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To cite this article: Mary Dozier, Caroline K. P. Roben, EB Caron, Julie Hoyer & Kristin Bernard (2016): Attachment and Biobehavioral Catch-up: An evidence-based intervention for vulnerable infants and their families, *Psychotherapy Research*, DOI: [10.1080/10503307.2016.1229873](https://doi.org/10.1080/10503307.2016.1229873)

To link to this article: <http://dx.doi.org/10.1080/10503307.2016.1229873>



Published online: 11 Oct 2016.



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METHOD PAPER

Attachment and Biobehavioral Catch-up: An evidence-based intervention for vulnerable infants and their families

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(Received 7 December 2015; revised 9 July 2016; accepted 5 August 2016)

Abstract

In this paper, we highlight issues we consider key to the development of an evidence-based intervention for the parents of young children who had experienced early adversity. The intervention was initially developed for foster infants, but adapted for infants living with their neglecting parents, then for young children adopted internationally, and finally for toddlers in foster care or living with neglecting birth parents. The intervention and its adaptations share a focus on the importance of providing nurturance to children when they are distressed, and following children's lead when they are not distressed. We approached intervention development from a theoretical position, with attachment theory and stress neurobiology central. But we are, at heart, clinical scientists and have been open to confirmation or disconfirmation of our ideas and hypotheses. In this paper, we describe our approach, discuss issues and challenges central to our work, and share advice for addressing similar issues and challenges.

Keywords: child psychotherapy; attachment; outcome research

Over the last 20 years, we have been conducting basic research about how early adversity disrupts children's healthy development, designing an intervention that targets the issues identified by our basic research, testing the efficacy of the intervention, and developing fidelity instruments that allow effective intervention dissemination. In this paper, we describe the process by which we have conducted this work.

Addressing Critical Needs of Infants in the Child Welfare System

One night as I (MD) watched the news, I saw a young foster child being taken away from her foster mother. The child was screaming. I was immediately struck with how upset my own child—who happened to be about the same age as this foster child—would be if he were taken from me. And yet, this foster child knew no more about foster care than my child did. From the foster child's perspective, she was losing

her mother and it was devastating. I immediately began pondering the questions about how this child would form new attachments, what this loss would mean for her, and how the system might change to make such losses less likely. Within two weeks, I had decided to focus my research on these questions. For the last two decades, along with my students, I have focused on the challenges facing children who experience early adversity, and on intervention strategies that can enhance their development.

At the point we began our research, infants in foster care had received little attention from psychologists. Although disruptions in care were of direct relevance to the study of attachment in infancy, attachment theorists and researchers had mostly neglected the study of foster care (Eagle, 1994). Further, despite evidence of the devastating consequences of disruptions in care on children's development, there were few evidence-based interventions that targeted young children in foster care (Barth, Crea, John, Thoburn, & Quinton,

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2005). The services offered in child welfare settings traditionally lacked strong research evidence to support their effectiveness (Barth, Landsverk, et al., 2005; Hurlburt, Barth, Leslie, Landsverk, & McCrae, 2007). To develop an intervention tailored to the needs of infants in foster care, we first needed to understand *how* adversity challenged infants' coping strategies. As described below, our basic research about infants in foster care suggested that early adversity interfered with (1) the development of secure, organized attachments, and (2) healthy biological regulation; we developed the Attachment and Biobehavioral Catch-up (ABC) intervention to target these critical needs.

Intervening to Change Attachment

Developing an attachment to a primary caregiver or caregivers is a key developmental task for infants. Forming attachments is evolutionarily based, with its roots in enhancing chances for survival, leading infants to favor proximity to parents under threatening conditions (Bowlby, 1969/1982). Children who have experienced maltreatment, however, are at risk of developing disorganized attachments (van IJzendoorn, Schuengel, & Bakermans-Kranenburg, 1999). The task of forming attachments is further complicated for children who experience disruptions in their relationships with their parents, as happens for foster children when they are placed into foster care, moved from one foster home to another, or placed back into their birth parents' home after foster care. In early work, we found that children who experienced disruptions in care were especially at risk for developing disorganized attachments to new caregivers unless they had nurturing parents (Dozier, Stovall, Albus, & Bates, 2001). Given that disorganized attachments are predictive of later externalizing problems (Fearon, Bakermans-Kranenburg, van IJzendoorn, Lapsley, & Roisman, 2010), and dissociative symptoms (Carlson, 1998; Lyons-Ruth, Easterbrooks, & Cibelli, 1997), it seemed critical to intervene in ways that would enhance the likelihood that these children would develop organized attachments (Leerkes, 2011; McElwain & Booth-LaForce, 2006). Thus, the first target of our intervention was to enhance nurturing care among foster parents, with the goal of enhancing attachment security and organization among children.

