Overview

The systematic search yielded 376 articles and 334 unique authors with contact information; 59 articles included feedback on the CFIR. Most of the projects discussed in the 59 articles were conducted in US healthcare settings; 27% (n = 16) were conducted in non-healthcare settings (e.g., educational, agricultural, or community settings), and 8% (n = 5) were conducted in low- and/or middle-income countries (LMICs) (see Additional file 3).

While 47% (n = 157/334) of authors responded to the survey, only 40% (n = 134/334) of authors completed the survey. Nearly 20% of authors reported use of the CFIR on five or more projects, and over 65% reported use in at least two projects. Over 80% of authors reported use of the CFIR in healthcare settings and to guide data collection, analysis, and/or interpretation (see Table 1).

While 50% of respondents felt the CFIR was easy to use for implementation science researchers, only 16% felt it was easy to use for non-researchers. In addition, 58% felt the CFIR was more complicated than necessary. One respondent stated: the â€œCFIR is far too complicated and difficult to use. I have been learning about and trying to use CFIR for more than 5 years and the more I use it the more difficult and uninterpretable I find it to beâ€• (survey response). However, another observed that, â€œImplementation research is challenging in itself, and I see that the complexity of CFIR gets blamed for the broader challengesâ€• (survey response). In addition, while the number of constructs was often cited as the reason the CFIR was too complicated, many users identified missing themes in the framework; nearly all respondents provided qualitative feedback about revising existing domain(s)/construct(s) or adding domain(s)/construct(s).

The other sensibility criteria from Flottorp et al. received positive ratings from over half of the survey respondents; most respondents felt the CFIR was applicable across settings (67%) and innovations (81%), useful for reporting determinants (77%) and designing implementation strategies (65%), and that the domains and constructs were labeled in a way that was easy to understand (77%) (see Table 2).

CFIR updates

Table 3 details the updated CFIR domain and construct names and definitions; it is also included in Additional file 6 for user convenience (see below). Word limits prohibit the ability to describe the updated CFIR in detail, but more detail is available in the Additional files:

Additional file 4 contains a mapping of the original CFIR constructs to the updated CFIR constructs;

Additional file 5 contains the mapping in Additional file 4 with the rationale for each update based on user feedback; and

Additional file 6 contains both the short and detailed descriptions of updated CFIR constructs, drawing on the descriptions from the original CFIR, feedback from our literature review, and support from other published literature.

Table 3 Updated CFIR domain and construct definitions Full size table

In the sections below, we summarize key updates in the updated CFIR and refer readers to the additional files and CFIR Outcomes Addendum [19] for details.

Overall framework

Construct names and definitions were updated in response to recommendations to make the framework more applicable across a range of innovations and settings [30,31,32,33,34,35]. This includes (1) using innovation (following Rogers that any â€œidea, practice, or object perceived as newâ€• is an innovation) [36] rather than intervention; (2) using recipients (individuals intended to benefit from the innovation) rather than patients; and (3) using deliverers (individuals involved in delivering the innovation). In addition, we have removed all references to stakeholders and instead refer to people who â€œhave influence and/or power over the outcome of implementation effortsâ€• when discussing how to identify a sample for data collection. Overall, every domain and construct had at least minor revisions.

Some survey respondents were unclear whether the CFIR seeks to elicit perceptions or reality: â€œA difficult distinction here is whether these are PERCEPTIONS [sic] of the implementer, or actual features of the program; both seem importantâ€• (survey response). Underlying assessment theories are needed to fully explicate a response to this concern. However, we acknowledge that responses to questions related to CFIR constructs will likely reflect a blend of objective reality and subjective perceptions that arise out of experiences within the setting (see â€œDiscussionâ€•).

Constructs and subconstructs were added to address missing themes and further develop domains; the number of constructs and subconstructs increased in all domains except the Innovation Domain; the updated CFIR contains 48 constructs and 19 subconstructs across 5 domains (with one domain including two subdomains). Domain-specific changes are summarized in the sections below and reflect our consensus decisions based on published feedback (noted by citations) and survey responses.

Innovation domain

Domain level

Survey respondents questioned whether the CFIR was intended to evaluate the innovation and/or the strategy being used to implement the innovation, and they found it difficult to differentiate between them. The literature has recognized that the lack of a clean boundary between the innovation and implementation strategies is a contributor to implementation complexity [22]; however, distinguishing between the innovation and implementation strategy is necessary for accurate attribution to implementation outcomes [28] and to identify appropriate areas for future intervention. As a result, the updated CFIR guides users to define the innovation (aka â€œthe thingâ€• [20, 25] being implemented), including the boundary between the innovation and implementation strategies. We encourage use of a reporting guideline to define the innovation (see Table 3).

