

Introduction to the Special Section: Toward Implementing Physiological Measures in Clinical Assessments of Adult Mental Health

Amelia Aldao¹ · Andres De Los Reyes²

Published online: 5 October 2015
© Springer Science+Business Media New York 2015

Abstract This article serves as the introduction to the Special Section called “Toward Implementing Physiological Measures in Clinical Assessments of Adult Mental Health.” As such, it provides an overview of the importance of integrating assessments of physiological and subjective processes in mental health assessments and discusses the Research Domain Criteria (RDoC) initiative. In addition, it summarizes the findings from the four empirical studies published in the Special Section. Collectively, these studies sought to illustrate how physiological assessments can be incorporated in mental health assessments conducted in applied research and clinic settings. In all, we hope that this Special Section will inspire the type of interdisciplinary research spanning basic and applied work that will be critical to advancing the RDoC initiative.

Keywords Physiology · RDoC · Emotion regulation · Assessment

Traditional mental health domains (e.g., anxiety, mood, substance use, aggressive behavior, hyperactivity/inattention) share much overlap in clinical presentations and domains of functional impairment (e.g., Kessler et al. 2006). In this

respect, in the past decade there has been a growing understanding that patterns of psychological dysfunction quite frequently cut across traditionally defined diagnostic categories as defined by the Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association 2013) or the International Classification of Diseases (World Health Organization 2007) (see Barlow et al. 2004; Kring and Sloan 2009; Nolen-Hoeksema and Watkins 2011). Furthermore, clinical scientists have begun to recognize that these overlapping patterns of dysfunction might best be quantified and examined by identifying patterns of patients’ functioning across multiple indices such as subjective feelings, physiological arousal, neurobiological processes, genetic factors, and motivated behaviors, among others (Cuthbert and Insel 2010).

In this respect, a few years ago, the National Institute of Mental Health (NIMH) developed the Research Domain Criteria (RDoC), which is a research initiative that seeks to organize the study of psychopathology by advocating the identification of pathological processes across diagnostic categories and units of analyses (Insel et al. 2010). Specifically, RDoC describes five domains (each with multiple sub 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; for descriptions, see Sanislow et al. 2010). Since the launching of the RDoC initiative, hundreds of studies have adopted this framework in order to shed more light onto psychopathology. A quick search on Google Scholar reveals that in 2010, a total of 25 articles mentioned “Research Domain Criteria” and in 2014, 837 articles did so (for a total of 1670 between 2010 and 2014). As a result, the field has made great progress in advancing *basic research* on the mechanisms underlying the development and maintenance of mental disorders.

✉ Amelia Aldao
aldao.1@osu.edu

Andres De Los Reyes
adlr@umd.edu

¹ Department of Psychology, The Ohio State University, 1835 Neil Ave, Columbus, OH 43210, USA

² Comprehensive Assessment and Intervention Program, Department of Psychology, University of Maryland at College Park, Biology-Psychology Building, Room 3123H, College Park, MD 20742, USA

The ultimate goal of the RDoC initiative is for this basic research to inform *applied research and practice*, namely the development of therapeutic techniques to aid in the prevention and treatment of mental health concerns. Yet, applied researchers and practitioners primarily rely on assessments with one unit of analysis, namely subjective reports by patients (and sometimes their relatives, friends, teachers, and colleagues) and clinical symptom and/or impairment ratings made by trained personnel (e.g., clinicians) (e.g., for reviews, see De Los Reyes et al. 2011, 2013). Further, when applied researchers rely on assessments with more than one unit of analysis, this approach frequently yields inconsistent findings that often create uncertainties in clinical decision-making (e.g., Achenbach et al. 2005; De Los Reyes et al. 2015b). However, RDoC places a key emphasis on multiple biologically focused units of analysis that reference dysfunction in brain circuitry. Currently, applied clinical researchers and practitioners rarely use biological-based assessments to characterize patient functioning, make diagnostic judgments, plan treatment, and monitor treatment response (e.g., De Los Reyes and Aldao 2015; Davis et al. 2011). Thus, there is a substantial gap between current research informed by the RDoC initiative and the implementation of findings from this work in applied research and clinical settings. Closing this gap is essential in order for RDoC to have a meaningful impact on the diagnosis, treatment, and prevention of mental disorders, and thus improve public health.

