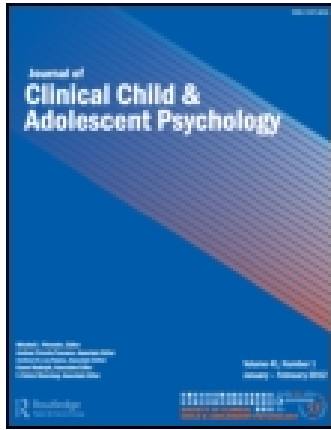


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Publisher: Routledge

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Journal of Clinical Child & Adolescent Psychology

Publication details, including instructions for authors and subscription information:

<http://www.tandfonline.com/loi/hcap20>

Introduction to the Special Issue: Toward Implementing Physiological Measures in Clinical Child and Adolescent Assessments

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Published online: 09 Feb 2015.



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To cite this article: Andres De Los Reyes & Amelia Aldao (2015) Introduction to the Special Issue: Toward Implementing Physiological Measures in Clinical Child and Adolescent Assessments, *Journal of Clinical Child & Adolescent Psychology*, 44:2, 221-237

To link to this article: <http://dx.doi.org/10.1080/15374416.2014.891227>

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Introduction to the Special Issue: Toward Implementing Physiological Measures in Clinical Child and Adolescent Assessments

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The National Institute of Mental Health recently launched the Research Domain Criteria (RDoC). The RDoC is an initiative to improve classification of mental health concerns by promoting research on the brain mechanisms underlying these concerns, with the ultimate goal of developing interventions that target these brain mechanisms. A key focus of RDoC involves opening new lines of research examining patients' responses on biological measures. The RDoC presents unique challenges to mental health professionals who work with children and adolescents. Indeed, mental health professionals rarely integrate biological measures into clinical assessments. Thus, RDoC's ability to improve patient care rests, in part, on the development of strategies for implementing biological measures within mental health assessments. Further, mental health professionals already carry out comprehensive assessments that frequently yield inconsistent findings. These inconsistencies have historically posed challenges to interpreting research findings as well as assessment outcomes in practice settings. In this introductory article, we review key issues that informed the development of a special issue of articles demonstrating methods for implementing low-cost measures of physiological functioning in clinical child and adolescent assessments. We also outline a conceptual framework, informed by theoretical work on using and interpreting multiple informants' clinical reports (De Los Reyes, Thomas, Goodman, & Kundey, 2013), to guide hypothesis testing when using physiological measures within clinical child and adolescent assessments. This special issue and the conceptual model described in this article may open up new lines of research testing paradigms for implementing clinically feasible physiological measures in clinical child and adolescent assessments.

Mental health concerns incur considerable personal, societal, and financial costs and affect tens of millions of people worldwide (e.g., Kazdin & Blasé, 2011). To meet the needs for identifying, classifying, and treating mental health concerns, mental health professionals have developed nosological systems to promote the reliable detection of these concerns and facilitate

treatment planning (e.g., *Diagnostic and Statistical Manual of Mental Disorders [DSM-5]*; American Psychiatric Association [APA], 2013; and *International Classification of Diseases [ICD-10]*; World Health Organization, 2007). Mental health professionals have also developed a host of reliable and valid instruments to assess mental health concerns and the factors that pose risk for or offer protection against the development of these concerns (Hunsley & Mash, 2007). Collectively, these instruments can assess patients' concerns across the lifespan, run the gamut of modalities (e.g., survey, interview, observational, and performance-based indices),

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and be used for a variety of purposes (e.g., screening, diagnostic, treatment planning, and treatment response assessments). Despite these efforts and advancements, four challenges complicate administering reliable and valid mental health assessments to child and adolescent patients.

First, multiple diagnostic conditions or syndromes often characterize a patient's mental health concerns, with no current model adequately accounting for the mechanisms underlying this comorbidity (for a review, see Drabick & Kendall, 2010). Second, current instruments often require extensive training and supervision for administration, scoring, and interpretation (e.g., structured interviews and standardized clinical tasks; Mash & Hunsley, 2005), thus resulting in considerable time and material costs (see also Yates & Taub, 2003). Third, for any one patient, a number of biological, psychological, and socio-cultural factors may explain their mental health concerns, which often manifest as maladaptive reactions to environmental circumstances or social contexts (e.g., Cicchetti, 1984; Luthar, Cicchetti, & Becker, 2000; Sanislow et al., 2010). Yet each patient's concerns may vary in their expressions within and across multiple contexts, such as home and school settings or within peer interactions (i.e., situational specificity; Achenbach, McConaughy, & Howell, 1987). Indeed, any one patient may experience concerns in one context but not another (e.g., home and not school), and any two patients may differ from each other in the specific contexts in which they experience concerns (e.g., home and not school vs. school and not home; Mischel & Shoda, 1995). In fact, contextual variations in mental health are so ubiquitous to patients' clinical concerns that they factor into conceptualizations of a variety of mental health domains including anti-social and oppositional behavior, attention and hyperactivity, and social anxiety (for reviews, see Bögels et al., 2010; Dirks, De Los Reyes, Briggs-Gowan, Cella, & Wakschlag, 2012; Kraemer et al., 2003). For instance, patients meeting *DSM-5* criteria for social anxiety disorder may experience symptoms and impairment across multiple contexts (e.g., one-on-one interactions, social gatherings, and eating in public places) or experience symptoms and impairment specifically within contexts typified by performance evaluations (e.g., public speaking; APA, 2013; Bögels et al., 2010).

Perhaps as a consequence of these challenges, a fourth challenge is that no single measure definitively captures a patient's mental health concerns (De Los Reyes, 2011). This challenge necessitates using and interpreting multiple measures to assess patients' concerns (e.g., Hunsley & Mash, 2007). Of importance, researchers have proposed a variety of methods for interpreting and integrating outcomes from comprehensive assessments and yet have struggled to yield consensus

on use of any one approach (for reviews, see De Los Reyes, Thomas, Goodman, & Kunder, 2013; Kraemer et al., 2003). In this special issue, we discuss recent attempts by the National Institute of Mental Health (NIMH) to address these fundamental issues in mental health research and practice. In doing so, we present both empirical research and a theoretical approach meant to serve as a bridge between NIMH's efforts and current research and theory in evidence-based assessments of child and adolescent mental health.

RESEARCH DOMAIN CRITERIA

In line with the challenges described previously, the NIMH recently launched the Research Domain Criteria (RDoC; Insel et al., 2010): A research initiative with the key goal of improving classification of mental health concerns. Specifically, RDoC seeks to link variations in mental health to variations in broad domains of functioning that cut across mental health conditions as defined within current nosological systems (e.g., *DSM-5* and *ICD-10*).

Briefly, RDoC describes five domains that relate to symptom expressions of one or more existing mental disorder categories (i.e., negative affect, positive affect, cognition, social processes, and regulatory systems; Sanislow et al., 2010). The RDoC seeks to promote continued inquiry of these broad functional domains. Specifically, the workgroup that developed RDoC envisioned individual studies examining how variations across one or more of the five domains relate to variations in patients' mental health as represented by multiple units of analysis. These units of analysis cover a range of methods including informants' reports, observed behavior, physiology, neural circuitry, cells, molecules, and genes (Cuthbert & Insel, 2010). It is important to note that a key assumption underlying RDoC is that by understanding how variations in the functional domains relate to variations in clinically relevant units of analysis, we may (a) improve our understanding of the mechanisms underlying mental health concerns, (b) develop new interventions that target these mechanisms and/or refine existing interventions, and thus (c) improve patient outcomes and overall public health (Insel et al., 2010; Sanislow et al., 2010).

