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Authors

Lee, James D

Meadan, Hedda

Sands, Michelle M

et al.

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The Cultural Adaptation Checklist (CAC): quality indicators for cultural adaptation of intervention and practice

James D. Lee¹, Hedda Meadan² , Michelle M. Sands³, Adriana Kaori Terol², Melanie R. Martin² and Christy D. Yoon² 

¹Department of Psychiatry and Behavioral Sciences, Seattle Children's Autism Center, University of Washington School of Medicine, Seattle, WA, USA; ²Department of Special Education, University of Illinois at Urbana-Champaign, Champaign, IL, USA; ³Department of Special Education and Early Childhood, University of Wisconsin Oshkosh, Oshkosh, WI, USA

Cultural adaptation of evidence-based interventions for children with developmental disabilities, including autism, is an effective way to increase the effectiveness and sustainment of intervention effects. Such uptake of interventions is especially needed for communities of marginalized and minoritized populations. However, there have been very limited guidelines on how to ensure quality for cultural adaptation in autism research. With this gap in mind, we present the Cultural Adaptation Checklist, which was developed in an iterative process based on the principles of implementation science with the purposes to (a) guide research on the cultural adaptation of evidence-based intervention with diverse populations, and (b) systematically appraise the quality of cultural adaptation reported in intervention literature. In this article, we describe the Checklist, the development process, and how it may guide cultural adaptation in autism research.

Keywords: cultural adaptation; implementation science; diverse families

Evidence-based interventions (EBIs) are a set of interventions with research support designed to increase positive outcomes for children. EBIs have been emphasized in developmental disabilities and autism literature for the past few decades to address the long-standing research-to-practice gaps (Carnine 1997, Cook and Odom 2013). Despite the progress made in identifying EBIs, the practical implementation of these EBIs in natural environments are often faced with barriers (Fixsen *et al.* 2013). Thus, researchers emphasize the importance of not only identifying EBIs but also improving the implementation of these EBIs in the 'real world' (e.g. community settings) to achieve the intended outcomes (Cook and Cook 2013, Odom 2009).

An important theoretical foundation of implementation science is that the unidirectional model of examining intervention development and efficacy does not enhance effectiveness in community settings (Rieth *et al.* 2018). Rather, optimal outcomes require a close

examination of how to adapt existing interventions and optimize their delivery to best suit the needs of the targeted population (Wang and Lam 2017). For example, special considerations would be warranted when implementing EBI with marginalized participants as EBIs are often validated with their counterparts. The '90–10' divide in global mental health also illustrates a similar picture and indicates that only 10% of research is performed in low- to middle-income countries where 90% of the world's children live (Franz *et al.* 2017, Kieling *et al.* 2011).

Similarly in the United States (US), it is widely known that EBIs in mental health are underutilized and less accessible to populations from marginalized and minoritized backgrounds than to their White counterparts (Cabassa and Baumann 2013). In the literature, the homogeneity of participant demographics (e.g. race, ethnicity, socioeconomic status) and underrepresentation of populations from diverse backgrounds were reported as significant limitations (West *et al.* 2016, Wong *et al.* 2015). This phenomenon of underrepresentation of diverse populations in research may also hinder the replicability and generalizability of research findings, especially those derived from intervention

Correspondence to: James D. Lee, Department of Psychiatry and Behavioral Sciences, Seattle Children's Autism Center, University of Washington School of Medicine, Seattle, WA, USA. Email: james153@uw.edu

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research. For example, Steinbrenner *et al.* (2022) conducted a comprehensive systematic review of autism intervention studies that were published since 1990. Among the 1,013 studies they reviewed, only about 25% of studies reported any information regarding participants' race or ethnicity. Among these studies, White participants had the most dominant rate of participation in research, who comprised 65% of all participants, followed by participants who identify as Latinx (9.4%), Black (7.7%), and Asian (6.4%). This reveals that when an intervention is established on research evidence that is largely based on a homogeneous population, it is difficult to estimate the effectiveness of the intervention when used with participants from diverse backgrounds.

Maye *et al.* (2022) also suggested that autism researchers must address disparities of populations historically underrepresented in research and stated that there needs to be more culturally competent and relevant research for these populations to reduce such disparities. Recently, increasing attention has been given to these marginalized and minoritized populations, who are systematically and intentionally alienated, disenfranchised, and isolated from societal participation based on their race, gender, income, ability, or immigration status. For example, it was reported that non-White caregivers with lower socioeconomic status or maternal education are more likely to withdraw their participation from autism intervention research that they could potentially benefit from for unknown reasons (Pellecchia *et al.* 2018). Furthermore, in a survey of 118 caregivers of children with autism from low socioeconomic backgrounds (i.e. below 250% of the federal poverty line) across four major cities in the US, Gulsrud *et al.* (2021) found that the larger size of a peer support network of families predicted a higher number of services received. Such phenomena are problematic as they hinder a deeper understanding of why there are non-responders to certain EBIs and what constitutes effective interventions for heterogeneous populations. These examples also acutely address the need for a diversified approach in research to address the gap and increase the cultural and social capital of traditionally minoritized and marginalized populations. Furthermore, it presents a dire need in research to increase diversity in each step of the research process, such as formulating a diverse research team, a community advisory board, or intentionally recruiting diverse populations (Roche *et al.* 2021, Williams *et al.* 2022).

