

Editorial Manager(tm) for Nursing Research  
Manuscript Draft

Manuscript Number: NRES-D-10-00261

Title: An Intervention Fidelity Framework for Technology-Based Behavioral Interventions

Article Type: Original Article

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Manuscript Region of Origin: UNITED STATES

Abstract: Background: despite the proliferation of technology-based behavioral interventions, descriptions of the unique considerations for evaluating intervention fidelity are lacking.

Objectives: 1) discuss how technology-based behavioral interventions challenge conventions about how fidelity is conceptualized and evaluated, 2) present an intervention fidelity framework for technology-based behavioral interventions, and 3) present the plan for monitoring the intervention fidelity of Pocket PATH® (Personal Assistant for Tracking Health), a mobile health technology designed to promote self-care behaviors after lung transplantation, as an exemplar.

Methods: discourses related to intervention fidelity and technology acceptance were used to explore the issues that are unique to fidelity of technology-based behavioral interventions.

Results: an intervention fidelity framework and an exemplar intervention fidelity monitoring plan for technology-based behavioral interventions were developed.

Conclusions: the resultant framework has the potential to guide the development of implementation fidelity monitoring tools for other technology-based behavioral interventions.

Running head: FIDELITY OF TECHNOLOGY-BASED BEHAVIORAL INTERVENTIONS

An Intervention Fidelity Framework for Technology-Based Behavioral Interventions

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Key words: treatment fidelity, technology acceptance, behavioral intervention studies

Acknowledgement: Funding source, NIH, NINR NR010711 (DeVito Dabbs, PI)

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13 implementation fidelity monitoring tools for other technology-based behavioral interventions.  
14

## 1 Introduction

2           Despite the proliferation of technology-based behavioral interventions and the growing  
3 recognition of the importance of evaluating intervention fidelity (the extent to which an  
4 intervention is given as conceived and planned) (Dusenbury, Brannigan, Falco & Hansen, 2003),  
5 descriptions of the unique considerations for evaluating fidelity of technology-based behavioral  
6 interventions are lacking. The discourses related to intervention fidelity and technology  
7 acceptance offer insight and practical guidance. The purposes of this paper are to: 1) discuss  
8 ways in which technology-based behavioral interventions challenge conventions about how  
9 fidelity is conceptualized and evaluated, 2) respond to those challenges by explaining how the  
10 intervention fidelity and technology acceptance literature informed the development of an  
11 intervention fidelity framework for technology-based behavioral interventions and 3) present the  
12 resulting plan for monitoring the intervention fidelity of Pocket PATH<sup>®</sup> (Personal Assistant for  
13 Tracking Health), a mobile health technology designed to promote self-care behaviors after lung  
14 transplantation, as an exemplar.

### 15 Intervention Fidelity

16           Since the early 1990's, there has been a call for a more rigorous, comprehensive approach  
17 to intervention fidelity assessment that incorporates multiple informants and multiple methods of  
18 measurement and analysis (Dane & Schneider, 1998; Gresham, MacMillan, Beebe-  
19 Frankenberger & Bocian, 1993; Song, Happ & Sandelowski, 2010). According to the revised  
20 CONSORT statement for reporting randomized trials (Moher, Schulz & Altman, 2001), ensuring  
21 a reliably delivered intervention is central to the integrity of research findings. However,  
22 systematic evaluation of intervention fidelity is often difficult, particularly for complex  
23 interventions (Carroll, Patterson, Wood, Booth, Rick & Balain, 2007; Santacroce, Maccarelli &

1 Grey, 2004; Song et al 2010). Furthermore, the lack of theoretical and practical guidance is  
2 regarded as a strong barrier to evaluating intervention fidelity (Perepletkhikova, Hilt, Chereji, &  
3 Kazdin, 2009).

