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Interdisciplinary Studies and Implementation Science: Clarifying the Concept of Fidelity

Catrine Demers
University of Alberta, Canada

Zoe Elizabeth Higgins
Laurentian University, Canada

Sayna Bahraini
Children's Hospital of Eastern Ontario-Research Institute, Canada

Roxanne Pelchat
Centre de services scolaire des Découvreurs, Canada

Wendy Gifford
University of Ottawa, Canada

Pascal Lefebvre
Laurentian University, Canada

Abstract: As implementation scientists know well, evaluating fidelity is essential for researchers and practitioners when making sure they implement a plan as intended. However, the concept of fidelity remains unclear, given that various conceptualizations exist within and across disciplines. To help researchers and practitioners understand fidelity, a conceptual framework integrating definitions within and across disciplines is needed. The study we report on here aimed to review the many different terms for and definitions of fidelity to create such an integrated interdisciplinary conceptual framework. We performed a rigorous and structured literature review, known as a scoping review. The 77 documents included in this scoping review: (1) defined fidelity by the degree to which a plan is implemented as planned, and (2) discussed fidelity as a concept, definition, conceptualization, facet, dimension, conceptual framework, model, or theoretical model. We used techniques that will be familiar to interdisciplinarians to find the commonalities amid the differences, allowing us to propose an integrated framework for this sort of endeavor. The conceptual framework we propose includes consideration of levels, dimensions, and relationships between key terms in the reviewed literature. It also clarifies the concept of fidelity and provides details regarding reliable measures

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to evaluate it. This framework can be used by those in all disciplines seeking to assess fidelity. And we think it will be especially helpful to those working in interdisciplinary teams.

Keywords: fidelity, conceptual framework, implementation, intervention, interdisciplinary

Introduction to Implementation Science and Fidelity

Implementation science, a field of interest and benefit to researchers and practitioners in many disciplines, helps explain and guide the implementation of research knowledge into routine use (Kislov et al., 2019). Studies in implementation science aim to find the quality of the uptake and implementation of evidence-based practices (Bauer et al., 2015) and improve that quality when need be. The study of implementation requires tools developed from different disciplines, e.g., psychology, organization studies, and sociology, making implementation science an interdisciplinary field (Kislov et al., 2019).

As one might expect, evaluating the fidelity with which practices are implemented is one of the essential tools for achieving the primary end of implementation science, the betterment of outcomes. However, because many disciplines are involved, the concept of fidelity and its evaluation processes remain unclear, even within fields. Fidelity is generally defined as the degree to which a plan is implemented as intended (Gresham, 1989), but there is much disagreement about any more detailed definition.

To help researchers and practitioners understand fidelity (and then evaluate it), a conceptual framework integrating the multiple definitions that exist within and across disciplines is needed. This article reports on a study examining the various definitions of fidelity to help create such an interdisciplinary conceptual framework. We performed a rigorous and structured literature review known as a scoping review. The 77 documents included in this review (1) defined fidelity by the degree with which a plan is implemented as planned, and (2) discussed fidelity as a concept, definition, conceptualization, facet, dimension, conceptual framework, model, or theoretical model. The proposed framework integrates this material and includes levels, dimensions, and relationships between key terms in the reviewed literature. It clarifies the concept of fidelity and provides details regarding measures to be taken for evaluating fidelity. This interdisciplinary framework can be used by those in all disciplines seeking to assess fidelity—and by those involved in interdisciplinary projects, as well.

Examples of the Need for Evaluation of Fidelity

Fidelity in Education

A school principal wants to implement effective teaching strategies to support the learning of children who speak a language at home other than the one used at school. Even though he has provided teachers with training from an expert on effective teaching strategies, the students' performances are not improving. He does not understand this lack of improvement. He is starting to think that these supposedly effective teaching strategies do not work in practice.

The school principal decides to look at what was actually done. He finds out that since many teachers in his school do not work on Fridays, they could not attend the training workshop when it was moved from a Monday to a Friday, just before the holidays. Initially, the workshop was supposed to last two days; however, it only lasted one day because they lacked substitute teachers to fill in for those missing classes. Furthermore, when looking at the teachers' feedback on the workshop, he sees they reported that the expert did not provide any examples to support the theoretical information. As a result, the teachers found the recommended strategies hard to apply in their classrooms. The school principal now understands why those strategies might not have given the anticipated results—not because they are ineffective, but because the workshop about their use was not correctly implemented. Therefore, the teachers were not appropriately using the strategies. There had been a failure regarding fidelity.

Fidelity in Health Sciences

A speech-language pathologist works in a clinic with a six-year-old child who has a speech sound disorder. She tries a new intervention supported by research evidence showing its effectiveness for children with similar disorders. After a few weeks, she believes the intervention is not working because the child is not showing signs of improvement. Nevertheless, before changing it, she evaluates her provision of the intervention. She realizes that her sessions were not scheduled as frequently as prescribed because the clinic only allows weekly client visits. Also, she realizes this client's appointment had been at 4 pm when he is already tired from his day at school. By reflecting on her intervention implementation, she realizes that the problem might not be the intervention itself but rather that she did not implement it as recommended. There had been a failure regarding fidelity.

These scenarios show the importance of measuring fidelity when implementing new practices. Fidelity can provide information on when to trust

that a new practice is effective or not (Sanetti et al., 2009). As shown in the examples above, when implemented practices do not result in the intended outcome, one may not simply conclude that the practices are ineffective. Without data on fidelity, one cannot know whether the lack of an intervention's efficacy should be attributed to the intervention per se or to weak implementation of the intervention (Carroll et al., 2007). Moreover, fidelity measures can provide reliable information about what was and what was not well put in place. Feedback from this specific information can allow improvements of what was poorly implemented to make better results possible (Begeny et al., 2013; Noltemeyer et al., 2014). Only if the fidelity measures are positive but the outcome is not should one begin to question the efficacy of the intervention itself.

Another goal of measuring fidelity is to identify which components of an intervention are essential if it is to have the intended impact. When implementing a practice, measures of different components of this practice, e.g., the content and the frequency, can be correlated with the results. The implemented components that lead to better outcomes are the essential ones. Thus, measuring fidelity can help determine the most critical components of an intervention, so practitioners will know where to focus their attention for the best outcomes (Century et al., 2010; Dunst et al., 2013).

However, a question remains: How does one measure fidelity? The following scenario illustrates how an interdisciplinary team of researchers can and indeed must tackle the many issues that arise in attempts at fidelity measurement, issues that emerged in the actual situation that led to the current study. It was our team (including some authors of this article) that ran into problems choosing a framework to develop fidelity instruments to evaluate an intervention. These problems prompted us to turn to another project, the scoping review presented in this article. We then used the conceptual framework we developed from the scoping review to guide our fidelity instruments development.

Fidelity Evaluation in an Interdisciplinary Team: The Origins of this Study

An interdisciplinary team is implementing new practices to prevent reading difficulties in schools. This team is composed of school board staff and researchers from many disciplines. School board staff include a school board coordinator, a school board administrator, a school principal, an educational advisor, a teacher, and a speech-language pathologist. Researchers are from the disciplines of education, nursing, and speech-language pathology. After researching the literature, the team realizes that researchers use various terms, definitions, and methods regarding fidelity evaluation (Nelson et al., 2012).

For example, authors refer to fidelity as *adherence, integrity* (Dunst et al., 2013), *treatment integrity*, *treatment plan implementation*, *procedural fidelity*, *implementation integrity* (Begeny et al., 2013), *fidelity of implementation* (Bianco, 2010), *treatment fidelity, intervention integrity, procedural reliability* (Sanetti & Kratochwill, 2009), *treatment plan implementation* (Noell & Gansle, 2006), and *process evaluation* (Steckler & Linnan, 2002). In addition, the same term used in different studies can refer to different conceptualizations or definitions. Hence, there is a lack of uniformity in the construct and definition of fidelity (Gearing et al., 2011) with no consistency across terms to represent distinctions (Noell, 2008).

The team members meet to discuss how to proceed with monitoring the implementation of the new practices. Implementation monitoring and evaluation are not part of the school board staff's usual responsibilities. However, while discussing the topic with the researchers, they realize that fidelity evaluation is essential to accurately measure the new practices' outcomes and provide feedback to the people in charge of actualizing these practices in the classrooms. When discussing how to monitor the implementation of the latest practices, the researchers suggest different frameworks that they have come across.