Intervening to Change Biology

Serendipity was involved in the development of our second intervention component when a pioneering neuroendocrinologist, Seymour Levine, moved to our university. Levine had studied the effects of early

separations on the functioning of the hypothalamus–pituitary–adrenal (HPA) axis among young squirrel monkeys. Levine's work indicated that the HPA axis, with cortisol as an end-product, was affected in the short- and long-term when infant monkeys experienced separations from their mothers (Levine, 2001). Given that we had witnessed the effects of separations on human infants' behaviors, it seemed plausible to us that the neuroendocrine system was affected in similar ways as seen among Levine's monkeys. With the collaboration of Dr Levine, we began studying how adversity was associated with HPA functioning among young children in foster care. The HPA axis has two primary functions: the maintenance of a diurnal pattern, and mounting a stress response. Although Levine had seen striking stress reactions among monkeys, human infants appear to be protected from mounting stress responses for the most part (Gunnar, Fisher, & The Early Experience, Stress, and Prevention Network, 2006). However, we saw robust effects of adversity on the diurnal patterning of cortisol production. Whereas a normative pattern involves high wake-up values and very low bedtime values, foster children showed a flatter slope than comparison children, with low morning values (Bernard, Butzin-Dozier, Rittenhouse, & Dozier, 2010). Children living with neglecting birth parents showed the most perturbed rhythm, with still lower wake-up values and flatter slope than foster children (Bernard et al., 2010). This research is in line with other work on diurnal cortisol patterns in young children who have experienced early adversity (Bruce, Fisher, Pears, & Levine, 2009; Cicchetti, Rogosch, Gunnar, & Toth, 2010).

It was on the basis of these findings that we developed our second intervention component. We reasoned that it was critical for children who had experienced early adversity to have caregivers who could help them develop adequate physiological regulation as well as behavioral regulation. To address this issue, we went to the literature for guidance. Work by Raver (1996) and others (e.g., Gunnar & Donzella, 2002; Levine, 2005) suggested that parents who followed their children's lead were more likely to have well-regulated children than were parents who were not responsive to children's signals. Based on these findings, we developed our second intervention component—helping parents follow their children's lead.

Attachment and Biobehavioral Catch-up

We developed the ABC intervention to target these critical needs (i.e., the need for secure, organized attachments, and biological regulation) for young children

who experience early adversity (Dozier & the Infant-Caregiver Lab, 2015). ABC is implemented by a parent coach through 10 sessions delivered in the home. Sessions 1 and 2 focus on the importance of nurturance for children who have experienced early adversity. Specifically, parent coaches emphasize that children need nurturance even when they do not signal for it clearly and that children's signals can powerfully influence parents' feelings and reactions. Sessions 3 and 4 focus on following the lead with delight (i.e., genuine positive affect and enjoyment), including specific practice activities for building these skills during play. In sessions 5 and 6, parents' overwhelming and frightening behaviors (e.g., tickling roughly, being intrusive with toys, harshly grabbing) are discussed, as are the ways in which such behaviors can interfere with the development of attachment. Sessions 7 and 8 help parents identify "voices from the past," recognizing how their own issues or memories may interfere with their ability to respond sensitively to their children's distress, their ability to follow the lead with delight, or their ability to refrain from frightening behaviors. Finally, Sessions 9 and 10 are reserved for reviewing intervention targets and consolidating gains. We consider it critical that the intervention take place in families' homes, the environment in which parents and children live their lives, increasing the likelihood that parents will generalize the skills acquired. Sessions are video-recorded for the purposes of supervision and video feedback of behavior targets to parents.

