

Special Issue Article

Toward a multi-level approach to the study of the intergenerational transmission of trauma: Current findings and future directions

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Abstract

A central goal in the field of developmental psychopathology is to evaluate the complex, dynamic transactions occurring among biological, psychological, and broader social-cultural contexts that predict adaptive and maladaptive outcomes across ontogeny. Here, I briefly review research on the effects of a history of childhood maltreatment on parental, child, and dyadic functioning, along with more recent studies on the intergenerational transmission of trauma. Because the experience and sequelae of child maltreatment and the intergenerational transmission of trauma are embedded in complex biopsychosocial contexts, this research is best conceptualized in a developmental psychopathology framework. Moreover, there is a pressing need for investigators in this area of study to adopt dynamic, multi-level perspectives as well as using developmentally guided, sophisticated research methods. Other directions for research in this field are suggested, including the implementation of collaborative interdisciplinary team science approaches, as well as community-based participatory research, to increase representation, inclusion, and equity of community stakeholders. A greater focus on cultural and global perspectives is also recommended.

Keywords: Developmental psychopathology; intergenerational transmission of trauma; maternal childhood maltreatment; multi-level perspectives; new directions

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Adverse childhood experiences, including child abuse and neglect and other traumatic experiences, affect the lives of millions of children globally each year (Stoltenborgh et al., 2015; World Health Organization, 2021). Early adversity is a long-standing public health concern because it has well-documented negative biopsychosocial consequences for individuals across the life span (Gonzalez et al., 2023; Hughes et al., 2017). Here, I briefly review research on the effects of childhood maltreatment on parental, child, and dyadic functioning, along with more recent work on the intergenerational transmission of trauma. Because the experience and sequelae of child maltreatment and the intergenerational transmission of trauma are embedded in complex biopsychosocial contexts, I argue that this research is best conceptualized in a developmental psychopathology framework. Such an approach calls for investigators to adopt dynamic, multi-level perspectives as well as to utilize developmentally guided, sophisticated research methods. Following this discussion, I suggest other directions for research in this field, including the implementation of collaborative interdisciplinary team science approaches, as well as community-based participatory research, to increase representation, inclusion, and equity of community stakeholders. A greater focus on cultural and global perspectives is also recommended.

The study of childhood maltreatment and its sequelae

A burgeoning literature indicates that a history of childhood maltreatment and other traumatic experiences are robustly linked to heightened risk for a variety of physical, behavioral, and developmental maladaptive outcomes. These diverse outcomes include (but are not limited to) poor physical and mental health (Felitti et al., 1998; Humphries et al., 2020; Kessler et al., 2010; Norman et al., 2012), insecure and disorganized attachment (Cyr et al., 2010), and lower educational attainment, employment, and life success (Shonkoff et al., 2012).

With the advent of increasingly sophisticated developmental models and methods, however, new findings in this field indicate that the developmental pathways from early adversity to later outcomes are not always direct. Rather, they are often indirect, complex, and nuanced, altered by the dynamic interplay of risk and protective factors from multiple levels of influence across ontogeny (“developmental cascades.” Masten and Cicchetti, 2010). As a consequence, individuals exposed to early adversity are not uniformly “doomed” but instead exhibit a range of possible outcomes cascading across development periods, including resilient outcomes (vanBronkhorst et al., 2023; Yoon et al., 2021). These findings are consistent with the concept of “multi-finality” in the field of developmental psychopathology (Cicchetti, 2010, 2012; Masten et al., 2021).

Moreover, concomitant with significant advances in assessment methods in the biological sciences, a growing literature shows that early childhood maltreatment and associated toxic stress can get “embedded in the body”; that is, early adversity is linked to

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alterations in biological systems, such as brain structure and function (McCrory et al., 2011; Shonkoff et al., 2012). For example, Broeks et al. (2023) found links between a history of childhood maltreatment and maternal hair cortisol concentration, a stress biomarker. In a study using functional magnetic resonance imaging, Olsavsky et al. (2021) showed that a history of childhood maltreatment was linked to alterations in mothers' neural responses when exposed to their infant's distress, compared to other stimuli (white noise). Specifically, mothers with a higher level of childhood maltreatment exhibited higher amygdala activation when exposed to their own baby's cries. The amygdala is a key brain structure associated with emotional processing and psychiatric health. Mothers with early adversity also displayed higher differential functional connectivity between the amygdala and amygdala-supplementary motor area in response to infant distress. Other research, guided by ecological systems models, has demonstrated that alterations in brain exist (particularly those in corticolimbic regions linked to emotional and social processing) that are associated with exposure to risk and protective factors from broader ecological contexts, such as neighborhood quality and socioeconomic status (Hyde et al., 2022).