We have recently taken a step in this direction by serving as Guest Editors for a Special Issue in the *Journal of Clinical Child and Adolescent Psychology* (JCCAP; De Los Reyes and Aldao 2015). Within this Special Issue, we invited researchers to contribute empirical papers illustrating assessment paradigms and/or treatment approaches that incorporate physiological measures in clinical assessments of children and adolescents (Aldao and De Los Reyes 2015; De Los Reyes and Aldao 2015). We requested articles focusing on physiological indices known to reflect emotion regulation processes. The emotion regulation framework has increasingly demonstrated utility in characterizing patterns of dysfunction within psychopathology (e.g., Aldao et al. 2010; Kring and Sloan 2009) and it has been incorporated into the theoretical foundations and techniques underlying manualized psychosocial interventions (e.g., Barlow et al. 2004; Bilek and Ehrenrich-May 2012; Hayes et al. 1999; Linehan 1993; Mennin and Fresco 2013; Roemer et al. 2008).

From an RDoC standpoint, emotion regulation is a particularly important process because it cuts across several domains of functioning (e.g., negative affect, positive affect, social processes, and regulatory systems) and units of analyses relevant to this initiative (e.g., subjective feelings, physiological arousal, and neurobiological circuitry). Indeed, the articles in our previous JCCAP Special Issue were quite diverse in foci. Empirical contributions spanned internalizing conditions

(e.g., Bress et al. 2015; De Los Reyes et al. 2015a), externalizing conditions (Gatzke-Kopp et al. 2015), and pervasive developmental disorders (Cohen et al. 2015). These studies also focused on a wide range of physiological and neurobiological processes, such as heart rate and heart rate variability (McLaughlin et al. 2015), blood pressure (Leitzke et al. 2015), and resting electroencephalography asymmetry (Moser et al. 2015). Consequently, the JCCAP Special Issue opened new avenues for how RDoC-inspired research may inform the development of innovative and clinically feasible assessment and treatment techniques.

In this Special Section of the *Journal of Psychopathology and Behavioral Assessment*, we sought to expand the work from our JCCAP Special Issue by focusing on the implementation of physiological measures within clinical assessments of adult mental health, with a focus on assessments of mood and anxiety concerns. Specifically, the four articles involved implementing physiological measures to improve the interpretability of clinical assessments of generalized anxiety, social anxiety, and depression. Two of the empirical articles focused on parasympathetic reactivity (Kircanski et al. [this issue](#)), one focused on creating graphical depictions of heart rate (Dunn et al. 2015), and one examined vocal pitch (Weeks et al. 2015). Importantly, the procedures implemented in each of these studies can be easily carried out in ambulatory settings. For example, heart rate and heart rate variability can be assessed with a number of low cost wristwatch monitors (ranging from under \$100 for heart rate to \$400 for heart rate variability) and they can be analyzed with a number of free software packages (for a review, see Thomas et al. 2012). Thus, it is our hope that this type of work can inspire the development and adaptation of experimental paradigms to assess emotion dysfunction in the context of clinical settings (as reviewed in Aldao and De Los Reyes 2015). Below we describe each of the contributions to this Special Section in greater detail.

Kircanski and colleagues ([this issue](#)) presented findings from a study examining physiological reactivity to social stress in women diagnosed with generalized anxiety disorder (GAD), major depressive disorder (MDD), both disorders, and healthy controls. The authors assessed respiratory sinus arrhythmia (RSA), which reflects high frequency variability (.12–40 Hz) in the time elapsed between successive heartbeats and, therefore reflects parasympathetic nervous system (the sympathetic branch work on a much slower scale; e.g., Thayer et al. 2012). Critically, RSA withdrawals in response to stressors reflect adaptive and flexible emotional functioning (e.g., Graziano and Derefinko 2013). The investigators found that healthy controls exhibited an adaptive pattern of RSA withdrawal to a social stressor followed by a subsequent rebound. In contrast, participants in the clinical groups evidenced smaller withdrawal and recovery. Importantly, none of the clinical groups differed from one another suggesting that disrupted RSA

reactivity to social stressors might be a transdiagnostic feature across these conditions. In addition, the authors found that, whereas trait levels of rumination were linked with smaller RSA withdrawal, trait levels of worry were associated with greater RSA withdrawal. They interpreted this diverging pattern of findings as suggesting that worry might play a stronger role in threat states, such as the one elicited in their study. In all, these findings speak to the importance of examining RSA withdrawal in relation to multiple diagnostic groups and types of perseverative cognition (see also Aldao et al. 2013).