However, we consider it most important to deliver high quality and frequent in the moment comments. By providing frequent and specific feedback on moment-to-moment interactions, the parent coach supports the primary caregiver in being nurturing when the child is distressed and following the child's lead. In the moment comments highlight and celebrate parent behaviors that are consistent with intervention targets. For example, if a foster mother picks up her child after he falls and begins whimpering, a parent coach might say, "He started crying and you picked him right up. What beautiful nurturance! This will help him learn that you are there for him." This example uses all three potential components a parent coach might use in a comment: (1) describing the specific parent behavior, (2) labeling the behavior as an ABC target, and (3) naming a future outcome that the behavior will have on the child.

Adapting ABC for Different Populations

Children Living with High-Risk Birth Parents

We first designed the ABC Intervention for foster parents, targeting the specific needs of children who

had experienced adversity. In our work with foster infants, some children returned to the care of their birth parents. Given that we had committed to work with children wherever they went, we intervened with birth parents when children returned to their care. To our surprise, the intervention seemed as well-suited to birth parents as to foster parents for the most part (Bernard et al., 2012). The one exception was that we observed frequent parental frightening behaviors, which had not been a primary target of the original intervention. Examples of frightening behavior include a parent saying, "Next time you touch that, you'll be sorry" or a parent harshly grabbing a child's arm and giving a threatening look after the child has done something the parent did not like. We knew that frightening parental behavior, that includes yelling at, threatening, or physically interacting with in a child in a way that could be scary, interferes with children's ability to develop organized attachments (Hesse & Main, 2000; Main & Solomon, 1990), and with physiological regulation (Bernard & Dozier, 2010). Therefore, we increased attention to frightening behaviors in our intervention for high-risk birth parents.

Toddlers

Although we had designed our intervention for infants (6–24 months of age), we found ourselves being asked to intervene with children outside that range especially as children were placed multiple times into foster or birth parent care. We found that the emphasis on nurturance and following the lead remained important for toddlers. However, conflict and "butting heads" also often dominated parent-child interactions, issues that were not addressed in the infant version of ABC. We adapted our intervention for toddlers, helping parents support children in learning to calm down when they became emotionally or behaviorally dysregulated. A key distinction between ABC and many toddler/preschool interventions was that the parent was asked to serve as a "co-regulator" for the child, staying with the child to the extent possible through the distress. Avoiding escalating conflict and "butting heads" was one of the goals.

Children Adopted Following Institutional Care

Whereas infants and toddlers living in foster care or with high-risk birth parents face ongoing adversity, children adopted following institutional care experience very severe privation (institutional care, typically characterized by low staff to child ratio, changes in

caregivers, inadequate attention, etc.) followed by an enriched environment (adoptive care). Behaviors sometimes manifested by these children post-adoption included pseudo-autistic behaviors (e.g., rocking), and indiscriminate friendliness (e.g., behaving with a stranger in ways typically reserved for attachment figures), in addition to the issues seen among neglected and foster children (Rutter et al., 1999, 2007). We adapted the intervention by focusing manual-guided discussion on indiscriminate friendliness in Session 3, including assessing parents' awareness of and feelings about children's indiscriminate behaviors, providing information about negative developmental outcomes linked to these behaviors, and collaboratively strategizing about ways to prevent such behaviors (e.g., picking children up before answering the door). Discussion of indiscriminate behaviors was also integrated into session content about ways to follow the child's lead (and times not to). The primary focus on nurturance, following the lead with delight, and reducing overwhelming or frightening behaviors remained.

Our Conceptual and Methodological Approach to Clinical Research

Developing Intervention on the Basis of Research Findings

The ABC Intervention targets specific issues that were identified as problematic through earlier research findings, rather than on the basis of a priori assumptions. Our work is certainly not atheoretical, though. Theory guided us as to where to look for challenges facing children who had experienced adversity. Attachment theory and stress neurobiology were the organizing disciplines in our early research, and both combing the literature and contributing to it led us to target parents' nurturing care and ability to follow children's lead, as described previously. Defining intervention targets on the basis of research findings is a distinct aspect of our intervention development.