Examining RDoC's proposed units of analysis yields two observations. First, RDoC's core mission is to improve understanding of the *brain* mechanisms underlying mental health concerns. Indeed, Insel and colleagues (2010) recently articulated this central tenet of RDoC: "The RDoC framework conceptualizes mental illnesses as brain disorders. In contrast to neurological disorders with identifiable lesions, mental disorders can be addressed as disorders of brain circuits" (p. 749).

Second, RDoC seeks to advance knowledge on these brain mechanisms by encouraging researchers to examine patients' responses on multimethod assessments of mental health, but with a heavy emphasis on examining patients' responses on biological measures. This second observation of RDoC's mission and underlying methodology spurred this special issue. That is, consistent with RDoC, a core assumption underlying best practices in clinical assessment is that a multi-informant, multimethod approach—batteries consisting of reports on surveys and interviews provided by patients, parents, clinicians, teachers, and/or patients' peers, as well as observational assessments of patients' behavior within clinically relevant tasks—validly assesses patients' concerns (e.g., Hunsley & Mash, 2007). Indeed, a great deal of research highlights the limitations inherent in relying on a single measure to estimate clinical outcomes, such as treatment response as indexed by symptom reduction (for reviews, see De Los Reyes, Kundy, & Wang, 2011; De Los Reyes, Thomas, et al., 2013; Dirks et al., 2012; Hunsley & Meyer, 2003; Johnston & Murray, 2003).

In fact, multi-informant, multimethod approaches feature prominently in empirical tests of processes relevant to child and adolescent mental health (e.g., emotion; Lang, 1979). Specifically, the most widely represented measures in empirical work on emotion are informants' reports and participants' observed behavior as previously described, as well as participants' physiology (e.g., heart rate and skin conductance; Bradley & Lang, 2000). It is important to note that a large body of basic empirical research indicates significant relations between activity on these measures and mental health concerns (e.g., APA, 2013; Cuthbert & Insel, 2010; Insel et al., 2010; Sanislow et al., 2010). Further, two of these measures—namely, informants' reports and observed behavior—also have a long history and frequency of use in mental health assessments (e.g., Jensen-Doss & Hawley, 2010; Palmiter, 2004; Weisz, Jensen-Doss, & Hawley, 2005). However, recent work indicates that mental health professionals rarely implement physiological measures within clinical and empirical work (e.g., for reviews, see Davis, May, & Whiting, 2011; Thomas, Aldao, & De Los Reyes, 2012).

In this special issue, we seek to bridge the gap between RDoC and clinical child and adolescent research and practice by highlighting the current status of methods for feasibly implementing physiological measures within clinical assessments. Specifically, we illustrate methods for integrating low-cost physiological measures within assessment batteries that represent current evidence-based procedures for assessing child and adolescent mental health (for a review, see Hunsley & Mash, 2007). By "low cost," we mean tools to assess cardiovascular activity with purchasing ranges on the low end, from \$100 to \$400 (e.g., wireless wristwatch

heart rate monitors and blood pressure monitors), to more high-end comprehensive units that cost a few thousand dollars and can assess multiple physiological metrics (e.g., heart rate and heart rate variability, respiration, and skin conductance; for a review, see Thomas et al., 2012). Stated another way, we illustrate measures of cardiovascular activity for which the current costs of low-end measures roughly approximate what a patient might pay for a single session of therapy. Also included among these measures are tools to assess brain activity—namely, electroencephalography—with price points that currently fall far below alternative tools (e.g., functional magnetic resonance imaging, functional near-infrared spectroscopy; positron emission tomography; Bunce, M. Izzetoglu, K. Izzetoglu, Onaral, & Pourrezaei, 2006; Luck, 2005). It is important to note that the value in physiological measures lies in examining convergence or divergence between responses on these measures and responses on reliable, valid, and well-established clinical tools. Indeed, integrating physiology within existing mental health assessments may improve the ability of these assessments to detect the specific contexts within which patients experience mental health concerns (see also De Los Reyes, Thomas, et al., 2013).¹ In this way, physiological measures may assist in addressing the phenomenological, contextual, financial, and measurement challenges highlighted previously.

CHALLENGES TO IMPLEMENTING PHYSIOLOGICAL MEASURES WITHIN CLINICAL ASSESSMENTS

In seeking to address current challenges to identifying, classifying, and treating mental health concerns, RDoC introduces new challenges. We see four pressing challenges. First, in contrast to clinical adult assessments, clinical child and adolescent assessments have long

¹In fact, the issues we raise in this special issue relate to standardized assessments in clinical neuropsychology. Specifically, often patients' performance on standardized neuropsychological tasks can be linked to brain abnormalities (e.g., brain lesions or trauma; Yeates, 2010). Further, neuropsychological tests often include guidelines for interpreting patients' scores as a function of contextual factors, an example of which may include interpreting a patient's poor performance on a test as reflecting patient malingering or anhedonia (e.g., the Continuous Performance Test; Gooding, Matts, & Rollmann, 2006; Henry & Enders, 2007; Ord, Bottecher, Greve, & Bianchini, 2010; Quinn, 2003; Sollman, Ranssen, & Berry, 2010). At the same time, some mental health assessment literatures, namely, research on diagnosis of attention-deficit/hyperactivity disorder, have found that standardized neuropsychological tasks contribute little incremental information to diagnosis when compared against the information provided by relatively inexpensive and less time-consuming clinical tools (e.g., informants' symptom reports; Pelham, Fabiano, & Massetti, 2005).

incorporated use of multiple informants, measures, and measurement modalities (Achenbach, Krukowski, Dumenci, & Ivanova, 2005; Hunsley & Mash, 2007). However, surveys of mental health professionals' assessment practices, as well as quantitative reviews of the methodological characteristics of treatment studies, find that mental health professionals who work with children and adolescents rarely use methods other than informants' reports and observed behavior (Jensen-Doss & Hawley, 2010; Palmiter, 2004; Weisz et al., 2005). Second, research and practice areas in which biological systems feature squarely in conceptualizations of symptom expression rarely use biological measures. For example, a key component of clinical models of social anxiety involves understanding how patients' interpretations of physiological arousal within social situations contribute to the development and maintenance of social anxiety concerns (Barlow, 2002). It is important to note that these clinical models inform treatment techniques for the condition, such as use of in vivo exposure to reduce patients' maladaptive reactions to physiological arousal within social situations (e.g., Alfano & Beidel, 2011). Thus, without physiological measures, a mental health professional may have difficulty determining whether treatment changed how a patient interprets their own physiological arousal (Davis et al., 2011).

Third, the dissemination of effective treatments to routine clinical practice lags far behind the accumulation of research findings supporting these treatments (i.e., "the research-practice gap"; see Kazdin, 2008). This gap is even wider for mental health assessments. In fact, advancements in the research movement dedicated to identifying effective assessment practices (i.e., "evidence-based assessment") have historically experienced delays relative to advancements in identifying effective treatment practices, perhaps because the first evidence-based practice initiatives and practice guidelines emphasized treatment practices (see Hunsley & Mash, 2007). Along these lines, the prevalence of evidence-based assessment usage is unacceptably low for widely available interview and survey measures (Jensen-Doss & Hawley, 2010; Palmiter, 2004). This does not bode well for incorporating new indices in routine clinical practice that may require additional personnel training and costs, such as physiological measures.