Intervention adaptation

To ensure optimal delivery, effectiveness, and sustainability of EBIs to diverse populations, it is crucial to investigate adaptation and achieve contextual fit (Betancourt and Chambers 2016, Cabassa and Baumann 2013, Horner *et al.* 2014). To do this, implementation scientists and researchers have created frameworks for

adapting EBI to enhance the uptake of interventions. For example, Cabassa and Baumann (2013) stated that the underlying assumption of cultural adaptation is to increase the acceptability, effectiveness, and sustainability of EBIs by integrating cultural factors to decrease inequities in care. They also described how to integrate cultural adaptation and implementation science to adapt EBIs to be responsive to the needs of diverse populations. According to Cabassa and Baumann, implementation science may provide a unique perspective that examines the cultural adaptation of EBIs across multiple levels and provides a deeper understanding of the complex, heterogeneous adaptation process. Moreover, recent efforts for anti-biased lenses in implementation science and health equity research provide examples of the advancement of racial equity in intervention research among marginalized populations (e.g. Baumann and Cabassa 2020, Shelton *et al.* 2021).

Adapting an intervention has not always been seen as a necessary component for better dissemination and implementation. The notion of a 'fidelity-adaptation tension' explains the importance of achieving a balance between implementing an intervention with high fidelity and modifying or adjusting components or delivery of the intervention to fit the needs of the population (Gonzalez-Castro and Yasui 2017, Wang and Lam 2017). Lack of balance could potentially result in implementation failure and challenges (e.g. cultural mismatches), which advances the concept of cultural adaptation as a multidimensional construct that could improve general outcomes (Hansen 2014). Notably, there are other components of an intervention that could be modified to better fit the needs of a population besides cultural reasons. For example, in a systematic review examining the adaptation process of 83 intervention studies that targeted mental health symptoms among youth with autism, Dickson *et al.* (2021) found that most studies adapted interventions that originally targeted youth without autism. They also reported that the most common adaptation among the studies was adding elements to an intervention that would fit into the context of the population while preserving the main components. Similarly, Griner and Smith (2006) conducted a meta-analysis with 76 studies on culturally adapted mental health interventions, which indicated moderately strong efficacy ($d = .45$) of culturally adapted interventions. They further found that mental health interventions that specifically targeted a cultural group were four times more effective than generic interventions.

Despite the long practice of intervention adaptation, the literature remains limited regarding guidelines and quality indicators for cultural adaptation. Several frameworks and theories have been identified to emphasize the role of cultural adaptation of intervention. For example, Bernal *et al.* (1995) first described the

ecological validity framework (EVF) that consisted of eight dimensions of interventions to guide cultural adaptation of existing EBIs, including language, persons, metaphors, content, concepts, goals, methods, and context. The notion of cultural adaptation was twofold: (a) preserving the scientific integrity and promoting the ecological validity of EBIs, and (b) widely disseminating EBIs to reduce health disparities (Bernal and Domenech-Rodriguez 2012). Cultural adaptation is also essential to the notion of equitable implementation science (Metz *et al.* 2021). It not only emphasizes specific attention to culture but also enhances the responsiveness of interventions to the needs and preferences of diverse populations and can be used to address the health and educational effects of structural racism and bias (Shelton *et al.* 2021).

A few researchers reported using the EVF as a foundation to culturally adapt an existing intervention to specific underrepresented populations. For example, Buzhardt *et al.* (2016) adapted the Online and Applied System for Intervention Skills (OASIS), a caregiver training program originally developed by Heitzman-Powel *et al.* (2014), to use with Latinx families of children with autism. They reported adapting the OASIS around five of the eight dimensions of the EVF, including language, persons, content, methods, and context. In addition to using the EVF, Buzhardt *et al.* (2016) reported forming a community advisory group that provided input related to adaptation. The advisory group was composed of stakeholders from the community (e.g. families and community leaders in the Hispanic community). Similarly, Lopez *et al.* (2019) conducted a randomized controlled trial with 26 Latinx caregivers of children with autism using an adapted version of the Parents Taking Action (PTA). In this study, all eight dimensions of the EVF were addressed in the cultural adaptation of the PTA. Lopez *et al.* also reported forming a community advisory board by collaborating with stakeholders in the community, which indicates the importance of community-academic partnerships in improving implementation results and extending the reach of EBI in a community (Stahmer *et al.* 2020). Notably, the PTA was further adapted to conduct interventions with different groups, including (a) families of Black children with or at-risk for autism (Dababnah *et al.* 2021), (b) Chinese immigrant families of children with autism (Magaña, Dababnah *et al.* 2021), and (c) caregivers in Colombia (Magaña, Tejero Hughes *et al.* 2021). The positive outcomes of the different versions of the PTA demonstrated that it could be more effective and socially valid to adapt established autism interventions to fit the needs of specific populations instead of developing new interventions *de novo* (Wang 2008).