The researcher from education suggests Dane and Schneider's (1998) framework for program integrity in primary and early secondary prevention programs aiming to prevent academic, behavioral, and social maladjustment in children. This framework includes dimensions of adherence, exposure, quality, participant responsiveness, and differentiation. Adherence refers to the degree to which the intervention components were delivered as planned. Exposure includes the number of sessions in the intervention and their length and frequency. Quality is related to the implementer's enthusiasm, preparedness, and effectiveness, and the leader's attitude regarding the program. Participant responsiveness is the participant's level of enthusiasm and participation. Finally, differentiation refers to comparing two groups, for example, a group receiving an intervention and another group receiving either no intervention or another intervention, to ensure that each group is different and receives only the planned interventions.

The researcher from nursing suggests a framework of process evaluation for public health interventions by Linnan and Steckler (2002). They describe process evaluation components as context, reach, dose delivered, dose received, fidelity, implementation, and recruitment. Context refers to the political, social, and economic environment. Reach is the proportion of the target population that participates in an intervention. Dose delivered is the amount of intervention provided by implementers. Dose received reflects the engagement of the participants in the intervention. Fidelity refers to the degree to which the intervention was delivered as planned. Implementation is a score that includes reach, dose delivered, dose received,

and fidelity. Finally, recruitment is related to the procedures used to recruit the participants.

The researcher from speech-language pathology highlights that in implementation research, authors often differentiate between two levels of fidelity: implementation fidelity (Dunst et al., 2013), also called organizational fidelity (Fixsen et al., 2005), and intervention fidelity (Dunst et al., 2013; Fixsen et al., 2005). Implementation fidelity refers to the implementation strategies put in place to help implement an intervention, whereas intervention fidelity refers to the actual intervention being implemented. It is crucial to measure both these aspects of fidelity.

The team members have a difficult time choosing a specific framework. They quickly search for other frameworks and realize that there are many more that have been published and that each of them has similarities and differences with the others. When the team members evaluate the pros and cons of choosing one of these frameworks, they realize that none includes all facets of fidelity.

Researchers often use multiple frameworks to comprehensively respond to the needs of a study because a single framework does not cover all of their needs (Birken et al., 2017). In fact, "When addressing a complex problem, there are likely to be a number of frameworks or theories from a variety of disciplines that provide at least a partial explanation of the concepts involved and how they influence the problem" (Morse, 2014, p. 4). This is precisely what we in our team found: different conceptual frameworks and definitions of fidelity from various disciplines with none inclusive of all the levels and dimensions of fidelity. For example, the conceptualizations of Fixsen et al. (2005) and Dunst et al. (2013) on the two levels of fidelity do not include discrete dimensions (e.g., adherence, reach, dose). In turn, dimensions by Dane and Schneider (1998) as well as by Linnan and Steckler (2002) do not include the two levels of fidelity. The well-known framework by Carroll et al. (2007) contains dimensions of content, coverage, frequency, and duration. Furthermore, this framework also includes potential moderators of fidelity, i.e., factors that will influence fidelity. In this framework, these moderators are implementation strategies as well as dimensions of quality and participant responsiveness. Although these moderators are not integral components of the concept of fidelity, we can agree that implementation strategies are another aspect of fidelity that needs to be evaluated (e.g., Dunst et al., 2013; Fixsen et al., 2005). But Carroll et al.'s framework (2007) is otherwise lacking; it does not break down the fidelity of implementation into the different dimensions of fidelity.

Trying to proceed without a comprehensive and integrative framework may lead to evaluating only some aspects of fidelity, missing out on essential components that may influence outcomes. If a team evaluates fidelity only

partially, the incomplete evaluation will add to the confusion around the relationship between fidelity and outcomes. And yet, as the scenario based on our personal experience shows, there is a lack of uniformity in the construct and definition of fidelity (Gearing et al., 2011) with no consistency in terms and usage that represent the different components of fidelity (Noell, 2008), enabling its reliable evaluation. This is where interdisciplinary studies come in to help resolve this major issue in the practice of implementation science.

The Lessons of Interdisciplinary Studies

One major issue that interdisciplinary studies can help tackle is establishing a common language to overcome communication barriers among those working in different disciplines. In fact, such communication can be challenging (Crowley et al., 2015). Members of interdisciplinary teams from different disciplines frequently disagree on which language to use for the various concepts they are working with. Efforts to develop and share the same language culture will allow people to cross borders to coordinate their understandings and thus their actions (Laursen & O'Rourke, 2019). The present study has highlighted this need. And the literature of interdisciplinary studies is full of helpful suggestions for meeting this need. That literature can help researchers and practitioners find a language for all disciplines or an interlanguage (Pohl et al., 2019) that will increase the chances of successful communication and collaboration among those in different disciplinary areas working in an interdisciplinary team (Crowley et al., 2015).

Moreover, the present study has also highlighted the need for a framework that introduces an integrative view of fidelity within and across disciplines (Sanetti & Kratochwill, 2009). Again, the literature of interdisciplinary studies offers guidelines to create such a framework by integrating the understandings of different disciplines for a more comprehensive insight into a large or complex topic than a single discipline can provide (Repko & Szostak, 2017). As interdisciplinarians know well, Repko and Szostak have written at length about steps in the process that allow teams to establish this common understanding: (1) defining the problem or stating the research question; (2) justifying the use of an interdisciplinary approach; (3) identifying relevant disciplines; (4) conducting the literature search; (5) developing adequacy in each relevant discipline, (6) analyzing the problem and evaluating each insight or theory, (7) identifying conflicts between insights and their sources; (8) creating common ground between insights; (9) constructing a more comprehensive understanding; and (10) reflecting on, testing, and communicating the understanding. We decided to take these steps within *our* team, a process that led to the completion of this study and of this article, conducting a

scoping review that allowed us to integrate the languages and frameworks we discovered in that review and develop an interdisciplinary conceptual framework of fidelity. Thus, this very article illustrates how interdisciplinary studies and implementation science can work together in creating a much needed common language and framework that unifies fidelity as a concept within and across disciplines and enables the reliable practice of the measurement of fidelity.

Objectives

The current study aimed to understand how fidelity is conceptualized in the literature within and across disciplines. The specific objectives were to: (1) categorize all the terms and definitions used, and (2) create an interdisciplinary conceptual framework to guide research and practice when individuals and teams are implementing practices in many disciplines that are not narrowly disciplinary, including education, health sciences, and interdisciplinary fields.

Methods

Approach

Since many documents have already conceptualized and defined fidelity, these texts were searched and reviewed to identify the different ways of seeing fidelity. We chose a scoping review to meet the objectives of the current study. A scoping review is a rigorous literature review covering all the information available in scholarly publications (Arksey & O'Malley, 2005). We used the scoping review steps proposed by Arksey and O'Malley (2005): (1) identify the research question; (2) identify the relevant studies; select the studies; chart the data; and (3) collate, summarize, and report the results. We reported the current scoping review using the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist (Tricco et al., 2018; the document is available from the corresponding author). No protocol was registered for this review.

Identify the Research Question

The research question to be answered by this scoping review was "What are the existing concepts, definitions, conceptualizations, facets, dimensions, conceptual frameworks, models, and theoretical models of fidelity in an implementation context?"

Identify the Relevant Studies

The following electronic databases were searched from inception until March 2016: Ovid Medline, EBSCOhost CINAHL, Ovid PsycINFO, Ovid ERIC, and EBSCOhost Education Source. In addition, we explored the grey literature through ProQuest Dissertation theses and abstracts. Finally, we searched additional electronic databases: Scopus, Web of Science, and Google Scholar. Other activities supplemented this search, including hand-searching the journal *Implementation Science*; scanning the reference lists of articles discussing fidelity (including documents that we kept in this scoping review); and examining the first author's list of references.

The literature search included a combination of two main concepts using free-text terms and medical subheadings (MeSH): (1) fidelity, adherence, implementation integrity, intervention integrity, procedural integrity, procedural reliability, professional compliance, program integrity, teacher compliance, treatment integrity, treatment plan implementation, guideline adherence, process evaluation, and (2) framework, concept, and model. The Medline literature search is available from the corresponding author. We modified the search strategy to match the syntax proposed in CINAHL, PsycINFO, ERIC, and Education Source. To limit the results, we restricted the search to the combination of these words in the title for the additional databases of Scopus, Web of Science, and Google Scholar: (1) fidelity and (2) framework.