Fourth, and perhaps most important, measures routinely used to assess child and adolescent mental health historically exhibit only modest correspondence with one another (i.e., r s in the .20s to .30s; see Achenbach et al., 1987). These modest correspondence levels are among the most robust observations in clinical science (De Los Reyes & Kazdin, 2005), routinely translate to inconsistent research findings (e.g., identifying

efficacious treatments; De Los Reyes & Kazdin, 2006), and create interpretive dilemmas for clinical decision-making in practice settings (e.g., treatment planning; see Hawley & Weisz, 2003). Therefore, introducing physiological measures into a comprehensive set of assessment procedures that already evidences inconsistencies will likely result in additional inconsistencies. This challenge may introduce greater uncertainties in clinical and empirical work than the uncertainties resulting from current procedures.

ADDRESSING CHALLENGES TO IMPLEMENTING PHYSIOLOGICAL MEASURES WITHIN CLINICAL ASSESSMENTS

We see four recent advancements in technology, research, and theory that may address challenges to applying RDoC to clinical child and adolescent assessments. First, the availability of low-cost and noninvasive methods for assessing physiological processes may promote their integration within clinical assessments. Indeed, many of these measures can be administered in vivo within clinically relevant tasks. For example, ambulatory, wireless heart rate monitors have been successfully implemented within clinical assessments of adolescent social anxiety (see Anderson & Hope, 2009; De Los Reyes, Aldao, et al., 2012; Thomas et al., 2012). These monitors can assess adolescents' heart rate responses within situations relevant to adolescent social anxiety. For instance, researchers recently implemented the Groningen Social Stress Task in a large-scale epidemiological study of adolescents to elicit stress responses to social evaluation (e.g., stressful speech and arithmetic performance tasks; Bouma, Riese, Ormel, Verhulst, & Oldehinkel, 2009). Importantly, heart rate assessments taken within tasks such as the Groningen Social Stress Task have the potential for widespread use in routine clinic settings. This is because free and publically available software can be used to calculate heart rate metrics (e.g., CmetX; Kubios HRV; Allen, Chambers, & Towers, 2007; Niskanen, Tarvainen, Ranta-aho, & Karjalainen, 2004). Further, work in this special issue illustrates the possibility of establishing assessment paradigms that allow for assessors without a background in physiology to interpret heart rate data (De Los Reyes, Augenstein et al., 2014). Thus, there exist examples of physiological measures, along with clinically relevant behavioral tasks and low-cost tools for data interpretation, that appear ready for the initial stages of empirical work on translating physiological measurement paradigms to clinical use.

Second, measures taken from low-cost physiological methods meaningfully relate to psychological constructs

with wide applicability to commonly assessed mental health concerns. These links between physiology and psychological constructs may improve the ability of mental health professionals to incorporate physiology into conceptual models of mental health concerns, case conceptualizations of individual patients, and ultimately as treatment response metrics. Specifically, recent work indicates that patients' capacities to express and regulate their emotions (i.e., *emotion regulation*) vary in both form and function across both mental disorders (e.g., Aldao, 2013; Aldao & Nolen-Hoeksema, 2010; Aldao, Nolen-Hoeksema, & Schweizer, 2010; Chaplin & Aldao, 2012; Kring & Sloan, 2009) and the lifespan (e.g., Cicchetti, Ackerman, & Izard, 1995; Isaacowitz, Wadlinger, Goren, & Wilson, 2006; Nolen-Hoeksema & Aldao, 2011; Shiota & Levenson, 2009). Further, commonly used physiological measures (e.g., heart rate/heart rate variability, pupillometry, and skin conductance) correlate, albeit in the low-to-moderate range, with informants' reports and behavioral measures of emotion regulation (e.g., Mauss, Levenson, McCarter, Wilhelm, & Gross, 2005; Sze, Gyurak, Yuan, & Levenson, 2010). Of importance, links between physiology and emotion regulation do not coincide with a single RDoC domain. Rather, these links may improve our understanding of multiple RDoC domains—namely, the positive and negative affect, cognition, and regulatory systems domains. That is, emotion regulation highlights the richness of the RDoC domains, as emotion regulation research spans several processes and sub processes (e.g., arousal, flexible updating of memory, emotional inhibition or suppression, initial response to reward, response selection, threat), and studies routinely incorporate systematic assessment of multiple units of analysis (e.g., subjective, physiological, behavioral; Bradley & Lang, 2000).

Third, low-cost physiological methods may inform clinical decision making, potentially addressing issues arising from the research–practice gap (Kazdin, 2008). Indeed, research demonstrating innovative and clinically feasible methods for using physiology to improve patient care may spur the dissemination of these methods for widespread use. As an example, consider recent studies with adults that have incorporated pupillometry methods (i.e., assessments of pupil diameter via infrared videography) into clinical assessments of depression (e.g., Dahl, Silk, & Siegle, 2012). Specifically, sustained pupil reactivity in response to affective stimuli (i.e., difficulties downregulating emotion-related arousal) distinguished depressed from nondepressed adults: Relative to nondepressed adults, depressed adults expressed greater sustained pupil dilation when instructed to identify the valence of emotional words (i.e., positive, negative, or neutral words; Siegle, Granholm, Ingram, & Matt, 2001). Further, among depressed patients with high pretreatment symptom severity, those also showing

sustained pupil dilation in response to emotional stimuli tended to evidence the lowest remission rates following cognitive behavioral therapy (Siegle, Steinhauer, Friedman, Thompson, & Thase, 2011). Thus, pupillometry methods may inform decision making in both assessment screening and treatment prognosis. Further, a focus of recent work involves examining whether the value of pupillometry methods generalizes to assessing adolescent patients (Dahl et al., 2012).

Fourth, researchers recently developed a framework for using and interpreting multiple informants' clinical reports. With some modifications, this framework might guide hypothesis testing within mental health assessment batteries that integrate physiological measures. Consequently, this framework may guide mental health professionals' use of physiological measures within the already comprehensive assessments conducted in clinical and empirical work. Specifically, the Operations Triad Model (OTM; De Los Reyes, Thomas, et al., 2013) provides an organizing framework for distinguishing those instances in which multiple reports of the same behavior or construct yield similar or disparate assessment outcomes. Further, as we describe next, the OTM provides guidelines for distinguishing those instances in which discrepant assessment outcomes yield meaningful information (e.g., variation in the assessed behavior across relevant social contexts) from those instances in which the discrepancies can be explained by mundane methodological processes (e.g., measurement error). In line with the OTM, recent theoretical work has delineated instances in which divergent assessments of adolescents' self-reports of physiology and measures of physiology as taken via wireless heart rate monitors yield meaningful clinical information to inform treatment planning (for a review, see Thomas et al., 2012). Consequently, we describe next how the OTM may inform the hypothesis testing of relations between physiological measures and existing clinical measures.

THE PRESENT SPECIAL ISSUE

Overall, exciting developments in the availability and use of physiological measures in basic clinical science may inform advancements in using and interpreting these measures within mental health assessments. Thus, mental health professionals who work with children and adolescents would benefit from a collection of articles illustrating methods for integrating low-cost physiological measures within clinical assessments. To this end, this special issue addresses three aims. First, we provide a guiding conceptual framework for integrating physiological measures within clinical child and adolescent assessments. Second, we have assembled a collection of articles by researchers from diverse areas of study.

Collectively, these articles demonstrate approaches to implementing physiological measures in clinical child and adolescent assessments. Third, two commentaries (i.e., Aldao & De Los Reyes, 2015; Youngstrom & De Los Reyes, 2015) outline directions for future research on integrating physiological measures within clinical child and adolescent assessments. In addressing these aims, we seek to increase the likelihood that NIMH's RDoC demonstrably improves patient care and overall public health.