Despite its necessity for optimal implementation and potential to create positive outcomes, cultural adaptation is still not widely studied in autism research,

evidenced by the lack of a gold standard or a set of quality indicators to guide adaptations. The lack of a tool for quality appraisal and a systematic guide for cultural adaptation of intervention research also poses many challenges and may perpetuate the marginalization of diverse populations in autism research. There is limited literature reporting cultural adaptation in more detail in a few closely related fields. For example, Baumann *et al.* (2015) conducted a systematic review of interventions for caregiver training. They reported that only eight out of 610 studies explicitly addressed some form of cultural adaptation to be used with diverse populations. Similarly, Castellanos *et al.* (2020) found that only a few studies on mindfulness-based interventions for Latinx families in the US addressed all eight dimensions described in the EVF. Notably, the rigor appraisal of cultural adaptation in these two reviews had a somewhat limited systematic method. They only rated the rigor by counting the number of dimensions used out of the eight dimensions in the EVF. While these reviews provide a general picture of *what* was addressed and adapted, they do not necessarily account for the *quality* of cultural adaptation of these interventions, which presents a gap in research. Furthermore, there is no framework in extant research for systematically guiding researchers on how to culturally adapt established interventions. Moreover, Kuhn *et al.* (2020) provided an overview of seven theoretical models of cultural adaptation in intervention literature. It was revealed that partly because these researchers are based in different disciplines, they rarely referenced each other's work and, therefore, showed a lack of theoretical cohesiveness. Kuhn *et al.* suggested that there is still a lack of clear quality indicators and guidelines for researchers on cultural adaptation of an intervention.

With these gaps in mind, we developed the Cultural Adaptation Checklist (CAC), which consists of seven dimensions with 32 items to provide researchers and practitioners with guidance and standards for adapting EBIs for minoritized and marginalized populations. The purpose of this article is twofold: (a) present the CAC by highlighting the process of development and the items within each dimension, and (b) discuss the potential usage of the CAC to guide research and practice in cultural adaptation.

Method

Development of the CAC

Cultural adaptation frameworks (e.g. EVF) have emphasized the need for an iterative and collaborative process to be utilized when adapting interventions. As such, our research team utilized such a process to develop the CAC. The process began by identifying a foundational framework and defining initial indicators based on its dimensions. Next, we referenced existing literature to design items for each indicator. Finally, we solicited

outside feedback that was utilized to further enhance the quality of the CAC. Our research team consisted of faculty members and doctoral students in special education at a large Midwestern university who are from diverse backgrounds in terms of race, ethnicity, gender, countries of origin, cultural, and linguistic backgrounds. The team also had various professional and personal backgrounds related to disability. For example, the team included speech-language pathologists, behavior analysts, and special educators, and also included direct family members of individuals with disabilities. Our team also collectively established a list of additional researchers in and outside of our university from whom we elicited feedback regarding the clarity of individual items, as well as the functionality of the CAC as a whole. These individuals had specific expertise in autism, special education, and/or cultural adaptation of interventions. The EVF and its dimensions (Bernal et al. 1995) were used by our research team to initially define and outline potential indicator items for the CAC. It was chosen as a basis because it is inclusive of elements and actions suggested and used in prior cultural adaptation literature (e.g. Barrera and Gonzalez Castro 2006, Sands et al. 2021). As mentioned, the EVF's eight dimensions include language, persons, metaphors, content, concepts, goals, methods, and context.