4 Technology-based behavioral interventions use information and communication  
5 technology applications to promote behavioral outcomes (Poelmans, Wessa, Milis, Bloemen &  
6 Doom, 2008). Despite their proliferation, no reports were found that described the unique  
7 considerations for fidelity of technology-based behavioral interventions or the evaluative  
8 procedures employed, and there are substantial issues to deal with here. First, the term  
9 intervention fidelity is neither defined nor applied consistently. Second, the belief that methods  
10 of evaluating intervention fidelity can be uniformly applied to all interventions fails to account  
11 for the technological elements (i.e., features and interfaces) and theoretical elements of  
12 technology-based behavioral interventions. Third, the steps to ensure system quality of the  
13 technological application itself (i.e., its stability, reliability, functionality, usability etc) may be  
14 confused with strategies to promote intervention fidelity. Fourth, the intended outcomes of  
15 technology-based behavioral interventions, such as adoption and enactment of behaviors, may be  
16 conflated with components of intervention fidelity. A final consideration is the limited  
17 understanding of the social construction of technology (how technology is embedded in its social  
18 context), and the role that human factors play in technology acceptance. The latter are perhaps  
19 most germane to this discussion, since they determine the degree to which a technology-based  
20 behavioral intervention will be adopted.

21 Two areas of discourse helped explore these unique considerations and develop a  
22 technology-specific framework of intervention fidelity: 1) the recent emphasis on evaluating  
23 intervention fidelity and thus the ability to draw conclusions about intervention efficacy and 2)

1 the emergence of the theoretical model of technology acceptance that explains variance among  
2 intended users in achieving the desired outcomes of technology-based behavioral interventions.

### 3 *Defining Intervention Fidelity*

4 Intervention fidelity is defined and applied differently, leading to confusion about its  
5 meaning and strategies to evaluate and enhance it (Song, et al 2010). Terms such as treatment  
6 fidelity, intervention fidelity, procedural integrity, and intervention integrity are often used  
7 interchangeably to mean the degree to which interventions are delivered as conceived and  
8 planned (Dumas, Lynch, Laughlin, Phillips & Prinz, 2001; Dusenbury et al., 2003; Leff,  
9 Hoffman & Gullan, 2009; Moncher & Prinz, 1991; Perepletchikova & Kazdin, 2005, Santacrocce  
10 et al., 2004, Stein, Sargent & Rafaels, 2007). When fidelity is defined with the focus solely on  
11 intervention delivery, evaluation of intervention delivery alone is typically the cornerstone and  
12 thought to be a sufficient measure of fidelity because of the notion that variation of the  
13 intervention occurs only by the interventionist(s). Measurement of delivery typically includes  
14 assessing whether all the intervention components and activities were actually delivered and  
15 were they implemented in the proper manner. In traditional interventions, for example, cognitive  
16 behavioral therapy or motivational interviewing, the interventionist typically determines delivery  
17 (Waltz, Addis, Koerner & Jacobsen, 1993). However, in technology-based behavioral  
18 interventions, because intervention delivery and receipt are reciprocal, participants' receipt of the  
19 intervention determines the completion of the intervention delivery-receipt process.  
20 Measurement of fidelity for technology-based behavioral interventions therefore extends beyond  
21 delivery to include what happens after the technology is introduced to the participant (delivery)  
22 and the participant receives the intervention (receipt).

23 Other authors have extended the definition of intervention fidelity beyond delivery to

1 include an assessment of other components that influence the fidelity with which an intervention  
2 is delivered, such as participant responsiveness and engagement (Carroll et al., 2007;  
3 Perepletchikova, Treat & Kazdin, 2007; Song, et al., 2010) or components that enhance trial  
4 integrity and replication, such as design (e.g., theoretical framework, length of contact, number  
5 of contacts, duration of contact over time) and training (e.g., procedures for training across  
6 providers, measurement of skill acquisition and maintenance of skill overtime) (Bellg, et al.,  
7 2004; Burgio, et al., 2001; Dane & Schneider, 1998; Lichstein, Riedel & Grieve, 1994), although  
8 even these components are not consistently defined.