Given the multi-level, dynamic complexity of development, there is a pressing need for investigators who study early adversity and its sequelae to adopt multi-level, organizational theoretical models and research methods, if they are to assess these processes accurately and understand them clearly. This call for a multiple levels of analyses approach mirrors those made by researchers in the field of developmental psychopathology (Cicchetti & Toth, 2009), including those focused on the study of resilience in maltreated children (e.g., Cicchetti, 2010; 2013; Masten & Cicchetti, 2010; Masten, 2019; Masten et al., 2021).

Notably, the idea that development is dynamic and shaped by transacting factors from multiple levels of analysis is not new; in fact, mid-century biologists such as Kuo (1976) and developmental psychobiologists such as Gilbert Gottlieb (2007) have long described this complexity and pleaded for the implementation of multi-level approaches to the study of development. However, until recently, most researchers studying human development have employed simpler conceptual models and methods.

A notable exception is the field of developmental psychopathology. From its inception, a key tenet has been the multimodal and polyphasic nature of typical and atypical development and the need for multi-level system approaches to study it adequately (Cicchetti & Toth, 2009). A central goal is to evaluate the complex, dynamic transactions occurring among biological, psychological, and broader social-cultural contexts that predict adaptive and maladaptive outcomes across ontogeny (Cicchetti & Curtis, 2007; Cicchetti, 2010). Dante Cicchetti was a founder of this field and the first (and until now, sole) editor of its flagship journal, *Development and Psychopathology*.

On a personal note, I was fortunate to be mentored as a postdoctoral fellow by Dante Cicchetti as part of the John D. and Catherine T. MacArthur Foundation's Research Network on the Transition from Infancy to Early Childhood. During my postdoctoral years, I had many opportunities to ascertain the tenets of the then-emerging developmental psychopathology perspective from Dante, and it is notable that one of our first mentor-mentee discussions focused on Zing-Yang Kuo's work and his call for the establishment of multidisciplinary research institutes (Kuo, 1976). I also had the opportunity to flesh out and apply this knowledge in a practical way by collaborating

with Dante and other members of his research team on two ongoing prospective longitudinal research studies: One evaluated the effects of childhood maltreatment on children's behavioral and developmental outcomes, and another focused on the development of children with Down syndrome from an organization perspective. Dante's thinking, guidance, support, and generosity have made a significant impact on me over the years, not only shaping my approach to developmental science but also the way I mentor the trainees under my supervision. I am eternally grateful.

Studies of the intergenerational transmission of trauma

Over the past 30+ years, the field of developmental psychopathology has continued to grow and evolve, shaped by ongoing concomitant advances in multiple other areas of scientific inquiry. One specific example of such an advance in this field is research on the intergenerational transmission of trauma. Although this area of inquiry is particularly complex and challenging to conduct, research findings to date confirm that early adversity can negatively affect not only the individuals who experienced it, but also their offspring. Illustrations from several recent longitudinal studies on the intergenerational transmission of trauma are provided below.

In a large covariate-controlled study of 4447 mother-child dyads from 21 longitudinal cohorts evaluated in the NIH's Environmental Influences on Child Health Outcomes (ECHO) program, Moog et al. (2023) identified significant associations between maternal childhood maltreatment history and a variety of problems in offspring. Specifically, the authors found that children of mothers with childhood maltreatment were more likely to have clinically significant internalizing problems, autism spectrum disorder, ADHD, and asthma and were also at higher risk for developing multiple problems (multi-morbidity). Moreover, children whose mothers were exposed to multiple forms of childhood maltreatment had the highest risk for negative health outcomes, suggesting a dose-response relationship.

