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Title

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Permalink

https://escholarship.org/uc/item/5n62w8v0

Journal

Psychological Services, 17(3)

ISSN

1541-1559

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Publication Date

2020-08-01

DOI

10.1037/ser0000383

Peer reviewed

Trauma-Informed Measurement-Based Care for Children: Implementation in Diverse Treatment Settings

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Ongoing and comprehensive assessment is a critical part of the implementation of evidence-based care; yet, most providers fail to routinely incorporate measurement into their clinical practice. Few studies have focused on the complex application of routine assessment or measurement-based care (MBC) with children. This pilot examined the *acceptability*, *appropriateness*, *adoptability*, and *feasibility* of an MBC effort, the Clinical Improvement through Measurement Initiative (CIMI), across several child-serving settings (e.g., community mental health center, residential treatment facility). CIMI includes a comprehensive mental health assessment protocol and combines a mobile technology platform with implementation support. Survey and focus group information, assessing implementation constructs and outcomes, was collected from 44 clinicians and staff. Overall, participants agreed that the implementation process and technology were *acceptable*, *appropriate*, and *feasible* for use in child mental health and that CIMI can be used to guide case conceptualization, facilitate treatment planning, and monitor outcomes. Strategies that supported the implementation *process* were identified as were recommendations to enhance *adoption*. Significant differences were observed by Community versus Specialized settings with respect to *feasibility* and *appropriateness*, likely because of factors associated with *inner setting* (climate, compatibility), *outer setting* (patient needs), and the phase of implementation achieved by sites. Implications and recommendations for tailoring MBC implementation by characteristics related to setting are discussed. MBC across child service settings are discussed in the context of implementation frameworks.

Keywords: measurement based care, implementation, child service settings, child traumatic stress

Ongoing assessment is essential to informing case conceptualization, selecting and implementing evidence-based interventions, and monitoring treatment progress; yet, estimates suggest that fewer than 20% of behavioral health providers use outcome measurement as part of clinical care (i.e., Measurement-Based Care [MBC]; Scott & Lewis, 2015). This alarming trend continues despite urgent calls for routine use of assessments to govern clinical decision-making over the course of treatment (Institute of Medicine, 2006; Valenstein et al., 2009). Although there have been several notable empirical studies of MBC, most have focused

primarily on mental health settings that provide services for adults with specific psychiatric symptoms and diagnoses (e.g., depression, anxiety disorders, and alcohol addiction; Lewis et al., 2018, 2015; Oslin et al., 2014; Pence et al., 2012; Roy-Byrne et al., 2010; Trivedi et al., 2007). Despite the benefits of MBC observed in these studies (e.g., significant improvements in client outcomes, active involvement of clients in the treatment process, and timely alterations in interventions based on client's needs) far fewer MBC studies have been conducted with children (Elmquist, Melton, Croarkin, & McClintock, 2010; Taghon, 2018; Wallander, Schmitt, & Koot, 2001) or across the array of service settings in which children receive care. A few studies of MBC implementation have been conducted in schools (Borntrager & Lyon, 2015; Lyon et al., 2016; Lyon, Pullman, Whitaker, et al., 2019) and suggest that a setting specific approach for the use of MBC is advised. Given the unique developmental considerations, complex clinical presentations, and challenging diagnostic issues/concerns of children and adolescents, additional research is needed to fully understand how to maximize the benefits of an MBC approach across an array of child-serving settings and systems.

To support the use of MBC in child-serving settings, the National Child Traumatic Stress Network (NCTSN) developed the Clinical Improvement through Measurement Initiative (CIMI). This project fits within the NCTSN mission to raise the standard of care and increase access to services for children and families who experience or witness traumatic events. NCTSN members serve a wide range of populations in many different service settings. The CIMI approach to MBC combines a comprehensive mental health assessment protocol (including trauma exposure and symptoms) with real-time, mobile technology (e.g., computes scores, generates reports) that can be used throughout the course of service delivery. The CIMI package also includes organizational-level implementation supports that can be tailored to setting specific attributes and needs. Thus, CIMI is designed to be used flexibly to guide case conceptualization, facilitate treatment planning, monitor outcomes based on periodic assessment of children's symptoms and functioning, and improve the quality of care provided.

The CIMI assessment protocol was informed by, and builds upon, the NCTSN Core Data Set (CDS), a quality improvement initiative that included data on mental health assessment and treatment services for over 14,000 children from 56 NCTSN centers across the United States (Briggs et al., 2013; Steinberg et al., 2014). Additional clinical content, data validations (alerts to missing or out of range responses), and real-time reporting features were incorporated into CIMI based on lessons learned from the CDS. NCTSN subject matter experts and collaborative workgroup members were engaged in stakeholder interviews to enhance CIMI's clinical content and utility in specific assessment areas (e.g., strengths, physical health) across diverse treatment populations (e.g., young children, military families, immigrant, and refugee children). Specifically, CIMI captures information in the following domains: demographics; living situation; functional impairments; services received; trauma history (e.g., onset, duration, and frequency); and emotional and behavioral symptoms. The CIMI assessment battery also includes developmentally- and age-appropriate standardized measures such as the Child Behavior Checklist (Achenbach & Rescorla, 2000), the Strengths and Difficulties Questionnaire (Goodman, 1997, 2001), and the UCLA Posttraumatic Stress Disorder Reaction Index for *Diagnostic and Statistical Manual of Mental Disorders-Fifth Edition* (*DSM–5*; Elhai et al., 2013; Steinberg, Brymer, Decker, & Pynoos, 2004). Moreover, CIMI's user-friendly interface allows clinical content to be implemented with flexibility, across devices (e.g., tablets, laptops) and in a variety of settings where children and families are served (e.g., residential treatment facilities, children's advocacy centers [CAC]). This, in turn, expands upon MBC initiatives that utilize specific devices and focus on specific service systems and settings, such as the Department of Veterans Affairs Medical Centers (Wray, Ritchie, Oslin, & Beehler, 2018) or community mental health centers (e.g., Lewis et al., 2015, 2018).

