Assessment
2015, Vol. 22(6) 704–714

DOI: 10.1177/1073191114561254
asm.sagepub.com
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Perceived Characteristics of Intervention Scale: Development and Psychometric Properties

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Abstract

The Perceived Characteristics of Intervention Scale (PCIS), a 20-item assessment measure, was developed to assess health care providers' views of interventions. Two hundred and fifteen Department of Veterans Affairs' residential treatment providers from 38 programs across the United States completed an online survey that included the PCIS as well as self-reported use of two evidence-based treatments. The PCIS was anchored to ask about two evidence-based psychotherapies for posttraumatic stress disorder, prolonged exposure, and cognitive processing therapy. The PCIS is a reliable measure of perceived characteristics of interventions, with some preliminary support for its validity. Consideration of providers' perceptions of particular evidence-based treatments may serve as an aid to improve their dissemination, implementation, and sustained use.

Keywords

implementation, dissemination, evidence-based treatment, provider attitudes, posttraumatic stress disorder

Implementation of evidence-based treatments (EBTs) is a national public health priority (U.S. Department of Health and Human Services, 2006). Although extensive data from randomized controlled trials exist supporting the efficacy of various treatments, there is minimal adoption of these interventions in community practice. Numerous theoretical and practical models exist to explain the dissemination and implementation of EBTs into routine clinical care and all of them note that attention needs to be paid to key stakeholders, most important on the potential adopter (e.g., Durlak & DuPre, 2008; Fixsen, Naoom, Blase, & Friedman, 2005; Greenhalgh, Glenn, Bate, Macfarlane, & Kyriakidou, 2005).

Research has shown that providers' perceptions of an intervention may act as a barrier or facilitator to its implementation (Aarons, 2006; Henggeler et al., 2008; Jensen-Doss, Hawley, Lopez, & Osterberg, 2009). For example, awareness of provider perceptions of EBTs is relevant to facilitation of treatment dissemination, implementation, and sustainability within organizations. Provider perceptions may influence whether they are willing to try these treatments, how these treatments get presented to clients, and provider willingness to continue to use these treatments if treatment difficulties arise (e.g., temporary exacerbation of symptoms).

Provider perceptions of treatment are not often examined in dissemination and implementation studies. However, assessing the attitudes of front-line providers may improve training and consultation in EBTs as well as help understand where treatments may require modification. For example, knowing that providers do not see a treatment as compatible with their existing practices, see it as potentially provoking symptom exacerbation in patients, can allow for the trainers and consultants to address these issues upfront. Therefore, psychometrically sound measures of providers' attitudes can likely assist and enhance the implementation of EBT process. Indeed, recently, Chaudoir, Dugan, and Barr (2013) explained that a current methodological barrier to implementation science is the lack of identifiable measures of relevant constructs, including provider perceptions toward EBTs.

Over the past decade, several measures have been constructed to measure mental health care providers' attitudes toward EBTs (e.g., Aarons, 2004; Addis & Krasnow, 2000; Becker & Jensen-Doss, 2013; Borntrager, Chorpita, Higa-McMillan, & Weisz, 2009; Jensen-Doss et al., 2009; Stumpf, Higa-McMillian, & Chorpita, 2009). Some have focused on

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specific interventions (e.g., knowledge and positivity toward computer-assisted therapies and belief that one can execute the intervention; Becker & Jensen-Doss, 2013), or populations (e.g., provider knowledge of various evidence-based and nonevidence-based techniques for four prevalent childhood problem areas; Stumpf et al., 2009). Other investigators have measured attitudes toward treatment manuals (Aarons, 2004) or EBTs more generally (Borntrager et al., 2009; Jensen-Doss et al., 2009). The majority of these measures, however, were developed without direct connection to an evidence-based theoretical framework (Chaudoir et al., 2013), and with some exceptions (the Evidence-Based Practice Studies Scale [EBPAS]; Aarons, 2004), have had minimal analysis of psychometric properties.

Evidence suggests that general attitudes may be very different from attitudes toward or perception of a specific EBT. A provider may be generally open to trying new practices and value research-based interventions but find a particular EBT unappealing for a host of reasons. For example, in one study, trauma professionals (the majority of whom were psychologists) completed the EBPAS as well as a survey about their use of EBTs for posttraumatic stress disorder (PTSD; Gray, Elhai, & Schmidt, 2007). Although the overwhelming majority of participants were favorably disposed to using empirical research to inform their clinical work, less than a quarter used the treatments found to be efficacious in randomized controlled trials, namely exposure-based cognitive–behavioral interventions. This is consistent with other research that indicates that providers are not using trauma-focused EBTs for PTSD, despite a stated preference for EBTs generally (Becker, Zayfert, & Anderson, 2004; Sprang, Craig, & Clark, 2008). A potential reason for this discrepancy is that the EBPAS does not measure perceptions of specific interventions that have been identified as potential predictors of adoption by implementation theorists.