9 We chose to adopt the more comprehensive definition of intervention fidelity by Carroll  
10 (2000) "...as the degree to which the intervention implementation process is an effective  
11 realization of the intervention as planned..." (p. 1). This broader definition is preferred because  
12 it extends beyond mere delivery and receipt and allows for the inclusion of additional  
13 components of importance to the fidelity of technology-based behavioral interventions, such as  
14 the human factors that account for technology acceptance, known predictors of intention to use  
15 and adopt a technology.

### 16 *Evaluating Intervention Fidelity*

17 The belief that methods for evaluating intervention fidelity can be uniformly applied  
18 to all interventions fails to recognize the need for customization. Song and colleagues (2010)  
19 established that evaluating treatment fidelity of complex interventions is challenging due to their  
20 dynamic and highly individualized nature and must be carefully integrated into the intervention  
21 studies. Because technology-based behavioral interventions are often dynamic (e.g., the  
22 intervention relies on an interplay between participant and technological application or interface)  
23 and lend themselves to individualization (e.g., applications can be programmed to respond to

1 various participant characteristics or patterns of use), elements associated with such  
2 characteristics need to be evaluated accordingly. Unlike the delivery of pharmacotherapy,  
3 technology-based behavioral intervention effects are not only a function of how many elements  
4 were delivered (i.e., dose) but also a function of how elements were delivered (quality) and the  
5 type and quality of interactions between the participant and technology. Yet, uncertainty exists  
6 about how to account for the use of technology. When the technology is considered an essential  
7 and distinct element of the intervention, as is the case for example for a technology-based  
8 behavioral intervention that includes interplay between the participant and the technology (e.g.,  
9 automated decision-support features react to participants' input to generate prompts  
10 recommending that participants perform certain actions), the technological element should be  
11 measured and quantified. Alternatively, for other technology-based behavioral interventions the  
12 technology may merely serve as a platform or vehicle, and would therefore not be considered a  
13 distinct element of the intervention.

#### 14 *Confusion between System Quality and Fidelity*

15 Implementation of an intervention can vary at any stage of the process (delivery,  
16 receipt, acceptance, etc), hence the need to evaluate all components that have the potential to  
17 vary aspects of its fidelity. System quality or the quality of the technological system used for the  
18 intervention (e.g., usability, functionality, and reliability) on the other hand should not vary,  
19 having been methodically attended to during the intervention design phase before the  
20 technology-based behavioral intervention is implemented. The methods used to ensure the  
21 quality of the technological system prior to its introduction to participants e.g., applying  
22 principles of user-centered design (DeVito Dabbs, Myers, et al., 2009) and following industry  
23 standards for reliability and security), are distinct from the methods to promote intervention

1 fidelity. Because system quality is essential for the usability and functionality of technology-  
2 based behavioral interventions and therefore considered a constant, it is not an element of  
3 intervention fidelity.

#### 4 *Conflating Intended Outcomes and Fidelity*

5 Adoption is defined as the extent to which the individual participant uses the technology-  
6 based behavioral intervention. It is akin to terms such as intervention usage, utilization and  
7 intervention dose, and should not be confused with the use of the term for describing diffusion of  
8 innovations (how new ideas and technologies spread among groups) (Rogers, 1983). Enactment  
9 is defined as the extent to which the participant performs the behaviors that the technology-based  
10 behavioral intervention is intended to promote (e.g., follow an exercise regimen, monitor health  
11 indicators, etc). Since adoption moderates the relationship between the intervention and  
12 treatment effects (enactment), it is important to quantify both to determine the strength by which  
13 one can conclude that the intended outcomes were indeed due to the use of intervention. Since  
14 neither adoption nor enactment are measures of how well the intervention was delivered as  
15 conceived and planned, they are not included as components of intervention fidelity.

