <p>Outer: Interorganizational networks and relationships</p>	<p>Networks and relationships</p>	<p>Formal or informal networks and/or relationships that may be/have been leveraged to support or hinder implementation. Networks/relationships may be professional, task-related, or social and may occur at any level or across levels of the context. Examples of formal networks/relationships include memberships, listservs, communities of practice, learning communities, learning collaboratives, practice-based research networks, etc. Examples of informal networks/relationships include social practices such as getting together with colleagues for lunch; regular hallway conversations with certain colleagues; friendships; ‘huddles’ among clinical providers/teams; etc.</p>
<p>Inner/Organizational: Structures and Systems</p>	<p>Structures and systems</p>	<p>Formal and informal ways in which the organization or organizational unit is structured and managed and/or its processes for accomplishing work. Examples of structure include authority hierarchies (e.g., chain of command), service lines, matrices, specialized or functional units or departments, inter-/multi-disciplinary teams and task forces, and decision-making levels represented in organizational charts. Although structure and systems are not always distinct, systems generally are related to organizational routines and processes, e.g., for information sharing, learning, workflow, IT, etc.</p>

<p>¹Context characteristics modified for sub-code label</p>
<p>²Subcode added during the development process</p>
<p>³Context characteristic excluded as a subcode</p>

Characteristics of Context by Level [30]	Context Subcodes	Context Subcode Definitions
Inner/Organizational: Absorptive capacity	Absorptive capacity	How the organization or organizational unit (e.g., department or clinic) identifies, acquires, assimilates, transforms, and/or applies new, valuable knowledge (e.g., evidence, Guidelines, best practices). This includes analyzing, processing, interpreting, understanding, combining with existing knowledge, and applying/incorporating new knowledge into organizational competencies and routines.
Outer: Incentives and Mandates	Incentives and rewards ¹	Mechanisms/strategies that motivate/encourage/reinforce or that deter/discourage the implementation of the innovation and proposed changes, including incentives/rewards (e.g., casual dress day; pizza day; time off; recognition; financial incentives, i.e., pay for performance; etc.) and disincentives (e.g., negative performance reviews, reprimands, regulatory requirements, etc.).
N/A	Infrastructure, resources, and support ²	Presence or absence of infrastructure (e.g., facilities, space, equipment, transportation), resources (e.g., funding, staffing, time, education, skills training, materials) and/or support (e.g., supervisory, clerical) for implementing the innovation.
N/A	Political factors and dynamics ²	Organizational politics, i.e., how individuals or groups use political strategies to gain/use power and/or social influence in order to positively or negatively affect decisions and activities related to the adoption or implementation of an innovation. For example, they might create conflict, form alliances, bargain, use stalling tactics, discredit others, or compromise. If relevant, this code also includes discussion about the larger political environment (e.g., state or national government) and prevailing political ideology (e.g., nationalism, populism) as it relates to innovation implementation.
Inner/Local: Mechanisms for embedding change ³	N/A	
Outer: Environmental Stability ³	N/A	
¹ Context characteristics modified for sub-code label		
² Subcode added during the development process		
³ Context characteristic excluded as a subcode		

Second, the organizational scientist we consulted felt strongly that there were characteristics of context missing in the framework. To address this concern, we modified some subcodes and added several others. We modified the initial *Culture* subcode by adding the word 'climate'; the initial *Evaluation and*

feedback subcode by adding the word 'monitoring'; and the initial *Incentives* subcode by adding the word 'rewards. For conceptual clarity, we added the word 'mandates' to the initial *Policies and priorities* subcode. We also added two new subcodes: *Infrastructure, resources, and support* and *Political factors and dynamics*. As with the other constructs, we modified definitions of the context subcodes across the phases of development.