Cutting Across Behavior and Biology: Assessment of Outcomes

As described previously, we did not anticipate incorporating biological findings into our research and intervention development, and were fortunate to be exposed to research that pushed us in this direction. Our first findings that children who experienced adversity were dysregulated physiologically (Dozier, Manni, et al., 2006) not only affected our intervention development, but also sensitized us to the

relevance of biological outcomes. We now study a range of biological factors that may be important to understanding neural mechanisms for intervention effects. As discussed later in more detail, we (Bernard, Simons, & Dozier, 2015) have studied differences in brain activity among parents as the result of the intervention. In an assessment of intervention outcomes in middle childhood, we are beginning studies of brain activity (assessed through both event-related potentials and functional magnetic resonance imaging) of school-aged children whose parents received the intervention during the children's infancy. We are assessing children's heart rate, skin conductance, and respiratory sinus arrhythmia as they interact with their parents during challenging tasks. Our lab is also conducting a study on epigenetic alterations that occur as a result of our intervention. These data are expected to provide insights into how the intervention has short- and long-term effects on biological systems that could affect behavioral outcomes. Assessing intervention effectiveness through biological as well as behavioral indices is a key, distinguishing feature of our approach.

Assessing Intervention Fidelity at a Micro-Analytic Level

When we first disseminated our intervention other places, we had not yet articulated fidelity criteria carefully. Although adherence to discussion of the manual content was relatively easy to monitor, competence in the process of implementing the intervention, particularly the use of in the moment comments, was challenging to assess and monitor because we had not yet developed a fidelity assessment measure. This made the task of disseminating the intervention while ensuring fidelity to the model challenging.

Over time, we identified in the moment comments as key to parent coach effectiveness; however, parent coaches often struggled to learn this skill much more than they struggled with adherence to manual delivery. A critical decision, and one we feel has been key to our success in measuring fidelity, was to develop a fidelity assessment focused on these in the moment comments. The fidelity assessment involves coding both opportunities for parent coach comments (i.e., targeted parent behaviors), as well as the frequency and quality of comments made in response to these opportunities (Meade, Dozier, & Bernard, 2014). This coding system has proven to be a powerful tool both for monitoring parent coach commenting and for providing feedback to parent coaches (Meade et al., 2014). Since beginning to

use this innovation in dissemination sites, we have observed strong implementation outcomes at the parent coach and family levels (Caron, Weston-Lee, Haggerty, & Dozier, 2016; Roben, Dozier, Caron & Bernard, *in press*)).

Research Findings and Implications for Clinical Practice

Efficacy of the ABC Intervention

We developed the ABC intervention with the goal of enhancing parental nurturance and following the lead, with the expectation these parental behaviors would lead children to develop more secure and organized attachments, more normative regulation of cortisol production, and better regulation of emotions and behaviors than children whose parents did not receive the intervention. We have findings from three separate randomized clinical trials that support these hypotheses (e.g., Bernard, Dozier, Bick, & Gordon, 2015; Dozier, Peloso, et al., 2006; Lind, Raby, Caron, Roben, & Dozier, *in press*). In all randomized trials, families in the ABC intervention group were compared to families in a control intervention, Developmental Education for Families (DEF). Like ABC, DEF is a 10-session, manualized intervention that takes place in the home, but session content does not focus on parenting behavior. Instead, sessions focus on important developmental targets for children, such as language, cognition, and motor skills. The DEF intervention was based on the Abecedarian approach developed by Ramey and colleagues (Ramey, McGinness, Cross, Collier, & Barrie-Blackley, 1982), but excluded content related to sensitive or nurturing caregiving.

Child attachment quality. A key goal for us has been enhancing children's attachment security and decreasing the incidence of disorganized attachment. In our randomized clinical trial with 120 children living with their neglecting parents, we found that children formed secure attachments more frequently and disorganized attachments less frequently when their parents had received the ABC intervention than when parents had received the control intervention. More specifically, 52% of the children in the ABC group formed secure attachments as compared with 33% of children in the control group. Further, only 32% of the children in the ABC group formed disorganized attachments as compared with 57% of children in the control group (Bernard et al., 2012).