#### 16 *Social Construction of Technology*

17 Social construction of technology theorists argue that the ways a technology is used cannot  
18 be understood without understanding how that technology is embedded in its social context  
19 (Bijker, Hughes & Pinch, 1987). According to social constructivists, technology is viewed not  
20 merely in terms of its inputs and outputs, for which one need not understand anything about what  
21 goes on inside (Winner, 1993). Nor can the definition of technology be reduced to instruments  
22 that merely perform functions (Pinch & Bijker, 1987). Furthermore, human factors literature  
23 (Dixon, 1999; Goodhue, 1995) purports that the meanings people attach to a particular

1 technology and its uses can vary widely. Therefore, it is important to account for human factors  
2 (i.e., an individual's perspective about the acceptability of technology) when evaluating  
3 intervention fidelity of technology-based behavioral interventions. Pereplechikova & Kazdin  
4 (2005) identified the importance of participants' acceptance of an intervention, yet the relevance  
5 of technology acceptance theory to intervention fidelity has received little attention in spite of its  
6 potential to uniquely influence fidelity of a technology-based behavioral intervention and thus  
7 have profound effects on the outcomes that are intended.

#### 8 Beyond Delivery: Technology Acceptance and Intention to Use

9 Measuring fidelity of delivery alone is particularly inadequate with technology-based  
10 behavioral interventions because human factors are known to influence and increase variability  
11 across all components of implementation fidelity including technology receipt, acceptance,  
12 adoption and enactment. For technology-based behavioral interventions to be successful in  
13 achieving intended behavioral outcomes, it is essential to address the human factors that  
14 influence technology acceptance and include these in the evaluation of intervention fidelity. For  
15 the intervention implementation to be realized as planned, the emphasis must extend beyond  
16 'was the intervention delivered as planned' (i.e., delivery) and 'can people demonstrate how to  
17 use a technology-based behavioral intervention' (i.e., receipt), to 'do people perceive the  
18 technology to be useful and easy to use' (i.e., acceptance) and 'do they intend to use a  
19 technology-based behavioral intervention' (i.e., intention), and most importantly, 'do they use  
20 and understand it in the intended way?' A variety of strategies have been employed to evaluate  
21 the fidelity of delivery and receipt, and less attention paid to technology acceptance and  
22 intention, the moderators (variables that affect the relationship) between technology adoption and  
23 enactment. Yet these moderators are important to evaluate for technology-based behavioral

1 interventions because it is only by making a comprehensive evaluation of the fidelity with which  
2 an intervention has been implemented and accepted that a viable assessment can be made of the  
3 contribution of the intervention to outcomes such as adoption (actual usage) and enactment (the  
4 effect on performance of intended behaviors).

5         The Technology Acceptance Model (TAM) (Davis, 1989) is parsimonious with concepts  
6 that are well grounded and measures that are standardized, reliable and valid (Poelmans, et al.,  
7 2008). The primary strength of the TAM is that it was specifically developed to predict and  
8 explain human behavior by measuring behavioral beliefs about technology, such as ‘ease of use’,  
9 ‘usefulness’ and ‘intention to use.’ The TAM posits that perceptions of usefulness (the degree to  
10 which a user believes that using the technology will enhance his/her performance) and  
11 perceptions about ease of use (the degree to which the user believes that using the technology  
12 will be free of effort) have a significant impact on a user’s intention to use the technology and, in  
13 turn, ultimately predict actual adoption of a technology (Davis, Bagozzi & Warshaw, 1989;  
14 Taylor & Todd, 1995). It is robust and has been used across different settings and information  
15 systems, and demonstrated that an individual’s acceptance of the technology is a strong predictor  
16 of future adoption. Although the TAM has its roots in theories that identify the characteristics of  
17 technology that influence user adoption (Moore & Benbasat, 1991; Rogers, 1983; Tornatsky &  
18 Klein, 1982) and determine social behavior (Ajzen, 1985; Feldman & Lynch, 1988), the concept  
19 of technology acceptance has received little attention among researchers involved in designing  
20 and testing technology-based behavioral interventions.