The primary objective of this pilot study was to assess what works, where, and for whom when implementing MBC in child-serving settings. Two compatible frameworks were used to guide the evaluation of CIMI implementation. The first framework was based on the heuristic proposed by Proctor and colleagues (2011) that described how to evaluate implementation outcomes. Specifically, we evaluated whether the CIMI clinical content, technology (e.g., real-time scoring and reporting features), and implementation supports (e.g., technical assistance, consultation, and coaching) that were provided by the NCTSN coordinating center, the UCLA-Duke University National Center for Child Traumatic Stress (NCCTS), were deemed *acceptable* (desirable), *adoptable* (able to be utilized), *appropriate* (good fit, relevant), and *feasible* (obtainable with available resources) by staff. The second framework used was the *Consolidated Framework for Implementation Research* (CFIR; Damschroder et al., 2009). The CFIR framework was used to categorize potential facilitators and barriers to the implementation outcomes using the following constructs: *intervention characteristics* (e.g., relative advantage, adaptability), *outer setting* (e.g., patient needs and resources), and *inner setting* (e.g., compatibility with existing systems). Specifically, we evaluated whether service and setting characteristics contributed to successful implementation of CIMI across participating sites. Sites included three community mental health centers, a domestic violence shelter, a residential treatment facility, a child advocacy center, and a substance use treatment program. We expected, based on prior studies (see Lewis et al., 2018), that flexibly tailoring implementation (timelines and processes) based on setting would enhance implementation outcomes.

Method

Participants

All NCTSN members (currently and formerly funded) were invited to apply to participate in the CIMI pilot study. This included 78 funded grantees as well as 122 formerly funded NCTSN grantees—aka "affiliates" (48 organizational and 74 individual). Recruiting and outreach activities included informational emails and calls. NCCTS staff also provided individual technical assistance (TA) and consultation in response to CIMI inquiries. Selection criteria for pilot sites included: type of care setting, alignment of CIMI with the agency's implementation goals and protocols, and several organizational readiness factors (e.g., intention to use the CIMI technology vs. use of paper assessments; ability to provide a full implementation team; demonstration of suitable data security procedures; and the agency's ability to meet the technology requirements for the CIMI system). Timing of

recruitment occurred in the second year of a 5-year funding cycle. Timing of recruitment may have inadvertently led some sites to opt out of participation because of financial concerns or the need to focus on writing a competitive grant application. All CIMI applications were reviewed and scored by a team of reviewers from the NCCTS.

A total of 11 NCTSN centers applied to participate in the pilot study; seven agencies were accepted representing the Northeast, Midwest, South, and West regions of the United States. The seven CIMI MBC pilot sites included three community-based mental health centers (Sites A–C) with a range of 10–15 clinicians serving 140–380 clients per year; and four agencies that provide treatment and support in specialized services settings (Sites D–G): 1 outpatient substance abuse treatment program, 1 domestic violence shelter, 1 child advocacy center, and 1 residential treatment facility. Specialized service settings reported 4–65 clinicians serving 44–1700 clients per year. Hereafter referred to as *Community* and *Specialized*, respectively. Four agencies that applied to participate in the pilot study were excluded based on factors associated with *implementation climate* (i.e., competing demands for resources), *structural characteristics* (i.e., agency maturity), and data-sharing restrictions.

Across settings, the majority of participating providers were White women (82%) and most identified social work or counseling (68%) as their professional discipline. Most participants (55%) had at least 5 years of experience providing behavioral health services to children. The seven sites selected for the MBC pilot included CIMI implementation teams that ranged in size from 4 to 7 members. Specifically, each agency had a team that consisted of: 1 senior leader; 1 clinical supervisor; at least 2 mental health clinicians; and/or a data manager or program evaluator. The senior leader role in the initiative represented a team member who provided agency-level commitment to MBC implementation and had authority to make decisions to help address barriers to implementation such as resource allocation, scheduling requirements, and modification of job tasks. The role of the clinical supervisors was twofold: (a) they provided oversight and coaching regarding the MBC techniques utilized by the clinicians; and (b) they served as the primary connection between direct clinical care and senior leadership. The mental health clinicians were responsible for learning, understanding, and applying CIMI MBC techniques in clinical practice to inform their case conceptualization, partnership with families, and assessment of treatment progress. The data manager and/or evaluator role served to ensure that CIMI information was collected across clients and was best represented, on an agency-level, to assist with evaluation and reporting efforts. The five NCCTS staff who served as purveyors and consultants for CIMI implementation served in the following roles: an overall program director; a project lead in charge of designing and supporting implementation efforts, providing site consultation, and overseeing the development of technology; a project manager and cofacilitator of implementation efforts; a data technician; and a computer programmer.

Procedures

The Duke University Health System Institutional Review Board (IRB) reviewed and approved all study procedures; additionally, each site was responsible for obtaining initial and continuing local IRB reviews and approvals. The implementation design of CIMI combined externally led training and consultation components as suggested by Harding and colleagues (2011) to establish clear expectations for use, create a measurement toolkit, build an information system, foster practice-based capacities for MBC, and engage clients. All of the pilot teams began implementation within 30 days of one another. Teams met monthly with NCCTS staff via a web-based meeting interface (i.e., WebEx) for 13 months to direct and refine implementation. During the first 3 months of the pilot, teams focused on establishing role expectations, learning the assessment protocol, and designing the assessment process to include the CIMI protocol and technology in clinical care. Strategies for engaging children and caregivers were interwoven throughout implementation. In this initial phase, consultation emphasized the utility of MBC in partnering with children and families regarding their care. Providers also actively participated in engagement activities with children and their families (e.g., identifying client preferences, providing client support, educating clients, and providing elevator speeches to key stakeholders). The elevator speeches, for example, were developed in an effort to explain the role of MBC and how it can result in: improvements in the quality of care delivered to families; increased family and youth understanding of and engagement in the assessment and treatment process; more accurate case conceptualizations and diagnoses; and better treatment outcomes. Months 4–13 were generally used to implement and improve the use of CIMI in clinical practice. Implementation strategies were outlined before the pilot's initiation and included assessment of readiness, capacity building, ongoing technical assistance, coaching, evaluation, and support. Moreover, each agency's implementation plans were tailored to address client needs, clinical expertise, and agency goals. Examples of the importance of client engagement in this phase include the following: modifying the therapeutic setting to accommodate technology usage for clients, testing tablets to ensure ease-of-use for clients and families, and utilizing the real-time scoring to best engage and partner with families regarding assessment results. Lastly, a process was created for using lessons learned to revise CIMI content, technology, and implementation supports on an ongoing basis (Chaudoir, Dugan, & Barr, 2013; Meyers, Durlak, & Wandersman, 2012). Specifically, lessons from pilot sites were used to improve the implementation process and technology usage within and across participating agencies. For example, when a participating clinician shared a successful strategy to engage clients through CIMI, this information was shared among clinicians within the agency during implementation meetings and across participating pilot sites via the NCCTS purveyors. In addition to sharing this information, the feedback was also used to enhance instructional materials and refine the functioning of the CIMI technology.