Next, we attempted to further define the EVF's dimensions to create a checklist to be used reliably by multiple stakeholders and for various interventions. However, developing definitions was challenged by the overlap between three dimensions: metaphors, content, and concepts (see Figure 1). While the term *metaphors* has been described as the inclusion of cultural symbols, sayings, and concepts, the term *content* was described as relating to cultural knowledge (Bernal et al. 1995, Kuhn et al. 2020). When presented to multiple researchers, most indicated these were often hard to distinguish and somewhat interdependent. For example, Latinx cultural values of collectivism and familism have been used to inform and adapt interventions (Magaña, Dababnah et al. 2021) and may be an example of adaptation based on both the *metaphors* and *content* dimensions. Furthermore, the term *concepts* also could be dependent on researchers' adaptations relevant to metaphors and content. *Concepts* had been used to describe the degree to which treatment concepts are aligned with culture and contexts (Bernal et al. 1995, Kuhn et al. 2020). Therefore, for the purposes of the CAC, it was determined that we would maintain the term *content* and include indicators representative of each of the three overlapping dimensions, *metaphors*, *content*, and *concepts*, to ensure the relevance of the intervention to culture and contexts, and to incorporate culturally significant content.

In seeking to identify ways in which the CAC could further distinguish and evaluate the cultural adaptation process as iterative, we determined the need for an additional dimension, *process*, which refers to the consideration of how an intervention is adapted and implemented in an iterative process. The cultural adaptation process has been described as iterative and collaborative (Kuhn et al. 2020, Magaña, Tejero Hughes et al. 2021) as it requires multiple sources of information and opportunities for review and revisions based on feedback from participants and community stakeholders. Based on this need, *process* was added as the seventh dimension to the CAC. Finally, it was determined that each dimension had elements that can be distinguished as occurring within the adaptation and within the implementation phases of the cultural adaptation process. As a result, 32 items across seven dimensions and two categories were identified and developed based on the relevant literature. See Table 1 for a copy of the CAC and abbreviation for each dimension. In addition, to increase accuracy in the quality appraisal of cultural adaptation, we created a set of rubrics for each item across the seven dimensions with examples from the literature. This rubric contains three columns indicating whether an item was not fulfilled, partially fulfilled, or completely fulfilled (See Supplementary File A).

To develop the items for each dimension, we first reviewed the literature and developed an initial list of items for each dimension. Then, each item was developed based on our synthesis of the literature on culturally adapted interventions for marginalized and minoritized families. See Supplementary File B for a detailed description and citations for each item. Next, four additional faculty members from the same university with expertise in supporting and conducting research with relevant populations reviewed the CAC and provided feedback and suggestions to improve the clarity of the items. For example, it was suggested to increase the clarity of language throughout the CAC, use vocabulary with clear operational definitions, and use strength-based language that can highlight the roles of community stakeholders. The CAC was then revised based on the feedback and shared with the experts in the field ($N=10$). Experts were asked to review and provide feedback via Google Forms on each dimension and the CAC as a whole. Ten researchers with expertise in cultural adaptation, implementation science, and autism research completed the Google Form and provided feedback. The feedback included information about the clarity of the items (e.g. clarify what 'community' means in the items, use consistent terminology), missing items (e.g. emphasize community-academic partnership, examine viability within a community), and overall usefulness of the CAC. It was then revised and reviewed again by the research team based on their