21         As previously pointed out by Carroll (2007), the uptake of an intervention (adoption of  
22 technology) depends on acceptance by and acceptability to those receiving it. Therefore, including  
23 measures of technology acceptance in the evaluation of intervention fidelity of technology-based

1 behavioral interventions is crucial because the research subjects must first accept the technology before  
 2 they intend to use it (adopt) to assist them to enact the intended health behaviors. This is particularly  
 3 important for research trials where it is not at all unusual for intervention utilization to be compromised  
 4 by low retention and rendered inconsistent by variability among the subjects in their level of  
 5 participation. Individuals' perceptions of technology acceptance influence their intention to use the  
 6 technology. In this sense, intention to use a technology is similar to what in the evaluation literature has  
 7 been termed 'reaction evaluation' (i.e., a measure of how far participants respond to or are engaged by  
 8 an intervention) (Kilpatrick, 1967). Thus, intention to use the technology moderates the relationship  
 9 between quality of the delivery-receipt and the proximal outcome of adoption (actual usage), which  
 10 ultimately mediates enactment (performance of the intended health behaviors). Measuring the degree of  
 11 technology acceptance allows researchers to differentiate its effects on various components of  
 12 implementation fidelity, including: delivery, receipt, and ultimately adoption and enactment.

### 13 Intervention Fidelity Framework for Technology-Based Behavioral Interventions

14 Implementation of a technology-based behavioral intervention can vary at any stage of the  
 15 process (delivery, receipt, acceptance, and intention to use), hence the need to evaluate all  
 16 potentially variable aspects of its fidelity. The proposed intervention fidelity framework (Figure  
 17 1) purports that:

- 18 1. Intervention fidelity extends beyond delivery to include receipt and technology  
 19 acceptance, (perceived ease of use, perceived usefulness, attitudes toward use, and  
 20 intention to use).
- 21 2. There is a reciprocal relationship between delivery and receipt, (i.e., qualities of delivery  
 22 affect receipt and vice versa).
- 23 3. Human factors (technology acceptance), moderate the relationship between

1 delivery/receipt and ultimate adoption (use of technology).

2 The concepts included in the model of intervention fidelity for technology-based  
 3 behavioral interventions (delivery, receipt, technology acceptance) are universal, yet the  
 4 information to monitor and the types of data available are intervention specific. As an exemplar,  
 5 below we describe the plan for monitoring the intervention fidelity of Pocket PATH<sup>®</sup> (Personal  
 6 Assistant for Tracking Health).

7 Exemplar: Evaluating Intervention Fidelity of Pocket PATH<sup>®</sup>

8 Pocket PATH<sup>®</sup> is a mobile health application with customized data recording, trending,  
 9 and decision-support programs to promote active involvement of patients in self-care after lung  
 10 transplantation (DeVito Dabbs, Dew, et al., 2009). Our multi-dimensional plan to evaluate  
 11 intervention fidelity of the Pocket PATH<sup>®</sup> intervention includes: 1) evaluating intervention  
 12 delivery using audio-tapes of training sessions to assess interventionist's adherence, and real-  
 13 time observations of training sessions to assess interventionist's competence, (2) evaluation of  
 14 participant receipt using data from device logs to assess appropriateness of screen usage and  
 15 navigation sequences during training and return demonstrations; 3) assessment of technology  
 16 acceptance using audio-tapes and observations of training sessions to assess the level of  
 17 participants' engagement and self-reported perceptions of ease and usefulness, attitude toward  
 18 use and intention to use. Definitions and measures for evaluating intervention fidelity of the  
 19 Pocket PATH<sup>®</sup> intervention are shown in Table 1. It is important to note, that the concepts of  
 20 adoption and enactment are included in the table for completeness but are not considered to be  
 21 components of intervention fidelity.