PRINCIPLES UNDERLYING INTEGRATING PHYSIOLOGICAL MEASURES WITHIN CLINICAL CHILD AND ADOLESCENT ASSESSMENTS

Recent Theoretical Advancements Linking Informants' Reports to Observed Behavior

As mentioned previously, a key challenge with implementing physiological measures within clinical assessments is that mental health professionals already administer comprehensive assessment batteries (Hunsley & Mash, 2007). These assessments commonly yield inconsistent assessment outcomes, particularly when they incorporate reports from multiple informants (e.g., De Los Reyes, 2011). Mental health professionals have long encountered difficulties with integrating discrepant assessment outcomes to make decisions in clinical and empirical work (De Los Reyes, 2013). Thus, to implement physiological measures within clinical assessments, mental health professionals likely require a guide for integrating these measures into the assessment batteries they already use. Ideally, this guide would facilitate the generation of hypotheses about how assessment outcomes generated from physiological measures will relate to outcomes generated from commonly used clinical measures, namely, reports taken from multi-informant assessments.

Recent theoretical work has sought to increase the interpretability of multi-informant assessments and the inconsistencies that commonly arise. As mentioned previously, the OTM is a theoretical framework originally developed to assist in using and interpreting the outcomes of multi-informant clinical assessments (Figure 1; De Los Reyes, Thomas, et al., 2013). In light of the possibility that mental health professionals may observe either consistencies or inconsistencies among informants' clinical reports, the OTM guides mental health professionals to hypothesize whether multi-informant assessments in a study or clinical scenario will converge on a common conclusion or diverge toward inconsistent or discrepant conclusions.

Briefly, hypothesizing convergence among conclusions involves operationally defining a threshold for

convergence. For instance, one might hypothesize that 80% of all informants providing reports to assess a child patient's disruptive behavior will endorse sufficient symptoms for the patient to meet diagnostic criteria for conduct disorder. This scenario characterizes Converging Operations, historically the dominant concept for interpreting outcomes in multi-informant, multi-method assessments (Garner, Hake, & Eriksen, 1956; Figure 1a). In addition to Converging Operations, the OTM delineates two scenarios in which mental health professionals might observe and interpret discrepant conclusions: Diverging Operations and Compensating Operations. In both of these scenarios, conclusions drawn based on assessment outcomes from multiple informants' reports fall at or below a hypothesized level of correspondence among findings (e.g., Pearson r correlation among reports at or below .30). Additional examples for operationally defining converging versus diverging assessment outcomes can be found elsewhere (e.g., De Los Reyes & Kazdin, 2006, 2009; De Los Reyes, Thomas, et al., 2013).

What distinguishes Diverging Operations from Compensating Operations is the mechanism that explains the divergence among informants' reports. Specifically, Diverging Operations characterizes those instances in which informants' reports diverge for meaningful reasons (Figure 1b). An example of Diverging Operations might involve taking reports from informants who vary in the contexts in which they observe the behaviors about which they provide clinical reports (e.g., parent vs. teacher reports of childhood disruptive behavior). Alternatively, Compensating Operations characterizes scenarios in which divergence among informants' reports occurs for mundane methodological reasons (Figure 1c). Compensating Operations might occur if low measurement reliability among one or more reports explains why reports diverged. In addition, Compensating Operations might occur if one does not hold measurement content constant across informants' reports. For instance, a parent and teacher might have provided discrepant reports of a patient's attention and hyperactivity concerns because the parent completed a measure that contained items about both attention and hyperactivity concerns, whereas the teacher completed a measure that only contained items about hyperactivity concerns.

The key strength in the OTM is that use of its components (Figure 1) allows mental health professionals to make informed decisions based on multi-informant assessment outcomes. For instance, when a researcher encounters outcomes reflecting Compensating Operations, he or she has attained the necessary justification to warrant integrating multi-informant data using methods that treat divergence among reports as measurement error. This form of divergence can be addressed in

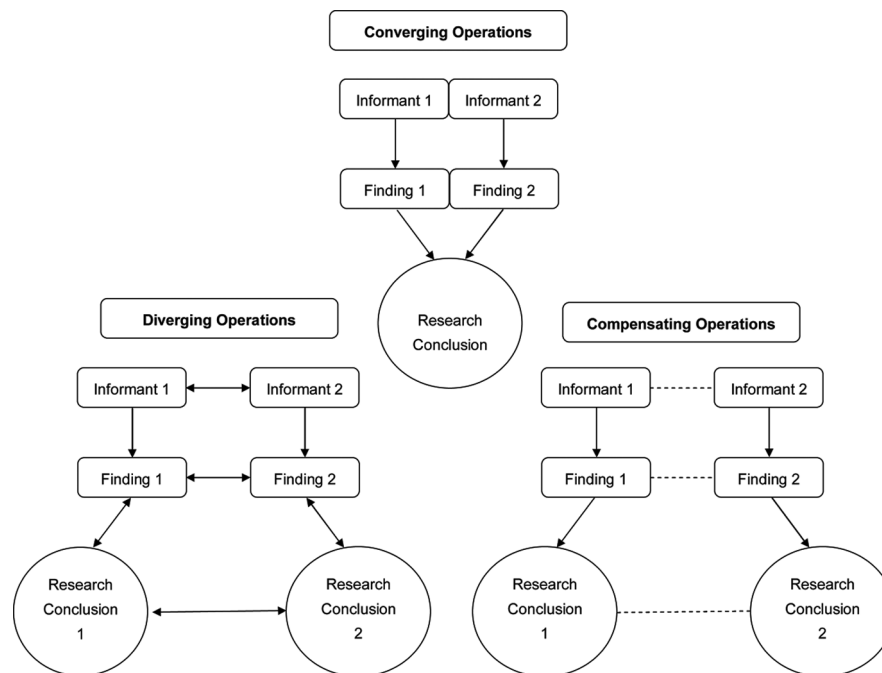


FIGURE 1 Graphical representation of the research concepts that comprise the Operations Triad Model. *Note:* The top half (Figure 1a) represents Converging Operations: a set of measurement conditions for interpreting patterns of findings based on the consistency within which findings yield similar conclusions. The bottom half denotes two circumstances within which researchers identify discrepancies across empirical findings derived from multiple informants' reports and thus discrepancies in the research conclusions drawn from these reports. On the left (Figure 1b) is a graphical representation of Diverging Operations: a set of measurement conditions for interpreting patterns of inconsistent findings based on hypotheses about variations in the behavior(s) assessed. The solid lines linking informants' reports, empirical findings derived from these reports, and conclusions based on empirical findings denote the systematic relations among these three study components. Further, the presence of dual arrowheads in the figure representing Diverging Operations conveys the idea that one ties meaning to the discrepancies among empirical findings and research conclusions and thus how one interprets informants' reports to vary as a function of variation in the behaviors being assessed. Lastly, on the right (Figure 1c) is a graphical representation of Compensating Operations: a set of measurement conditions for interpreting patterns of inconsistent findings based on methodological features of the study's measures or informants. The dashed lines denote the lack of systematic relations among informants' reports, empirical findings, and research conclusions. Originally published in De Los Reyes, Thomas, et al. (2013). © [Annual Review of Clinical Psychology]. Copyright 2012 Annual Reviews. All rights reserved. The Annual Reviews logo, and other Annual Reviews products referenced herein are either registered trademarks or trademarks of Annual Reviews. All other marks are the property of their respective owner and/or licensor.

empirical work with a variety of sophisticated analytic procedures, such as structural equations modeling (e.g., Holmbeck, Li, Schurman, Friedman, & Coakley, 2002). In clinical work, practitioners might integrate reports for which measurement error best explains divergence by using a relatively simple algorithm for combining reports, such as taking an average of reports.