Along these lines, LeMoult and colleagues (this issue) examined the relationship between RSA withdrawal and the use of the putatively maladaptive strategy of rumination and the putatively adaptive strategy of distraction in the context of MDD (for a review of the literature comparing the effects of rumination to those of the distraction, see Nolen-Hoeksema et al. 2008). After a forced-failure stressor, depressed participants were instructed to engage in either rumination or distraction. Whereas rumination resulted in increases in negative affect, distraction produced decreases in negative affect. Interestingly, distraction was linked with greater RSA withdrawal in participants with MDD than in healthy controls. This suggests that using this more adaptive form of regulation (which depressed individuals do not frequently use) might have functioned as an intense emotional induction and/or it might have required more cognitive resources (which are also associated with sharp vagal withdrawals) (see Aldao and Mennin 2012).

Dunn and colleagues (2015) took a different approach and focused on whether cardiovascular reactivity data (in this case, heart rate) could be effectively depicted in graphical representations that could be easily read and interpreted in clinical settings with personnel who do not have a background in physiology. To this end, we represented heart rate data using Chernoff Faces, which is a method that capitalizes on people's ability to fast and effectively read facial stimuli (see also, De Los Reyes and Aldao 2015). We plotted heart rate values from baseline and reactivity to a disgust-eliciting film clip against adult norms and asked three independent coders to identify which face corresponded to greater arousal. The study indicated that, not only were the coders very reliable, but their judgments predicted time-point changes in heart rate over the course of an emotional induction, and particularly among participants self-reporting relatively high social anxiety concerns. As such, these findings speak to the ability to integrate untrained rater judgments about physiological arousal and subjective self-report measures of mental health in the context of screening assessments of social anxiety.

Weeks and colleagues (this issue) focused on a different aspect of physiological reactivity, namely vocal pitch. They found that men who had a diagnosis of social anxiety disorder displayed an increase in fundamental frequency (F0) when participating in a diagnostic interview relative to healthy controls.

Such difference, however, was not found in women. Interestingly, the authors found that a previously used threshold helped differentiate men with and without social anxiety disorder. Thus, this work highlights the usefulness of paying attention not only to what patients say, but how they say it.

Lastly, Bylsma et al. (this issue) wrote a thoughtful commentary highlighting critical next steps in order to translate RDoC-informed research to assessment and treatment techniques that can be feasibly implemented in the clinic.

The RDoC initiative has opened a new era in terms of conceptualizing and understanding mental disorders from a multi-modal perspective that entails subjective, behavioral, and physiological processes. As Bylsma and colleagues (this issue) discuss, we have a long road ahead in terms of conducting this multi-modal research and adapting it to clinical settings. We hope that the studies and commentary in this Special Section inspire the type of interdisciplinary research spanning basic and applied work that will be critical to advancing the RDoC initiative.

Conflict of Interest Amelia Aldao and Andres De Los Reyes declare that they have no conflict of interest.

References

- Achenbach, T. M., Krukowski, R. A., Dumenci, L., & Ivanova, M. Y. (2005). Assessment of adult psychopathology: meta-analyses and implications of cross-informant correlations. *Psychological Bulletin*, *131*, 361–382. doi:10.1037/0033-2909.131.3.361.
- Aldao, A., & De Los Reyes, A. (2015). Commentary: a practical guide for translating basic research on affective science to implementing physiology in clinical child and adolescent assessments. *Journal of Clinical Child & Adolescent Psychology*, *43*, 341–351. doi:10.1080/15374416.2014.895942.
- Aldao, A., & Mennin, D. S. (2012). Paradoxical cardiovascular effects of implementing adaptive emotion regulation strategies in generalized anxiety disorder. *Behaviour Research and Therapy*, *50*, 122–130. doi:10.1016/j.brat.2011.12.004.
- Aldao, A., Nolen-Hoeksema, S., & Schweizer, S. (2010). Emotion regulation strategies across psychopathology: a meta-analysis. *Clinical Psychology Review*, *30*, 217–237. doi:10.1016/j.cpr.2009.11.004.
- Aldao, A., Mennin, D. S., & McLaughlin, K. (2013). Differentiating worry and rumination: evidence from heart rate variability during spontaneous regulation. *Cognitive Therapy and Research*, *37*, 613–619. doi:10.1007/s10608-012-9485-0.
- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders-text revision (5th ed.) (DSM-IV-TR)*. Washington: Author.
- Barlow, D. H., Allen, L. B., & Choate, M. L. (2004). Toward a unified treatment for emotional disorders. *Behavior Therapy*, *35*, 205–230. doi:10.1016/S0005-7894(04)80036-4.
- Bilek, E. L., & Ehrenrich-May, J. (2012). An open trial investigation of a transdiagnostic group treatment for children with anxiety and depressive symptoms. *Behavior Therapy*, *43*, 887–897. doi:10.1016/j.beth.2012.04.007.
- Bress, J. N., Meyer, A., & Hajcak, G. (2015). Differentiating anxiety and depression in children: evidence from event-related brain potentials.