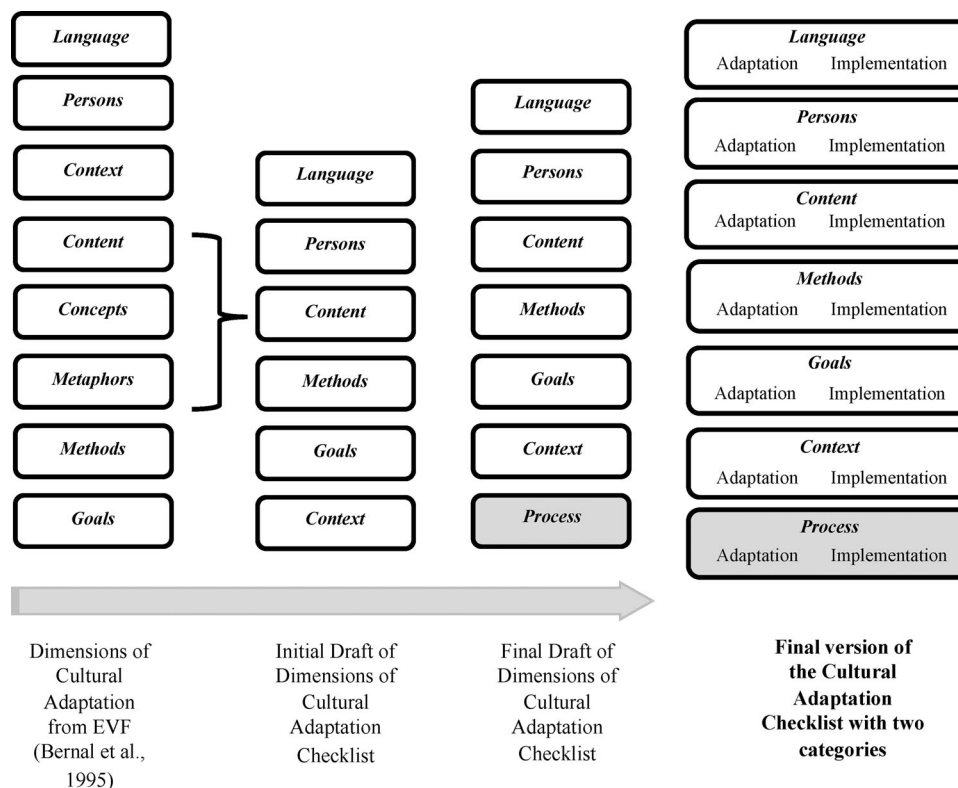


Figure 1. Development process of the CAC.

feedback. The input from stakeholders in our own iterations of developing and culturally adapting interventions was critical and included in the process of developing the CAC.

Description of the CAC

In this section, we describe the items in each dimension separated by two categories – adaptation and implementation. Adaptation refers to the process of preparing for and adapting an intervention, and implementation refers to the process of actual delivery of an adapted intervention to the targeted population. See Table 2 for a list of keywords and their definitions.

Language

As noted by Bernal *et al.* (1995), the dimension of *Language* in cultural adaptation is often ‘the carrier’ of the culture and an essential component (p. 73). This dimension includes activities that are related to linguistic translation and adaptation of the intervention. There are two items in the Adaptation category of the *Language* dimension. LA1 is an item related to both backward and forward translation of the materials, including any verbal or written instructions in the intervention. This item also calls for a collaborative approach to translation. LA2 is related to the verification of all the translated materials using a consensus process with community stakeholders. In other words, materials for intervention would not only be translated forward and backward, but these would ideally also go

through verification by the community stakeholders who are proficient in the language and culture of the target group. For example, Kuhn *et al.* (2020) reported that native Spanish-speaking stakeholders reviewed the translated materials and provided feedback for their intervention with Latinx families of children with autism. There are also two items in the Implementation category of *Language*, which require careful consideration of the cultural match between the translated materials and the targeted population. LI1 is related to using culturally relevant terminology and local dialects when delivering culturally adapted interventions. LI2 refers to ensuring participants’ understanding and acceptability of the terms when implementing the intervention and revising them as necessary. For example, Buzhardt *et al.* (2016) reported providing alternative descriptions for terminology related to the intervention contents to enhance participants’ understanding.

Persons

The dimension of *Persons* is related to the relationships and human components of an intervention. In the Adaptation category of *Persons*, PA1 refers to forming mutually beneficial and reciprocal community-academic partnerships when adapting the intervention. For example, Garcia-Huidobro *et al.* (2019) partnered with community stakeholders throughout their intervention to promote participation. PA2 is related to identifying community stakeholders who can support intervention delivery and collaborating with them in the adaptation

Table 1. Cultural Adaptation Checklist.

Dimension 1: Language Using culturally appropriate language when planning and delivering intervention					
Adaptation Planning (LA)	NR/ NA	Partial	Yes	Total Count	
1. Backward and forward translate intervention materials by a team of bilingual and bicultural persons	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
2. Verify all translated materials and terms using a consensus process with community stakeholders	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Total					Total Count
Implementation Process (LI)					
1. Implement the intervention using culturally relevant and familiar terminology and local dialects	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
2. Assess participants' understanding and acceptability of concepts and terms during the intervention and revise as needed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Total					Total Count
Dimension Total (Adaptation + Implementation)					
Dimension 2: Persons Determining roles and relationships between all parties (e.g. research team, participants, community stakeholders)					
Adaptation Planning (PA)	NR/ NA	Partial	Yes	Total Count	
1. Partner with community stakeholders throughout the iterative process of adaptation for ongoing consideration of recommendations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
2. Identify community stakeholders who will support intervention delivery and partner with them in the adaptation process	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Total					Total Count
Implementation Process (PI)					
1. Partner with community stakeholders throughout the iterative process of implementation for ongoing consideration of recommendations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
2. Partner with community stakeholders throughout the intervention after building trusting relationships/rapport	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Total					Total Count
Dimension Total (Adaptation + Implementation)					
Dimension 3: Content Incorporating cultural knowledge in the intervention as it relates to values and traditions					
Adaptation Planning (CA)	NR/ NA	Partial	Yes	Total Count	
1. Ensure relevance of the original intervention content to the targeted population, identified jointly by the research team and the community stakeholders	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
2. Include information related to strengths, needs, values and desired outcomes of the targeted population throughout adaptation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
3. Provide accessible explanations when using technical language	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Total					Total Count
Implementation Process (CI)					
1. Incorporate content that has cultural significance to the targeted population throughout the intervention	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
2. Evaluate participants understanding and agreement with the rationale and content of the intervention	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Total					Total Count
Dimension Total (Adaptation + Implementation)					
Dimension 4: Goals Determining compatibility and appropriateness of goals and outcomes for the community stakeholders					
Adaptation Planning (GA)	NR/ NA	Partial	Yes	Total Count	
1. Partner with community stakeholders to identify intervention goals in alignment with the targeted population's unique values	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
2. Individualize intervention goals to align with cultural values and expectations of the targeted population	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Total					Total Count