As another example, consider a practitioner who observes that the parent of one of her patients reports aggressive behavior concerns expressed by the patient that go uncorroborated by reports taken from the patient's teacher. Here, the practitioner might also find home observations to reveal the parent exhibiting poor behavior management strategies that result in the child behaving aggressively at home. Alternatively, school observations might reveal the teacher displaying a comprehensive behavior management system in the classroom, resulting in the patient expressing little-to-no aggressive behavior at school. Thus, the discrepancies

between reports can be best explained by Diverging Operations. That is, the parent reported aggressive behavior about the patient that the teacher did not because the home environment (and not the school environment) contained contingencies that pose risk for expressions of aggressive behavior. In fact, Diverging Operations allows the practitioner to meaningfully interpret the discrepancies between informants' reports. Specifically, interpreting these discrepancies as reflecting contextual variations in the patient's aggressive behavior allows the practitioner to use the reports to tailor or personalize treatment to the patient's unique needs. For instance, the practitioner might implement a behavior management training program with the parent. At the same time, the practitioner would coordinate with the teacher to ensure continued implementation of behavior management strategies in the school. In fact, assuming the discrepancies reflected measurement error (i.e., Compensating Operations) might have led the practitioner to make fundamentally different clinical

decisions. For example, using Compensating Operations might have resulted in the practitioner assuming that the patient exhibits aggressive behavior across contexts, resulting in a treatment plan involving reducing aggressive behavior across home and school contexts (i.e., a cost-inefficient treatment plan).

In sum, the OTM provides mental health professionals with a hypothesis generation tool to plan for the outcomes of a multi-informant assessment. This hypothesis-driven process allows mental health professionals to attain greater certainty when evaluating assessment outcomes than the alternative, namely, entering an assessment without a hypothesis as to whether informants' reports will converge or diverge. In turn, this increased certainty should improve mental health professionals' applications of appropriate methodological and statistical procedures to integrating multi-informant data. This increased certainty ought to also increase opportunities for mental health professionals to personalize care to address patients' unique needs.

Applying the OTM to Integrating Physiology Within Clinical Assessments

Conceptual overview. The OTM examples noted previously involved identifying links between informants' reports and independent assessments of patients' observed behavior, such as performance on laboratory tasks, or naturalistic observations of patients' behavior in home and school settings. We can generalize this key element of the OTM, namely, identifying links between informants' reports and independent assessments of patients' functioning, to assessment scenarios that integrate physiological measures. Specifically, we previously discussed that clinical child and adolescent assessments typically rely on some combination of informants' reports and behavioral observation methods. Thus, a framework for guiding the integration of physiological measures into mental health assessments ought to involve linking physiological measures with these two commonly used methods. Such a framework might usefully inform mental health professionals' decision making in both clinical and empirical work. For example, when Converging Operations guides integration of a physiological measure, the purpose of the physiological measure might be to corroborate findings linking informants' reports to a criterion measure (e.g., consensus diagnosis). Further, physiological measures rely on distinct methods relative to existing clinical tools that often serve as criterion and predictor variables. For instance, mental health professionals often conduct diagnostic interviews using reports from the same informants who provide reports on the survey measures used to predict the outcomes of diagnostic interviews. Thus, physiological measures might serve to rule out shared

informant variance as the reason for identifying links between informants' reports and criterion measures.

Three key principles guide our translation of the OTM for integrating physiological measures. First, one can integrate physiological measures by taking them in vivo or simultaneously within performance-based clinical tasks or behavioral observations (e.g., assessments of a patient's heart rate during a stressful speech task). In this way, a patient's physiological functioning can be interpreted relative to clinically meaningful contexts or environmental demands that tend to elicit observable signs of the patient's concerns (e.g., anger or anxiety-provoking scenarios, frustrating tasks, or social interactions). Second, one can link multiple informants' reports to physiological assessments by treating informants' reports as proxy measurements of contextual variations in patients' behavior. For instance, a practitioner may treat parent and teacher reports as reflections of how a patient behaves within home and school settings, respectively (e.g., Kraemer et al., 2003).² One can then observe whether informants' reports relate to physiological functioning differently depending on the contexts represented by the tasks within which one took physiological measurements (e.g., task meant to reflect parent-child interactions vs. task meant to reflect patient's interactions with peers at school). Third, one can take a patient's report in vivo or during a clinical task using repeated measurements of the patient's subjective impressions of their behavior or emotions. Using this design, one can gauge how a patient's subjective impressions of distress change during a task compared to changes observed on measures of the patient's physiology during the same task.

Together, these three principles yield two different paradigms for applying the OTM to integrating physiological measures. Specifically, one might implement a physiological measure to understand convergence or divergence between informants' reports, much like the previously described examples of Converging and Diverging Operations that involved examining links between informants' reports and independent observations of a patient's behavior (see also De Los Reyes, Bunnell, & Beidel, 2013; De Los Reyes, Henry, Tolan,

²In treating informants' reports as proxy measurements of contextual variations in patients' behavior, it is important to rule out plausible rival hypotheses for the discrepancies between informants' reports. For instance, a patient's parent may provide a report that is discrepant from the teacher's report about the patient because the parent experienced poor memory functioning at the time of the report. To address this issue, the assessor may administer to the informants both the reports about the patient's functioning and standardized tests of memory functioning to determine whether the discrepancies between reports could be accounted for by relatively poor memory functioning (e.g., relative to normative scores of such functioning) on the part of one or both informants.

& Wakschlag, 2009). Alternatively, one might examine a physiological measure alongside an informant's report, and assess convergence or divergence in the abilities of these two measures to predict a common criterion (e.g., diagnostic status or treatment response). In each scenario, one might apply Converging, Diverging, or Compensating Operations to interpret the findings. Therefore, we outline each concept, and discuss applicable assessment scenarios.

Converging Operations: Multi-informant reports in relation to physiology. Use of Converging Operations within physiological assessments might involve a multi-informant assessment of a patient within which a mental health professional expects the results of the informants' reports to each overlap with or corroborate the results obtained from a physiological assessment (Figure 2a). That is, the relations observed between each informant's report and the physiological measure result in drawing the same or similar conclusions as to the links between informants' perspectives and physiological processes. For example, as mentioned previously, researchers have recently observed sustained pupil dilation among depressed adults in response to affective stimuli, relative to nondepressed adults (e.g., Dahl et al., 2012). In line with this, consider an example in which a researcher conducts a case-control study of adolescents either experiencing clinically relevant depressive symptoms or not. Specifically, the researcher might hypothesize that