A mixed-methods approach was used to evaluate this pilot and included: (a) a study-specific individual user survey, the CIMI Implementation Questionnaire (CIQ) and (b) team level interviews and focus groups. Approximately 13 months after the initiation of the pilot, the CIQ was administered to individual implementation team participants using a web-based survey developed in Qualtrics. To minimize group influences on individual feedback during the focus groups, surveys were collected from implementation team members before their participation in team-level focus group interviews. Surveys were distributed to 44 individuals and

completed by 37 for an overall response rate of 84%. CIQ items were asked based on the participant role (e.g., senior leader, clinician) in CIMI implementation; thus, not all CIQ items were displayed to all participants. Participants were assured that the information provided would only be shared in aggregate form to increase accuracy of responses.

To get additional information on perceptions, insights, attitudes, and experiences regarding CIMI implementation, virtual focus groups were conducted using a web-based meeting platform approximately 14 months after the initiation of the pilot. Seven focus groups were conducted, one for each site, the size of each focus group ranged from 3 to 7 implementation team members for a total of 33 participants. A topic guide was used to direct the discussion and inquire about facilitators and barriers to implementation. Sample questions from the topic guide included: "How much progress have you made with CIMI implementation?"; "What factors (or characteristics) have helped you get this far in the process?"; "What factors have held you back?" Discussions were recorded and transcribed by program staff not involved with TA or consultation. Three program staff independently coded the transcripts using the definitions provided in the Proctor and CFIR frameworks. The coders held regular meetings over a three month period to develop standard operating procedures for coding, code the responses and reach unanimous consensus on the most appropriate themes.

CIMI Technology

The CIMI technology was developed by modifying the Salesforce platform (www.salesforce.com) with custom code to deliver an interface with the following features: real-time scoring and reporting of assessment measures; client progress indicators; mobile capabilities; and multiple user levels based on roles (e.g., clinician, supervisor) to support agency-level, data-driven decision making. Figure 1a depicts a sample client homepage while Figure 1b illustrates a sample assessment report. In addition to real time scoring and reporting, ad hoc reports and summaries allowed supervisors and agency leaders to compare symptoms and progress over time at the agency level. Lastly, each device had to be encrypted by an agency technology specialist. To be compatible with the CIMI technology, sites were required to have: access to high speed Internet connections; recent browsers (Internet Explorer 9, Safari 6, Chrome); and minimum computer or tablet requirements (i.e., Intel Pentium 4 [Windows] or Intel ×86 [Mac] Processor, 1024 × 768 Display, 1GB RAM and 6GB Hard Drive, Windows XP or Mac OSX10.7).

Measures

The CIQ was designed to evaluate pilot specific implementation outcomes. The selected CIQ items were based on the Proctor and CFIR frameworks and were derived from several of the instruments listed in the Society for Implementation Research and Collaboration (SIRC) Instrument Review Project (IRP) https://societyforimplementationresearchcollaboration.org/. Figure 2 illustrates the conceptual relationship between CFIR constructs and Proctor implementation outcomes used for this CIMI evaluation. Facilitators and barriers to implementation are categorized by *outer setting*, *inner setting*, *process*, *CIMI intervention charact-eristics*, *characteristics of individuals*, and their influence on implementation outcomes (*acceptability*, *adoptability*, *feasibility*, etc.). The SIRC IRP ratings were used to select subscales and items that had the most robust psychometric properties. The final version of the CIQ included 36 items (see Table 1 for additional details). Items were rated using a six point Likert scale (1 = *strongly disagree*, 2 = *disagree*, 3 = *slightly disagree*, 4 = *slightly agree*, 5 = *agree*, 6 = *strongly agree*). An additional CIQ item assessed participants' ratings of their site's overall stage of implementation as defined by the National Implementation Research Network (NIRN) and refined by Bertram, Blase, and Fixsen (2015) (i.e., Exploration, Installation, Initial Implementation, and Full Implementation).

Data Analysis

Quantitative responses from the CIQ survey were analyzed by computing the mean and *SD* for each item. Additionally, analysis of variances (ANOVAs) were conducted (via general linear models; PROC GLM) to identify differences in the Proctor and CFIR constructs by agency. Contrasts of the mean rating on each Proctor and CFIR construct were conducted to compare *Community* (Sites A–C) versus *Specialized* (Sites D–G) sites. All quantitative analyses were conducted using Statistical Analysis Software (SAS) Version 9.4. Qualitative software, *NVivo* 11, was used to identify the most common themes from approximately 150 focus group statements in terms of Proctor Implementation Outcomes and CFIR constructs. Hierarchy charts were utilized to compare the frequency of coded Proctor and CFIR constructs.