Child cortisol production. As described earlier, we had found that neglected children showed flatter

patterns of cortisol production across the day than foster children, who in turn showed flatter patterns than children living under low-risk conditions (Bernard et al., 2010). In developing our intervention, we aimed to enhance at-risk children's ability to regulate their cortisol production more normatively. Through randomized clinical trials, we have indeed found that the intervention is effective in normalizing children's cortisol production. Shortly after the intervention, children whose parents had received the ABC intervention showed higher wake-up values and a steeper diurnal slope across the day than did children in the control intervention (Bernard, Dozier, et al., 2015). Additionally, these intervention differences were maintained approximately three years following intervention (Bernard, Hostinar, & Dozier, 2015).

Child emotion regulation. Along with problems regulating physiology, children who experience early adversity have trouble regulating their emotions and behaviors (Cicchetti, Ackerman, & Izard, 1995; Kim & Cicchetti, 2010; Rogosch, Cicchetti, & Aber, 1995). When children were approximately 2 years of age, on average at least a year after completing the intervention, they were asked to complete a challenging task (retrieving a small toy from a clear container that requires a specific use of a tool; Matas, Arend, & Sroufe, 1978). Children whose parents had received the ABC intervention expressed lower levels of negative affect during the task compared to children whose parents completed the control intervention (Lind, Bernard, Ross, & Dozier, 2014).

Child executive functioning. Executive functioning refers to the set of skills involved in organizing and controlling cognition and behavior. Among executive functions are the ability to inhibit a prepotent response, and the ability to shift sets (i.e., switch from a practiced task to a task with competing demands; Miyake, 2000; Zelazo & Frye, 1998). Executive functions are key to success in school (Blair & Razza, 2007; McClelland et al., 2007)—children who have problems with inhibitory control or shifting sets have trouble functioning in the classroom setting, and often fall behind academically. Children who experience early adversity are especially at risk for problems with executive functioning (Pears, Fisher, Bruce, Kim, & Yoerger, 2010).

Along with regulation of physiology and emotions, we expected the ABC intervention to enhance children's ability to regulate behavior. We found that neglected children in the ABC intervention had better inhibitory control when asked not to touch

an attractive set of toys than children whose parents received the control intervention (Lind, Bernard, & Dozier, 2016). Foster children whose foster parents had received the ABC intervention were more effective in shifting sets than children whose foster parents received the control intervention (Lewis-Morrarty, Dozier, Bernard, Moore, & Terraciano, 2012). These effects have been observed both among children who received the original ABC intervention (Lewis-Morrarty et al., 2012), as well as the ABC adaptation for toddlers in foster care (Lind et al., in press).

Parent report of child behavior problems.

ABC intervention parents reported levels of problem behaviors that were not significantly different from levels reported by parents in the control intervention group (Dozier, Peloso, et al., 2006). In our work, we rely almost exclusively on observational data rather than on parental report for assessing child behavioral functioning because parental report is susceptible to bias (e.g., Maoz et al., 2014). Therefore, although we acknowledge that these parental report data fail to support changes in child behavior, we suggest that differences in inhibitory control assessed observationally provide strong support for the intervention's efficacy in changing behavior.

Parent sensitivity. Although our primary focus in our randomized clinical trials has been on child outcomes, we have collected data that have allowed us to examine parental behavior as well. Parents' following children's lead was assessed through play interactions when parents were instructed to play as they usually would. We found that parents in the ABC intervention showed greater improvements in sensitivity than parents in the control condition (Bernard, Simons, et al., 2015; Bick & Dozier, 2013). We have also found that ABC enhances parents' following the lead when it is implemented by community clinicians in dissemination sites (Caron, Weston-Lee, et al., 2016; Roben et al., *in press*).

Parent brain activity. We examined parents' brain activity 3 years post-intervention through event-related potentials (ERPs), changes in the brain's electrical activity in response to a stimulus. ERPs are extracted from continuous electroencephalogram activity measured non-invasively from electrode sensors placed on the scalp. We based our hypotheses on findings of Rodrigo et al. (2011), who found that neglecting mothers' N170 (a negative deflection occurring approximately 170 ms after a stimulus) did not differentiate between crying, laughing, and neutral infant faces. In contrast, typical

mothers showed larger N170 responses to crying infant faces than neutral or laughing infant faces (Rodrigo et al., 2011). In our study (Bernard, Simons, et al., 2015), parents who had received the control intervention did not show neural differentiation of infant expressions, consistent with previous findings. However, parents who had received the ABC intervention showed larger N170 responses to emotional infant faces than neutral infant faces, similar to a low-risk comparison sample. Further, maternal sensitivity (i.e., following the lead) was correlated with the magnitude of brain responses to emotional versus neutral infant faces.