- Journal of Clinical Child & Adolescent Psychology*, 43, 238–249. doi:10.1080/15374416.2013.814544.
- Bylsma, L. M., Mauss, I. B., & Rottenberg, J. (this issue). Is the divide a chasm? Bridging affective science with clinical practice. *Journal of Psychopathology & Behavioral Assessment*.
- Cohen, S., Masyun, K., Mastergeorge, A., & Hessel, D. (2015). Psychophysiological responses to emotional stimuli in children and adolescents with autism and Fragile X syndrome. *Journal of Clinical Child and Adolescent Psychology*, 43, 250–263. doi:10.1080/15374416.2013.843462.
- Cuthbert, B., & Insel, T. (2010). The data of diagnosis: new approaches to psychiatric classification. *Psychiatry*, 73, 311–314. doi:10.1521/psyc.2010.73.4.311.
- Davis, T. E., May, A., & Whiting, S. E. (2011). Evidence-based treatment of anxiety and phobia in children and adolescents: current status and effects on the emotional response. *Clinical Psychology Review*. doi:10.1016/j.cpr.2011.01.001.
- De Los Reyes, A., & Aldao, A. (2015). Introduction to the special issue: toward implementing physiological measures in clinical child and adolescent assessments. *Journal of Clinical Child & Adolescent Psychology*, 44, 221–237. doi:10.1080/15374416.2014.891227.
- De Los Reyes, A., Kundey, S. M. A., & Wang, M. (2011). The end of the primary outcome measure: a research agenda for constructing its replacement. *Clinical Psychology Review*, 31, 829–838. doi:10.1016/j.cpr.2011.03.011.
- De Los Reyes, A., Thomas, S. A., Goodman, K. L., & Kundey, S. M. A. (2013). Principles underlying the use of multiple informants' reports. *Annual Review of Clinical Psychology*, 9, 123–149. doi:10.1146/annurev-clinpsy-050212-185617.
- De Los Reyes, A., Augenstein, T. M., Aldao, A., Thomas, S. A., Daruwala, S. E., Kline, K., & Regan, T. (2015a). Implementing psychophysiology in clinical assessments of adolescent social anxiety: use of rater judgments based on graphical representations of psychophysiology. *Journal of Clinical Child & Adolescent Psychology*, 43, 264–279. doi:10.1080/15374416.2013.859080.
- De Los Reyes, A., Augenstein, T. M., Wang, M., Thomas, S. A., Drabick, D. A. G., Burgers, D., & Rabinowitz, J. (2015b). The validity of the multi-informant approach to assessing child and adolescent mental health. *Psychological Bulletin*, 141, 858–900. doi:10.1037/a0038498.
- Dunn, E. J., Aldao, A., & De Los Reyes, A. (2015). Implementing physiology in clinical assessments of adult social anxiety: A method for graphically representing physiological arousal to facilitate clinical decision-making. *Journal of Psychopathology & Behavioral Assessment*, 37, 587–596.
- Gatzke-Kopp, L. M., Greenberg, M., & Bierman, K. (2015). Children's parasympathetic reactivity for specific emotions moderates response to intervention for early onset aggression. *Journal of Clinical Child & Adolescent Psychology*, 43, 291–304. doi:10.1080/15374416.2013.862801.
- Graziano, P., & Derefinko, K. (2013). Cardiac vagal control and children's adaptive functioning: a meta-analysis. *Biological Psychology*, 94, 22–37. doi:10.1016/j.biopsycho.2013.04.011.
- Hayes, S. C., Strosahl, K. D., & Wilson, K. G. (1999). *Acceptance and commitment therapy: An experiential approach to behavior change*. New York: Guilford Press.
- Insel, T., Cuthbert, B., Garvey, M., Heinssen, R., Pine, D. S., Quinn, K., & Wang, P. (2010). Research domain criteria (RDoC): toward a new classification framework for research on mental disorders. *The American Journal of Psychiatry*, 167, 748–757. doi:10.1176/appi.ajp.2010.09091379.
- Kessler, R. C., Chiu, W. T., Delmer, O., & Walters, E. E. (2006). Prevalence, severity, and comorbidity of 12-month DSM-IV disorders in the national comorbidity survey replication. *Archives of General Psychiatry*, 62, 617–627. doi:10.1001/archpsyc.62.6.617.
