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Review article

Sex differences in behavioral and psychological expression of grief during adolescence: A meta-analysis

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ABSTRACT

This meta-analysis synthesizes the results of 14 independent studies conducted in the U.S. (N = 6979 participants) that examined sex differences in internalized, externalized, and PTSD symptoms associated with grief during adolescence. The mean age of participants was 12.22 years (SD = 2.31) with 50% male and 50% female sex assigned at birth. While no mean-level differences were found between adolescent females and males in externalizing behaviors associated with grief (d = 0.03), on average, females reported higher levels of internalized grief responses (d = 0.18) and higher levels of PTSD symptoms (d = 0.36) than their male counterparts. Findings suggest the need for additional, more nuanced research to investigate possible sex differences in externalized behaviors relating to grief. In addition, research should examine whether tailored therapeutic and intervention measures and resources are needed for adolescents experiencing internalized grief and PTSD symptoms given sex differences in these reactions.

Grief manifests itself in many different ways. Often associated with grief are feelings of anger, hostility, and immense sadness or depression, as well as so many other internalized and externalized expressions (Worden, 2003). In addition, grief may appear through post-traumatic stress disorder (PTSD) symptoms (Mitchell & Terhorst, 2017). By senior year of high school, approximately 90% of adolescents have experienced the death of a family member or friend (Ens & Bond, 2005), with approximately 3–5% of those individuals experiencing a parental death (Garmezy & Masten, 1994). Thus, there is a compelling need to understand how deaths experienced during adolescence are associated with internalizing, externalizing, and PTSD symptoms.

The period of adolescence is a time of many developmental and life changes, such as increases in academic rigor, autonomy-seeking, emotional development, and rapid physical growth and change (Shifflet-Chila, Harold, Fitton, & Ahmedani, 2016; Tau & Peterson, 2010). The timing of and extent to which developmental changes affect an adolescent are partially determined by an adolescent's sex assigned at birth (Perry & Pauletti, 2011). The timing of the maturation of brain structures and subsequent functionality differs by sex assigned at birth (Christakou et al., 2009), and these differences play a role in an adolescents' behavioral responses to ongoing environmental change (Casey, Jones, & Hare, 2008). As both brain development and behavior vary by sex during adolescence, it is important to explore how these differential changes in adolescent development are associated with the exhibitions of grief responses (i.e., externalizing problems, internalizing problems, and PTSD symptoms). Thus, this meta-analysis examined sex differences in internalized and externalized expressions of grief and PTSD symptoms during adolescence.

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1. Grief and adolescent emotion regulation

Adolescents cope with stressful stimuli by adapting to better handle their environment (Aronfreed, 2013). Reactions to a stressor can be coded as internalized or externalized coping behaviors. Internalized behaviors involve reacting to a stressor by focusing inward, and may include depression, anxiety, loneliness, withdrawal, or suicidal ideation (Bornstein, Hahn, & Suwalsky, 2013). Externalized behaviors include those directed towards the adolescent's environment and may involve other objects or people; these responses can include impulsivity, aggression, attention difficulties, losing one's temper, or delinquency behaviors (Herres et al., 2017). With repeated need for adaptive functioning over time in order to cope with their environment, an individual may develop internalized or externalized behavioral problems (Reijneveld et al., 2014). A behavioral problem occurs when the consequences of an adaptive behavior interferes with daily functioning (Bornstein et al., 2013). Such behavioral responses have the potential to be maladaptive, resulting in new, negative behaviors in order to reach equilibrium (Schneiderman, Ironson, & Siegel, 2005). Further, striving for a level of homeostasis that allows for survival against repeated stressors requires continuous energy (Hobfoll, 1989). Negative behavioral outcomes emphasize the important roles of adaptive stress responses.

PTSD occurs after witnessing, hearing, or having first-hand direct exposure to a stressful or traumatic experience, and PTSD is prevalent among adolescents (Abate, Marshall, Sharp, & Venta, 2017). The effects from PTSD are unique in that they contribute to both the mental health of an individual and the physical behaviors they exhibit (Danielson et al., 2017). As the manifestations of PTSD are so vast, it is important to consider PTSD as a separate entity from internalizing and externalizing disorders.