Although these research findings are compelling, the specific processes underlying these associations remain unclear. A large group of studies in this area have focused on parenting quality as a potential explanatory mechanism. Results from scoping and meta-analytic reviews confirm that a history of childhood maltreatment is indeed linked to later parenting quality (Chamberlain et al., 2019; Greene et al., 2020; Khoury et al., 2022; Madigan et al., 2019; Savage et al., 2019). However, consistent with a developmental psychopathology perspective, specific findings in this literature are often complex and nuanced. For example, in one study, the association between maternal childhood maltreatment and disorganized attachment in offspring was mediated by sensitive parenting and maternal depression (Alto et al., 2021). In another longitudinal study (Martinez-Torteya et al., 2014), a history of childhood maltreatment was not directly associated with either parenting quality or infants' biobehavioral regulatory capacity during a social stressor. Rather, maternal childhood maltreatment was indirectly related to parenting quality, via its links with maternal depression. In turn, parenting quality predicted infants' biobehavioral regulation (Martinez-Torteya et al., 2014). In contrast, other studies describe resilient parenting outcomes in the context of early adversity (Yoon et al., 2021).

Another possible (but understudied) mechanism that could help explain the intergenerational transmission of childhood maltreatment is the biological embedding of maternal adversity in

offspring. In a recent study using magnetic resonance imaging, Moog et al. (2018) showed that newborns of mothers with a childhood maltreatment history had smaller brains and less gray matter than infants of mothers without early adversity. In a study of infants in the first two years of life, Khoury et al. (2021) reported that infants of mothers with a childhood history of maltreatment had lower gray matter volume and lower amygdala volume. Similar (but not identical) findings were reported in a Finnish cohort by Tuulari et al. (2023) using similar methods. Specifically, maternal childhood maltreatment was associated with infants' greater left (but not right) amygdala volume. In another study, Hendrix et al. (2021) evaluated infant functional brain connectivity using resting-state functional magnetic resonance imaging during natural sleep. Their findings indicated that one-month-old infants of mothers who had experienced a higher level of emotional neglect in childhood exhibited stronger positive amygdala-ventromedial prefrontal cortex connectivity and stronger amygdala-dorsal anterior cingulate cortex connectivity. These associations remained significant after controlling for a composite measure of maternal self-reported prenatal stress. Notably, other forms of maternal childhood maltreatment (e.g., physical or sexual abuse) did not emerge as significant correlates.

The biological embedding of maternal adversity in offspring may also occur prior to birth. According to the Developmental Origins of Health and Disease model, stress-related alterations in parental biological systems during pregnancy may alter ("program") fetal brain development and other gestational processes (Buss et al., 2017; Yehuda & Meaney, 2018). Although human studies evaluating this novel possibility are still sparse, recent methodological advances have supported this line of inquiry by allowing investigators to measure functional connectivity in fetal brain using resting-state functional magnetic resonance imaging (Turk et al., 2019; van den Heuvel, 2021; van den Heuvel & Thomason, 2016). For example, in a recent study by van den Heuvel et al. (2023), fetuses of mothers with a higher level of childhood maltreatment exhibited greater connectivity of the amygdala network to the left (but not right) frontal areas (prefrontal and premotor), and relatively lower connectivity to right premotor regions and brainstem regions. Notably, these associations remained significant after controlling for a number of maternal and infant covariates, including level of maternal prenatal distress, socioeconomic status, fetal movement, and gestational age (both at the time of scan and at birth). These results mirror the postnatal brain findings reported by Hendrix et al. (2021) and others for infants of trauma-exposed mothers and are similar to findings regarding altered amygdala networks among trauma-exposed urban youth reported by Thomason et al. (2015).

The implications of these pre- and postnatal associations for offspring' later physical and mental health, behavioral functioning, and developmental trajectories remain unclear. For more than a decade, I have been collaborating on a prospective longitudinal study of urban low-income families, the Brain Development Study (M. Thomason, PI) which is attempting to shed further light on the association between measures of resting-state fetal brain connectivity and postpartum outcomes. This study provided the sample that was evaluated in van den Heuvel et al. (2023) study, described above. Next steps in this project are to evaluate whether measures of fetal brain functional connectivity (particularly between amygdalar systems and prefrontal cortical circuits) alter the association between maternal childhood maltreatment history and children's postpartum behavioral and social-emotional outcomes or the quality of the parent-child relationship.