Intervention Process: In the Moment Comments

Beyond our interest in the efficacy of the ABC intervention, we have been interested in understanding the mechanisms of ABC's effectiveness. Using our fidelity coding system, we tested our hypothesis that in the moment comments act as an active ingredient of ABC, and tested whether comments predict intervention outcomes. We found that both comment frequency and comment quality predicted parents' behavior change (Caron, Bernard, & Dozier, 2016). We also found that clinicians' comment frequency predicted families' retention in treatment, a finding we attribute to commenting creating a strength based, supportive environment for parents (Caron, Bernard, & Dozier, 2016).

These findings have strengthened our belief that in the moment comments act as an active ingredient of intervention, and have influenced our approach to training and supervising clinicians in dissemination sites. Specifically, in addition to traditional clinical group supervision, we now provide fidelity-focused individual supervision. For this supplemental supervision, we ask clinicians to code their own fidelity from a recent intervention session video, and have an expert coder code the same video. Then, fidelity coders and clinicians meet to discuss both coding and in the moment commenting fidelity. In a single-subject design conducted in our laboratory, we observed that the process of coding one's own ABC sessions appeared to be linked to increased frequency of commenting (Meade et al., 2014), and we are currently examining the effects of fidelity-focused supervision in dissemination sites.

Future Directions for Our Research Program

One of the exciting aspects of our research program is that we have many questions that we have only begun to ask. We are starting to explore how to optimize the

treatment through an adapted design, and have many unanswered questions.

Optimizing Treatment

Through single-subject analyses, we have seen that parental sensitivity improves at varying rates (Yarger, Hoye, & Dozier, 2016). In addition, parents begin treatment with different strengths and weaknesses with regard to intervention targets (Bernard, Meade, & Dozier, 2013). Although our current 10-session treatment has impressive effects at the group level, optimizing dosage according to parent response to treatment seems an important next step. Sequential multiple assessment randomized trials and multiphase optimization strategies are methodological approaches adapted from engineering to optimize interventions (e.g., Collins, Chakraborty, Murphy, & Strecher, 2009). We are beginning to use these approaches to optimize ABC to specific needs based on carefully identified tailoring variables, such as parents' frequency and quality of nurturing and following the lead behaviors.

Dissemination Study

As of April 2016, we have trained and supervised coaches across 15 states in the United States and in several international locations. We have large trainings in additional locations that are planned into the future. Meeting the demand for dissemination while also maintaining our strict practices concerning fidelity is challenging. We are frequently asked if we could make our trainings more frequent or the training process less intense as a way to disseminate more widely and perhaps make sustainability a more easily accessible goal. We are hesitant to do so for several reasons. First, although the intervention targets are straightforward, they can often be misunderstood or emphasized in ways that are not in line with the development of the model, and we see potential for drift from the model. Second, we have seen success with teaching others to make in the moment comments, but only with time-intensive training, coding, and practice with our supervisory staff. Our data suggest that training at this level is key to implementing with fidelity in the community (Caron, Weston-Lee, et al., 2016).

We are taking several steps to increase our capacity for dissemination with our existing training model. First, we are expanding our supervisory staff. We are hiring full- and part-time supervisors with advanced degrees who are experienced in evidence-based treatments in early childhood and with the ABC model in particular. Second, we are partnering

with some dissemination sites to train ABC supervisors at each site. Third, we continue to monitor both parent coach fidelity and intervention effectiveness at dissemination sites. We hope these data will help us shape training and supervision to fit best different implementation sites' needs and to learn how to best launch new initiatives, such as training new supervisors. Finally, we are studying our supervision process, tracking supervisor behaviors and tasks in conjunction with parent coach progress, with the aim of understanding the most effective components of our training model in order to better inform our use of time in supervision.