In 2007, the U.S. Department of Veterans Affairs (VA) established national initiatives to provide training and consultation in two EBTs for PTSD (Karlin et al., 2010), prolonged exposure (PE; Foa, Hembree, & Rothbaum, 2007) and cognitive processing therapy (CPT; Resick & Schnicke, 1993). In brief, PE is a trauma-focused individual therapy covering 8 to 15 sessions. PE exposes patients to trauma-related situations that are objectively safe but typically avoided by patients due to trauma-related distress (in vivo exposure) and to trauma memories through repeated recounting out loud of the details of the most disturbing event (imaginal exposure). CPT is a 12-session trauma-focused treatment that can be delivered in group, individual, or combined format. CPT focuses on the relationship between unhealthy thinking patterns related to trauma, by teaching more adaptive ways of thinking.

Despite the apparent appropriateness of these treatments, only a limited number of veterans with PTSD currently receive PE or CPT, and this is especially true in outpatient clinics (Mott et al., 2014; Shiner et al., 2013). Furthermore, when patients do receive these EBTs, it may not be at a sufficient therapeutic dose to constitute a full course (Mott et al., 2014; Shiner et al., 2013). Namely, only 6.3% of outpatients admitted to New England area VA PTSD clinics received at least one session of PE and/or CPT and, of those, the mean number of EBT sessions received was only six (Shiner et al., 2013). Data on the use of EBTs in residential settings, however, appear more promising (Cook, Dinnen, Thompson, Simiola, & Schnurr, 2014).

One theory-based model that might be helpful in assisting in the development of a provider attitudes measure toward specific EBTs is Rogers's (1962, 2003) *Diffusion of Innovations.* Studied in over 13 distinct research traditions (e.g., medicine, public health), the original model posited that there are five facets of such perceptions: relative advantage, compatibility, low complexity, observability, and trialability. Additional proposed perceived characteristics include: potential for reinvention, risk, task issues, nature of the knowledge required for use, and augmentation/technical support (Greenhalgh et al., 2005). A great deal of empirical investigation has focused on this aspect of Rogers's model, and examined the role of adopters' perceptions on characteristics of innovations and uptake of innovations (for review, see Greenhalgh et al., 2005).

Rogers (1995, p. 208) hypothesized that these attributes are empirically linked but conceptually distinct. However, neither Rogers nor Greenhalgh and colleagues proposed a specific factor structure for the characteristics; their descriptions are consistent with a unidimensional model, a correlated traits model, or a hierarchical second-order model. In other words, there is no clear theoretical guidance for whether to construe these perceived attributes as representing a single dimension, or multiple dimensions (and if so, how many dimensions).

Additionally, few investigators have examined the intercorrelations among these attributes. For example, an early meta-analysis of research in the manufacturing industry identified only three studies out of 75 studies that examined the intercorrelations of these variables (Tornatzky & Klein, 1982). More recent research has only rarely examined intercorrelations among the attributes, focusing instead on factor analysis within attributes (Van Slyke, Lou, & Day, 2002), or on a very small subset of the attributes (e.g., Völlink, Meertens, & Midden, 2002). There were no recent examinations of these intercorrelations in mental health care, or for that matter, in health care more generally. The EPBAS, as noted earlier, has had extensive evaluation of the intercorrelations of its subscales (Aarons et al., 2010), but this instrument is not closely linked to the Rogers–Greenhalgh model. Furthermore, Greenhalgh et al. also did not suggest how different attributes relate to one another and no investigator has examined how these characteristics are associated with one another in the health care arena.

The primary purpose of this investigation was to examine the psychometric properties and factor structure of the Perceived Characteristics of Intervention Scale (PCIS), a measure we developed to capture provider perceptions toward a particular mental health care intervention. The PCIS was developed to be applied to a variety of interventions and may be applicable to innovations that are not interventions per se such as screening tools and clinical reminders. However, for the purposes of this investigation, we examined the measure referring specifically to PE and CPT. In addition, evidence for the validity of the PCIS is presented in terms of its relationship with self-reported use of PE and CPT.

Method

Procedure and Participants

The data come from a larger theory-based mixed-method investigation examining the implementation of two EBTs for PTSD in 38 VA residential treatment settings across the United States (Cook et al., 2014). All PTSD treatment providers in 38 VA residential treatment settings that reported patient outcomes to the VA's Northeast Program Evaluation Center were invited to participate between January 2010 and March 2012. Of the 241 providers identified as working in the residential programs, 15 (6.2%) had left their setting by the assessment period. Of the 229 eligible, 215 (93.9%) responded and completed the survey with sufficient data to be included.