(Continued)

Dimension 4: Goals				
Determining compatibility and appropriateness of goals and outcomes for the community stakeholders				
Implementation Process (GI)				Total Count
1. Use culturally appropriate and sound measures to assess outcomes	NR/ NA	Partial	Yes	<input type="checkbox"/>
2. Assess social validity of goals, procedures, and outcomes of the intervention	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Total				
Dimension 5: Methods				
Incorporating cultural knowledge into planning, procedures, and implementation of the intervention				
Adaptation Planning (MA)				Total Count
1. Plan intervention delivery methods based on the targeted population's preferences	NR/ NA	Partial	Yes	<input type="checkbox"/>
2. Plan for sustainability to ensure targeted population will retain access to resources upon completion of the study	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Total				
Implementation Process (MI)				Total Count
1. Ensure accessibility of recruitment and intervention delivery	NR/ NA	Partial	Yes	<input type="checkbox"/>
2. Use diverse methods for recruitment with community stakeholders' involvement	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Communicate with the participants using their preferred mode of communication throughout the study	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Use intervention delivery modality preferred by the participants	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Total				
Dimension 6: Context				
Determining how social, economic, and political contexts are incorporated to support cultural sensitivity of the intervention				
Adaptation Planning (CoA)				Total Count
1. Partner with community stakeholders to identify the specific social, economic, and political context of targeted population	NR/ NA	Partial	Yes	<input type="checkbox"/>
2. Ensure that research team is familiar with the culture and resource levels of the targeted population prior to intervention adaptation and implementation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Total				
Implementation Process (CoI)				Total Count
1. Choose appropriate environment for intervention delivery	NR/ NA	Partial	Yes	<input type="checkbox"/>
2. Use diverse methods for participant retention	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Total				
Dimension 7: Process				
Considering how the intervention is adapted and implemented in an iterative process				
Adaptation Planning (PrA)				Total Count
1. Partner with and engage community stakeholders throughout the adaptation process	NR/ NA	Partial	Yes	<input type="checkbox"/>
2. Pilot the intervention and revise the intervention components based on feedback by community stakeholders and targeted population in multiple iterations throughout the process	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Total				
Implementation Process (PrI)				Total Count
1. Learn about the targeted population and individualize the intervention based on the participants' needs	NR/ NA	Partial	Yes	<input type="checkbox"/>
2. Build trusting relationships with the targeted population and the community stakeholders	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Actively seek feedback from community stakeholders and targeted population members to make additional revisions to the intervention as needed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Total				
Dimension Total (Adaptation + Implementation)				

Table 2. Keywords used in the CAC and definitions.

Adaptation Planning	Process of preparation for implementing adapted intervention, which occurs as an iterative process
Bilingual	Persons who have ability to communicate and are proficient in two languages
Bicultural	Person who has a deep cultural understanding of two cultures and participate in cultural practices of two different cultural groups
Community stakeholders/ members	Both specialists (e.g. clinicians, teachers, physicians, health workers) and non-specialists (e.g. parent advocates, immigrant groups, religious leaders) who work with children with disabilities and their families in the targeted population.
Community	A social unit with commonality such as norms, religion, values, customs, or identity, which may share a sense of place situated in a given geographical area (e.g. a country, village, town, or neighborhood) or in virtual space through communication platforms.
Culture	Learned and shared behaviors and beliefs of a particular social, ethnic, or age group.
Implementation process	Process of implementation of adapted intervention in the field, which occurs as an iterative process
Partnership	Relationship between two or more people who maintain close, collaborative working relationship
Targeted population	The intended or actual participants of an intervention within a specific community

process. In the Implementation category, we continue to emphasize the partnership with local stakeholders to optimize intervention delivery. PI1 refers to continuing the partnership between the researcher and the community stakeholders throughout the iterative process of implementation. For example, Magaña, Tejero Hughes *et al.* (2021) formed a community advisory board consisting of bilingual and bicultural community stakeholders who provided recommendations throughout the implementation process. Similarly, PI2 calls for involving community stakeholders throughout the intervention after building trusting relationships with them.