Future directions

The illustrative studies reviewed here highlight that the processes underlying the intergenerational transmission of trauma are dynamic, complex, and biopsychosocial in nature. As such, they require multi-level perspectives, modern developmental conceptual models, and sophisticated, developmentally guided methods utilizing measures from multiple levels of analysis. Additionally, such studies require ongoing collaboration among experts trained in diverse fields (e.g., neuroscience, medicine, psychology, and psychiatry, to name a few) for their successful accomplishment (Cicchetti & Toth, 2009).

For these reasons, I suggest that an important future direction for research in this area of developmental psychopathology is the implementation of collaborative, multi-university *team science* approaches. In fields outside of developmental psychopathology, there is growing recognition of increasing scientific and societal complexity and the need for collaborative multi-university/organization team-based approaches to address this complexity (Hall et al., 2018; Wuchty et al., 2007).

Although team science approaches are promising, collaboration among investigators from multiple, diverse disciplines can be complex and challenging. For example, neuroscientists trained in sophisticated imaging techniques and psychologists or psychiatrists trained in assessing individuals' trauma history and mental health may face communication barriers because they may not share the same level of understanding regarding the complex issues addressed in the field of developmental psychopathology (Cicchetti & Toth, 2009).

In addition, multi-site team science approaches are expensive and require complex organization, planning, and communication across institutions. Many administrators question whether team science approaches "add value" over those of unidisciplinary teams, or whether team science is the best, or the most cost-effective way to support science (Hall et al., 2018). These concerns have been sufficiently serious to warrant the provision of additional federal research initiatives to study "the science of team science," including the evaluation of specific moderators and mediators that contribute to its successful implementation (Stokols et al., 2008), and the "best practices" to implement, in order to enhance its effectiveness (National Research Council, 2015). Despite these initiatives and the need for effective, evidence-based interdisciplinary team-based research approaches, the funding available to support team science approaches is still relatively limited (Hall et al., 2018).

Arguably, our knowledge about the complex developmental processes involved in the intergenerational transmission of trauma has grown substantially from collaborative interdisciplinary research approaches. However, the involvement of community stakeholders and participants engaged in this research is still limited, as is the case in studies in the larger field of psychology (Amauchi et al., 2021; Espinosa & Verney, 2021; Tebes & Thai, 2018; Williford et al., 2021). Moreover, traditional research methodologies in the field of developmental psychopathology have not adequately represented or addressed the needs or goals of multicultural community members, which may contribute to, or even exacerbate, health disparities (Espinosa & Verney, 2021). Thus, efforts to increase the active engagement and participation of community collaborators, research participants, and other stakeholders in all phases of research ("community-based participatory team science") are needed (Tebes & Thai, 2018). Such an approach strives to enhance

equity and inclusion by promoting social/environmental justice in science (Amauchi et al., 2021; Williford et al., 2021).

A potential barrier to implementing this approach is that building relationships with community stakeholders takes time. However, there is growing evidence that such initiatives are successful in enhancing the voice and involvement of under-represented members of the community in research (Brush et al., 2020), thereby creating a more equitable and inclusive partnership between researchers and community members (McFarlane et al., 2022; Tebes & Thai, 2018). This approach also has the potential to increase the effectiveness of efforts to translate scientific findings into policy and practice (Amauchi et al., 2021).

Finally, an increased focus on cultural and global perspectives is needed in the field of developmental psychopathology. It is estimated that over 95% of participants in developmental psychology research live in countries that account for only 12% of the global population, that is, Western, Educated, Industrialized, Rich, and Democratic (WEIRD) societies (Henrich et al., 2010). Similarly, Mistry et al. (2013) point out that over 90% of developmental research has been conducted in the United States, Canada, or Western Europe, and the remaining 10% comes from regions that account for 90% of the world's population. These estimates are calculated for the broad field of developmental psychology but likely also apply to the field of developmental psychopathology. Thus, there is a critical need for researchers who study human development, including the intergenerational transmission of trauma, to globalize and expand their models and methods beyond Western borders to include diverse cultural and geopolitical contexts (Jensen, 2012; Singh et al., 2023). Such an approach would contribute to the creation of a more inclusive, integrated theory of development. A globalized approach could also help identify universal and context-specific patterns of development and their specific associations with the biopsychosocial risk and protective factors across the life span.

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