Finally, several characteristics of Context identified by i-PARIHS, mechanisms for embedding change and environmental stability, which we excluded as subcodes, are higher level concepts that can best be identified during the analysis process. For example, i-PARIHS developers suggest that mechanisms for change may include a variety of activities that fall under other context characteristics, such as regular team meetings and performance review systems (examples of *Structures and systems*) or audit and feedback processes (included in *Evaluation, monitoring, and feedback*). By co-coding characteristics of context subcodes with a generic *Enablers of implementation* subcode, investigators can identify mechanisms for embedding change during the analysis process. Similarly, environmental stability is related to multiple contextual events/circumstances, e.g., changes or lack of changes in structures and systems, leadership, or policies and procedures. We felt that ultimately determining environmental stability calls for judgement based on a full understanding of the context at multiple levels.

Facilitation Activities

We based the initial Facilitation Activities subcodes on 32 activities previously identified and defined by BH QUERI investigators [35, 39]; and we clustered these into 10 higher order facilitation activity subcodes. The expert panel recommended standardizing subcode labels, (e.g., *Providing clinical education* rather than *Clinical education*); significant changes to many of the individual subcode definitions; and minor changes to the clustered subcode definitions. See Table 4 for clustered subcodes and final definitions; see Additional File 2 for the 32 individual subcodes and definitions. I-PARIHS developers declined to provide feedback on the Facilitation Activities subcodes as they were not derived directly from the i-PARIHS framework.

Table 4
Facilitation activities subcodes and definitions

Facilitation Activities Subcodes	Facilitation Activities Subcode Definitions
Providing education/information	Educating stakeholders on clinical skills, the conduct of innovation marketing and/or organizational change processes and providing information to promote/publicize the innovation. This includes: 1) the content of education/information (e.g., information about the innovation and evidence for it, reasons for change, potential outcomes, clinical knowledge/skills needed, etc.); and/or 2) the process of providing education/information (e.g., teaching, training, mentoring, coaching, supervision, experiential/active learning, etc.). <i>This is a cluster code that can be sub-coded with the following activity codes: Providing education on clinical skills, Providing education on marketing, Providing education on organizational change, and Marketing.</i>
Collecting data/providing feedback	Collecting data and other information to 1) assess and understand the local context, baseline performance, and implementation barriers/enablers; 2) collect/monitor implementation activities, progress, and outcomes; and 3) provide stakeholders with feedback on data and updates on implementation activities and relevant professional or system-level information. <i>This is a cluster code which can be sub-coded with the following activity codes: Conducting ongoing monitoring of innovation implementation, Data collection to assess context and baseline performance, and Providing updates and feedback.</i>
Building relationships, teams, and networks	Engaging and building relationships with stakeholders, seeking their participation and buy-in, overcoming resistance to change, managing groups and team processes (including creating an atmosphere of mutual respect, empowering group members, and building relationships between them), and fostering stakeholder networking with peers and external experts/organizations. <i>This is a cluster code that can be sub-coded with the following activity codes: Engaging stakeholders, obtaining buy-in, Fostering networking with experts, Fostering peer networking, Managing group/team processes, and Overcoming resistance to change.</i>
Enabling/fostering change	Encouraging, promoting and helping to support changes in the organization, including by interceding and liaising with leadership or other stakeholders and assisting with the development of strategies and policies. The target of change efforts may be the organizational structure or culture or the target of change may not be specified but the methods of fostering change are specified. (For example, discussion may be about assisting stakeholders with conducting quality improvement activities, helping them build capacity for sustainment, or guiding and supporting them during the implementation process.) <i>This is a cluster code that can be sub-coded with the following activity codes: Fostering organizational change: cultural, Fostering organizational change: structural, Fostering change/unspecified, Interceding/liasing with others, and Strategy/policy development.</i>
Problem identification and resolution	Conducting or helping stakeholders 1) identify, become aware of, or clarify implementation challenges/barriers/problems and/or 2) generate potential solutions/countermeasures or select the one(s) most likely to address/solve implementation challenges/barriers/problems. <i>This is a cluster code and can be sub-coded with the following activity codes: Problem identification, Problem solving.</i>