22 *Measures of Technology Acceptance*

23 The Perceived Usefulness (PU) and Perceived Ease of Use (PEU) scales are used to

1 measure the construct of technology acceptance (Davis, et al., 1989). The two scales are  
2 administered after the intervention has been delivered and the user has demonstrated receipt, but  
3 before users have any significant experience with the system. Each scale is self-administered and  
4 comprised of 4 items that use Likert type responses from very likely to very unlikely. The scales  
5 have been empirically validated and found to be robust in assessing acceptance of technologies  
6 for a variety of different tasks, are parsimonious (strongly grounded in existing theory), easy to  
7 administer, and demonstrate desirable psychometric properties. They were deemed internally  
8 consistent (Cronbach's alpha coefficients of 0.90-0.92); confirmatory factor analysis revealed all  
9 reliability for all scales were greater than .80, all factor loadings exceeded .7, and statistically  
10 significant relationships in the predicted direction between PEU and PU ( $p < .001$ ) provide  
11 evidence of the scales' construct validity (Morris & Dillon, 1997). PU and PEU are powerful  
12 predictors of an individual's intention to use a system, which subsequently predicts the extent to  
13 which the participant uses the system (adoption) and performs the behaviors the technology is  
14 intended to promote (enactment).

15 Monitoring and evaluating intervention fidelity of Pocket PATH<sup>®</sup> is challenging, but  
16 essential to ensure that the intervention is delivered consistently, to explain study findings, draw  
17 accurate conclusions about treatment efficacy, increase internal validity (replication), external  
18 validity (generalizability), and translate interventions into practice. In order to account for  
19 variation in the degree of fidelity between various components of the model, data for each  
20 component are measured and analyzed.

## 21 Conclusions

22 While a variety of models and definitions of intervention fidelity have been proposed, an  
23 assessment of the human factors that influence technology acceptance is an important, yet

1 overlooked dimension of fidelity for technology-based behavioral interventions. The Technology  
2 Acceptance Model offers a theoretically grounded approach to the study of the acceptability of  
3 technology-based behavioral interventions, yet to our knowledge, this is the first paper to suggest  
4 that technology acceptance be included as a component of intervention fidelity. We developed an  
5 intervention fidelity framework to guide the development of multi-component plan to evaluate  
6 intervention fidelity for the Pocket PATH<sup>®</sup> project. The exemplar illustrates the components of  
7 the framework, how each is measured and how the data regarding fidelity are used to draw  
8 conclusions about the consistency, validity, and effectiveness of the Pocket PATH<sup>®</sup> intervention.  
9 The proposed framework has the potential to guide the development of implementation fidelity  
10 monitoring tools for other technology-based behavioral interventions. While the fidelity  
11 evaluation of Pocket PATH<sup>®</sup> is still underway, the plan was deemed feasible, practical to  
12 implement and showed utility in assessing interventionists' delivery and participants' acceptance  
13 of the technology-based behavioral intervention. Further application of this framework to the  
14 evaluation of intervention fidelity for a variety of technology-based behavioral interventions is  
15 warranted. Wider use will allow for a better understanding of the role that technology acceptance  
16 plays in adoption and thus enactment of the behaviors that technology-based behavioral  
17 interventions are intended to promote.