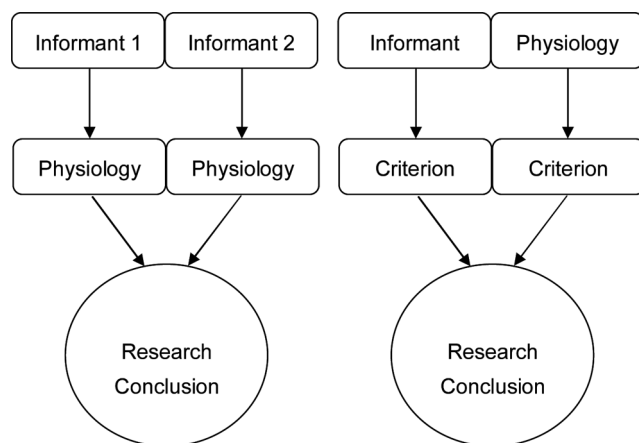


FIGURE 2 Graphical depiction of two manifestations of Converging Operations, adapted for use in hypothesis testing within assessment batteries seeking to link informants' clinical reports and physiology (Garner et al., 1956). *Note:* The graphic on the left (Figure 2a) characterizes assessment scenarios in which one examines relations between informants' reports in relation to a physiological assessment. The graphic on the right (Figure 2b) characterizes assessment scenarios in which one examines relations between an informant's report and a physiological assessment in relation to a third clinical variable (e.g., diagnostic status and treatment response). Adapted from De Los Reyes, Thomas et al. (2013) by permission of Annual Review of Clinical Psychology.

sustained pupil dilation during a valence identification task (i.e., identifying the emotionality of positive, negative, or neutral words) differentiates adolescents on depressive symptom status, regardless of the informant relied upon to identify the adolescents' status. For instance, conclusions regarding the links between adolescents' depressive symptoms and pupil dilation in reference to affective stimuli remain the same, regardless of whether one determines symptom status using clinical cutoff scores for adolescent self-reports or clinical interviewer reports. This example illustrates an instance in which a researcher expects to observe Converging Operations in the links between informants' reports and physiological measures.

Converging Operations: Informant's report and physiology in relation to a common criterion. Interpreting physiological assessment outcomes using Converging Operations might also involve a mental health professional hypothesizing that an informant's report and a physiological measure will each point to or predict outcomes on a common, independently assessed clinical measure of a patient's functioning. In contrast to the model depicted in Figure 2a, Figure 2b depicts a circumstance in which a mental health professional examines the physiological measure and informant's report in reference to a third clinical variable. One example might be a practitioner administering a classroom behavior management intervention to decrease school-based hyperactivity in his patient. Before and after the intervention, the practitioner takes the teacher's report of the patient in class. Specifically, the teacher provides reports via a behavioral observation system designed to train teachers to take frequency counts of a patient's expressions of behaviors germane to assessments of attention and hyperactivity (e.g., Individualized Target Behavior Evaluation; see Pelham, Fabiano, & Massetti, 2005). Within the same classroom setting and time frame within which the teacher bases his report about the patient's hyperactivity, the practitioner also has the patient wear a wireless wristwatch monitor designed to assess the patient's frequency in movement (i.e., actigraphy monitor). Independent of the outcomes of these two assessments, the practitioner completes a clinical measure of improvement following the intervention (e.g., Clinical Global Impressions Severity of Illness and Improvement Scale; Guy, 1976). The practitioner would make observations consistent with Converging Operations if (a) the teacher report evidenced significant reductions in frequencies of behaviors indicative of hyperactivity, (b) the actigraphy monitor revealed significant reductions in the patient's activity level or movement, and (c) the practitioner identified significant clinical improvements in the patient's functioning. Stated

another way, pre-to-post changes on both the teacher report and actigraphy monitor reflected the clinical improvements observed by the practitioner.

Diverging Operations: Multi-informant reports in relation to physiology. Mental health professionals hypothesizing data to conform to Diverging Operations might be interested in examining links between a multi-informant assessment of a patient and a physiological assessment (Figure 3a). Under these circumstances, the relations observed between each informant's report and the physiological assessment result in drawing different conclusions as to the links between informants' perspectives and physiological processes. Further, the patterns of findings would point to meaningful reasons for the different findings between the two informants' reports in relation to the physiological assessment.

For instance, as mentioned previously, parents and teachers often systematically vary in the contexts within which they observe children (i.e., home vs. school; see also De Los Reyes, 2011). Consequently, their reports of children's behavior should differ, and do so because children might vary in where they express specific behaviors (e.g., anxiety, disruptive behavior, or irritable mood; Achenbach et al., 1987). Thus, a researcher might examine links between parent and teacher reports of children's irritable mood symptoms in relation to physiological assessments of children when completing a series of frustrating tasks (e.g., completion of complex puzzles or models), which have been shown to elicit individual differences in children's emotional expressions (e.g., Youngstrom, Izard, & Ackerman, 1999). Specifically, to test hypotheses consistent with Diverging Operations, the researcher would structure the frustrating tasks such that they reflect contextual variability in terms of tasks typical of home (e.g., tasks completed

within the context of daily mother-child interactions) and school settings (e.g., child completing school work while a nonparental adult attends to other activities). Researchers recently developed contextually varying behavioral tasks such as these to assess disruptive behavior in preschool children (for a review, see Wakschlag, Tolan, & Leventhal, 2010). Further, the researcher might assess children's physiology within and across frustrating tasks using ambulatory wireless heart rate monitors as previously described (e.g., Thomas et al., 2012).

Presumably, children experiencing irritable mood symptoms in school settings and not home settings would evidence relatively low heart rate variability within the "school tasks" (i.e., a marker of poor emotion regulation; Mauss et al., 2005), and relatively high heart rate variability within the "home tasks" (i.e., a marker of adaptive emotion regulation). The alternative pattern might characterize children experiencing irritable mood symptoms in home settings and not school settings (i.e., low heart rate variability on "home tasks" and high heart rate variability on "school tasks"). Thus, to identify links between informants' reports and physiological assessments, the researcher might identify groups of children who vary in which informant(s) identified them as exhibiting irritable mood symptoms. For example, the researcher could identify a group of children reported by parents and not teachers as expressing irritable mood symptoms, and then another group reported by teachers and not parents as expressing irritable mood symptoms (for an example of this method, see De Los Reyes et al., 2009). Evidence consistent with Diverging Operations might come from examining whether these two groups of children evidenced patterns of physiological reactions to contextually sensitive laboratory tasks that "matched" the patterns of reports provided by parents and teachers. That is, did "teacher-identified" children evidence maladaptive physiological

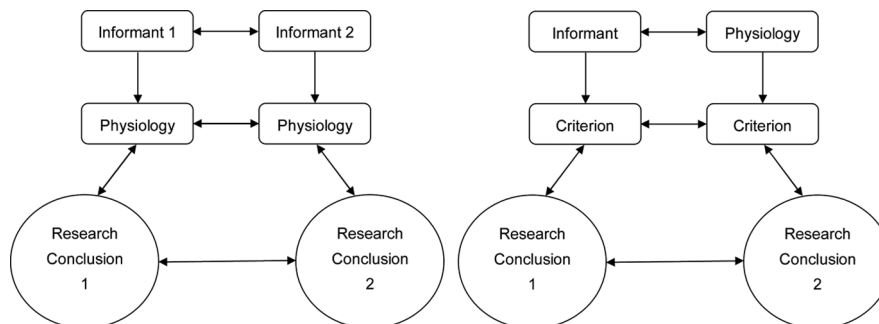


FIGURE 3 Graphical depiction of two manifestations of Diverging Operations, adapted for use in hypothesis testing within assessment batteries seeking to link informants' clinical reports and physiology (De Los Reyes, Thomas, et al., 2013). *Note:* The graphic on the left (Figure 3a) characterizes assessment scenarios in which one examines relations between informants' reports in relation to a physiological assessment. The graphic on the right (Figure 3b) characterizes assessment scenarios in which one examines relations between an informant's report and a physiological assessment in relation to a third clinical variable (e.g., diagnostic status and treatment response). Adapted from De Los Reyes, Thomas et al. (2013) by permission of Annual Review of Clinical Psychology.

reactions to “school tasks” and not “home tasks,” whereas “parent-identified” children evidence maladaptive reactions to “home tasks” and not “school tasks”?