Only information on gender and professional discipline was available for nonparticipants. There were no significant differences between those who participated and those who did not in terms of the proportion of male gender (37.2% vs. 42.3%), $\chi^2(1, N = 229) = 0.09$, *ns*, or proportion of doctoral-level psychologists (51.4% vs. 40.7%), $\chi^2(1, N = 229) = 1.94$, *ns*. A large majority of the sample (84.7%, $n = 182$) were White and more than half (62.3%, $n = 134$) were female. Slightly more than half of the sample (51.6%, $n = 111$) were psychologists, while 29.8% ($n = 64$) were social workers; the remaining 18.6% ($n = 40$) were psychiatrists, nurses, or other professionals. The mean age was generally middle-aged ($M = 45.47$, $SD = 11.21$).

All providers were asked to log on to an encrypted Internet site and give their assent before participation. This study was deemed exempt from formal review by the Yale Human Research Protection Program due to low perceived risk, and was approved by the VA Connecticut Health Care System Institutional Review Board.

Measures

Perceived Characteristics of Intervention Scale. The measure reported here was part of a broader theory-based measurement of an implementation model. A complete description of the process of survey development can be found in Cook et al. (2012). In brief, a systematic literature search of PsycInfo and Medline was conducted on keywords representing the implementation model, including the perceived characteristic of innovation construct initially developed by Rogers (1962, 2003) and elaborated on by Greenhalgh et al. (2005). The 10 perceived characteristics of innovation were: relative advantage, compatibility, complexity, trialability, observability, potential for reinvention, risk, task issues, nature of knowledge, and augmentation-technical support.

An iterative approach was taken to measure development. First, existing measures were reviewed for potential items. Attempts to operationalize Rogers's perceived characteristics of innovation were highly specific to the particular domain in question. The scale most theoretically consistent with Rogers was focused on a nonhealth technology and produced high content and construct validity and acceptable levels of reliability (Moore & Benbasat, 1991). Several items from that instrument that were deemed applicable to mental health practice (i.e., *complexity, observability, trialability, compatibility)* were reworded to be more relevant to health care treatments (e.g., "The treatment [name] is more effective than the other therapies I have used").

A questionnaire by Steckler, Goodman, McLeroy, Davis, and Koch (1992) further informed the phrasing of our survey items for content and face validity. For several of the perceived characteristics (e.g., risk, potential for reinvention), there were no existing applicable measures and thus we created our own. Two items were either selected or created for each of the 10 perceived characteristics. This limited number of items was used so as to reduce participant burden and maximize response rate.

The resulting pool of items was presented to 12 mental health professionals who offered feedback on item redundancy and response burden. Items were further revised by the team for clarity and consistency. Initial analyses of the data collected suggested that the items assessing *risk* did not relate to other measures of attitudes toward treatments and had some problems in their performance (Cook et al., 2015), and so these two items were dropped from these analyses.[1] The operational definitions and items used to represent a brief measure of the perceived characteristics of a (mental health treatment) innovation are presented in Table 1.

Because two different EBTs were being evaluated by this research, parallel questions were asked regarding both PE and CPT, separately. The item-level means for each, and the alphas are all reported in Table 2.

Institutional Support. As described more fully in Cook, Dinnen, Thompson, et al. (2014), institutional support for PE and CPT, respectively, was assessed by asking several questions

Table 1. Perceived Characteristics of Intervention Scale Constructs: Definitions and Items.

Construct	Operational definition	Items
Relative advantage	Degree to which the innovation is considered superior to existing practices.	[The treatment] is more effective than other therapies I have used.
		[The treatment] is more convenient than other therapies I have used.
Compatibility	Innovations' consistency with existing values, experiences, and needs of adopter and system.	Using [the treatment] fits well with the way I like to work.
		[The treatment] is aligned with my clinical judgment.
Complexity	Level of difficulty to understand and use the innovation.	[The treatment] is clear and understandable.
		[The treatment] is easy to use.
Trialability	Ability to experiment with the innovation on a limited or trial basis.	[The treatment] can be tested out with patients without disrupting their overall therapy.
		It is easy to try out [the treatment] and see how it performs.
Observability	Innovations' results are observable to others.	It is easy to tell whether patients are benefitting from [the treatment].
		[The treatment] produces improvements in my patients that I can actually see.
Potential for reinvention	Ability to refine, elaborate and modify the innovation.	[The treatment] can be adapted to fit my treatment setting.
		[The treatment] can be adapted to meet the needs of my patients.
Task issues	Concerns about the innovation that need to be focused on to accomplish implementation.	Using [the treatment] improves the quality of work that I do.
		Using [the treatment] makes it easier to do my job.
Nature of knowledge	Information about the innovation can be codified and transferred from one context to another.	The knowledge required to learn [the treatment] can be effectively taught.
		The skills required to implement [the treatment] can be effectively taught.
Technical support	Available support components (e.g., training, manuals, consultation help desk).	[The treatment] manual is helpful.
		[The treatment] has helpful supportive materials for patients.

about the degree to which the provider perceived their institution as providing incentives and mandates for their use and dedicated time and resources to their adoption.