Select the Studies

Three reviewers (CD, RP, SB) screened the documents by titles and abstracts, and two reviewers (CD, SB) screened them by full texts. They selected the studies according to the following inclusion and exclusion criteria.

Inclusion Criteria

All types of documents were considered, including peer-reviewed articles of primary research, non-peer-reviewed articles, commentaries, editorials, books, book chapters, theses, and reports. Authors' research methods could be of any type, including reviews, quantitative, qualitative, and mixed designs. We considered documents published in English or French. We included papers if they discussed (1) the degree to which something was implemented as planned (e.g., intervention, treatment, curriculum, strategy, guidelines); (2) concepts, definitions, conceptualizations, facets, dimensions, conceptual frameworks, models, or theoretical models of fidelity; (3) original ideas of the authors.

Original ideas are novel definitions that do not use or cite other authors' definitions or conceptualizations. Original ideas also include the work of other authors if it was merged or reorganized to create a different vision that adds something new, modifies something, or creates a new perspective.

While fidelity can be conceptualized in many ways, the conceptualizations we discovered share a similar concept: people implementing the intervention or implementation strategies, referred to as "implementers," should implement the intervention as accurately as possible. The term "implementers" often refers to employees of an organization where service is given, for example, teachers, nurses, physicians, social workers, psychologists, and caregivers. When putting in place implementation strategies, implementers are usually acting as administrators, managers, coordinators, principals, or team leaders. The people that are receiving the intervention or implementation strategies are labeled the "receivers." When receiving an intervention, the receivers can be clients, patients, or students. For example, when receiving an intervention in health sciences, receivers could be patients, and implementers could be physicians. Among individuals benefiting from implementation strategies at the organizational level, the receivers can also be teachers, nurses, physicians, social workers, psychologists, caregivers, etc. For example, when receiving implementation strategies in education, receivers could be teachers, and implementers could then be school principals. For the current review, the documents had to consider implementers as the main actors who put in place the intended plan. We included authors from any environments and disciplines discussing fidelity in the context of implementation.

Exclusion Criteria

We excluded documents if fidelity was conceptualized through a different definition than that of the degree to which something was implemented as planned (e.g., romantic relationship, reproduction of human models, computer programs). We also rejected documents if they introduced the concept of fidelity but did not define it or discuss its levels or dimensions. More specifically, the documents were rejected if they only included brief definitions to introduce the concepts of fidelity, structure and process, or adherence and competence that were not the authors' original idea. These are familiar concepts, and they are often presented as known facts. We rejected documents if other authors' ideas were only combined or used in part without adding anything new. Finally, documents were dismissed if the ideas were too detailed or specific to a particular intervention or discipline. Very specific intervention components or implementation strategies restrict the generalizability to other interventions or implementation strategies.

Moreover, when extracting the data from the documents we did include, we excluded other topics related to fidelity, such as factors that can moderate fidelity and act as facilitators or barriers to fidelity, the fidelity-adaptation debate, the frequency of fidelity evaluation in studies, the importance of evaluating fidelity, etc. Although these topics are important to understand contextualized fidelity, they were not aimed at by this study.

Chart the Data

The data were extracted from the selected documents and charted according to the following: authors; year of publication; discipline; and conceptualizations of fidelity. More specifically, we charted the data according to a content analysis within a directed approach. This approach creates initial categories using existing theories and forms new categories with data that cannot be coded in initial categories (Hsieh & Shannon, 2005). We based our initial categories on four well-established frameworks (Dane & Schneider, 1998; Dunst et al., 2013; Fixsen et al., 2005; Gresham, 1989) that researchers commonly use. These frameworks also complement each other in their conceptualizations. With those frameworks, we created three categories and their subcategories deductively on spreadsheets. We created categories according to these already established conceptualizations: fidelity in general according to Gresham (1989), two levels of fidelity according to Fixsen et al. (2005) and Dunst et al. (2013), and five dimensions of fidelity according to Dane and Schneider (1998). If there was no category or subcategory appropriate to the definition extracted from a document, we created a new category or subcategory inductively, i.e., the categories were created directly from the data by the reviewers and added in spreadsheets. Two independent reviewers extracted data from the full-text documents (CD, ZH). They identified the concepts and their definitions within the documents and classified each data entry into corresponding categories and subcategories as well as into newly created categories and subcategories. Finally, they compared their results for agreement, and disagreements were solved by a third reviewer (PL).

Collate, Summarize, and Report the Results

Terms and definitions found in all the categories and subcategories were grouped with the help of tables to reach the first objective of the current review: listing all the terms for and definitions of fidelity used in the literature. Next, we created integrative definitions and chose terms for each category and subcategory to represent adequately the similarities in the terms and definitions

of the different authors. We thus synthesized categories and subcategories to reach the second objective of the current review: creating an interdisciplinary conceptual framework to guide research and practice.

Results

Search Results

After we removed duplicates, we selected 3770 documents. Three authors screened the documents by titles and abstracts, 3461 were removed, and 309 documents were included based on exclusion and inclusion criteria. Two authors read the full texts of these 309 documents to screen for the documents that answered the research questions. They dismissed a total of 232 documents, leaving 77 documents to be included in the current review (see Figure 1 for the PRISMA diagram (Moher et al., 2009); the complete list of references is available from the corresponding author).

The 232 documents were excluded based on the following reasons: the concept of fidelity was too general or generic, not detailed or subdivided (83), the definition of fidelity was not derived from original work by the authors (80), there was no mention of fidelity (36), the concept of fidelity was other than that of the degree to which something was implemented as planned (14), the full text could not be found or was not available (11), the definition was too specific to the program or subject (4), there was already work by the same author in another article (2), the full text was not in English or French (1), or the document was only an abstract (1).

Characteristics of the Documents Included

The documents included were published from 1971 to 2016. There were 22 documents published from 1971 to 2000 and 55 documents from 2000 to 2016. The studies came from various disciplines: health (27), education (18), psychology (14), psychiatry (6), nutrition (3), nursing (3), program evaluation (2), society and health (1), behavioral sciences (1), business (1), and social work (1). The documents originated from several countries: United States (60), Canada (5), United Kingdom (4), Netherlands (3), Sweden (2), Australia (1), Cuba (1), and Singapore (1). The documents included articles (62), book chapters (9), reports (3), theses (2), and a conference presentation (1). The documents included were mainly laying out primary research data (26) and reviews (51) that were divided into systematic (7) and non-systematic (44) reviews. The primary research data were drawn from quantitative methods (9), qualitative methods (6), mixed methods (7), and case studies (4).

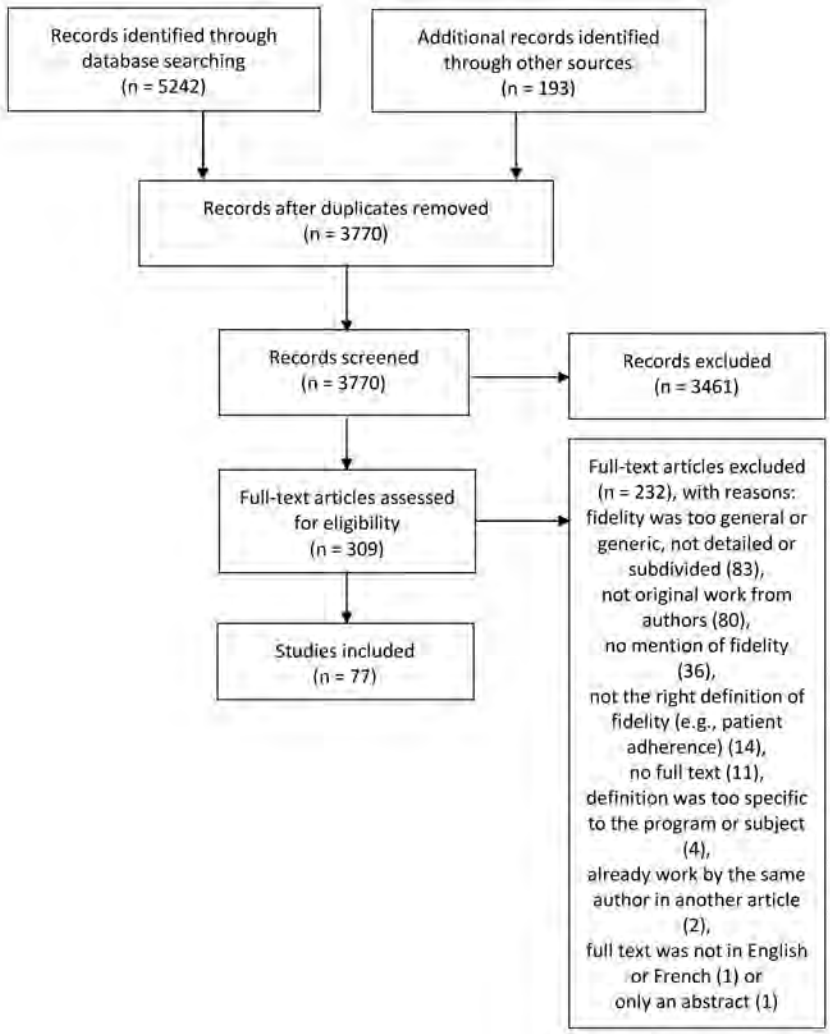

Figure 1. PRISMA flow diagram of the scoping review on fidelity. The PRISMA flow diagram of the scoping review, including the records identified through databases and other sources, the records after the duplicates were removed, the screening by titles and abstracts, the screening by full texts, the studies included, and the reasons for exclusion.