Results

The teams used a parallel process to implement CIMI. After gaining familiarity with the protocol and the technology, teams identified existing practices to facilitate the use of CIMI; developed communication strategies to engage clients in both MBC and CIMI; integrated supervision into clinical care to support case conceptualization and treatment planning; and created a process for additional dissemination and staff recruitment. Despite these similarities, there were some observable differences by settings. *Community* Sites (Sites A–C), were more likely to describe themselves as achieving full implementation versus *Specialized* Sites (Sites D–G) that rated themselves as being in the installation phase (i.e., acquiring the resources to implement CIMI) or initial implementation phase (i.e., attempting newly learned skills to accommodate CIMI). Based on the 28 respondents (16 from *Community* and 12 from *Specialized*) who rated their stage of implementation on the CIQ, it was determined that 50% (8 of 16) of *Community* respondents rated their site as in the "full implementation" phase (i.e., 50% or more of intended clinicians or staff are using CIMI with fidelity and good outcomes). In contrast, none (0 out of 12) of the members from *Specialized* Sites rated themselves in the full implementation phase, rather ~92% (11 out of 12) rated themselves in the initial implementation phase (i.e., the implementation team is attempting to use newly learned CIMI skills and are making changes to accommodate and support the work) and 8% rated themselves in installation phase (developing skills and gathering resources).
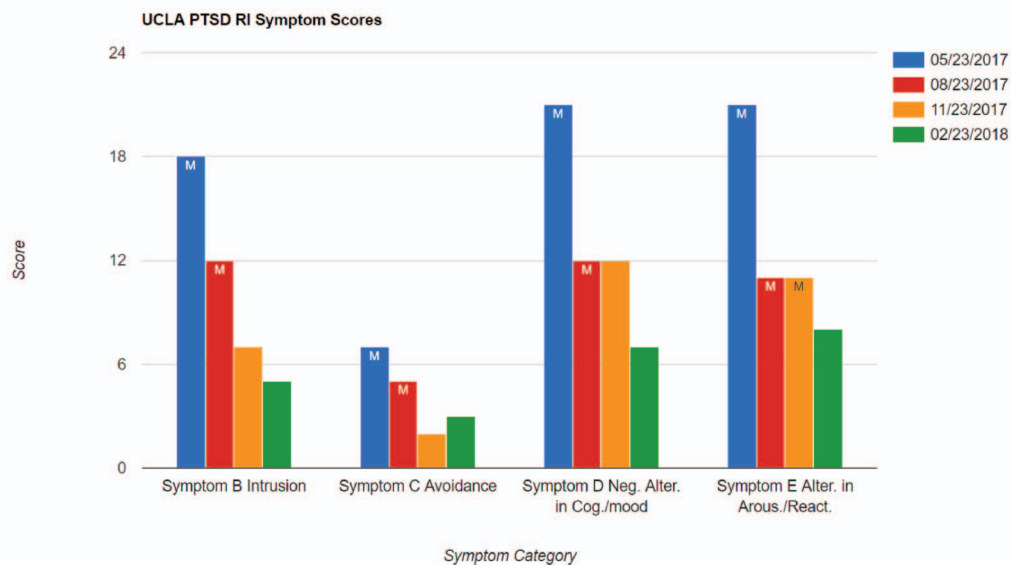
Figure 1. (a) Sample CIMI client record home page. (b) Sample CIMI assessment report for PTSD symptoms. CIMI = Clinical Improvement through Measurement Initiative; PTSD = post-traumatic stress disorder. See the online article for the color version of this figure.
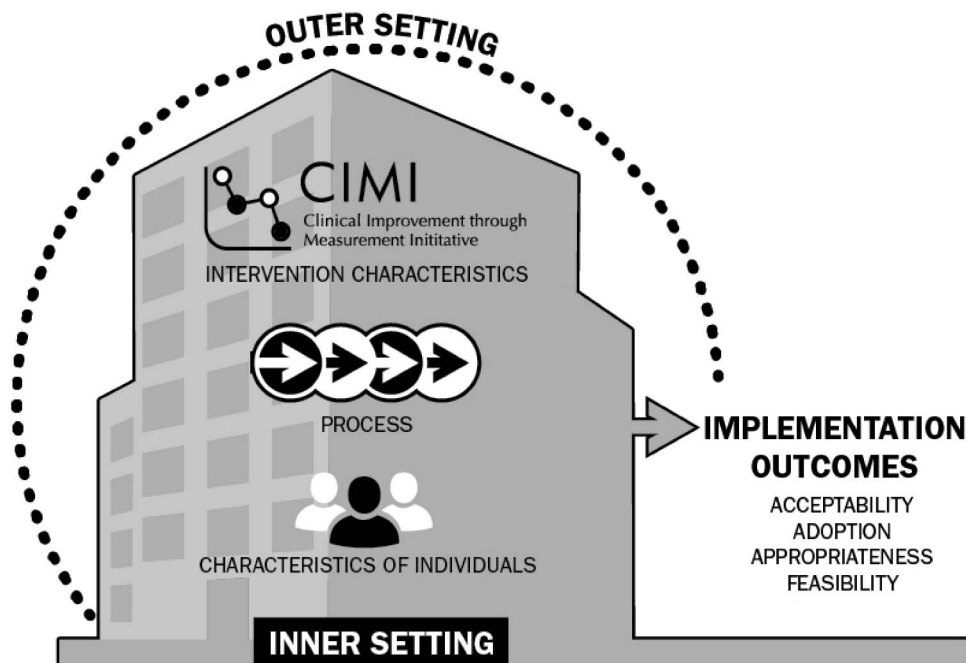
Figure 2. Clinical Improvement through Measurement Initiative (CIMI) conceptual framework and evaluation model. Adapted from "Fostering implementation of health services research findings into practice: A consolidated framework for advancing implementation science," by L. J. Damschroder et al., 2009, *Implementation Science, 4*(1). "Outcomes for implementation research: Conceptual distinctions, measurement challenges, and research agenda," by E. Proctor et al., 2011, *Administration and Policy in Mental Health, 38,* 65–76.

Implementation Process and Technology

When viewed overall as a group, participants agreed that CIMI was able to assist with key components of MBC as shown in Table 1 ($N = 37$). Participants agreed (slightly [4] to strongly [6]), that the CIMI project facilitated usage of MBC ($M = 5.33, SD = 0.99$), specifically facilitating the use of assessments for: case conceptualization ($M = 5.34, SD = 1.00$), treatment planning ($M = 5.28, SD = 0.77$), and monitoring progress ($M = 5.18, SD = 1.09$). Additionally, most participants agreed that their senior leadership supported their participation in the CIMI project ($M = 5.57, SD = 0.78$); that coaching for CIMI usage was incorporated into supervisory practices ($M = 4.40, SD = 1.58$); and that the CIMI technology assisted with case conceptualization ($M = 4.84, SD = 0.83$), treatment planning ($M = 4.72, SD = 0.96$), and modifying treatment to meet the needs of clients ($M = 4.56, SD = 0.92$). Moreover, participants agreed that even if they stopped participating in CIMI, their ability to apply MBC to their work would continue ($M = 5.08, SD = 1.05$).