Facilitation Activities Subcodes	Facilitation Activities Subcode Definitions
Planning/preparing for implementation	Helping stakeholders develop or refine Action/Implementation plans, come to consensus, adapt the innovation to the local context (structure, staffing, culture, and other initiatives), share a vision for change, and identify goals and priorities. <i>This is a cluster code that can be sub-coded with the following activity codes: Action/implementation planning, Adapting innovation to local context, Developing shared vision/consensus building, and Goal/priority setting.</i>
Helping to define, identify, and fill stakeholder roles	Helping to identify and select local change agents (e.g., facilitators, QI team members, local champions, opinion leaders) and/or hire innovation providers, as well as establish, describe/clarify, and/or allocate facilitator and stakeholder roles and responsibilities. <i>This is a cluster code and can be sub-coded with the following activity codes: Describing/clarifying roles and responsibilities, Helping to hire clinical program staff, Helping identify/select local change agents.</i>
Providing administrative/technical support	Conducting administrative tasks that support the operationalization of implementation activities and providing technical support, i.e., practical help and assistance to support implementation. Examples of administrative tasks include arranging calls, meetings, and implementation site visits; developing/preparing and disseminating minutes/reports and educational/marketing materials; and organizing innovation provider training. Examples of technical support include providing tools/sample materials; working with site stakeholders to co-create tools/materials, identifying/providing information about available resources for implementation, and working with relevant stakeholders to ensure that Information Technology (IT) systems accurately capture innovation activity and support implementation. <i>This is a cluster code and may be sub-coded with the following activity codes: Administrative tasks, Technical support.</i>
Using interpersonal skills to create a supportive environment	Using positive, supportive behaviors and communications to create an open, supportive, and trusting environment conducive to change, including being generally helpful and available, communicating regularly, acknowledging ideas and efforts and celebrating achievements/success. This code also includes selectively reducing the level of facilitation support, including positive supportive behaviors, in order to allow the transfer of facilitation roles to site stakeholders. <i>This is a cluster code that can be sub-coded with the following activity codes: Providing support, Pulling back/transferring roles.</i>
Obtaining/disseminating innovation or facilitation knowledge	Obtaining information about/developing skills needed for facilitating implementation of the innovation or fostering dissemination of knowledge about the innovation or facilitation other than at the implementation site(s). Facilitators may foster dissemination by attending, presenting at or organizing non-local meetings or by assisting with dissemination at sites not receiving facilitation. <i>This is a cluster code that can be sub-coded with the following activity codes: Attending, presenting at, and/or organizing non-local meetings; Fostering spread of clinical innovation/facilitation methods; Obtaining training/continuing education.</i>

Instructions and Explanatory Material

In addition to i-PARIHS construct codes, subcodes, and definitions, the codebook includes instructions for the application of individual codes and for the use of the codebook more generally. We initially developed instructions for applying some of the individual codes during Phase 1 and then modified them based on feedback from the expert panel, i-PARIHS experts, and the piloting process. Instructions expand on subcode definitions by providing inclusion and/or exclusion criteria, as well as guidance for differentiating between subcodes and/or co-coding when subcodes are difficult to differentiate.

We also developed instructions for the use of the codebook, as well as explanatory material. For example, we encourage users to adapt the codebook to their project and to create their own examples. We also recommend that they co-code i-PARIHS subcodes, as applicable, to indicate factors that may impede implementation (barriers) and/or factors that may enhance or improve implementation (enablers). We added instructions and explanatory material based on feedback across the phases of development. For example, in response to i-PARIHS developers' recommendations, we clarified that we developed the codebook based on our interpretation of the i-PARIHS framework.

Discussion

Lack of standardized definitions of the i-PARIHS framework's constructs and sub-constructs had resulted in the development of definitions for individual studies and limited the opportunity for comparing findings across studies that are guided by i-PARIHS. Using a rigorous, structured process, authors developed a qualitative codebook, informed by the i-PARIHS framework, that addresses this gap. The inclusion of subcodes and definitions for facilitation activities will allow users to cross-code activities with other construct sub-codes in order to explore how facilitators address barriers and leverage enablers related to construct characteristics, as well as how these constructs interact with each other.