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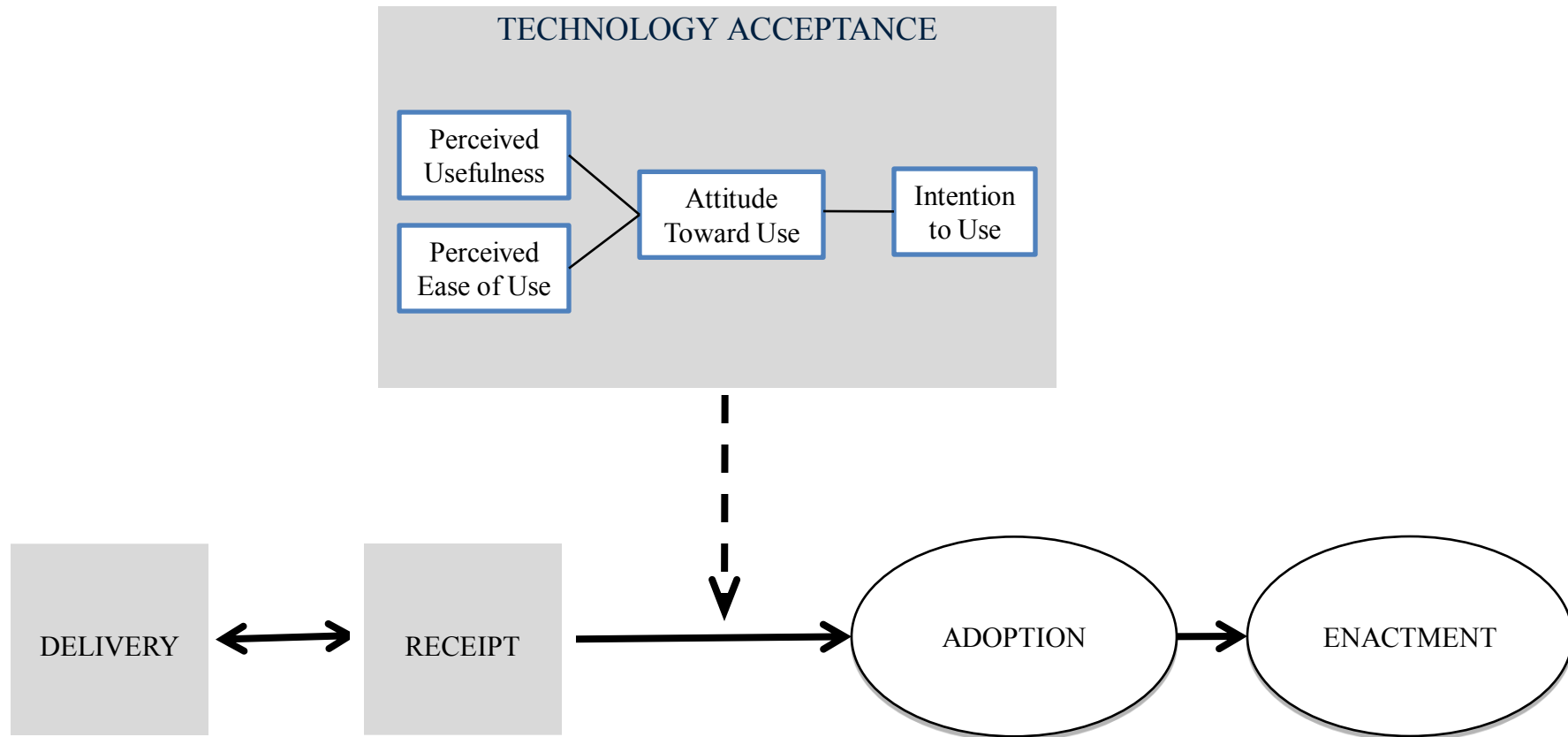
Figure legend

FIGURE 1.

INTERVENTION FIDELITY FRAMEWORK  
FOR TECHNOLOGY-BASED BEHAVIORAL INTERVENTIONS

\*Figure 1 footnote: The concept of adoption and enactment are included in the table for completeness but are not considered to be components of intervention fidelity

**FIGURE 1.**  
**INTERVENTION FIDELITY FRAMEWORK**  
**FOR TECHNOLOGY-BASED BEHAVIORAL INTERVENTIONS**



Note: Shaded areas reflect the components of intervention fidelity

Table 1. Definitions and Measures for Evaluating Intervention Fidelity of Pocket PATH<sup>®</sup> Intervention