Diverging Operations: Informant’s report and physiology in relation to a common criterion. Applying Diverging Operations within physiological assessments might also involve a mental health professional expecting that an informant’s report and a physiological measure will meaningfully differ in how or whether they predict outcomes on an independent clinical assessment of a patient’s functioning (Figure 3b). This instance of Diverging Operations involves hypothesizing that an informant’s report and a physiological assessment differentially predict outcomes on a third clinical measure. Further, a hypothesized mechanism exists to explain differential predictions between the informant’s perspective and physiological processes.

Recent work highlights an example of this form of Diverging Operations. In this study, researchers recruited adolescents from public schools and identified via semistructured interview a group of adolescents who met diagnostic criteria for social anxiety disorder and a group of adolescents who did not meet criteria for any mental disorder (Anderson & Hope, 2009). All adolescents in the sample gave a 10-min speech to three strangers and engaged in a 10-min conversation with a confederate (i.e., research assistant) assuming the role of a college freshman. Of importance, researchers chose situations that totaled 20 min to allow for physiological reactivity and habituation to transpire among adolescents in the sample. In line with these behavioral tasks, adolescents provided self-reports of their physiological arousal before and after the tasks and wore ambulatory heart rate monitors to track their heart rates before and during the tasks.

A key finding in this study is that adolescents, regardless of social anxiety status, tended to evidence physiological habituation to the behavioral tasks when assessed via heart rate monitors (Anderson & Hope, 2009). That is, adolescents tended to display a sharp increase in heart rate at the beginning of the tasks, followed by gradually declining heart rate as the task progressed. In fact, it was the adolescents’ self-reports that differentiated the clinical and community control groups. Relative to adolescents who did not meet criteria for a mental disorder, adolescents meeting criteria for social anxiety disorder self-reported relatively higher and stable reports of physiological arousal. Thus, subjective impressions of arousal and not the putatively objective physiological measure differentiated adolescents on the third clinical measure (i.e., diagnostic status).

The discrepant outcomes observed by Anderson and Hope (2009) between self-report and physiological

measures raise an important question: What useful clinical information could the integration of both self-report and heart rate monitoring measures provide that could not be obtained with either measure alone? Of interest, exposure-based therapies train adolescents to understand that, although they may not think prolonged exposure in an anxiety-provoking situation will eventually result in decreased physiological arousal, a gradual decrease in arousal is the exact process their bodies will undergo if they remain in the situation for a sufficient period (e.g., Beidel et al., 2007). Thus, in Anderson and Hope, adolescents experiencing social anxiety evidenced patterns of outcomes on self-report and physiological assessments consistent with their mental health concerns. Indeed, these discrepancies between self-report and physiological measures can be used by mental health professionals for case conceptualization, treatment planning, and treatment response metrics. For example, in discovering a discrepancy between a patient’s self-report and physiological measures, a practitioner might identify an important target of treatment: Increasing a patient’s ability to subjectively perceive the habituation to anxiety-provoking social situations evidenced by their own physiology (for an extended discussion of these issues, see Thomas et al., 2012). It is important to note that neither measure alone yields this important clinical information. That is, both self-report and physiological measures need to be administered and interpreted to understand these important clinical phenomena and make reliable and valid clinical decisions about the patient’s arousal within social situations. In sum, Anderson and Hope highlighted the utility of interpreting meaningful differential predictions of a clinical variable among informants’ reports and physiological assessments as instances of Diverging Operations.

Compensating Operations: Multi-informant reports in relation to physiology. In examining links between a multi-informant assessment of a patient and a physiological assessment, mental health professionals observing data that conform to Compensating Operations find the informants’ reports to vary in their relations to the physiological assessment. However, unlike Diverging Operations, what accounts for these relations are mundane empirical factors such as measurement error or differences among the assessments in measurement content or methodology (Figure 4a). In fact, what separates assessment outcomes that reflect Diverging Operations from those that reflect Compensating Operations is that with Diverging Operations, the assessor has constructed the assessment battery so as to rule out mundane empirical factors as accounting for the discrepancies among assessment outcomes. Examples of the precautions one might take include using parallel

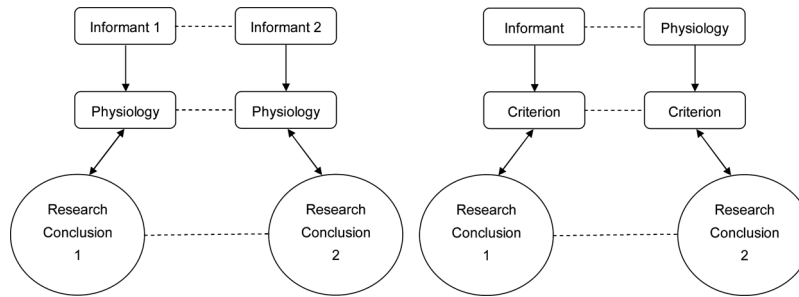


FIGURE 4 Graphical depiction of two manifestations of Compensating Operations, adapted for use in hypothesis testing within assessment batteries seeking to link informants' clinical reports and physiology (De Los Reyes, Thomas, et al., 2013). *Note:* The graphic on the left (Figure 4a) characterizes assessment scenarios in which one examines relations between informants' reports in relation to a physiological assessment. The graphic on the right (Figure 4b) characterizes assessment scenarios in which one examines relations between an informant's report and a physiological assessment in relation to a third clinical variable (e.g., diagnostic status and treatment response). Adapted from De Los Reyes, Thomas et al. (2013) by permission of Annual Review of Clinical Psychology.

measures to take informants' reports of patients' mental health concerns and taking physiological measures within behavioral tasks meant to reflect processes that share contextual overlap with informants' reports (e.g., assessing both patient's heart rate during a public speaking task and informants' perceptions of the patient's physical experiences with anxiety during performance situations; see also De Los Reyes, Thomas, et al., 2013).

In one hypothetical scenario, consider a study in which a researcher administered to parents and children nonparallel survey reports about the child's fear levels (e.g., survey reports differ in item content). The child also completed a behavioral avoidance test (BAT; for a review, see Vasey & Lonigan, 2000), a commonly used performance-based task to assess phobic avoidance of feared stimuli (e.g., animals, enclosed spaces, or heights). During the BAT, the child wore an ambulatory wireless heart rate monitor to assess physiological reactivity to feared stimuli. In this hypothetical study, children's self-reports related to physiological assessments taken during the BAT, whereas parent reports did not evidence these relations with the physiological assessments. Consistent with Compensating Operations, the reasons for these discrepant relations between informants' reports and physiological assessments lie in the item content of the parent and child reports. Specifically, child self-reports consisted of items assessing physical symptoms of anxiety. In contrast, parent reports consisted of items assessing behaviors indicative of separation fears unrelated to the feared stimuli. Thus, the diverging findings between informants' reports and physiology occurred because only one of the informants' reports (i.e., child self-report) contained items that meaningfully overlapped with the focus of the behavioral task linked with the physiological assessment. Consequently, the researcher might well be justified to interpret the child self-reports in relation to physiology. In contrast, the lack of content overlap between the

parent reports and physiology renders the links between these two measures inconclusive and thus uninformative for drawing research conclusions.