We chose not to use facilitation activities described by i-PARIHS developers as the basis for subcodes in the codebook for the following reasons. First, the i-PARIHS framework was originally presented within the context of a guide for facilitation practitioners in which developers described, based on their own experiences, what facilitators should do to address characteristics of the innovation, recipients, and context [30]. In this guide, there are no clear and succinct definitions of facilitation activities that can be used as a foundation for code definitions in a qualitative codebook. Second, some of the activities identified in the guide are extremely complex. For example, "boundary spanning" consists of scanning the organizational environment and employing four different types of activities: collecting and disseminating information; developing and maintaining relationships; coordinating, aligning, and negotiating with the environment; and facilitating cooperation by mediating between different interests and identities [40, 41]. I-PARIHS developers identified "networking" and "negotiating and influencing," activities that are typically conducted when "boundary spanning," as separate facilitation activities. The use of complex and overlapping constructs as subcodes would make coding and analyzing qualitative material incredibly challenging. Third, i-PARIHS developers link facilitation activities to specific constructs (Innovation, Recipients, Context) and many of the activities are narrowly focused. For example, "context assessment" is linked only to the local context, but assessment of the inner organizational and outer contexts is also

important. Similarly, “problem identification” is only linked to the innovation, while in our own work we have found that facilitators also identify problems related to the context and recipients. Finally, no studies to date have used facilitation activities identified in the i-PARIHS framework as subcodes.

Therefore, we opted to use facilitation activities we had identified and defined in previous work [35, 39] as the foundation for subcodes. In a large VA-funded project which applied and evaluated an implementation facilitation strategy, investigators performed a targeted literature review, including empirical and conceptual literature about the PARIHS framework. They then conducted a directed content analysis of 85 qualitative interviews with three facilitators over a two- and one-half-year period to create a list of facilitation activities. Building on this work, in preparation for another study, BH QUERI investigators further refined this list, resulting in 32 facilitation activities and operational definitions. This list was the foundation for the facilitation activity subcodes. Thus, the final subcodes and definitions were informed by the PARIHS and i-PARIHS frameworks but are not linked to a specific construct and can be combined during analysis to form higher order constructs such as boundary spanning.

Limitations

There are several limitations to the development of the codebook. First, for the facilitation construct, we focused exclusively on the activities that facilitators conduct. However, facilitator skills and attributes can impact both the types and quality of activities facilitators conduct. Lack of appropriate skills and attributes can potentially have a negative impact on fidelity to the planned facilitation strategy and ultimately on outcomes [42–45]. We acknowledge that evaluation of an implementation facilitation intervention should likely include an assessment of facilitators’ skills; the addition of sub-codes for skills was beyond the scope of the workgroup. However, previous work identified and described facilitation skills [46]; this work could form the foundation for coding facilitation skills in qualitative material. Future work should apply these and further refine descriptions for addition to the current codebook.

Second, the purpose of piloting the codebook was to inform rather than test the final version. Additionally, although interview guides used for data collection were broadly informed by i-PARIHS constructs to capture information about the innovation, recipients, context, and facilitation, guides were not designed to probe for the specific construct characteristics represented by subcodes. Analysis of the data using the codebook thus resulted in identification of the influence of those constructs that were most salient to study participants and confirmed that the codebook could be applied to data. However, use of interview guides that included probes for relevant construct characteristics would have ensured that we comprehensively assessed each of the constructs and sub-constructs. Future studies should develop and apply interview guides informed by characteristics of i-PARIHS constructs and test the codebook to maximize its value. Finally, the codebook was developed based on the VA research context and our experience with PARIHS and i-PARIHS. Others following the same process might have developed different construct subcodes and definitions. It is important to note that although our team created the codebook independently, i-PARIHS developers reviewed it and their input was incorporated into the final version for the innovation, recipients, and context constructs.