Common features of the pilot that worked well regardless of setting and phase of implementation achieved were identified based on the focus group interviews. Certain *process* characteristics from CFIR were commonly reported as contributors to implementation success and included the support of external change agents (implementation purveyors), formally appointed internal implementation leaders, and CIMI champions. External change agents were "Very, very helpful and willing to listen to concerns and ideas and help problem-solve. They are key factors in helping us to get where we are." Additionally, "[External Change Agent]

was very good about sharing resources that maybe she and one of the other sites came up with and having that accessible to other sites to use as kind of a framework to start with." Internal implementation leaders were also important for success, "To me, my team has been really helpful in helping me to be more comfortable because we work well together, we communicate, and we try to make it easier to get to materials and things like that." Participants also frequently reported that a champion for CIMI was important, "I feel like we had a strong internal champion who kept us on task in a way that was not intrusive, but very supportive."

When barriers to implementing CIMI were explored, improvements regarding the technology were advised. For example, participants slightly disagreed ($M = 3.90, SD = 1.37$) that using the CIMI technology is a good fit with their therapy style/orientation; that CIMI technology makes their job easier ($M = 3.37, SD = 1.45$); and/or that CIMI technology helps them to accomplish tasks quickly ($M = 3.74, SD = 1.37$). In the focus group interviews, the most commonly reported themes with respect to barriers were *intervention characteristics* and *inner setting*. Namely for *intervention characteristics*, CFIR constructs of *complexity* and *design quality and packaging* (e.g., structure and layout of the technology) made implementation challenging for some sites. An implementation team member reported, "It's still a challenge to figure out how to gather the data and enter it live with the client." Another barrier noted was accessibility within sites. A team member stated that CIMI is challenging in part

> Because of the fact that not all of the therapists have access to CIMI, so even though I may assess a CIMI client, if they get referred to a

Table 1

Means and SDs for CIQ Implementation Outcomes and CFIR Constructs (N = 37)

Implementation outcome	CFIR construct	Item	M	SD
Acceptability	Inner setting	My colleagues support the goals of the CIMI Project.[a]	4.86	1.06
Acceptability	Inner setting	The environment we work in makes it difficult to use the CIMI Technology.[a] (Reverse Scored)	3.20	1.49
Acceptability	Intervention characteristics	I am satisfied with how easy it is to use the CIMI Technology.[a]	4.36	1.19
Acceptability	Intervention characteristics	The CIMI Technology facilitates my use of assessments to inform case conceptualization.[a]	4.84	.83
Acceptability	Intervention characteristics	The CIMI Technology helps me use assessments to develop individualized treatment plans.[a]	4.72	.96
Acceptability	Intervention characteristics	The CIMI Technology helps me appropriately modify treatment to meet my clients' needs.[a]	4.56	.92
Acceptability	Intervention characteristics	The CIMI Project facilitates the use of Measurement-Based Care principles.[a]	5.33	.99
Acceptability	Intervention characteristics	The CIMI Project facilitates the use of assessments to inform case conceptualization.[a]	5.34	1.00
Acceptability	Intervention characteristics	The CIMI Project facilitates use of assessments to develop treatment plans.[a]	5.28	.77
Acceptability	Intervention characteristics	The CIMI Project facilitates the modification of treatment to meet the client's needs.[a]	4.78	1.01
Acceptability	Intervention characteristics	The CIMI Project facilitates monitoring treatment progress.[a]	5.18	1.09
Acceptability	Intervention characteristics	The CIMI Project facilitates my use of assessments to inform case conceptualization.[a]	4.90	1.09
Acceptability	Intervention characteristics	The CIMI Project helps me use assessments to develop individualized treatment plans.[a]	4.84	1.17
Acceptability	Intervention characteristics	The CIMI Project helps me appropriately modify treatment to meet my clients' needs.[a]	4.79	1.08
Acceptability	Intervention characteristics	The CIMI Project helps me in my efforts to monitor treatment progress.[a]	4.95	.89
Acceptability	Intervention characteristics	Families and children become disengaged when providers use the Measurement-Based Care principles that were taught in the CIMI Project.[a] (Reverse Scored)	3.78	1.27
Adoption	Characteristics of individuals	I could explain to others how using the CIMI Technology has helped clients.[b]	4.16	1.27
Adoption	Characteristics of individuals	I could explain to others how using the CIMI Technology has benefited my practice.[b]	4.35	1.14
Adoption	Characteristics of individuals	Using the CIMI Technology fits into my work style.[b]	4.36	1.19
Adoption	Characteristics of individuals	The CIMI Technology is easy to learn for someone in my role.[b]	4.79	1.20
Adoption	Characteristics of individuals	Using the CIMI Technology fits with my therapy style/orientation.[b]	3.90	1.37
Adoption	Intervention characteristics	Using the CIMI Technology helps me accomplish tasks quickly.[b]	3.74	1.37
Adoption	Intervention characteristics	Using the CIMI Technology makes my job easier than it was before the project started.[b]	3.37	1.45
Adoption	Intervention characteristics	Using CIMI Technology improves the quality of the care I provide.[b]	4.26	.99
Appropriateness	Inner setting	Our current work processes are easily adaptable to include the CIMI technology.[e]	4.62	1.28
Appropriateness	Inner setting	I think that using CIMI in our organization requires an excessive amount of resources.[e] (Reverse Scored)	3.18	1.36
Appropriateness	Inner setting	The current level of computer use at our organization is conducive to CIMI implementation.[e]	4.69	1.02
Appropriateness	Outer setting	The CIMI Protocol is appropriate for delivering care to a variety of children.[e]	4.74	1.38
Appropriateness	Outer setting	Families and children who receive care from providers using the CIMI Protocol are satisfied with their experience.[e]	4.86	1.04
Feasibility	Intervention characteristics	Participating in this initiative will produce lasting improvement in my ability to apply Measurement-Based Care principles to my work.[d]	4.80	1.35
Feasibility	Intervention characteristics	Even if I were to stop participating in the CIMI Project, I think that my ability to apply Measurement-Based Care principles to my work would continue.[d]	5.08	1.05
Feasibility	Intervention characteristics	Agencies will notice a positive change in the quality of care they provide as a result of participating in the CIMI project.[d]	4.68	1.39