Implementation. Implementation was assessed using a series of items assessing use of PE administered on an individual basis, CPT administered on an individual basis, and CPT administered on a group basis (PE is not routinely delivered as a group intervention). Each of these three outcomes was assessed using a single item. For example, the item assessing PE read, "How often do you conduct PE on an individual basis?"; items assessing CPT in individual and group formats were similar. Response options were on a 7-point scale, ranging from 0 = *not at all* to "6 = *with over 90% of clients*.

Data Analysis

To evaluate the factor structure of the PCIS, a series of dimensionality investigations were conducted using a bifactor modeling approach (Reise, Moore, & Haviland, 2010; Reise, Morizot, & Hays, 2007) and the model provided by Reise et al. (2007). This approach is especially suited to assessing unidimensionality and for evaluating whether deviations from unidimensionality are significant and substantively important (Reise et al., 2007). Although it has been less commonly used than "common practices" such as eigenvalue ratios, scree plot investigations, and the like, it is more informative and typically provides a more clear solution (Reise et al., 2007). It also allows researchers to take into account the formative nature of a great deal of scale data (Reise et al., 2010). Given that the description of provider attitudes is of a domain comprised of several constructs (Greenhalgh et al., 2005), it is especially important to take into account this potentially hierarchical nature while retaining the possibility of evaluating a single model of attitudes toward particular treatments.

In practice, this approach incorporates more commonly used approaches to factor analyses, but extends them allowing for a more clear examination of the dimensionality of a given scale or measure (Reise et al., 2010). In these analyses, we first conducted conventional exploratory principal factors analyses; for both attitudes toward PE and CPT, there were four eigenvalues greater than 1. Thus, these analyses examined one- and four-factor extractions, with geomin rotations. Next, we conducted exploratory bifactor

Table 2. Perceived Characteristics of Intervention Scale: Constructs, Descriptives, and Reliabilities.

	PE		CPT	
Construct	α	*M* (*SD*)	α	*M* (*SD*)
Relative advantage	.55	6.02 (1.40)	.80	6.65 (1.67)
. . . is more effective than the other therapies I have used.		3.34 (0.86)		3.43 (0.89)
. . . is more convenient than the other therapies I have used.		2.65 (0.86)		3.20 (0.92)
Compatibility	.81	7.11 (1.61)	.87	7.65 (1.62)
Using . . . fits well with the way I like to work.		3.38 (0.94)		3.74 (0.92)
. . . is aligned with my clinical judgment.		3.73 (0.83)		3.91 (0.80)
Complexity	.73	7.33 (1.49)	.85	7.24 (1.77)
. . . is clear and understandable.		3.94 (0.71)		3.73 (0.93)
. . . is easy to use.		3.43 (0.98)		3.47 (0.95)
Trialability	.69	6.21 (1.47)	.71	7.26 (1.39)
. . . can be tested out with patients without disrupting . . .		3.00 (0.83)		3.67 (0.73)
It is easy to try out . . . and see how it performs.		3.20 (0.89)		3.56 (0.86)
Observability	.64	7.39 (1.34)	.67	7.54 (1.35)
It is easy to tell whether patients are benefitting from . . .		3.57 (0.75)		3.61 (0.79)
. . . produces improvements that I can actually see.		3.86 (0.81)		3.88 (0.78)
Potential for reinvention	.81	7.08 (1.56)	.90	8.00 (1.46)
. . . can be adapted to fit my treatment setting.		3.45 (0.96)		4.00 (0.78)
. . . can be adapted to meet the needs of my patients.		3.64 (0.75)		4.00 (0.76)
Task issues	.68	6.87 (1.94)	.80	7.31 (1.63)
Using . . . improves the quality of work I do.		3.71 (0.78)		3.81 (0.85)
Using . . . makes it easier to do my job.		3.12 (0.83)		3.44 (0.93)
Nature of knowledge	.94	7.95 (1.41)	.95	8.01 (1.37)
The knowledge required to learn . . . can be effectively taught.		4.01 (0.74)		4.01 (0.72)
The skills required to implement . . . can be effectively taught.		3.98 (0.71)		3.97 (0.70)
Augmentation-technical support	.83	7.63 (1.42)	.88	7.91 (1.55)
The . . . manual is helpful.		3.89 (0.80)		3.95 (0.81)
. . . has helpful supportive materials for patients.		3.77 (0.74)		3.93 (0.82)

Note. PE = prolonged exposure; CPT = cognitive processing therapy.

modeling with a four-group factor extraction and geomin rotation. Four-factor and four-group extractions were chosen because there were four eigenvalues greater than 1 in the initial factor analyses.