- Kircanski, K., Waugh, C. E., Camacho, M. C., & Gotlib, I. H. (2015). Aberrant parasympathetic stress responsivity in pure and co-occurring major depressive disorder and generalized anxiety disorder. *Journal of Psychopathology & Behavioral Assessment*.
- Kring, A. M., & Sloan, D. S. (2009). *Emotion regulation and psychopathology*. New York: Guilford Press.
- Leitzke, B. T., Hilt, L. M., & Pollack, S. D. (2015). Maltreated youth display a blunted blood pressure response to an acute interpersonal stressor. *Journal of Clinical Child & Adolescent Psychology*, 43, 305–313. doi:10.1080/15374416.2013.848774.
- LeMoult, J., Yoon, K. L., & Jormann, J. (this issue). Rumination and cognitive distraction in major depressive disorder: An examination of respiratory sinus arrhythmia. *Journal of Psychopathology & Behavioral Assessment*.
- Linehan, M. M. (1993). *Cognitive-behavioral treatment for borderline personality disorder*. New York: Guilford Press.
- McLaughlin, K. A., Rith-Najarian, L., Dirks, M. A., & Sheridan, M. A. (2015). Low vagal tone magnifies the association between psychosocial stress exposure and internalizing psychopathology in adolescents. *Journal of Clinical Child & Adolescent Psychology*, 43, 314–328. doi:10.1080/15374416.2013.843464.
- Mennin, D. S., & Fresco, D. M. (2013). *Emotion regulation therapy. In handbook of emotion regulation* (2nd ed., pp. 469–490). New York: Guilford Press.
- Moser, J. S., Durbin, C. E., Patrick, C. J., & Schmidt, N. B. (2015). Combining neural and behavioral indicators in the assessment of internalizing psychopathology in children and adolescents. *Journal of Clinical Child & Adolescent Psychology*, 43, 329–340.
- Nolen-Hoeksema, S., & Watkins, E. R. (2011). A heuristic for developing transdiagnostic models of psychopathology explaining multifinality and divergent trajectories. *Perspectives on Psychological Science*, 6(6), 589–609. doi:10.1177/1745691611419672.
- Nolen-Hoeksema, S., Wisco, B. E., & Lyubomirsky, S. (2008). Rethinking rumination. *Perspectives on Psychological Science*, 3, 400–424. doi:10.1111/j.1745-6924.2008.00088.x.
- Roemer, L., Orsillo, S. M., & Salters-Pedneault, K. (2008). Efficacy of an acceptance-based behavior therapy for generalized anxiety disorder: evaluation in a randomized controlled trial. *Journal of Consulting and Clinical Psychology*, 76, 1083–1089. doi:10.1037/a0012720.
- Sanislow, C. A., Pine, D. S., Quinn, K. J., Kozak, M. J., Garvey, M. A., Heinssen, R. K., & Cuthbert, B. N. (2010). Developing constructs for psychopathology research domain criteria. *Journal of Abnormal Psychology*, 119, 631–639. doi:10.1037/a0020909.
- Thayer, J. F., Ahs, F., Fredrikson, M., Sollers, J. J., & Wager, T. D. (2012). A meta-analysis of heart rate variability and neuroimaging studies: implications for heart rate variability as a marker of stress and health. *Neuroscience & Biobehavioral Reviews*, 36, 747–756. doi:10.1016/j.neubiorev.2011.11.009.
- Thomas, S. A., Aldao, A., & De Los Reyes, A. (2012). Implementing clinically feasible psychophysiological measures in evidence-based assessments of adolescent social anxiety. *Professional Psychology: Research and Practice*, 43, 510–519. doi:10.1037/a0029183.
- Weeks, J. W., Srivastava, A., Howell, A. N., & Menatti, A. R. (this issue). "Speaking more than words": Classifying men with social anxiety disorder via vocal acoustic analyses of diagnostic interviews. *Journal of Psychopathology & Behavioral Assessment*.
- World Health Organization. (2007). *International statistical classification of diseases and related health problems* (10th rev.). Retrieved from <http://apps.who.int/classifications/apps/icd/icd10online>