Content

The dimension of *Content* is also known as ‘cultural knowledge’ (Bernal *et al.* 1995, p. 75), which involves the adaptation of an intervention to include important community values. There are three items in the Adaptation category of *Content*. CA1 refers to ensuring the relevance of the original intervention content to the targeted population through a collaborative process between the researcher and the community stakeholders. For example, Yingling *et al.* (2020) removed some components of their intervention and modified the contents in collaboration with the community stakeholders to increase contextual fit. CA2 calls for including information related to the targeted population’s strengths, needs, values, and desired outcomes throughout the adaptation process. CA3 is related to providing accessible explanations when using technical language or jargon to increase the accessibility of interventions for the targeted population who may have diverse backgrounds. In addition, there are two items in the Implementation category of the *Content* dimension. CI1 refers to incorporating content with cultural significance to the targeted population, including culturally relevant and appropriate information in an intervention to increase social validity. CI2 involves evaluating participants’ understanding and agreement with the rationale and content of the intervention by soliciting feedback to

improve on their content during implementation and revising the intervention to inform the next iteration.

Goals

The dimension of *Goals* is related to the mutually agreed social significance of the intervention goals. There are two items in the Adaptation category of *Goals*. GA1 calls for partnering with the community stakeholders to identify intervention goals that align with the targeted population’s unique cultural values. For example, Kuhn *et al.* (2020) used a multistep collaborative approach to identify the needs and interests for an intervention of the community stakeholders. GA2 refers to individualizing intervention goals to align with the expectations of the targeted population. Both items in this dimension called for a collaborative process of identifying intervention goals for the targeted population. In the Implementation category of this dimension, GI1 refers to using culturally appropriate and sound measures to assess outcomes. It was emphasized because of the importance of choosing outcome measures that would accurately assess the impact of an intervention on the targeted population. For example, Domenech Rodríguez *et al.* (2011) used an iterative process to use measures that were normed with the targeted population and conducted pilots to ensure the validity of these measures. GI2 calls for the assessment of the social validity of goals, procedures, and outcomes, which would require careful examination of the acceptability and feasibility of an intervention.

Methods

The *Methods* dimension largely refers to the procedural components of attaining goals that were defined in the intervention. In the Adaptation category, MA1 refers to planning the intervention delivery model based on the preference and context of the targeted population. MA2 refers to planning for sustainability to ensure that the targeted population would retain access to resources after the completion of the research study and to increase the capacity of the community. For example,

Lopez *et al.* (2019) promoted service coordination by the regional center by connecting their clients to appropriate services and producing documents such as a folder of additional information related to local resources. In the Implementation category, MI1 refers to ensuring the accessibility of recruitment and intervention delivery. One example includes activities such as providing childcare or transportation for the targeted population to participate in research activities. MI2 refers to using diverse methods for recruitment with the community stakeholders' involvement. For example, Meadan *et al.* (2020) recruited their participants through trusted community members with whom they previously had built rapport.

Context

The next dimension, *Context*, involves considerations of various contextual circumstances of the targeted population. These efforts would allow a better understanding of the targeted population of interest. In the Adaptation category, CoA1 involves partnering with the community stakeholders to identify the social, economic, and political context of the target population. CoA2 calls for ensuring that the research team is familiar with the culture and resource levels of the targeted population. In doing so, researchers would be able to adapt an intervention to be more socially significant. For example, Dababnah *et al.* (2021) provided detailed descriptions of the city where the intervention took place in their study to provide a better context. There are two items in the Implementation category of *Context*. CoI1 refers to choosing an appropriate environment for intervention delivery. CoI2 is related to using diverse methods for participant retention. For example, Meadan *et al.* (2020) reported providing childcare and transportation to accommodate the participants' schedules and increase feasibility.

Process

The last dimension, *Process*, was added by our research team to emphasize the iterative and collaborative nature of cultural adaptation. It serves as the foundation of other dimensions in adapting an intervention. The Adaptation category includes two items. PrA1 refers to partnering with and engaging the community stakeholders throughout the adaptation process. In relation to this item, researchers are encouraged to form continuous and reciprocal relationships with the community stakeholders when they adapt the intervention, as opposed to having a unilateral line of communication. For example, Kuhn *et al.* (2020) reported several activities for community-academic partnerships, including having formal and informal meetings to learn about the characteristics of the targeted population and sharing information about themselves as researchers. PrA2 refers to piloting and revising the intervention components based on the

feedback provided by the community stakeholders from the targeted population. By piloting the adaptation, researchers would be able to revise and make additional adaptations to all the intervention dimensions as necessary. In addition, there are three items in the Implementation category of the *Process* dimension. PrI1 calls for learning about the targeted population and individualizing the intervention based on the participants' needs. This would also require researchers to gain a deeper understanding of the population and to tailor the intervention to fit their contextual needs. PrI2 calls for building trusting relationships with the targeted population and community stakeholders. For example, Magaña *et al.* (2014) reported building rapport with the *promotoras*, who helped disseminate EBI to their fellow caregivers. Lastly, PrI3 refers to actively seeking feedback from the community stakeholders and the targeted population to make additional revisions to the intervention as needed.