2. Grief and adolescent brain development

The brain rapidly matures during adolescence. In terms of brain development relevant to grief during adolescence, the prefrontal cortex and the limbic system play the most crucial roles (Casey et al., 2008). The prefrontal cortex is involved in cognitive control (Dixon, 2015). The dense white matter involved with myelination of the prefrontal cortex develops later in adolescence (Riva & Giorgi, 2000), which indicates that the prefrontal cortex is one of the last brain regions to mature. The developmental timing of this maturation renders executive cognitive communication unpredictable during adolescence (McGuire & Botvinick, 2010). On the other hand, the limbic system, including the amygdala, the hippocampus, and the hypothalamus, all found deep in the cerebrum, is primarily involved in processing emotional information (Nieuwenhuys, 1996), which is found to be exaggerated among adolescents when compared to children or adults (Arain et al., 2013). That is, there is an overproduction of axons and synapses involved in the limbic region that supports communication of emotions during adolescence (Casey et al., 2008), resulting in greater emotional reactivity due to high limbic system activity and low prefrontal cortex involvement. Towards late adolescence and early adulthood, programmed apoptotic cell death and neurogenesis (Nuñez, Lauschke, & Juraska, 2001; Rankin, Partlow, McCurdy, Giles, & Fisher, 2003), in addition to synaptic pruning which removes the overproduction of axons and synapses in the limbic system, leaves a more balanced communication pathway between the emotional limbic system and the prefrontal cortex (Blakemore, 2008). The delayed maturation of the prefrontal cortex and the overactive limbic system indicates a potential for more significant behavioral and emotional reactions during the time of adolescence, particularly in reaction to stressors like the loss of a loved one or family member.

Studies have identified sex differences in brain structure and size (Leonard et al., 2008), and these differences vary by chronological age (Ruigrok et al., 2014). First, across the lifespan, males have an average of 10% larger brain volume compared to females (Paus, Wong, Syme, & Pausova, 2017; Ruigrok et al., 2014). In addition, across all age groups, males consistently show a relatively stable 9–14% larger cortical gray matter and peak density occurs at the age of 14.5 years among males versus peak female brain size at 10.5 years (Giedd, Raznahan, Mills, & Lenroot, 2012). White matter, due to myelinated axons, grows more rapidly in males than females (Perrin et al., 2008). This higher density of white matter in males is indicative of sexual dimorphism seen across all ages of development (Paus, 2010).

Sex differences in brain size and development have also been observed in the limbic system, specifically the amygdala and hippocampus (Gur, Gunning-Dixon, Bilker, & Gur, 2002). A high density of androgen receptors are found in the amygdala, while a high number of estrogen receptors reside in the hippocampus (Giedd et al., 2012). When evaluated during adolescence, males are seen to have larger gray matter volume in the amygdala while females have a larger hippocampus (Giedd, Castellanos, Rajapakse, Vaituzis, & Rapoport, 1997; Neufang et al., 2009). Behavioral reactivity from activation in brain regions that exhibit sex differences may show not only an increased emotional response in adolescence, but also increase the sex gap in behavioral and emotional responses to grief.

3. Combining sex, brain structure, and behavior

The differences in brain structure sizes in males compared to females can be applied to known internalized and externalized behaviors that are linked to different areas of the brain. One example that encompasses sex differences in behavior and brain structure is the extensively studied history of depression. Adolescent females are two times more likely than adolescent males to be diagnosed with anxiety and depression during adolescence (Rutter, Caspi, & Moffitt, 2003). Relating to neuroimagery, this is not surprising, as depression and anxiety have been linked to disrupted hormone levels, particularly estrogen, as well as differing hippocampal volumes (Albert, 2015).

The prevalence of a major depressive episode lasting at least 30 days is about 2% in childhood and 6% in adolescence, and begins to decline in early adulthood (Costello et al., 2002). The increased rates of depression in adolescence operate in conjunction with reduced activity in the left dorsolateral prefrontal cortex (dlPFC) (Engels et al., 2010). The dlPFC is a superiorly located brain region