Constructs and subconstructs

The word Innovation was added to the name of each construct in the Innovation Domain to orient users to the focus of this domain: the Innovation itself, independent of the implementation strategy. Major revisions were made to the definition of Innovation Complexity: the text â€œdifficulty of implementationâ€• was replaced with â€œthe innovation is complicatedâ€• to focus attention on the innovation, not implementation.

Outer Setting domain

Domain level

While some users recommended dividing the Outer Setting into multiple levels, others wanted to combine the Outer and Inner Settings, describing difficulty understanding boundaries between the two settings. In the original CFIR article's Additional file 1, the boundary between the Inner and Outer Settings was visually depicted using â€œoverlapping, irregular, and thick grayed linesâ€• to highlight that the line between them is not always clear [17]. Lengnick-Hall et al. expand on this reality and call for researchers to take an â€œopen-systemsâ€• perspective â€œto highlight interdependence between outer and inner contexts and [to] view organizations as part of a broader interdependent system that may range from simple to complex, rigid to flexible, and loosely to tightly coupledâ€•

[37]. Although embracing an open-systems perspective may be challenging, conceptually differentiating internal and external influences on the performance of organizations has been a central tenet of organization science [38] and highlights the level at which to focus interventions. As a result, the updated CFIR retains the two domains and guides users to objectively define their Outer vs. Inner Settings, including defining multiple levels of the Outer Setting if appropriate.

Constructs and subconstructs

A few constructs were renamed because users felt the labels were unintuitive (e.g., Cosmopolitanism) or confusing (e.g., Peer Pressure). Patient Needs and Resources was separated into three constructs and relocated to the Inner Setting and Individuals Domains in response to comments that it captured two distinct themes: awareness of patient needs versus prioritization of patient needs [39].

Users remarked that the Outer Setting domain was underdeveloped [40, 41]. The updated CFIR adds constructs to capture the potential influence of Local Attitudes, i.e., sociocultural values and beliefs, and Local Conditions, i.e., economic, environmental, political, and/or technological conditions, on the willingness and ability of entities within the Outer Setting to support implementation and delivery of the innovation [42,43,44,45,46,47], which may influence equity in implementation. These constructs are especially important for innovations that require support from community entities, such as Housing First models of care [48], and for capturing common resource constraints in LMICs [42].

The original CFIRâ€™s broad construct, External Policies and Incentives, was separated into several new constructs, including, for example, the key role of Financing [46, 49,50,51]. The updated CFIR also better captures diverse sources of External Pressures [46], including Societal Pressure (e.g., pressure from social movements and protests) [45], Market Pressure (e.g., pressure to compete with and/or imitate peer entities), and Performance Measurement Pressure (e.g., pressure to meet publicly reported goals).

Inner Setting domain

Domain level

Some users recommended dividing the Inner Setting into multiple levels [52] to account for teams or units [53, 54]. We added guidance for users to objectively define their Inner Setting and to add additional levels as needed. For example, Safaeinili et al. adapted the CFIR to accommodate three embedded levels: (1) pilot clinics, (2) peer clinics, and (3) the larger health system [54].

Constructs and subconstructs

New constructs and subconstructs were added to the Inner Setting to address several critiques. For example, Culture was felt to be too broad, with one survey respondent stating, it â€œends up becoming my â€˜I donâ€™t know where else this fitsâ€™ bucketâ€• (survey response). Additionally, users noted the absence of equity considerations [40, 42], including â€œmore specifically racism, patriarchy and misogyny, that [are] so much a part of the care that we provideâ€• (survey response). As a result, four subconstructs were added to Culture, including Human Equality-Centeredness, Recipient-Centeredness, Deliverer-Centeredness, and Learning-Centeredness, which serve to orient users to determinants that may influence equity in implementation.

In addition, as described in our companion article, The CFIR Outcomes Addendum [19], Implementation Climate and Readiness for Implementation were removed from the updated CFIR. Though few users commented on these constructs, some questioned their meaning and â€œnestingâ€• of subconstructs within each in the framework (e.g., Leadership Engagement, Available Resources, and Access to Knowledge and Information were all nested within Readiness for Implementation). Though there is broad recognition that implementation climate and readiness are a function of multiple implementation determinants, there is no consensus on precisely which determinants. Therefore, we have reclassified these constructs to more appropriately position them as antecedent assessments [55], on the pathway between implementation determinants and outcomes in the CFIR Outcomes Addendum [19].