Categories

The 77 documents included definitions that we charted into the categories of fidelity, levels of fidelity, and dimensions of fidelity (see Table 1). First, the data were classified into the category of fidelity when the authors defined

the general concept of fidelity. Next, they were categorized into the levels of fidelity category when the authors divided the concept of fidelity into distinct levels. We further ordered the data into implementation level and intervention level. Finally, the data were categorized into dimensions of fidelity when the authors divided the concept of fidelity into discrete dimensions. We organized the data into the following dimensions: adherence, dosage, timeliness, quality, differentiation, adaptation, reach, exposure, responsiveness, and enactment.

Fidelity

There were 34 documents discussing the general concept of fidelity (see Table 2 for examples; the complete list is available from the corresponding author). A common conceptualization across all included studies was, as expected, similar to the inclusion criteria definition of fidelity: the degree to which the plan is implemented as intended; the correspondence between the intended plan and the actual plan. However, some variations were present within the different definitions. For example, these definitions sometimes

Table 1: The number of studies discussing each category

Categories	Number of studies
Fidelity	34
Levels of Fidelity	13
Implementation	13
Intervention	12
Dimensions of Fidelity	65
Adherence	39
Dosage	34
Timeliness	2
Quality	35
Differentiation	15
Adaptation	10
Reach	17
Exposure	8
Responsiveness	29
Enactment	9

included and specified dimensions, and sometimes didn't. Moreover, the envisioned ideal plan usually consisted of theories, essential components, research-based methods, best practice protocols, gold standards, or recommendations.

Table 2: Examples of terms and definitions of the general concept of fidelity

Author(s)	Year	Discipline	Term(s)	Definition
Dunst et al.	2013	Early intervention	Fidelity; adherence; integrity	"Fidelity, as used in this article, refers to the use of the key characteristics of an evidence-based practice in a manner that mirrors what was learned from research about the relationship between the characteristics and consequences of a practice." p. 89
Graham et al.	2012	Nursing	Monitor knowledge use	"Monitoring the adoption of the new knowledge introduced (i.e. adherence to BPG recommendations or clinical process changes)." p. 81 "Monitoring knowledge use provides: An indication of the extent to which BPG recommendations are known, accepted and applied." p. 85
Bianco	2010	Special Education	Fidelity of implementation; treatment integrity	"Fidelity of implementation or treatment integrity requires that teachers provide instruction and progress monitoring according to the research-based method prescribed or to a best-practice protocol." p. 6
Sanetti & Kratochwill	2009	Educational Psychology	Treatment integrity	"Treatment integrity is the extent to which essential intervention components are delivered in a comprehensive and consistent manner by an interventionist trained to deliver the intervention." p. 448
Dusenbury et al.	2003	Prevention/ Health Education	Fidelity of implementation	"Fidelity of implementation refers to the degree to which teachers and other program providers implement programs as intended by the program developers." p. 240
Hogue et al.	1996	Center for Research on Adolescent Drug Abuse	Treatment adherence	"Treatment adherence research refers to the methodological strategies used to document that a given therapy has genuinely been carried out in accordance with essential theoretical and procedural aspects of the model." p. 333
Scheirer	1994	Program Evaluation	Process evaluation	"Process evaluation is the use of empirical data to assess the delivery of programs. . . . In contrast, process evaluation verifies what the program *is*, and whether or not it is delivered as intended to the targeted recipients and in the intended 'dosage.'" p. 40
Gresham	1989	Psychology	Treatment integrity	"Treatment integrity refers to the degree to which a consultation plan is implemented as intended." p. 37

Levels of Fidelity

Thirteen documents distinguished between two levels of fidelity: implementation level and intervention level (see Table 3 for examples; the complete list is available from the corresponding author). The primary difference between these two levels is related to what is being evaluated. At the implementation level, the strategies being used to implement the intervention, such as training, workshops, or coaching, are the focus of the evaluation. At the intervention level, the intervention being implemented is the focus of the assessment, such as a language, reading, or behavioral intervention. These definitions are similar to those included in the general definition of fidelity. Therefore, we propose this integrative definition of implementation fidelity from findings of the review: "the degree to which the implementation strategies are implemented as intended; the correspondence between the intended implementation strategies and the actual implementation of strategies." At the intervention level, the definitions are comparable to those for the general concept of fidelity since the authors usually conceptualize fidelity at the intervention level. Therefore, we suggest this integrative definition of intervention fidelity: "the degree to which the intervention is implemented as intended; the correspondence between the intended intervention and the actual implementation of the intervention."

Dimensions of Fidelity

The authors reported various dimensions of fidelity distributed across 65 documents. After we deconstructed the definitions of the dimensions and grouped them within similar definitions, we identified ten dimensions. Six dimensions were more related to the implementers, including adherence, dosage, timeliness, quality, differentiation, and adaptation. Four dimensions were more related to the receivers: responsiveness, enactment, reach, and exposure. Whether they are related to the implementers or the receivers, all ten dimensions can be evaluated at both the implementation and intervention levels.

Dimensions Related to the Implementers

Adherence. A total of 39 studies reported adherence as a dimension of fidelity (see Table 4 for examples; the complete list is available from the corresponding author). The definitions of this dimension are similar to the definitions included in the general concept of fidelity. However, the definitions were included under adherence and not under the general concept of fidelity when the authors divided fidelity into dimensions. Adherence is the degree to

Table 3: Examples of terms and definitions of the two levels of fidelity

Author(s)	Year	Discipline	Term(s)	Definition	Term(s)	Definition
Hulleman et al.	2013	Education; Implementation Science	Implementation fidelity	"Our definition of intervention fidelity is different from implementation fidelity, which involves the contextual factors that support the implementation of the intervention core components, such as staff selection, administrative training, and the provision of resources." p. 68	Intervention fidelity	"Intervention fidelity is the extent to which the program, as designed, was actually implemented." p. 68
Fixsen et al.	2005	Maternal and Child Health/ Implementation Research	Organizational fidelity	"Descriptions or measures of the correspondence in overall operations (e.g., staff selection, training, coaching, and fidelity assessments; program evaluation; facilitative administration) between implementation site and the prototype site. (Sometimes a standard measure that has been developed by the purveyors of a program; may be referred to as adherence, organizational fidelity measures or certification criteria at an organizational level)." p. 85	Intervention fidelity	"Descriptions or measures of the correspondence in service delivery parameters (e.g. frequency, location, foci of intervention) and quality of treatment processes between implementation site and the prototype site (Sometimes a standard measure that has been developed by the purveyors of a program; sometimes called an adherence or certification measure at a practitioner level)." p. 85
Gresham	1989	Psychology	Integrity of the consultation process	"That is, one can assess the degree to which a consultant follows a predetermined sequence of events in consultation or adherence to a consultation protocol." p. 37	Treatment integrity	"A second type of integrity focuses upon the degree to which the intervention plan is implemented as intended." p. 37

which the interventions or implementation strategies are similar to what was planned. It refers to the presence, number, or percentage of the components of the intervention or strategies that have been implemented.

Dosage. We found this dimension in 34 documents (see Table 5 for examples; the complete list is available from the corresponding author). This dimension represents the amount of time spent on intervention or implementation strategies. More specifically, it refers to the frequency, duration, length, intensity, and number of sessions.