Component	Measurement	Data Source	Items
Delivery: the extent to which the intervention is delivered as intended	Content fidelity (quantity)	Audio-tapes of Pocket PATH training session	<ul style="list-style-type: none"> <li>Interventionist's adherence: percent of prescribed behaviors performed</li> </ul>
	Process fidelity (quality)	Observations of Pocket PATH training session	<ul style="list-style-type: none"> <li>Interventionist's competence: quality ratings of skill performing prescribed behaviors</li> </ul>
Receipt: the extent to which the intervention is received as intended	Content fidelity (quantity)	Device logs of Pocket PATH training session	<ul style="list-style-type: none"> <li>Participant's adherence: percent of prescribed behaviors demonstrated</li> </ul>
	Process fidelity (quality)	Audio-tapes of Pocket PATH training session	<ul style="list-style-type: none"> <li>Participant's competence: quality ratings of skill demonstrating prescribed behaviors</li> </ul>
	Satisfaction with delivery-receipt process	After Scenario Questionnaire	<p>Overall, I am satisfied with:</p> <ul style="list-style-type: none"> <li>...the ease of completing the tasks in this scenario</li> <li>...the amount of time it took to complete the tasks</li> <li>...the amount of support I got to complete the tasks</li> <li>Strongly agree---strongly disagree</li> </ul>
Technology Acceptance: the extent to which the participant has positive perceptions, attitude and intention to use a system	Participant beliefs that using system will enhance performance	Perceived Usefulness Scale	<ul style="list-style-type: none"> <li>Using Pocket PATH would enable me to improve performance of tracking my health information</li> <li>Using Pocket PATH would increase productivity of tracking my health information</li> <li>Using Pocket PATH would increase</li> </ul>

	Participant's beliefs that using system will be free from effort	Perceived Ease of Use Scale	<p>effectiveness of tracking my health information</p> <ul style="list-style-type: none"> <li>• I would find Pocket PATH useful for tracking my health information</li> <li>• Learning to operate Pocket PATH would be easy for me</li> <li>• I would find it easy to get Pocket PATH to do what I want it to do</li> <li>• It would be easy for me to become skillful at using Pocket PATH</li> <li>• I would find Pocket PATH easy to use</li> </ul>
Attitude: the extent to which the participant views a system positively	Participant's positive attitude toward using system	Attitude Toward Use Scale	<p>All things considered, using Pocket PATH to track my health information is:</p> <ul style="list-style-type: none"> <li>• very wise - - very foolish</li> <li>• very negative - - very positive</li> <li>• very harmful - - very beneficial</li> <li>• very good - - very bad</li> </ul>
Intention: the extent to which the participant intends to use the system	Participant's intention to use a system	Intention to Use Scale	<p>I intend to use Pocket PATH to track my health information.</p> <ul style="list-style-type: none"> <li>• strongly agree - - strongly disagree</li> </ul>
*Adoption: the extent to which the participant uses the system (dose)	Quantity of system usage	Device utilization logs	<ul style="list-style-type: none"> <li>• the types of Pocket PATH features participant accesses and uses</li> <li>• the frequency and duration participant accesses and uses Pocket</li> </ul>

Fidelity of Technology-Based

	Quality of system usage	Device utilization logs Progress notes	PATH features <ul style="list-style-type: none"> <li>the features participant accesses and uses in relation to his condition changes</li> </ul>
*Enactment: the extent to which the participant performs intended behaviors	Performance of Intended Self-Care Behaviors:	Performing self-monitoring: device logs  Adhering to regimen: Health Habits Survey  Communicating with clinician about condition: review of progress notes	<ul style="list-style-type: none"> <li>the frequency with which the participant tracks data and reviews logs/graphs</li> <li>percentage of adherence to elements of the medical regimen</li> <li>frequency and appropriateness of participant initiated communication to clinician</li> </ul>

\*Note: The concept of adoption and enactment are included in the table for completeness but are not considered to be components of intervention fidelity