Individuals domain

Domain level

Many users felt the CFIR did not provide â€œsufficient individual-level constructsâ€• [45] and were unclear about which individuals were included [45,46,47, 56,57,58,59]. Furthermore, they felt that constructs in this domain overlapped with constructs in other domains and failed to capture more important individual-level characteristics. One

user summarized this feedback well: â€œ[The CFIR needs to focus] more on who the individuals are and their underlying characteristicsâ€• (survey response). As a result, the Individuals Domain was significantly reorganized and now includes two subdomains: Roles and Characteristics.

Roles subdomain

In the original CFIR, roles were spread across three different domains: Patient Needs and Resources was listed in the Outer Setting, Leadership Engagement was listed in the Inner Setting, and multiple implementation-specific roles were listed in the Process Domain (e.g., Formally Appointed Internal Implementation Leaders). All roles have been relocated to this new subdomain, and additional roles were added, including Implementation Team Members [60]. In addition, the Formally Appointed Internal Implementation Leader and Champion constructs were combined into the Implementation Leads role because of the inability of users to distinguish between the two roles [61], and as affirmed in a review of champions [62].

Characteristics subdomain

Users felt that the existing Characteristics constructs overlapped with constructs in other domains, e.g., Knowledge and Beliefs overlapped with all constructs in the Innovation Domain. In addition, they thought the domain failed to capture more relevant characteristics related to professional roles and identities, skills and capabilities, autonomy, and level of involvement [46, 47, 59]. Some CFIR users combine this domain with the Theoretical Domains Framework (TDF), which was developed with the intent â€œto simplify and integrate a plethora of behavior change theories and make theory more accessible to, and usable by, other disciplinesâ€• [63]. The COM-B system was developed as an even more simplified system by which to acknowledge key domains related to behavior change based on US consensus of behavioral theorists and a principle of criminal law defining specific prerequisites for volitional behavior [29]. As a result, the original CFIR Characteristics constructs were replaced with constructs based on Michie et al.â€™s COM-B system [29]. The COM-B posits that broad categories of Capability (e.g., skills), Opportunity (e.g., autonomy), and Motivation (e.g., commitment) shape behavior.

The COM-B constructs are each mapped to 14 domains in the TDF, which provides CFIR users a wide portal into a repository of 84 behavior-change theoretical constructs. In addition, we encourage users to add additional constructs and map them to the COM-B as appropriate. For example, theories, models, and frameworks related to:

Behavior change, e.g., the TDF [63, 64], the Theory of Planned Behavior [65], or the Social Ecological Theory [66] may provide constructs relevant for Innovation Recipients and Innovation Deliverers.

Facilitation [67, 68] and project management [69, 70] may provide constructs relevant for Implementation Facilitators and Implementation Leads.

Leadership [67, 68] may provide constructs relevant for High- and Mid-Level Leaders.

We also added the Need construct, based on feedback about its importance for all constituents [56], and to capture facets of the original CFIR Patient Needs and Resources construct.

Implementation Process

Domain level

We added guidance to encourage users to describe their overall approach or implementation process framework to guide implementation, e.g., the Interactive Systems Framework [71]. Doing so helps distinguish the Innovation from the Implementation Process and accompanying implementation strategies.

Some users questioned the inclusion of the Implementation Process Domain in the CFIR because it appears to include strategies, not contextual factors. We clarify that the goal of this domain is to capture â€œthe degree to whichâ€• each of these processes occur during implementation and influence implementation outcomes. Additional constructs were added in the updated CFIR to acknowledge scientific advancement since 2009 that are common across many process frameworks [8] and collective-level change theories [72]. Depending on the process framework used for a particular project and the implementation strategies used [26, 27], there may be other components of the implementation process that users should add.

Constructs and subconstructs

The updated CFIR has expanded the number of constructs within the Implementation Process Domain in response to critiques that key processes and strategies were missing. Though it is outside the scope of the CFIR to include all 73

implementation strategies from the Expert Recommendations for Implementing Change (ERIC) [26, 27], a few best practices have been added: Teaming [42, 46, 73], Assessing Needs [46, 47], Assessing Context, Tailoring Strategies [14], and Adapting [45, 74, 75]. Published guidance highlights the importance of Adapting the innovation [76], and the updated CFIR notes the importance of adapting the setting as well [77]. The addition of Assessing Needs: Innovation Recipients and Engaging: Innovation Recipients serves to better center Innovation Recipients in the updated CFIR and orient users to these as important determinants to equity in implementation.

## Reference

[Practitioner's Guide to Using Research for Evidence-Based Practice]

[Survey Scales: A Guide to Development, Analysis, and Reporting]