(table continues)

Table 1 (*continued*)

Implementation outcome	CFIR construct	Item	M	SD
Feasibility	Intervention characteristics	Clinicians will notice a positive change in the quality of care they provide after using the CIMI protocol.[d]	4.64	1.19
Feasibility	Intervention characteristics	Even after a short time (a month or less) of implementing their CIMI Protocol, agencies will notice a positive change in the quality of care they provide.[d]	4.27	1.33
Penetration	Inner setting	Clinical supervision at our agency includes coaching on how to use the CIMI Protocol to inform client care.[c]	4.40	1.58
Penetration	Inner setting	My organization's senior leadership actively supports my involvement with the CIMI project.[c]	5.57	.78

Note. CIQ = CIMI Implementation Questionnaire; CFIR = Consolidated Framework for Implementation Research; CIMI = Clinical Improvement through Measurement Initiative.
The CIQ includes items adapted from [a] "Measuring acceptability of clinical decision rules: Validation of the Ottawa Acceptability of Decision Rules Instrument (OADRI) in four countries," by J. C. Brehaut, I. D. Graham, T. J. Wood, M. Taljaard, D. Eagles, A. Lott, & I. G. Stiell, 2010, *Medical Decision Making, 30,* 398–408. [b] "Development of an instrument to measure the perceptions of adopting an information technology innovation," by C. C. Moore & I. Benbasat, 1991, *Information Systems Research, 2,* 173–239. [c] "Development of level of institutionalization scales for health promotion programs," by R. M. Goodman, K. R. McLeroy, A. B. Steckler, & R. H. Hoyle, 1993, *Health Education Quarterly, 20,* 161–178. [d] "The behavior intervention rating scale: Development and validation of a pretreatment acceptability and effectiveness measure," by S. N. Elliott & M. V. B. Treuting, 1991, *Journal of School Psychology, 29,* 43–51. [e] "Information technology (IT) appropriateness: The contingency theory of "FIT" and IT implementation in small and medium enterprises," by D. Khazanchi, 2005, *Journal of Computer Information Systems, 45,* 88–95.

therapist who doesn't do CIMI, it can get cumbersome. So, how do we do the reassessment without putting too much burden on [CIMI team clinicians], who did the initial assessments?

For some, the assessment battery "Felt a little bit long—and just felt in some ways a bit intense, especially if I was doing a paper assessment and then had to enter it into the database." The availability of measures was also challenging with some noting,

We traditionally used the UCLA, CBCL, and Youth Self Report (YSR) and when we started CIMI, only one version of the UCLA was in there—the Child/Adolescent—so, we were still having to do the parent version by paper. The CBCL was there, but the YSR was not,

so we then used the SDQ in CIMI which was new for us and so the change was challenging and not what people had been used to.

Implementation Outcomes

Each CIQ item was organized using implementation outcomes identified by the Proctor framework. Both the CIQ items and the focus group interviews were also coded by the most applicable CFIR constructs based upon definitions by Damschroder. For implementation outcomes, Table 2 ($N = 37$), most of the participants agreed that CIMI was an *acceptable* ($M = 4.74$, $SD = 0.79$), *appropriate* ($M = 4.42$, $SD = 0.95$), and *feasible* ($M = 4.81$, $SD =$

Table 2
Overall and Setting Specific Means and SDs for Implementation Outcomes and CFIR Constructs (N = 37)

			Community sites			Specialized sites			
Construct	Overall M	Overall SD	Site A M (n = 8)	Site B M (n = 5)	Site C M (n = 5)	Site D M (n = 5)	Site E M (n = 5)	Site F M (n = 6)	Site G M (n = 3)
Acceptability[*]	4.74	.79	5.34	4.25	4.90	4.13	5.13	3.44	4.88
Adoption	3.91	1.09	4.50	3.38	4.54	3.25	4.13	2.50	5.25
Appropriateness[*,††]	4.42	.95	5.14	4.45	4.64	3.27	4.53	3.55	4.60
Feasibility[**,†]	4.81	1.06	5.45	4.87	5.08	3.20	5.20	3.07	5.40
Inner setting[**,††]	4.35	.90	5.30	4.57	4.34	3.39	4.61	3.43	4.21
Implementation climate[**,††]	4.03	1.03	5.19	3.90	4.10	3.25	4.25	3.08	3.67
Compatibility[**,††]	3.90	1.13	4.81	4.40	4.10	2.50	4.00	3.17	3.25
Readiness[**]	4.89	.94	5.71	5.13	4.67	4.08	5.25	3.83	5.33
Intervention characteristics[*]	4.70	.91	5.18	4.27	4.95	3.32	5.20	3.18	5.36
Relative advantage[*]	4.20	1.06	4.82	3.56	4.70	2.83	4.89	2.72	5.11
Evidence strength[*]	5.02	.87	5.50	4.67	5.17	4.08	5.58	3.46	5.50
Design quality and packaging[††]	4.36	1.19	4.75	4.17	4.80	3.67	3.75	3.83	6.00
Outer setting[*,††]	4.84	1.13	5.50	4.50	5.20	3.67	5.17	3.63	5.50
Characteristics of the individual[*]	4.20	1.14	4.80	3.80	4.67	4.00	4.40	2.40	5.20
Personal attributes[*]	4.23	1.15	4.78	3.67	4.67	4.17	4.33	2.33	5.33
Knowledge and beliefs	4.23	1.17	4.83	4.00	4.67	3.75	4.50	2.50	5.00

Note. CFIR = Consolidated Framework for Implementation Research. Implementation outcomes are acceptability, adoption, appropriateness, and feasibility. CFIR constructs are inner setting, intervention characteristics, outer setting, characteristics of the individual.
Site comparison: [*] *p*-value < .05. [**] *p*-value < .01. Setting comparison of community setting (Sites A–C) vs. specialized setting (Sites D–G): [†] *p*-value < .05. [††] *p*-value < .01.