Multiple indices of fit were used to evaluate and compare these solutions. For all analyses, we calculated three indices of fit (Dyer, Hanges, & Hall, 2013; Hu & Bentler, 1999): comparative fix index (CFI), standardized root mean square residual (SRMR), and root mean square error of approximation (RMSEA). Different standards for acceptable fit are extant, and caution is recommended in interpreting these statistics (Dyer et al., 2013); however, conventional cut-points are (Hu & Bentler, 1999): CFI greater than .95; SRMR less than .08; and RMSEA less than .06. Finally, to assess the plausibility of the bifactor solution and unidimensionality, explained common variance was calculated for the general factor and the group factors, and coefficient omega hierarchical was calculated to assess reliability of the general factor (Reise et al., 2010).

It is important to acknowledge two ways that the data analyses reported here deviated from the approach proposed and modeled by Reise et al. (2007, 2010). First, because data were likely to be clustered within the 38 residential programs, it was important to take this clustering into account (Stochl, 2013). All factor analyses reported here used multilevel modeling as specified by Muthen (1991; Muthen & Muthen, 2010). In multilevel modeling, separate factor analytic models are produced for between- and within-level covariance matrixes. Because the primary interest was in the development of a measure of provider perceptions toward interventions that would be useful in other settings, this article focuses on the models for within-level covariance matrixes. The within-level model represents the portion of the variance that is not influenced by the effects of site-level variance (represented by between-level covariance matrixes; Stochl, 2013). The second deviation from the recommendations of Reise et al. (2007, 2010) was the use of exploratory bifactor modeling as proposed by Jennrich and Bentler (2011), rather than the Schmid–Leiman method used by Reise et al. (2007, 2010). A full comparison of the two approaches is beyond the scope of this article, but in short, the Schmid–Leiman method can

often fail to identify a true bifactor solution, and bifactor rotations can improve the likelihood of finding a solution (Jennrich & Bentler, 2011). In these analyses, where bifactor models were used, a bifactor-geomin rotation was used.

Based on the results of these factor analyses, scales were constructed, measuring perceptions toward CPT and PE, respectively. The internal reliability and descriptive data on these scales are reported, as is skew and kurtosis. Finally, to evaluate the validity of the scales, their relationships to other relevant variables were examined.

Results

The unidimensional, multidimensional, and bifactor models of perceived characteristics of CPT are presented in Table 3. As can be seen, there was very modest evidence for fit in the simple unidimensional model. The multidimensional model had substantially better fit, although the CFI did not meet threshold. All items loaded significantly on the first factor. Complexity and trialability also loaded on a second factor. The two potential for reinvention items loaded on a third factor. The nature of knowledge items loaded on a fourth factor. An inspection of the bifactor model revealed a similar pattern, although in this case, more modest loadings were present for more items, and the fit was within conventional thresholds. An additional difference was that the trialability and complexity items no longer substantially coloaded; rather, the trialability items loaded significantly on one of the factors, while an observability item loaded on a separate factor. In terms of explained common variance, there was further evidence for unidimensionality: general factor explained more than two thirds of the common variance. As well, the omega hierarchical for the general factor was .91, consistent with a reliable measure (Resie et al., 2010).

The unidimensional, multidimensional, and bifactor models of perceived characteristics of PE are presented in Table 4. As can be seen, there was very modest evidence for fit in the simple unidimensional model, and one item (a relative advantage item) failed to load substantially on the factor. The multidimensional model had superior fit, but the solution was both somewhat different than that for CPT and had more substantial secondary and tertiary factors: (a) a relative advantage item, a complexity item, and both trialability items all loaded on the second factor; (b) as was the case for CPT, both reinvention items loaded on a third factor (but did not load on the first factor); and (c) in contrast with nature of knowledge in CPT, task issues, relative advantage, and a compatibility item formed the final factor. Finally, in examining the bifactor model of attitudes toward PE, there is clear, albeit more modest, evidence of unidimensionality. In this case, the explained common variance was slightly more than 50%, and the omega hierarchical was .78. This is slightly below the threshold recommended by Reise et al. (2010) for reliability. The solution for the *g* factors was similar to that for CPT in terms of the first two factors. However, the third factor was substantially different. Only the second relative advantage item loaded on this factor. Overall, in both cases, there was some evidence for unidimensionality, although this evidence is somewhat qualified in the case of PE, driven largely by the behavior of the second relative advantage item.