Linking Biological and Behavioral Outcomes

Our research program has used a rich array of biological and behavioral outcomes measured longitudinally. An important ongoing direction of our work is examining associations between biological and behavioral outcomes that will allow us to understand basic mechanisms by which biological changes influence behavioral outcomes. Given research regarding how the functioning of the HPA axis influences the developing brain, we are interested in examining whether normalizing diurnal cortisol rhythms mediates the association between the ABC intervention and behavioral outcomes such as executive functioning and disruptive behavior. Likewise, intervention-related changes in cortisol regulation and telomere length may enhance later health outcomes (Price, Kao, Burgers, Carpenter, & Tyrka, 2013). We hope to further assess these mediational pathways throughout infancy, early childhood, and middle childhood.

Advice to Researchers: Practical Research Challenges

Following High-risk Children Longitudinally

Throughout our work, we have been studying very high-risk children longitudinally. We have now followed children who were involved with the child welfare system from infancy through middle childhood. These children are among the most difficult to follow because families change addresses often, their emergency contacts are often not reliable, children change caregivers, and so on. There have not been any easy solutions, but we have been successful.

Our success in finding families is attributable to an organized and tenacious approach. Although the simple strategies for contacting families through mail or previous telephone numbers have been largely unsuccessful, we have found many families through social media such as Facebook, through

driving by homes to leave information, or through contacting emergency contacts for information. We have also worked with a Participant Action Researcher who has stayed in touch with many of our families over the 8-year life of the study. He has been effective in finding many of our hardest to find families.

It is essential that families have very positive experiences with the project if we are to expect them to participate over a period of time. Indeed, for each of the three years of our middle childhood project, parents need to come into our laboratory, which is about an hour from their homes. We have worked very hard to make the experience of coming in memorable and fun and to minimize burden on the families (e.g., by providing transportation, child care for siblings, and food). We celebrate their attendance with enthusiastic and friendly research assistants, prizes, and carefully planned laboratory procedures that balance challenging tasks with fun, game-like activities. Children have made comments such as “this place is like heaven” on multiple occasions and have expressed great enthusiasm in returning for the next visit. Parents appear to feel respected and valued, and they are compensated for their time.

Dealing with Missing Data

Despite taking care to reduce participant attrition, we nonetheless have a data-set with missing data because participants are lost, equipment malfunctioned, recordings were lost, etc. When possible, we use data analytic approaches that can account for missing data without restricting our sample size. For example, hierarchical linear modeling (HLM; Raudenbush & Bryk, 2002) has been ideal for asking questions related to intervention effects on cortisol rhythms. Given that HLM treats repeated measurements as nested within individuals, this approach allows for variability in the number and spacing of within-person data units, which further accounts for missing data.

Another approach to handling missing data in dissemination sites has been to use data from intervention sessions to conduct intent-to-treat analyses (Caron, Weston-Lee, et al., 2016). In dissemination sites, outcome assessment is minimal (typically a brief, semi-structured assessment of parent behavior in a play interaction) and clinicians do not follow families that drop out of treatment the way these families would be followed in our laboratory. Thus, we have used parent behavior coding from fidelity assessments of intervention session videos to demonstrate that prior to dropout, parents' behavior

improved at a similar rate to parents who did not drop out of intervention (Caron, Weston-Lee, et al., 2016).

Improvements to Intervention After Beginning of RCT

We are now studying intervention outcomes 8 years after parents received the intervention. However, we have continued to improve and refine the intervention up until the last several years. Therefore, the intervention for which we are testing long-term outcomes is somewhat different from the updated version of the intervention. Perhaps the most important aspect of the intervention that has changed is the use of in the moment comments—an aspect that we consider very important. Given the expense of large longitudinal randomized clinical trials, it is difficult to conduct a new trial with the improved version. We have assessed the added value of the newest iteration of intervention in a variety of ways, such as examining the specific effect of rate and quality of in the moment comments on parent behavior change (Caron, Bernard, & Dozier, 2016), but we remain eager to examine long-term effects of the improved intervention.

Advice to Researchers: Process of Asking Questions

There are many ways to go about asking important, interesting questions in the field. Our advice is based on how we have approached the process of asking questions. We hope that it will be helpful to you, but we are aware that it represents just that—that is, the way we have approached things.