Timeliness. Only two studies mentioned the timeliness dimension (see Table 6; the complete list is available from the corresponding author).

Table 4: Examples of terms and definitions of the dimension adherence

Author(s)	Year	Discipline	Term (s)	Definition
Kaderavek & Justice	2010	Department of Early Childhood, Special, and Physical Education	Procedure	"Fidelity measures should document active ingredients relative to procedure (i.e., did the interventionist follow right steps)." p. 372
Schulte et al.	2009	Psychology	Treatment delivery - Adherence	"Number of specified treatment elements delivered." p. 463
Jones et al.	2008	The Children's Hospital of Philadelphia; Clinical Psychology	Therapist adherence	"Percent of prescribed components administered; Rating of the quality of administration of prescribed components." p. 4
Rossi et al.	2004	Program Evaluation	Process evaluation; implementation assessment	"Usually, program process evaluation is directed at one or both of two key questions: . . . (2) whether its service delivery and support functions are consistent with program design specifications or other appropriate standards." p. 171

Table 5: Examples of terms and definitions of the dimension dosage

Author(s)	Year	Discipline	Term(s)	Definition
Poltawski et al.	2014	Institute for Health Research	Dose	"In rehabilitation, dose is a multi-dimensional construct, encompassing factors such as the number of repetitions of an activity, its duration and intensity level—all of which may impact upon the therapeutic effect of the activity (29)." p. 612
Dunst et al.	2013	Early intervention	How much	"How much is typically measured in terms of the frequency, amount, number, or other indicators of the dose of a practice." p. 92
Century et al.	2010	Elementary Mathematics and Science Education	Exposure and dosage	"We decided to include the specific elements of exposure and dosage (e.g., time spent, frequency of sessions) in our framework but measure them as separate critical components in the structural—procedural category." p. 207
Schulte et al.	2009	Psychology	Treatment delivery: Exposure	"Number and length of sessions; frequency with which a treatment was implemented" p. 463
Carroll et al.	2007	School of Health and Related Research	Frequency, duration, coverage	"Subcategories of adherence concern the frequency, duration, or coverage of the intervention being delivered, i.e., what is more broadly defined as "dose" in the existing literature." p. 5
Baranowski & Stables	2000	Behavioral nutrition, Children's Nutrition Research Center, Department of Pediatrics	Implementation of program: Extent	"Extent (number or amount of units delivered or provided)" p. 160

Table 6: Terms and definitions of the dimension timeliness

Author(s)	Year	Discipline	Term(s)	Definition
Schwarz et al.	2015	Psychology	Timeliness	"The three aspects of fidelity in the framework (content, coverage and dose) were complemented with a fourth aspect, namely timeliness: i.e. if the intervention is carried out at the right time." p. 197
de Vos et al.	2013	Health Policy and Management	Timeliness	"Yet, we were unable to detect any measure of timeliness in the literature . . . . Hence, we constructed dichotomous scales to capture the timing of these intervention components, i.e. (1) performed in time and (2) performed later." p. 4

Timeliness is defined by the degree to which the intervention or implementation strategies are delivered at the right time. Being provided at the right time, for example, could mean at a specific time of day (Schwarz et al., 2015). For example, the right time to implement an intervention with students could be in the morning, when they are the most focused. Being delivered at the right time could also mean providing treatment for a patient or client within a certain period of time after admission (de Vos et al., 2013) or before a specific date because the treatment would be less effective if there were to be too much waiting.

Quality. This dimension was found in 35 studies (see Table 7 for examples; the complete list is available from the corresponding author). The label *quality* was often attributed to a definition similar to those included in the broader definition of fidelity or the adherence dimension. However, the quality dimension concerns the attitudes and skills of the individuals delivering the intervention or implementation strategies. For example, such an evaluation may say that the implementer is enthusiastic, well prepared, perceived as confident (Dunst et al., 2008), takes into account the context and variables (Waltz et al., 1993), and delivers the intervention smoothly (Sussman et al., 1993).

Table 7: Examples of terms and definitions of the dimension quality

Author(s)	Year	Discipline	Term(s)	Definition
de Vos et al.	>2013	Health Policy and Management	Competence	"The competence component is more complex and focuses on the interventionist's skillfulness in the delivery of the intervention." p. 2
Dunst et al.	2013	Early intervention	How well	"How well is typically measured in terms of the use of a practice in a manner that includes or mirrors the evidence-based characteristics of a practice." p. 92
Reinke et al.	2013	Educational, School, & Counseling Psychology	Quality	"Quality refers to the preparedness, enthusiasm, attitude, and skill level of the interventionists when using the training methods, processes and learning principles employed in the original intervention model." p. 495
Schulte et al.	2009	Psychology	Quality (or competence)	"Level of skill with which treatment was implemented" p. 463
Dunst et al.	2008	Early Literacy Learning	Exposure	"Exposure also includes the extent to which the training sessions were interactive, the trainer was well prepared and enthusiastic, and the trainer was perceived as confident and capable as part of his or her attempts to communicate the content of the training." p. 3
Stein et al.	2007	Nursing	Competence	"The competence component is more complex and is focused on the interventionist's skillfulness in the delivery of the intervention." p. 54
Moos & Finney	1983	Psychiatry and Behavioral Sciences	Treatment quality	"Whereas information on treatment components taps the quantity of treatment activities, "treatment quality" refers to the manner in which such activities are conducted." p. 1038

Differentiation. We found definitions of differentiation in 15 studies (see Table 8 for examples; the complete list is available from the corresponding author). The definitions revolved around ensuring that only the planned components are used in the intervention or implementation strategies and that no components from other interventions or strategies are added. This dimension is most relevant when evaluating fidelity in a research context, where there is more than one condition to compare. For some authors (Century et al., 2010), differentiation is not considered a component of fidelity. For others (Hutsebaut et al., 2012), there is an overlap with the concept of adherence. In fact, some definitions of adherence do include this aspect when referring to components that are proscribed. For example, one definition of adherence states that "Adherence is focused on the quantity of prescribed behaviors that are delivered in a treatment session or course, and compares the quantity of generic interventionist behaviors (common across psychotherapy) and behaviors that are proscribed by the protocol" (Stein et al., 2007, p. 54).

Evaluation of this dimension is a step that comes after monitoring adherence since adherence evaluation refers to verifying the planned components. In contrast, differentiation evaluation refers to verifying whether extra components were added. In addition to being useful in the research context, this dimension can be helpful in the context of implementation evaluation. For example, if implementers are implementing more components than required, this may impact outcomes by taking away some of the time needed for the most critical required components.

Adaptation. A total of ten studies mentioned this dimension (see Table 9 for examples; the complete list is available from the corresponding author). This dimension is the opposite of adherence. In other words, it deals with how the individuals involved are not adhering to the plan, detailing adaptations made to the intervention or implementation strategies. These adaptations can be considered as negative or positive factors. It can be beneficial to adapt the intervention or strategies with the help of the implementers' professional experience, and according to the local context, the specificities, and the receivers' needs, a practice also referred to as evidence-based practice (see APA Presidential Task Force on Evidence-Based Practice, 2008; Committee on Quality of Health Care in America Institute of Medicine, 2001). However, it can be harmful if the implementers make adaptations that affect the intervention or strategies' underlying principles and theoretical bases (Schwarz et al., 2015). In both cases, it is important to document which adaptations were made in the intervention and implementation strategies so as to ensure the implementations are keeping true to the main underlying principles and theoretical bases of the intervention or strategies (Schwarz et al., 2015).

Table 8: Examples of terms and definitions of the dimension differentiation

Author(s)	Year	Discipline	Term(s)	Definition
Hulleman et al.	2013	Education; Implementation Science	Differentiation	"Differentiation—Are critical program components that differentiate treatment from control present?" p. 69
Schulte et al.	2009	Psychology	Treatment delivery: Program differentiation	"Extent to which only planned treatment elements were delivered; extent to which two comparison treatments match their underlying program theory and/or differ from one another" p. 463
Gearing et al.	2011	Social Work	Monitoring intervention delivery: Execution, Differentiation of treatments	"1) Differentiation of treatments: A. Adherence to intended core elements, B. Adherence to proscribed interventionist behaviour, C. Exclude non-proscribed components/ behaviors" p. 81
Beets	2007	Public Health	Program differentiation	"The final component of implementation is program differentiation. Program differentiation deals with assuring that control conditions (e.g., classrooms, schools, districts) are not adopting or implementing programs/curriculum of similar content and techniques as specified in the program schools." p. 11
Dane & Schneider	1998	Department of Human Development and Applied Psychology, Ontario Institute for Studies in Education	Program differentiation	"Program differentiation: a manipulation check that is performed to safeguard against the diffusion of treatments, that is, to ensure that the subjects in each experimental condition received only planned interventions." p. 45

Dimensions Related to the Receivers

Reach. There were 17 studies that discussed this dimension (see Table 10 for examples; the complete list is available from the corresponding author). Reach corresponds to the number of receivers that received the intervention or implementation strategies. This number can be compared with that of the targeted population.