Conclusions

This paper describes the development of a qualitative codebook informed by the i-PARIHS framework. The codebook, which provides standardized subcodes and definitions for each of the i-PARIHS constructs, maximizes the potential for comparing findings across studies informed by i-PARIHS, thus advancing generalizable implementation science knowledge. It also enables researchers to explore interactions between the innovation, recipients, and context and how facilitators interact with these. TMFs are often treated as “received wisdom” that can inform research [47] with less emphasis on using research findings iteratively and recursively to further develop, refine, and expand them [48]. The original PARIHS framework had a rich history of scrutiny and refinement [11, 27, 49–51] ultimately leading to the development of the i-PARIHS framework [30]. In addition to focusing analysis of data for individual studies, the codebook described in this paper can support the refinement of the i-PARIHS framework using empirical findings from multiple studies. In conclusion, development of tools such as the i-PARIHS codebook will facilitate data exploration, pattern identification, and insight development which are critical for meaningful use of TMFs in implementation projects.

Abbreviations

BH QUERI	Behavioral Health Quality Enhancement Research Initiative
PARIHS	Promoting Action on Implementation Research in Health Services
i-PARIHS	Integrated-Promoting Action on Implementation Research in Health Services
TMFs	Theories, models, and frameworks
VA	Department of Veterans Affairs

Declarations

Ethics approval and consent to participate

Not applicable

Consent for publication

Not applicable

Availability of data and material

Not applicable

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

MJR, KLD, BNS, JLS, and SJL were members of the workgroup, conceptualized the codebook development process, and collaboratively drafted the initial codebook. MJR led the workgroup, the expert panel, and the validation process with i-PARIHS developers/experts. MJR and KLD incorporated feedback from the expert panel, i-PARIHS developers/experts, and the piloting process; refined the codebook; and drafted the manuscript. MJR, KLD, BNS, JLS, and SJL reviewed and made significant contributions to manuscript revisions. All authors read and approved the final manuscript.

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Figures

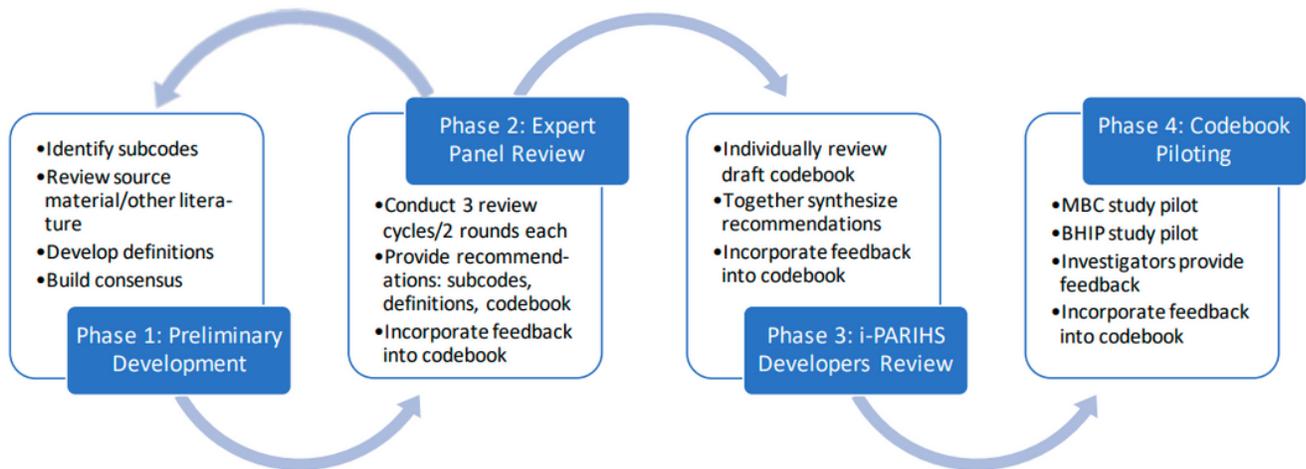


Figure 1

Summary of the codebook development process

Supplementary Files

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