Next, unidimensional scales were created for attitudes toward CPT and toward PE. The descriptive information on these scales is reported in Table 5. CPT was perceived more positively than PE, $t(197) = 4.07$, $p < .01$. There was no significant skew or kurtosis for either measure, although the PE scale was slightly more skewed and kurtotic than the CPT scale. The internal consistency of the scales was very high. There was a modest but significant correlation between the perceived characteristics of PE and the perceived characteristics of CPT, $r = .15$, $p = .04$.

The correlations of the two scales with other relevant variables are reported in Table 5. Perceived characteristics of CPT were associated with greater adoption of both individual and group CPT interventions, but not with adoption of PE. Perceived characteristics of CPT were very strongly associated with institutional support for CPT and (albeit much more modestly) associated with institutional support for PE. Perceived characteristics of CPT also were associated with training in CPT, but not with training in PE, and with larger facility size (in number of employees) and shorter typical length of stay in the facility.

Perceived characteristics of PE were associated with the adoption of PE and individual CPT but not with adoption of group CPT. Perceived characteristics of PE also were associated with more institutional support for and training in PE and CPT, although the strength of these relationships was greater for support and training in PE than in CPT. There was no association with facility size and a modest inverse correlation with typical length of stay.

Discussion

One methodological barrier to advancing the field of implementation science is the lack of identifiable valid measures of key constructs (Chaudoir et al., 2013). The PCIS was designed to measure perceived characteristics as proposed by Rogers's *Diffusion of Innovations* and refined by Greenhalgh et al. (2005). As was noted earlier, the dimensionality of these characteristics was unclearly specified by these theoretical proposals. The current analyses indicate that these attitudes appear unidimensional, although the evidence for unidimensionality in attitudes toward PE was somewhat weaker, driven by one of the relative advantage items ("PE is more convenient. . . ").

In a systematic review of available quantitative measures assessing implementation-related constructs (i.e.,

Table 3. Cognitive Processing Therapy Comparison of Univariate, Multidimensional, and Bifactor Models, With Risk Items Excluded.

		Multidimensional				Bifactor				
Item	Univariate	1	2	3	4	G	g1	g2	g3	g4
Relative Advantage I	**.66**	**.72**				**.71**				*.29*
Relative Advantage II	**.59**	**.60**				**.64**			*.21*	
Compatibility I	**.75**	**.78**				**.81**			*−.27*	
Compatibility II	**.69**	**.71**				**.74**			*−.19*	
Complexity I	**.67**	**.66**				**.70**				*−.17*
Complexity II	**.67**	**.64**	.47			**.71**				*−.28*
Trialability I	**.51**	**.47**	.40			**.52**			*.37*	
Trialability II	**.63**	**.59**				**.61**			**.41**	
Observability I	**.57**	**.54**				**.54**			*.30*	
Observability II	**.72**	**.74**				**.69**				**.40**
Potential for Reinvention I	**.64**	**.61**		**.73**		.59	**.76**			
Potential for Reinvention II	**.67**	**.63**		.51		**.62**	**.54**			
Task Issues I	**.69**	**.77**				**.71**				*.38*
Task Issues II	**.66**	**.68**				**.66**				*.37*
Nature of Knowledge I	**.74**	**.74**			.52	**.68**		**.61**		
Nature of Knowledge II	**.72**	**.72**			.59	**.67**		**.65**		
Augmentation-Technical Support I	**.74**	**.74**				**.76**		*.31*		
Augmentation-Technical Support II	**.58**	**.62**				**.63**		*.34*		
% ECV						**68.3**	8.4	10.7	6.0	6.6
Omega h						**.91**				
CFI	.569		.902					.957		
SRMR	.090		.041					.030		
RMSEA	.075		.040					.027		

Note. ECV = explained common variance; CFI = comparative fit index; SRMR = standardized root mean square residual; RMSEA = root mean square error of approximation. Loadings greater than .40 reported; highest loadings bolded (this includes highest among *g* factors even if the G is the absolute largest); items italicized if the highest loading is less than .4.

structural, organizational, provider, patient, and innovation level variables), Chaudoir et al. (2013) found that relatively few measures demonstrated criterion validity or reliable association with an implementation outcome. Results from this study seem more promising and could be viewed as an important first step in establishing the reliability and construct validity of a new implementation measure, the PCIS. Namely, the PCIS demonstrated reasonable evidence for unidimensionality, good psychometric properties and was correlated with constructs expected to relate to implementation as well as implementation outcomes.