Table 9: Examples of terms and definitions of the dimension adaptation

Author(s)	Year	Discipline	Term(s)	Definition
Durlak & DuPre	2008	Psychology	Adaptation	"Finally, there is adaptation, (8) which refers to changes made in the original program during implementation (program modification, reinvention)." p. 329
Fixsen et al.	2005	Maternal and Child Health/ Implementation Research	Program drift	"Program drift: Descriptions or measures of variations in a program that are stated to be undesirable or that impede the achievement of the overall goals and effectiveness of implementation site." p. 85
Sussman et al.	1993	Health Promotion and Disease Prevention	Reinvention	"Delivery fidelity is defined here as consisting of four levels of departure from ideal delivery: . . . reinvention (given that the whole curriculum was delivered, whether or not the curriculum was delivered as written) [etc.]"

Exposure. Eight studies discussed exposure (see Table 11 for examples; the complete list is available from the corresponding author). This dimension is similar to dosage. However, dosage is related to the implementers that deliver the intervention or implementation strategies, and exposure is the actual dosage received by the receivers. There may be differences between the dosage delivered, and the dosage received because of barriers to the reception, such as the absence of the receivers or the psychological state of the receivers due, for example, to personal or environmental distractions (Baranowski & Jago, 2005).

Responsiveness. A total of 29 studies mentioned responsiveness (see Table 12 for examples; the complete list is available from the corresponding author). This dimension refers to the quality of the receivers' response to the intervention or implementation strategies. Their response is qualified by their engagement, interactions, involvement, satisfaction, enthusiasm, attention, participation, attitudes, etc. The responsiveness indicates the effect of the implementers on the receivers and whether the implementers are succeeding

Table 10: Examples of terms and definitions of the dimension reach

Author(s)	Year	Discipline	Term(s)	Definition
Haynes et al.	2016	Health Policy/Public Health	Structural items	"Structural items such as participant attendance and the number, . . . are easily observed and can usually be captured numerically." p. 14
Grant et al.	2013	Quality, Safety and Informatics Research Group, Population Health Sciences, Medical Research Institute	Recruitment and reach in individuals	"Who actually receives the intervention in each setting? Are they representative?" p. 6
Durlak & DuPre	2008	Psychology	Program reach	"(7) Program reach (participation rates, program scope) refers to the rate of involvement and representativeness of program participants." p. 329
Carroll et al.	2007	School of Health and Related Research	Coverage	"Coverage may also be included under this element, i.e., whether all the people who should be participating in or receiving the benefits of an intervention actually do so." p. 2
Glasgow et al.	1999	AMC Cancer Research Center	Reach	"Reach is an individual-level measure (e.g., patient or employee) of participation. Reach refers to the percentage and risk characteristics of persons who receive or are affected by a policy or program." p. 1323

in their delivery of the intervention or implementation strategies. Responsiveness can also display the fit between the intervention or implementation strategies and the receivers, i.e., if their needs are being met.

Enactment. Nine studies included enactment as a dimension (see Table 13 for examples; the complete list is available from the corresponding author). This dimension is defined as the degree to which the receivers understand and adhere to the activities proposed by the implementers. This dimension is influenced by the receivers' characteristics, such as their abilities, skills,

Table 11: Examples of terms and definitions of the dimension exposure

Author(s)	Year	Discipline	Term(s)	Definition
Reinke et al.	2013	Educational, School, & Counseling Psychology	Exposure to Workshops	"Participant attendance and dose of workshop received" p. 497
Dabbs et al.	2011	Nursing	Receipt	"Receipt: the extent to which the intervention is received as intended" p.344
Schulte et al.	2009	Psychology	Treatment receipt: Participant exposure or dose	"Amount of the treatment received by the participant" p. 463
Jones et al.	2008	The Children's Hospital of Philadelphia; Clinical Psychology	Participant: Dosage Received	"Percent of sessions attended; Number of clinical contact hours" p. 4
Baranowski & Stables	2000	Behavioral nutrition, Children's Nutrition Research Center, Department of Pediatrics	Reach: Depth	"Reach: extent to which the program contacted or was received by the targeted group" p. 160 "Qualitative Aspect(s): Depth (aspects of components of the intervention received)" p. 160

and capacities. Like responsiveness, enactment indicates the fit between the intervention or implementation strategies and the receivers. This dimension can be informative to the implementers and help them adapt their intervention or implementation strategies to the characteristics of the receivers.

Relationships Between Levels and Dimensions

The relationships that emerged from the study of the documents are amongst the following: levels of fidelity; levels and dimensions of fidelity; and dimensions of fidelity.

Levels of Fidelity

Overall, three relationships between the two levels of fidelity were observed (e.g., Dunst et al., 2013; Lieberman-Betz, 2015). Firstly, implementation

Table 12: Examples of terms and definitions of the dimension responsiveness

Author(s)	Year	Discipline	Term(s)	Definition
Lieberman-Betz	2015	Communication Sciences and Special Education	Participant responsiveness	"Finally, participant responsiveness is a measure of engagement of the recipient of training or treatment, and can provide insight into how well-received implemented strategies are on the part of the parent and child." p. 23
de Vos et al.	2013	Health Policy and Management	Participant responsiveness	"Participant responsiveness refers to how well participants respond to, or are engaged by, an intervention." p. 8
Hulleman et al.	2013	Education; Implementation Science	Responsiveness	"Responsiveness—To what extent are participants engaged and involved in the treatment?" p. 69
Reinke et al.	2013	Educational, School, & Counseling Psychology	Engagement in Workshops	"Participant enthusiasm, attention, understanding, and participation in workshops" p. 497 (figure 1)
Keith et al.	2010	HSR&D Center for Clinical Management Research	Satisfaction	"Satisfaction represents organizational members' expressed level of enthusiasm with using the distinct components of the intervention." p. 2
Hulleman & Cordray	2009	Psychology and Human Development	Participant responsiveness	"Participant responsiveness was operationalized in two ways: (a) the frequency of responding to the instructions to write an essay, and (b) the quality of response in the essay." p. 94
Fixsen & al.	2005	Maternal and Child Health/ Implementation Research	Consumer satisfaction	"Consumer satisfaction: Descriptions or measures of the satisfaction of the clients or other direct consumers with important aspects of a program." p. 89
Hansen et al.	1991	Public Health Sciences, School of Medicine	Reception of the program	"The second component of program integrity deals with the reception of the program by the target audience." p. 569

Table 13: Examples of terms and definitions of the dimension enactment

Author(s)	Year	Discipline	Term(s)	Definition
Jones et al.	2008	The Children's Hospital of Philadelphia; Clinical Psychology	Client Participation—Participant Adherence	"Percent of homework completed; rating of participant use of prohibited techniques." p. 4
Rossi et al.	2004	Program Evaluation	N/A	"Do participants engage in appropriate follow-up behavior after service?" p. 172
Steckler & Linnan	2002	Health behavior and health education at the School of Public Health	Dose received	"The extent to which participants . . . and/or use materials or recommended resources." p. 12
Baranowski & Stables	2000	Behavioral nutrition, Children's Nutrition Research Center, Department of Pediatrics	Exposure	"Exposure: the extent to which participants viewed or read the materials that reached them" p. 160 (table 1)
			Initial use	"Initial use: extent to which a participant conducted activities specified in the materials." p. 160 (table 1)
Lichstein et al.	1994	Department of Psychology	Receipt	"However, if the patient did not (a) fill the prescription, they never received the treatment, and, . . . they may not have achieved adequate treatment exposure." p. 2
			Enactment	However, if the patient did not, . . . and (b) consume the medicine as instructed, they may not have achieved adequate treatment exposure." p. 2

fidelity directly influences intervention fidelity. Indeed, if implementation strategies are not put in place as planned, the implementation of the intervention might fall off track. For example, if coaching did not occur as planned, the implementers might have difficulty implementing the intervention with fidelity. Secondly, implementation fidelity directly (or indirectly) influences the outcomes. For example, implementation strategies such as leadership from administration might positively affect the intervention receivers, improving their health, education, or performance. Thirdly, intervention fidelity directly influences outcomes. The better the intervention is implemented, the more impact it will have on the receivers.