Discussion

As stated above, the purpose of this article was twofold: (a) describe the development of the CAC including the seven dimensions and 32 individual items, and (b) describe the potential usage of the CAC to guide research and practice. It is our hope that the CAC will enhance the discussion around the importance and need to adapt interventions to diverse populations and help the field move forward with developing a guide and systematic method to adapt interventions and to evaluate adapted interventions. Next, we suggest implications for both research and practice related to cultural adaptation.

Implications for research

There are several implications for research on cultural adaptation and working with minoritized and marginalized populations in autism research. First, as highlighted in multiple dimensions of the CAC, it is crucial to consider the community-academic partnership, especially when working with diverse populations who could benefit from culturally adapted interventions. This is apparent when considering how most of the research evidence in special education or autism interventions are developed in Western countries, which indicates that it is uncertain how effective these interventions will be with diverse populations. It becomes essential when considering the underrepresentation of diverse populations in research (Maye *et al.* 2022), and such partnership between the community and academics may address the longstanding issue of research-to-practice gaps.

Second, the CAC may be used as quality indicators to appraise the quality of cultural adaptation of interventions, which is crucial in establishing the standards for research and practice. In special education, for

example, quality indicators for each research methodology (group experimental, single case, correlational, and qualitative) were proposed in an issue of *Exceptional Children* in 2005, which provided guidelines for effective practice, accountability for researchers, and usability information for consumers of research findings (Odom et al. 2005). It is undeniable that these quality indicators generally increased the methodological rigor of special education research and further advanced the field. Therefore, more efforts are warranted to refine cultural adaptation to make EBIs widely available to historically marginalized populations in research.

Third, the CAC may be used in a comprehensive review to systematically appraise not only the methodological rigor but also the quality of cultural adaptation in the literature. For example, researchers may use Table 1 as a CAC paired with the rubric (Supplementary File A) for each item across all dimensions to quantify the quality of cultural adaptation by choosing whether researchers did not fulfill, partially fulfilled, or completely fulfilled an activity. For example, Lee et al. (2023) have used the CAC in a review to appraise the quality of cultural adaptation among 16 studies on caregiver-implemented intervention for autistic children, which revealed mediocre quality both in the actual cultural adaptation and the reporting of adaptations. Notably, however, the ratings may warrant some level of individualization based on each circumstance. For example, the ratings of Not Applicable and Not Reported may possess qualitative differences depending on what is required during the process of cultural adaptation, and they will not always be interchangeable.

In addition, although the items in the CAC were developed based on the autism literature, this process of cultural adaptation is not unique to the autistic population. Rather, it may be broadly utilized when adapting educational or psychological interventions with other populations due to the emphasis that adaptation is a process. Furthermore, it is important that researchers further examine stakeholders' perceptions on how the CAC can be used to enhance cultural adaptation and increase contextual fit (i.e. social validity) and how it can be improved as a tool for research and practice. It is important to note that not all activities related to the cultural adaptation of an intervention may be reported in detail in a published article and limit the applicability of such a tool, and additional details related to cultural adaptation should be accompanied by the manuscript in some way (e.g. a supplementary file or online archive). Therefore, we hope that having a set of quality indicators, such as the ones described in the CAC, could enhance current practices and improve researchers' reporting practices and possibly the editorial policies of peer-reviewed journals.

Implications for practice

There are also several implications for practice. First, service delivery agencies that work with diverse populations may refer to the CAC, reflect on what they are currently doing, and consider what other adaptations may be helpful. For example, an early intervention agency that serves immigrant families of young children with or with increased likelihood for disabilities may go through each dimension and consider how they may adapt their service provisions to fit the needs of their families. Second, researchers and practitioners could use the CAC to build awareness in terms of the quality of interventions that have been culturally adapted thus far. Finally, the CAC may be used to support practitioners in the community to gain a deeper understanding of culture and what careful considerations, beyond linguistic translation, are warranted when attempting to use EBI with diverse families.

As described throughout this manuscript, extant research has limited identified quality indicators and clear guidance despite the benefits of cultural adaptation of an intervention. The CAC, which was developed in an iterative process, may help address this gap to guide research and practice with the hope that services and interventions provided to marginalized families have the contextual fit to lead to the intended outcomes.

Disclosure statement

No potential conflict of interest was reported by the authors.

ORCID

Hedda Meadan  <http://orcid.org/0000-0001-7098-6176>

Christy D. Yoon  <http://orcid.org/0000-0002-7629-0468>

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