1.06) strategy to implement an MBC approach. Fewer agreed that CIMI was *adoptable* as initially designed ($M = 3.91$, $SD = 1.09$). Participants' quotes from the focus group further illustrate their sentiments on selected constructs. For example, one participant described CIMI *acceptability* as follows,

> . . . We were so astounded that this happened because it has never happened before at our site. We've tried so hard to get clinicians to want to use measures. And, even though we have psychologists on staff who believe in measurement, it's never happened before. It took off like a rocket.

For *adoptability* sites reported that it

> Took about three or four tries to try to get it right and try to streamline our process as far as how to give the families the documentation so that we could capture everything we needed to and in the right amount of sessions.

The findings from the CIQ identified differences in implementation outcomes by site, as shown in Table 2, namely, *feasibility* ($p < .00$; the ability to successfully use CIMI in a specific setting), *acceptability* ($p < .04$; desirability*), and *appropriateness* ($p < .03$; perceived fit with the setting). The most significant CFIR domain that contributed to these results is *Inner setting* ($p < .00$), specifically *implementation climate* ($p < .00$), with contributions from *compatibility* ($p < .00$), and *readiness* ($p < .00$). The following examples illustrate MBC facilitators in these areas of ". . . Another thing that was helpful to the team in getting this far was that we were already meeting as a team (clinical team and evaluation team) which lent itself to implementing CIMI," and "Having [a full-time evaluator] is a luxury that, perhaps, other sites don't have." One CIMI user reported that at their agency,

> No one sees clients on Fridays, so everyone is in our downtown office together and it's just known that Fridays are for trainings and meetings and getting caught up. So, if we have a meeting on a Friday, it's not rushed—the whole CIMI team is going to be there.

Several other less significant ($p < .05$) differences were noted across the CFIR framework, *intervention characteristics*, *outer setting, characteristics of the individual* that are likely to influence implementation outcomes. Examples by domain include: for *intervention characteristics* "to be able to enter data and then be able to see it delivered back to clients in a way that was user-friendly," for *outer setting* "the therapeutic engagement between our staff and the children and families [from CIMI] that's where the [payoff] occurs," and for *characteristics of the individual* selecting clinicians ". . . who were open to change and people who are open to the abstract and knowing that [CIMI] was a process."

By site there were significant differences in the implementation outcomes and noticeable differences in the implementation phase achieved. NCCTS implementation staff observed that the CIMI experience differed by the way mental health services were provided in different setting types. To test this observation of differences, the pilot sites were split into two groups (i.e., *Community* vs. *Specialized*). Typically *Specialized* sites, which rated their implementation progress as being less complete (e.g., installation phase or initial implementation phase), generally reported less agreement that CIMI performed as intended in terms of the implementation outcomes assessed. When the agencies were grouped

as either *Community* or *Specialized*, the most significant implementation outcome differences identified were *appropriateness* ($p < .00$) and *feasibility* ($p < .02$). CFIR constructs that differed significantly were *inner setting* ($p < .00$), with contributors from *implementation climate* ($p < .00$) and *compatibility* ($p < .00$), and *outer setting* ($p < .00$). For *Specialized* settings, representative focus group responses for *inner setting* included: "A lot of things fell on [supervisor's] shoulders and she wasn't able to always get them done as soon as she would like because she has a lot on her plate, as well." In terms of clinical practice, compatibility with existing client engagement strategies was challenging for example, "To figure out how to balance the face-to-face time with gathering this type of data . . ." and "Our offices aren't really set up for us to be facing the computer. That means that our back would be to the client or that we are sitting in an odd place to be close to the computer." In terms of *outer setting* representative focus group comments from *Specialized* settings included "parents and children are still being asked questions and they're on the third session, 'when are you going to see my kid'" and "asking questions that may be too direct given our population and what they are struggling with and the balance of asking questions that feel potentially intrusive or triggering could lead to possibly losing them as clients." Similarly, "at our shelter people are only here three months, transitional at the most two years, and they're working single mothers . . . bring their kids in another time, is really difficult."

Discussion

Despite the numerous benefits of MBC, few studies have been conducted that examine the implementation of MBC across an array of settings that provide treatment services to children. In fitting with the mission of the NCTSN to raise the standard of care for children exposed to trauma, the NCCTS used the Network's unique structure to pilot the use of MBC in different settings that provide mental health services to children. Furthermore, far fewer studies have included the use of more extensive assessment batteries, many MBC studies include brief screeners, several select items, or specific diagnosis assessment (e.g., depression). In an effort to enhance clinical applicability, the present pilot study contributes to the literature by including a diverse sample of child-serving treatment settings, many of which provide mental health and other ancillary services, as well as, a comprehensive assessment protocol. This study also used two prominent implementation evaluation frameworks to help categorize and describe the factors influencing implementation outcomes. Specifically, we examined the acceptability, appropriateness, adoptability, and feasibility of our implementation of CIMI. Lastly, we used the qualitative data to assess other implementation characteristics such as process (e.g., external change agents, champions) and characteristics of setting (e.g., compatibility, readiness).

Implementation Process and Technology

Overall, the CIMI implementation process and technology facilitated use of MBC, namely the use of assessments for case conceptualization, treatment planning, and monitoring treatment progress. Successful implementation processes included forming an implementation team, identifying an internal champion, and

providing regular consultation with an external change agent to provide resources and guide the tailoring of strategies. Findings underscored the need for implementation efforts to attend to the role of external change agents and internal champions in supporting implementation progress. CIMI participants reported a rather wide-range level of agreement with respect to how well the technology fit with their clinical orientation, made their jobs easier, and facilitated the timely accomplishment of tasks. Given the observed differences in phase of implementation by type of setting, it makes sense that settings would also vary with respect to reporting that technology was informative and easily integrated into their current practices. This finding is also consistent with mounting evidence for the need to support site-specific tailoring of implementation initiatives as implementation and sustainment are heavily influenced by contextual factors such as type of setting, services offered, resources available, and organizational structures and processes (Lewis et al., 2015, 2018).