Levels and Dimensions of Fidelity

We observed a general trend regarding the levels and dimensions of fidelity. Each implementation and intervention fidelity level can be divided into the different dimensions of fidelity (Dunst, 2011; Dunst et al., 2008, 2013; Lieberman-Betz, 2015; Mattera et al., 2013). For example, an implementation strategy such as a workshop can be evaluated for the planned components, length, intensity, and timing. The implementers can be assessed for their quality, such as enthusiasm and preparedness when delivering the workshop. The workshop components have to be constrained to the planned components only, although the components can then be adapted to the context to ensure relevancy without compromising the core theoretical bases. The workshop should be offered to all the targeted staff who then attend as receivers. Has it been? And finally, have the receivers put into action the components of the workshop?

Dimensions of Fidelity

According to various studies, the different dimensions of fidelity can be regrouped and divided into larger and smaller categories. As mentioned earlier, some dimensions are more related to implementers and others to receivers (e.g., Beets, 2007). In addition, the different dimensions can influence each other (Beets, 2007). According to some studies, the responsiveness dimension can mediate some relationships (e.g., Beets, 2007; Lieberman-Betz, 2015). More specifically, responsiveness has been reported as a mediator of the relationship between implementation fidelity and intervention fidelity, as well as the relationship between intervention fidelity and outcomes. The quality dimension has also been described as a mediator of the relationship between fidelity and outcomes (Reinke et al., 2013). However, these dimensions are already integral parts of both implementation and intervention fidelity, and these two levels of fidelity moderate each other as well as the outcomes. Consequently, they are already acting as moderators internally with the other levels and outcomes.

We illustrated the relationships we observed in the examined documents in the integrative conceptual framework of fidelity that we developed (Figure 2). Altogether, the levels of fidelity influence each other, as well as the outcomes. The dimensions also influence each other, and the dimension of adaptation is at the center of the other dimensions because it can influence any of those other dimensions.

Discussion

This scoping review found the existing concepts, definitions, conceptualizations, facets, dimensions, conceptual frameworks, models, and theoretical

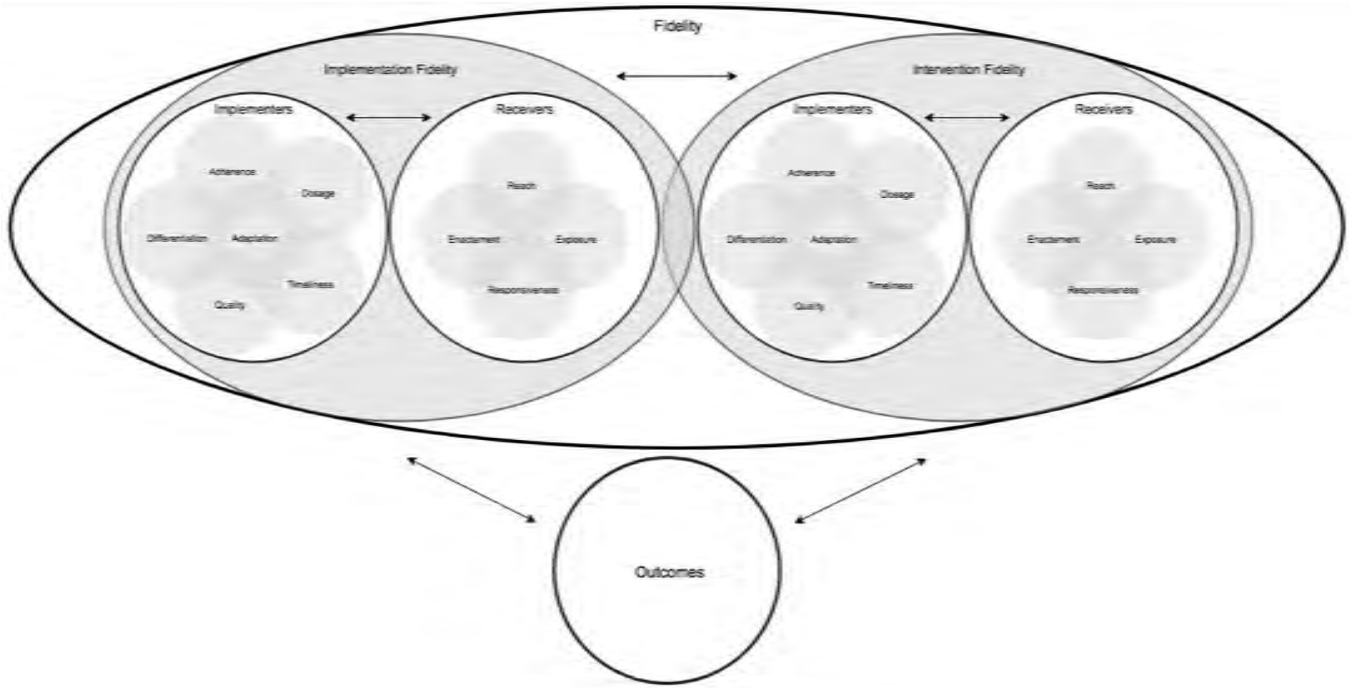

Figure 2. Integrative conceptual framework of fidelity. Conceptual framework of fidelity is divided into two main levels: implementation fidelity and intervention fidelity. Each of these levels is divided into ten dimensions, either the six implementers dimensions (adherence, dosage, timeliness, quality, differentiation, and adaptation) or the four receivers dimensions (reach, exposure, responsiveness, and enactment). The dimensions influence each other, and levels of fidelity influence each other as well as the outcomes.

models of fidelity in the context of implementation. A total of 77 documents met the inclusion criteria. The results were used to categorize all the terms for and definitions of fidelity employed within and across disciplines and create an interdisciplinary conceptual framework of fidelity to guide research and practice (Figure 2).

To our knowledge, this scoping review is the first to attempt to clarify the conceptualization of fidelity across disciplines. This scoping review is different from other reviews, as most have targeted work in specific disciplines or in a more restricted date range of publication than we did. For example, the review completed by Dane and Schneider (1998) was restricted to prevention research, and the review by Carroll et al. (2007) focused only on literature from 2002 to 2007. Another well-known review is by Fixsen et al. (2005) on the broad topic of implementation. However, this review was not specific to the conceptualization of fidelity, resulting in a limited review of that concept. The current scoping review has a broader scope than these reviews, as it includes studies from all disciplines up to 2016.

Some recognized research on fidelity was not used in this scoping review as it did not fit within the inclusion and exclusion criteria we established. For example, the framework of Power et al. (2005) did not add a new definition or conceptualization but lumped together the work of other authors. Pentz et al. (1990) and Mowbray, Holter, Teague, and Bybee (2003) also did not provide an innovative definition or conceptualization. Finally, Donabedian (1980, 1982) did not mention fidelity explicitly in his work. Instead, the work of Donabedian focuses on evaluating the quality of care. While the quality of care can overlap with fidelity, the two concepts are not the same. According to Donabedian (1980, 1982), quality of care can be evaluated with structure, process, and outcome categories. This evaluation focuses on the attributes of the settings in the structure, what practitioners and patients in the process currently do, and the effect of care on outcomes. This concept of quality of care focuses on the actual care within a setting without comparing the actual care and setting to a predetermined plan.

Some authors included in this review incorporated factors that can influence fidelity in their conceptualizations of fidelity. Factors are elements present in the context of an implementation that can affect fidelity positively or negatively. Examples of these factors include learning effect (Masterson-Algar et al., 2014), intervention complexity and facilitation strategies (Carroll et al., 2007), training (Bellg et al., 2004; Gearing et al., 2011), and resources and barriers (Baranowski & Stables, 2000), as well as context (Baranowski & Stables, 2000; Damschroder et al., 2009; Fixsen et al., 2005; Grant et al., 2013; Hasson, 2010; Haynes et al., 2016; Linnan & Steckler, 2002; McGraw et al., 1989; Saunders et al., 2005). Authors often mentioned the context, which could refer to the specific organizational environment or setting where the intervention

was being implemented or to the external organizational context such as the social, political, and economic environments. One must consider these factors when implementing or adapting interventions or implementation strategies. These factors can also help explain the results of fidelity evaluation.