Compensating Operations: Informant's report and physiology in relation to a common criterion. Mental health professionals observing data that conform to Compensating Operations might have observed differences in the relative abilities of an informant's report and physiological assessment to predict a common clinical criterion variable. Similar to the first Compensating Operations scenario, the differing abilities of the informant's report and physiological assessment to predict outcomes on the criterion measure can best be explained by mundane methodological factors or measurement error (Figure 4b). For this scenario, let us return to the hyperactivity example used to illustrate the second circumstance of Converging Operations. Recall that in this scenario, the practitioner administered a classroom behavior management intervention and took pre- and postintervention measures of the teacher's impressions of the patient in class. Let us continue to assume that the teacher reliably and validly completed behavioral observations denoting frequencies of the child's hyperactivity in class. However, for this Compensating Operations example, let us consider the implications of the practitioner instructing the patient to wear an actigraphy monitor during a 5-min period in which the patient was instructed to "sit still and read quietly." With this version of the actigraphy monitoring assessment, the practitioner observed at the preintervention assessment that the child complied with the instructions (i.e., the child read quietly). However, at the postintervention assessment, the child played a board game with a classmate during the 5-min actigraphy assessment. Independent of these assessments, the practitioner completed a postintervention clinical measure of improvement.

Of importance, following the intervention the practitioner observed (a) the teacher report evidenced significant reductions in hyperactivity behaviors, (b) the actigraphy monitor revealed no reductions in the patient's activity level, and (c) himself reporting significant clinical improvements in the patient's functioning. These findings conform to Compensating Operations for two reasons. First, the practitioner took actigraphy readings during a task that did not closely adhere to the activities about which the teacher based his own reports about the patient, nor was typical of the setting within which the practitioner administered the intervention. Second, the patient complied with the task instructions within which the practitioner took actigraphy readings during the preintervention assessment but not the postintervention assessment. As in the previous Compensating Operations example, the practitioner identified discrepancies among the assessment outcomes derived from informants' reports and physiological measures. Yet in the case of the practitioner the physiological measure was administered in error, and this renders links between the informants' reports and physiology inconclusive and thus uninformative for making clinical decisions. In sum, these examples illustrate findings among informants' reports and physiological assessments that one might observe when applying Converging Operations (Figures 2a, and 2b), Diverging Operations (Figures 3a and 3b), or Compensating Operations (Figures 4a and 4b) to integrating physiological measures within mental health assessments.

OVERVIEW OF SPECIAL ISSUE ARTICLES

The articles in this special issue illustrate the potential for physiological measures to augment current technologies for assessing mental health concerns. Indeed, across various study designs, clinical domains, and contexts of clinical assessment, these studies illustrate a variety of modalities that mental health professionals may implement, some of which involve little to no background in physiology to collect and interpret the data. Further, their findings may inform the design of future studies aiming to improve the clinical feasibility of implementing physiological measures within mental health assessments.

Specifically, two articles illustrate how physiological measures inform understanding of (a) links between exposure to real-world psychosocial stressors and internalizing and externalizing concerns (McLaughlin, Rith-Najarian, Dirks, & Sheridan) and (b) treatment response within targeted school-based mental health prevention programs for reducing incidences of aggressive behavior (Gatzke-Kopp, Greenberg, & Bierman). De Los Reyes and colleagues and Leitzke, Hilt, and Pollack

highlight methods for integrating physiological measures within clinical assessments of adolescent social anxiety and child maltreatment, respectively. Cohen, Masyn, Mastergeorge, and Hessel report findings about a multimodal physiological battery and its ability to distinguish subgroups of patients experiencing autism spectrum concerns. In particular, their findings may have implications for developing metrics to track treatment response among patient subgroups that evidence maladaptive physiological reactions to emotionally evocative stimuli. Three articles (Bress, Meyer, & Hajcak; Franklin, Glenn, Jamieson, & Nock; Moser, Durbin, Patrick, & Schmidt) take a transdiagnostic approach to incorporating physiological measures in practice settings, as well as in research on understanding the mechanisms underlying child and adolescent mental health concerns.

Last, in this introductory article we provided a conceptual overview of the basis for this special issue. We also advanced a theoretical framework for guiding hypothesis testing when integrating physiology within mental health assessments. In doing so, we omitted discussion of key practical issues regarding use, interpretation, and implementation of physiological measures within mental health assessments. In addition to the empirical articles, two commentaries focus on these practical issues. Specifically, Aldao and De Los Reyes discuss methods for making practical use of existing clinical techniques to integrate physiological measures within clinical and empirical work, examples of which include taking physiological measurements within in vivo behavioral exposures during therapy sessions. Further, Youngstrom and De Los Reyes discuss both key distinctions between research and practice settings in the potential clinical utility of physiological measures and important criteria that ought to be considered when making decisions about integrating physiological measures within mental health assessment batteries, namely, incremental prediction and costs.

CONCLUDING COMMENTS

The RDoC initiative seeks to significantly advance identifying, classifying, and treating mental health concerns by promoting research on the brain mechanisms underlying these concerns. The initiative's focus on brain mechanisms hinges on new lines of research examining patients' responses on biological measures. Findings from RDoC will present unique challenges to clinical and empirical work, as mental health professionals rarely integrate biological measures within mental health assessments. In this special issue, we focused on patients' biological responses as assessed via relatively low-cost and noninvasive peripheral physiology methods. However, the issues we raise apply to mental

health assessments that integrate biological measures beyond those discussed (e.g., genotyping and neural circuitry).

The extent to which RDoC results in research findings that improve patient care and overall public health rests, in part, on our ability to develop strategies for effectively integrating biological measures within mental health assessments. We are wading into new and uncharted waters. Consequently, we may instinctively assume that integrating biological measures within existing mental health assessments should involve using biological measures to corroborate responses on other clinical instruments (e.g., clinical interviews and informants' reports). In fact, sometimes biological measures may serve this corroborative function (Figure 2a). However, we should learn from our history so as to avoid costly mistakes. One of the most robust observations mental health professionals who work with children and adolescents make is that multi-informant, multi-method clinical assessments yield inconsistent outcomes (Achenbach et al., 1987). However, these inconsistencies may reveal important information about contextual variability in child and adolescent mental health (e.g., De Los Reyes, Thomas, et al., 2013; Kraemer et al., 2003). Thus, within many assessment scenarios we will encounter only disappointment—and lose valuable clinical information—if we expect convergence among assessments when prior research and theory clearly indicate that we should expect divergence.

Mental health professionals should think deeply when planning to integrate biological measures into their mental health assessments. In your clinical practice, how might you link biological assessments to clinically meaningful behavioral tasks? When conducting an empirical study, when might you predict that a biological measure will yield findings that converge with the other clinical tools in your battery? Under what circumstances might you predict that different clinical tools will diverge in their relations to biological measures? Can you construct your assessment so as to ensure that this divergence will yield valuable clinical information?

A key purpose of this introductory article was to provide a conceptual overview of the issues that informed this special issue and highlight the foci of its empirical articles. We also took this opportunity to give mental health professionals a guide for hypothesis testing within clinical assessment batteries that incorporate biological measures (Figures 1–4). We hope that our guide assists in improving certainty in clinical decision making among mental health professionals when administering comprehensive assessments of child and adolescent mental health. And we hope that this special issue will inspire and motivate you to wade along with us into these new and uncharted waters.

ACKNOWLEDGMENTS

We acknowledge a number of scientists for their guidance, feedback, and support in preparation of this special issue. First, we thank Mitch Prinstein for his guidance in selecting contributors and advice throughout the manuscript review process. Second, Deb Drabick graciously served as editor for the review of two articles in this special issue for which there was a conflict of interest on our behalf. Third, Jessica Borelli and Matthew Lerner provided insightful commentary on previous drafts of this introductory article to the special issue.

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