Implementation Outcomes

The CIMI method for implementing MBC was shown to yield implementation outcomes of *acceptability*, *appropriateness*, and *feasibility* for participants. Even with this general success, evaluation findings also indicated that improvements could be made to enhance *adoption*, and this information has been integrated into CIMI implementation processes. For example, a more comprehensive exploration phase is now in place so that future sites can better identify readiness and the necessary inner setting supports needed for successful implementation. Specifically, sites can better assess: CIMI compatibility with existing practices; availability of supportive agency resources; and/or utility of the CIMI technology in clinical-decision making before implementation. Further enhancements aimed at improving the adoption of CIMI have been made to augment flexibility to appeal to the individual needs of a setting and clinician concerns with regard to fit with their own clinical practice. Sites are encouraged to modify the standard CIMI assessment battery to fit agency specific session length, patient needs, and clinical experience. Additionally, a wider range of standardized assessments is now available to align with the many different assessments and clinical foci at such diverse sites. More team members have also been recruited to participate in the implementation effort. Specifically, sites are now encouraged to expand the number of clinicians and incorporate additional staff (i.e., front line staff) to help support use. CIMI technology is also changing to better meet the needs of clinicians and improve satisfaction (e.g., expanding administration features, reducing system complexity, and enhancing navigational features based on setting and needs of the client).

The findings also suggest that the *inner setting* played a more nuanced role in MBC implementation, specifically in supporting implementation (i.e., supportive climate, resource provision, and readiness) while sometimes creating additional challenges (i.e., strained climate, incompatible systems). Results suggested that when implementing MBC, special attention should be paid to the compatibility with existing practices and the availability of resources that can be devoted to the implementation process. The inner setting influences experienced in this pilot are consistent with MBC implementation recommendations that suggest that some level of customization is required to augment success and

address context specific facilitators and barriers (Lewis et al., 2015, 2018).

Overall, the *Community* agencies in the pilot were more likely than other agencies to fully implement CIMI. Specifically, the three community mental health agencies rated themselves as reaching full implementation and rated CIMI implementation outcomes more favorably because of inner setting factors. MBC was described as aligning well with existing clinical practices at these sites, and participants felt they were ready for implementation and that a climate that supported implementation (e.g., dedicated team time, clinical supervision that integrated CIMI, and appropriate session length to conduct the comprehensive assessments) existed. In settings where mental health is provided in conjunction with additional services (*Specialized*), CIMI could be improved to enhance *appropriateness* outcomes. Several factors unique to each setting contributed to the need for improvement including: poor alignment with existing assessment measures; existing clinical practices that focused on screening versus comprehensive assessment; and/or compatibility with meeting the divergent needs of their patients (e.g., use of protocols that assess parents vs. children, extensive needs of clients in residential treatment facilities or substance use treatment, acute needs of clients seeking services in a domestic violence shelter or CAC). Additionally, critical resources for MBC implementation (e.g., session time allotted with mental health providers, support from data managers or evaluators, time available for team planning, and training) were less available or established in these settings. These site differences may explain some of the variability in responses regarding CIMI fit with clinical style and CIMI's ability to make participant's jobs easier. Future studies can benefit from exploration of these individual, organizational, and setting level barriers both before MBC implementation and during implementation to better measure the association of specific resources that support MBC fidelity, organizational culture, policies, and incentives.

Several methodological limitations of this pilot study should be acknowledged. The present study was an initial pilot to evaluate the acceptability, adoptability, appropriateness, and feasibility of CIMI implementation across a variety of NCTSN centers. As noted in the results, many participants in this study self-identified as belonging to a single gender and race; thus, limiting generalizability based on race, ethnicity, and gender of providers. Additionally, we relied on a project-developed instrument, the CIQ, to assess key implementation constructs. The CIQ was constructed as a brief measure and the findings may not capture the full complement of factors influencing implementation. A recent assessment that measures inner setting domains of CFIR has been published and may provide a beneficial way to assess for the factors driving MBC implementation in specific settings (see Fernandez et al., 2018). Relatedly, the use of a robust measure of clinician MBC practices would have aided in the assessment of fidelity to the model. Recent examples of such measures include the Current Assessment Practice Evaluation-Revised CAPER (see Lyon, Pullmann, Dorsey, et al., 2019).

Despite these limitations, an important strength of the pilot was the exploration of MBC implementation in a diverse sample of settings that provided treatment to children. Given that children have contact with multiple providers in multiple settings (e.g., school, home, mental health services, and staff at specialized

settings), clinical care informed by real-time information from a robust set of indicators and informants is important to understanding the strengths and needs of and providing mental health services for children and their families. Moreover, the utility of the CIMI technology with regard to scoring and monitoring was shown to provide a "relative advantage" (i.e., CIMI was more advantageous than their current process) for most participants. Not only were we were able to develop an understanding of how to implement this MBC initiative in diverse settings, we were also able to delineate additional supports and resources needed to implement MBC in a variety of "real world" settings by a range of behavioral health professionals. Lastly, we were able to identify and make important enhancements to the clinical content, technology, and implementation supports that will improve the success of future sites participating in CIMI. Future studies could examine the role of implementation supports like those provided by the NCCTS (i.e., a technology solution, implementation support, and cost of standardized measures) when assessing feasibility in non-NCTSN programs.

MBC supports and compliments the use of evidence-based treatment, the gold standard of clinical practice, and has the potential to help bridge the long-standing gap between the implementation of clinical practice guidelines and routine clinical treatment (Kauffman Best Practices Project, 2004). In an era where pay for performance policies and enhanced reimbursement rates for evidence-based treatment are becoming more common (Amaya-Jackson et al., 2018), a variety of supports are needed to implement MBC successfully to foster the tracking of outcomes for children, clients, and agencies. Additionally, a strong emphasis should be placed on using MBC to partner with children and families in their treatment and clinical progress. MBC implementation leaders would do well to design processes that provide prolonged and frequent support from an external change agent, identify project champions, and fully address site-specific facilitators and barriers to successful MBC implementation. For many settings, readiness for implementation along with available resources are critical to make implementation feasible. Finally, some degree of customization by setting will likely be needed to augment implementation success.

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