The process of implementation can be evaluated at different stages, such as design or theory, adoption, recruitment, delivery, and maintenance (e.g., Baranowski & Stables, 2000; Bellg et al., 2004; Gearing et al., 2011; Glasgow & Eakin, 2000; Grant et al., 2013; Saunders et al., 2005). However, some authors included certain of these phases as integral dimensions of fidelity, particularly theory, recruitment, and maintenance. Theory refers to making sure there is a rationale regarding the intervention or implementation strategy before putting it in place. Recruitment is related to the procedures that are used to approach and attract receivers. Finally, maintenance resembles fidelity, as this phase aims to evaluate whether implementers and receivers are following the prescribed plan, though in this case, the evaluation is completed over a more extended period of time or after the initial implementation. Findings from our synthesis indicate that although these stages of implementation are not dimensions, they are phases that can help clarify at which points the fidelity evaluation should occur within the implementation process.

A strength of this integrative conceptual framework that we have developed is that it is comprehensive and applicable in all disciplines. One key finding is the need for the dimension of timeliness, which is rarely included in conceptual frameworks. Nonetheless, it can be an essential dimension of many interventions and implementation strategies. Furthermore, by dividing fidelity into two levels, this conceptual framework emphasizes the need to evaluate fidelity at both levels. It also highlights the idea that implementation fidelity must be assessed for all dimensions. This conceptual framework provides a clear distinction between implementer and receiver dimensions, which clarifies the concept of fidelity. This framework also helps clarify the conceptualization of fidelity concerning the factors and the stages of implementation.

Finally, we should note that this study brings together implementation science and interdisciplinary studies. We learned that, as an interdisciplinary field itself, implementation science can take advantage of the principles of interdisciplinary studies, particularly those that enable the integration of different perspectives, concepts, and theories from many disciplines in an interdisciplinary project. Specifically, we ourselves acted as interdisciplinarians as we completed the ten steps Repko and Szostak (2017) recommend for integrative interdisciplinary process: (1) we identified the complex problem, in our case, that of fidelity conceptualization, and defined research questions; (2) we justified the use of an interdisciplinary approach; (3) we identified relevant disciplines; (4) we completed a rigorous and structured literature

search, i.e., a scoping review; (5) we showed disciplinary adequacy by forming an interdisciplinary team: (6) we analyzed the problem and evaluated insights from each relevant discipline; (7) we identified conflicting findings; (8) we created common ground among insights using redefinition and mapping; (9) we constructed the integration we sought with our interdisciplinary conceptual framework of fidelity; and finally, (10) we reflected on and evaluated the integration.

The integration of material from various disciplines in implementation science is a challenge for all researchers and practitioners implementing research to practice. However, lessons learned from interdisciplinary studies can help implementation scientists – like the authors of this article—address complex problems (Morse, 2014). Interdisciplinary studies' methodology can help create a common language for better communication and collaboration, as well as conflict reduction within a team with members from different disciplines (Crowley et al., 2014; Laursen & O'Rourke, 2019; Pohl et al., 2019). Researchers and practitioners can better learn to cross disciplinary borders to achieve a more comprehensive understanding of complex problems and to consequently coordinate their actions to deal with them more effectively (Laursen & O'Rourke, 2019). It is also worth noting that interdisciplinarians may in turn benefit from better acquaintance with the work of implementation scientists—like that represented in this article; after all, they are themselves among the many researchers and practitioners who often have the need to evaluate fidelity in the course of their work.

Limitations

There are some limitations to the review process we undertook and have reported on here. First, even though a great effort was put into the search for all the relevant documents, it is possible that some documents might not have been found. We completed this scoping review with implementers as the primary focus in an implementation context. Therefore, studies in a context other than implementation, as, for example, those focusing only on receivers, might have been missed or excluded. Second, the quality of the studies included in this scoping review was not appraised, as scoping reviews usually do not include this step. Had quality appraisal been used as an exclusion criterion, it could have influenced the development of the conceptual framework. Third, the analysis of the diverse definitions and the categorization process were conducted within the authors' subjectivity, thus shaping the results. However, to mitigate the impact of subjectivity, the first two authors independently charted the results and met regularly and frequently to analyze and synthesize the findings.

Practical Implications

The interdisciplinary conceptual framework we have derived from our study can be applied in research and practice to assess fidelity for the purposes mentioned earlier such as evaluating the efficacy of an intervention, determining critical components of interventions or implementation strategies, and providing feedback that might improve interventions or implementation strategies and create better outcomes. In our education and health sciences examples, when the school principal and the speech-language pathologist decided to evaluate fidelity, they found out which components of the recommended interventions and implementation strategies had not been properly put in place. They then had feedback to help them improve the fidelity (i.e., adapt their interventions or implementation strategies) to obtain better outcomes. The school principal in our example might decide to offer a workshop that is better adapted to the teachers' needs and also provide them with continuous coaching to help them apply the theory in practice. In our other example, the speech-language pathologist might improve the fidelity of the intervention by increasing the frequency of sessions with the child and scheduling those sessions earlier in the day when the child will be alert and attentive.

As for the earlier example concerning our own interdisciplinary team and its efforts to improve reading instruction in schools, we were able to integrate the results of our scoping review into a common language and conceptual framework that served us well, enabling good communication and effective collaboration. Specifically, we used that interdisciplinary fidelity framework to develop fidelity instruments for the schools to use to monitor and evaluate the fidelity of the project. To develop these instruments, we first completed an extensive review of the literature on effective practices to prevent reading difficulties in children. We then used the interdisciplinary fidelity framework as a blueprint for this literature review of the essential components. We thus ensured that both the implementation and the intervention levels of the project were researched. We also made sure that we extracted all the available information from the ten different dimensions for the evaluation of fidelity in its entirety.

Conclusion

Through this scoping review, the various conceptualizations of fidelity in the context of implementation of interventions or implementation strategies to improve outcomes were synthesized into one interdisciplinary conceptual framework. With the use of this framework, fidelity can be seen as a unitary concept that can be evaluated through many levels and dimensions. This interdisciplinary framework will allow researchers and practitioners from

all disciplines to easily access, understand, and assess fidelity. A common framework for evaluating fidelity will enable consistency in terminologies and definitions used by those conducting studies, avoid confusion among those involved in studies, and facilitate the comparison of studies within and across disciplines. Future research is needed to further assess the applicability of this conceptual framework in work undertaken in different disciplines and in interdisciplinary work, as well.

Biographical Notes

Catrine Demers, S-LP and PhD, corresponding author for this article, earned her PhD in the School of Rehabilitation Sciences, Faculty of Health Sciences, at the University of Ottawa in Ottawa (Ontario), Canada. She is currently a Post-doctoral Fellow in the Department of Communication Sciences and Disorders, Faculty of Rehabilitation Medicine, at the University of Alberta in Edmonton (Alberta), Canada. She may be reached at catrine.demers@ualberta.ca.

Zoe Elizabeth Higgins, S-LP, is a PhD candidate in the School of Rural and Northern Health, Faculty of Health, at Laurentian University in Sudbury (Ontario), Canada. She may be reached at zhiggins@laurentian.ca.

Sayna Bahraini, RN and PhD, was in the School of Nursing, Faculty of Health Sciences, at the University of Ottawa in Ottawa (Ontario), Canada; she is currently Research Project Manager for the Children's Hospital of Eastern Ontario-Research Institute (CHEO-RI). She may be reached at sbahro80@uottawa.ca.

Roxanne Pelchat, S-LP and MScS, was in the Speech-Language Pathology, Faculty of Health, at Laurentian University in Sudbury (Ontario), Canada. She is currently a Speech-Language Pathologist at the Centre de services scolaire des Découvreurs. She may be reached at Roxanne.pelchat@csdecou.gc.ca.

Wendy Gifford, RN and PhD, is now Full Professor at the School of Nursing, Faculty of Health Sciences at the University of Ottawa in Ottawa (Ontario), Canada, Loyer-DaSilve Research Chair in Community and Public Health Nursing, and Co-Director of the Center for Research on Health & Nursing (CRHN). She may be reached at wgifford@uottawa.ca.

Pascal Lefebvre, S-LP and PhD, is Associate Professor in Speech-Language Pathology, Faculty of Health, at Laurentian University in Sudbury (Ontario), Canada. He may be reached at plefebvre2@laurentian.ca.

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