

## Early Caregiving Intervention Holds Promise for Long-term Improvements in Neural Function Following Adversity

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There is substantial agreement that adverse experiences in early life have long-term consequences. In this issue of *Biological Psychiatry*, Bick *et al.* (1) link early adversity to neural function in later childhood using a prospective longitudinal study. Their findings indicate that greater exposure to adversity in the early home environment is linearly associated with patterns of relatively immature neurophysiology during middle childhood. Unfortunately, many intervention programs designed to address, remediate, or mitigate these risks are associated with substantial fade-out, suggesting that what may have been promising early returns from interventions are not prolonged in their impact. Bailey *et al.* (2) recommended that efforts to improve child outcomes focus on targets that are fundamental to development, that are malleable, and that would not have developed in the absence of intervention. For infants and young children, no aspect of the environment is more fundamental than their caregiving context. Caregivers are the gatekeepers of children's experiences, both helpful and harmful. Given the nearly complete reliance on caregivers for instrumental care needs (e.g., food and shelter) and for stress-buffering and emotional and cognitive stimulation, improvements in the caregiving received by young children is most likely to result in broad-based outcomes.

However, families that may benefit the most from intervention may be the least likely to receive it. Stressful early childhood experiences are correlated with—and potentially causally linked to—other forms of adversity, including poverty, substance use, and exposure to domestic violence. A lack of resources, in terms of both awareness of services and the availability of transportation to seek traditional clinic-based treatments, is a significant impediment to intervention receipt. The Attachment and Biobehavioral Catch-Up (ABC) intervention designed by Bernard *et al.* (3) focuses on young children's caregivers, addressing malleable targets that are unlikely to develop without intervention through promoting nurturing caregiving behaviors in caregivers who are at risk of neglect and, critically, doing so in a format that families are most likely to complete by sending therapists to the families' homes for 10 sessions (plus two or three booster sessions). For these reasons, ABC is extremely promising as an intervention for treating families with the greatest need. As with the Nurse Family Partnership (4), the home-visiting framework makes it a particularly attractive option. Dozier *et al.* (5) have published numerous articles highlighting the positive effects of the intervention using a gold standard randomized controlled trial design comparing the ABC arm with a comparison

intervention (Developmental Education for Families, which focuses on child cognitive and language development) that provides a true test of the active ingredients of this attachment-oriented behavioral intervention. However, extensive training is required, and enabling clinicians to drive to and drive from participant's homes requires time and money. As such, significant investments must be made to assemble the teams needed to successfully implement this intervention on a large scale.

Researchers are trained in conducting the science to test our hypotheses. However, advocating for larger-scale use and implementation of effective interventions requires careful thinking regarding how policymakers and other relevant stakeholders evaluate the evidence. One pathway to persuasion is through the presentation of brain data (6), as identifying a physical basis for the cognitive processes studied may result in increased perception of authenticity. While it should not be a surprise that if an intervention changes behavior, it also results in changes to the brain, perhaps the novelty is that our tools are now capable of detecting, in part, what and where those neural changes occur.

Bick *et al.* (1) found that high-risk children randomized to the ABC intervention, relative to those in the Developmental Education for Families intervention, had greater relative power in the upper alpha and beta frequency bands during a resting assessment of electrophysiology. Importantly, such findings were conducted as part of a longitudinal follow-up after the 10-week intervention delivered in infancy (mean age 9 months) and occurred between 5 and 7 years postintervention. Further, relative to a group of community children, the ABC group did not differ in these frequency bands, indicating that the intervention resulted in a "normalization of neural function" among these high-risk children. The value of these findings is not only to provide greater credence to the value of the ABC intervention, but also to point to potential mediators or mechanisms by which this attachment-based intervention results in improved outcomes in these children across development.

Further, Bick *et al.* (1) provide more evidence regarding the long-term correlates of early adversity, as they present research concluding that children whose home environments were characterized by greater adversity, assessed on a continuum, had greater resting power in the theta and low alpha bands but lower resting power in the high alpha band. It is difficult to infer causality in complex situations including early adversity. Assuming that exposure to adverse experiences played a role in the observed patterns, which are thought to

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reflect relative immaturity of neural function, it is likely that such effects indicate delayed rather than accelerated neural development in this sample of high-risk children. As a field, we continue to identify the specific neurodevelopmental consequences of adversity, and it is possible that relative delay or acceleration of neural trajectories depends on not only the outcome of interest but also the type of adversity (7). Neglect—the most common reason for child welfare involvement—is associated with significant difficulties in a wide range of domains, but it is difficult to measure and recognize, given that it leaves no external physical marks [see Humphreys *et al.* (8)]. Studies like the Bucharest Early Intervention Project (9) find that removing children from highly psychosocially depriving institutions and placing them into families is associated with dramatic gains in a variety of outcomes, including neural function (10), as found by Bick *et al.* (1). Finding effective ways to serve children in their own families of origin, where neglect is likely to continue without intervention, is a societal imperative.

Bick *et al.* (1) merit praise for prospectively following this population, which they note is understudied and also provides methodological challenges. As with any study, replication is essential to be confident in these results. Obtaining a greater understanding of which types of children or families may benefit most from ABC is an important next step. Further, in addition to families involved in the child welfare system, this intervention may well serve families before referral to child welfare agencies, because this remains a population who may benefit greatly from such services. Given that the plasticity of the developing brain wanes across childhood, focusing on enhancing the child's caregiving environment in infancy is likely to be most effective in making long-term positive changes.

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