As assessed by the scale, CPT was viewed more positively by VA PTSD residential treatment providers than was PE. This may be due to less familiarity with the treatment, as providers may be hesitant to try PE or have less experience with its use than with CPT. In a prior investigation with the same population, VA residential treatment providers commonly reported that CPT was a better fit than PE for their setting for multiple reasons (Cook, Dinnen, Simiola, et al., 2014). One explanation was that CPT can easily be delivered in a group format, whereas, to date, there are no group protocols for PE. Because PE can only be delivered in individual format, it requires more resources, particularly time and providers to deliver. In addition, although most providers indicated that the barriers to PE adoption were primarily structural (e.g., difficult to deliver ten 90-minute individual sessions to patients over a 6- to 8-week length of stay with limited number of staff and other patients that need to be attended to at the same time), there were other perceived difficulties in implementing exposure with chronic PTSD patients (Cook, Dinnen, Simiola, et al., 2014; Cook, Schnurr, & Foa, 2004; Zayfert & Becker, 2000) including: marked psychological impairment among veterans (e.g., comorbidities, poor functioning), concurrent personality or substance abuse disorder, treatment noncompliance, and unresolved life crises (Litz, Blake, Gerardi, & Keane, 1990). These factors may both explain the lower scores in the assessment of PE.

In this sample of providers from VA residential treatment programs, over 45% had received VA training in PE and over 70% had received VA training in CPT (Cook, Dinnen, Simiola, et al., 2014). While almost 70% of programs had implemented CPT as a full or partial protocol, about half of the program reported no use of PE. The most common level of implementation for PE, when it was used, was that select patients received it. Furthermore, we found that supportive context (dedicated time and resources, and incentives and

Table 4. Prolonged Exposure Comparison of Univariate, Multidimensional, and Bifactor Models, With Risk Items Excluded.

		Multidimensional				Bifactor				
Item	Univariate	1	2	3	4	G	g1	g2	g3	g4
Relative Advantage I	**.54**	.40			**.57**	**.54**				*.35*
Relative Advantage II	.30		**.56**		.47	*.39*			**.99**	
Compatibility I	**.68**	.44			**.61**	**.76**	*−.18*			
Compatibility II	**.75**	**.62**				**.72**				*.17*
Complexity I	**.78**	**.78**				**.71**		**.41**		
Complexity II	**.63**	.54	**.55**			**.68**				*−.30*
Trialability I	**.40**		**.54**			**.44**				*−.30*
Trialability II	**.49**		**.59**			**.60**				*−.36*
Observability I	**.54**	**.51**				**.53**		*.15*		
Observability II	**.77**	**.75**				**.72**				*.31*
Potential for Reinvention I	.38			**.54**		.44	**.59**			
Potential for Reinvention II	**.50**			**.79**		.50	**.69**			
Task Issues I	**.79**	**.70**			.44	**.79**				**.40**
Task Issues II	**.56**				**.46**	**.59**			*.26*	
Nature of Knowledge I	**.65**	**.87**				.55		**.75**		
Nature of Knowledge II	**.65**	**.84**				.54		**.75**		
Augmentation-Technical Support I	**.67**	**.82**				.55		**.58**		
Augmentation-Technical Support II	**.61**	**.76**				.49		**.54**		
% ECV						**55.7**	8.1	19.7	9.9	6.6
Omega h						**.78**				
CFI	.590		.999					.990		
SRMR	.118		.035					.037		
RMSEA	.070		.000					.025		

Note. ECV = explained common variance; CFI = comparative fit index; SRMR = standardized root mean square residual; RMSEA = root mean square error of approximation. Loadings greater than .40 reported; highest loadings bolded; items italicized if the highest loading is less than .4. Factors after the first in the multidimensional model are organized, not by size, but by their correspondence to the factors in the model of attitudes to CPT.

mandates for using EBTs) was associated with use of individual CPT, group CPT and PE, and overall positive view of the treatment (PCIS) was also associated with PE. That is if there was adequate time, adequate numbers of trained providers, and availability of consultation to implement the EBT, it was more likely to be implemented, or if providers were expected to use the EBT as part of their job, then they were more likely to use it. This is consistent with previous research showing that resource inadequacy, notably time constraints, are perceived by providers to be a determining factor in their use of EBTs. Because providers in this study were part of a residential treatment team within an organization, perceived characteristics of intervention may be less influential in adoption. Namely, providers working for organizations and not in private practice may be more restricted in their ability to make autonomous decisions about adopting treatments. Their perceptions and choices may be constrained by how the treatments get implemented into their setting and how resources are made available to accommodate their use.