Theory Guided, but Empirically Driven

Having theoretical underpinnings has been key to our approach. Theory has guided the intervention we developed, the questions we asked, and the outcomes we cared about. Nonetheless, we have been open to disconfirmation of our hypotheses throughout. Although our findings have often been consistent with expectations, there are clear exceptions and we consider some of these findings that violated expectations among our most important contributions.

Two examples follow: First, we were interested in the process by which children form new attachments to new foster parents. To study this, we developed diaries that foster parents completed each day regarding their children's response to distress. We had anticipated that an extended time (e.g., weeks or

months) might be required before children formed consolidated attachments to new caregivers. What we found, though, was that infants younger than about a year developed a consistent approach to caregivers very, very quickly—within the first week of placement (Stovall-McClough & Dozier, 2004). Although this was startling to us at the time, it makes sense when considering how long a week is in the life of an infant, and how critical it is to develop expectations of new caregivers. We discovered this because we paid attention to our data, and adjusted our methodology (i.e., moved assessments as early in the process as possible) to allow careful assessment.

Second, in an NIMH-sponsored network on “Stress and Glucocorticoids,” which included Megan Gunnar, Phil Fisher, and others, we were having difficulty finding support for stress reactivity among young children. We pushed this in a variety of ways, testing in contexts that surely seemed stressful for young children (e.g., dentist office) to no avail. Along with Gunnar, Fisher, and others, we began to consider the possibility of a stress hypo-reactive period among human infants that parallels what is seen among rodents (Hostinar, Sullivan, & Gunnar, 2014). This eventually led to our studying whether we might see the effects of adversity on diurnal production of cortisol even though we could not see effects on cortisol reactivity. Indeed, this was the case.

Focus on Fidelity

Specifying clear criteria for fidelity is key to effective implementation of interventions in the community (Fixsen, Naoom, Blase, Friedman, & Wallace, 2005). For clinical scientists considering treatment development, there are advantages in thinking carefully about fidelity as early in the process as possible. Some have suggested that issues regarding dissemination should be considered when an intervention is first being developed. Although we did not find it possible to develop fidelity criteria until relatively late in the process, we consider developing such criteria very seriously.

Be Bold

Throughout my (MD) career, I have, from time to time, encountered people who discouraged boldness. But my advice to you is to be bold—you may be wrong from time to time, you may head into a dead end, but then again, you may not. During the first 10 years of my career, I conducted research in a totally different area, examining treatment use

among adults with serious psychiatric disorders. When I decided to change areas of research, several people whose opinion I trusted advised me against this decision. I was told that I was developing a reputation in my field, and that a change could lead to failure. I was excited about the new area of study I was embarking on, even though admittedly I knew nothing about it, and took it on, despite this advice. This is a decision I have never regretted. Similarly, our laboratory has been bold about taking on new challenges within the area that we study, becoming involved with new populations (e.g., foster children, children adopted internationally), and new questions (e.g., DNA methylation, functional magnetic resonance imaging, and event-related potentials).

Make Connections Between Fields, or Go Places Others Have Not Gone

Related to the issue of being bold is making connections between fields or asking questions that simply were not asked before. Some of the most important questions we have asked have involved thinking about things in a different way than is standard in a field. For example, rather than assessing attachment among foster infants (which would have been a variant of things that had been done before), we (Stovall & Dozier, 2000; Stovall-McClough & Dozier, 2004) assessed the process by which children were developing their attachments. We eventually asked the question regarding what children’s attachment quality looked like with their new foster parents, but that question was not as important, not as pioneering as the question regarding the process by which they formed attachments (Dozier et al., 2001).

As mentioned earlier, we have waded into areas in which we did not have a background, such as cortisol regulation, DNA methylation, and brain activity. In each case, we worked with people who were true experts in the field. We consider it important to engage scholars with expertise in the new areas in which we become involved. Not to do so would mean that we would likely make “amateur” mistakes, and/or add to the literature in ways that would not be helpful. But with expert consultation, you can tackle new and exciting questions. Typically, the greater the expertise, the more sophisticated the question you can ask.

Funding

This work was supported by National Institute of Mental Health [grant numbers R01 52135, 74374, and 84135] to the first author.

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