The findings here should be interpreted within the context of its limitations. This study had a high response rate of a national sample of VA residential PTSD treatment providers from several disciplines, mainly psychology and social work. In order to continue to further advance the field of implementation science, it will be important for future investigations to collect data from larger and more heterogeneous and representative samples with other non-VA trauma mental health providers (e.g., from community centers, university clinics, private practice) as well as with focusing on interventions for other psychiatric disorders.

There are also important limitations with the current measure, the PCIS. Specifically, the PCIS focuses on the relatively positive aspects of attitudes toward treatments, and does not include the issue of perceived risks associated with treatments. As well, although there was evidence for unidimensionality, this evidence was more modest in terms of attitudes toward PE; also, one specific aspect of relative advantage, perception that the treatment in question would be "more convenient" performed very differently for PE than for CPT. This is not surprising, given some evidence that providers have concerns about the ease of administering PE, and may also reflect providers concerns about negative outcomes for their patients if this treatment were to be delivered (e.g., potential exacerbation of symptoms; Cook, Dinnen, Simiola, et al., 2014). Furthermore, in each case, participants filled out PE items first followed by CPT items.

Table 5. Description of Perceived Characteristics of Intervention Scale and Correlations With Relevant Training and Implementation Variables.

	Perceptions CPT	Perceptions PE
Descriptive information		
Mean	67.32	63.25
Standard deviation	11.18	10.09
Skew (standard error of skew)	−.09 (.17)	.21 (.17)
Kurtosis (standard error of skew)	.02 (.32)	−.27 (.34)
Correlate		
Adoption CPT individual	.40*	.26*
Adoption CPT group	.35*	.09
Adoption PE individual	.02	.50*
Institutional support for CPT	.66*	.28*
Institutional support for PE	.20*	.61*
Training in CPT	.37*	.22*
Training in PE	−.03	.57*
Number of employees in organization	.40*	.14
Average length of stay	−.17*	−.18*

Note. CPT = cognitive processing therapy; PE = prolonged exposure. Correlations reported are *$p < .05$.

It would be ideal in forthcoming research for the items to be presented in a counterbalanced order.

Although the PCIS could be interpreted as mostly unidimensional, this does not mean that the perceived characteristics construct it is measuring is also unidimensional. An alternative explanation may be that there is insufficient content in the PCIS to identify multiple robust dimensions. Along those lines, it is possible that one could find other elements in the constructs with additional items in the measure. For example, potential for reinvention might make a robust factor in its own right, if it had additional items. Thus, continued development and refinement of the PCIS is necessary before generalizability of utility and applicability can be made. In addition, confirmatory factor analysis or item response theory could lead to additional refinements that could improve the measure. A related point is that while the administration of the PCIS regarding CPT and PE are independent (Smith, McCarthy, & Anderson, 2000), the samples are not independent. This highlights the need to test this measure on other samples.

Because implementation science measures have traditionally been fraught with conceptual ambiguities and disagreements as well as limited evidence of reliability and validity (Emmons, Weiner, Fernandez, & Tu, 2012), it seems that rather than creating new measures for each investigation, the focus should be on measures that can be readily applied in different settings. There is some evidence that the PCIS is promising in this regard. Overall, the PCIS performs as expected, and discrepancies between attitudes toward the two EBTs are interpretable. The PCIS might also allow for the assessment of baseline levels of perceptions of target interventions as well as a means for evaluating the effectiveness of dissemination and implementation efforts. It may be useful to evaluate the sensitivity of the PCIS to training to within-provider shifts in their perceptions after training, after use with clients, and after supervision/consultation. Providers could be sent the PCIS as part of a pretraining packet and this information could be used to better tailor dissemination efforts to meet providers' perceptions of the targeted treatment. Since provider perceptions can be a precursor to the decision to try a treatment or their decision-making regarding its actual use (Aarons et al., 2010), the findings here may have implications for design of training efforts. For example, administering the PCIS to training participants could be helpful in assessing whether perceptions are interfering with buy-in. It will also be interesting to see if provider characteristics including age, education level, theoretical orientation, and level of professional development are related to scores on PCIS. Repeated assessment of providers' perceptions may help in understanding changes over time. Further work could also evaluate the convergent validity of the PCIS with other indicators of perceptions of interventions (e.g., EBPAS). Indeed, we are currently in the process of further examining the concurrent and predictive validity of the PCIS and the degree to which these perceptions of PE and CPT predict implementation and sustained use of those treatments in this sample.

Authors' Note

The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institute of Mental Health or the U.S. Department of Veterans Affairs.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The authors disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This project described was supported by Award Number RC1-MH088454 from the National Institute of Mental Health.

Note

1. Results were largely similar when the risk items were included, albeit with lower fit. In addition, the risk items did not consistently load on the factor.

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