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Definitions, theories, and measurement of stress in children

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Abstract

Problem: Stress in children remains a complex concept to examine due to the inherent subjectivity and lack of specific manifestations, as well as the multiple ways stress can be defined and measured in children. Because stress is multifactorial,is experienced daily by children, and undergirds adolescent health and early mental illness, it is crucial to have a clear understanding of stress and the effects of stress in children from infancy through age twelve years.

Eligibility criteria: To be included in this review, literature must pertain to and highlight theories, definitions/classifications, and measurements of stress in children from infancy to 12 years of age.

Sample: The most pertinent articles identified through database searches (PubMed, Scopus, PsycINFO, CINAHL, Google Scholar), gray literature sources (e.g., child health websites), and reference lists of identified articles were included in this narrative overview.

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Declarations of interest

None.

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Results: The results of this review are organized by themes and include: classifications and definitions of stress, stress-related theories, and tools to measure stress in children.

Conclusions: Research addressing stressors and stress in children is limited, and there is wide variation in how researchers define and classify stress in children. Existing measures of stress in children younger than 12 address physiological, psychological, and observational components, but may be inconsistent and threaten validity of otherwise well-designed and well-executed studies.

Implications: Improving the understanding and accurate measurement of stress in children enables researchers and clinicians to curtail undesirable health outcomes.

Keywords

Stress; Children; Stress theories; Child stress measures

While the COVID-19 pandemic may have exacerbated stress in children, stress in this population has been apparent for decades (Compas et al., 2001; Munsey, 2010). Many types of stress can be seen in children but discussions limited to one or more types may not reflect the true picture of stress in children. A growing body of research is informing a new understanding of stress, particularly as it relates to children. Researchers recognize that children as early as infancy experience stress and may suffer long-lasting consequences of stress (Atkinson et al., 2016). However, stress remains a complicated concept to examine due to the inherent subjectivity and lack of specificity in effects (Selye, 1984) as well as the multiple ways it can be defined and understood. In children, signs and symptoms of stress can manifest differently in distinct age groups (Aldwin, 2007; Burns et al., 2020; Dufton et al., 2011).

The phenomenon of stress is multifactorial and the impact on children is complex and often detrimental. Experiences of early life stress in children may promote the development of short- and long-term behavioral and emotional problems that can increase risk of mental and physical health disorders into adulthood (Doom & Gunnar, 2015). In addition, patterns for coping with stress, whether beneficial or detrimental, are developed in childhood and may become lifelong (Compas et al., 2001). Given this and given that half of all mental health conditions in children begin before the age of 14 years, it is crucial to identify and address children's psychological needs and stress early in their lives (World Health Organization, 2020). It is important for researchers to define the type of stress under study, identify theories that address stress in children, use reliable and valid tools that measure stress in children, and acknowledge that signs and symptoms of stress may differ in children of various developmental periods. The purpose of this narrative overview paper is to discuss definitions and classifications of stress, examine theories of stress as they relate to children, review instruments useful for studying and treating stress in children, and discuss implications for practice and research.

Methods

A non-systematic literature search was conducted to identify literature that pertained to theories, definitions, and measurement of stress in children younger than 12 years. Databases used in the search included PubMed, Scopus, PsycINFO, CINAHL, and Google

Scholar. Although not a systematic review, example terms used to search the literature included child, stress, emotional stress, psychological stress, stress measurement tools and biomarkers, and stress theories. Gray literature, including lay publications related to stress, were also reviewed. In addition, reference lists of selected articles were reviewed to identify further sources of information related to stress in children. While articles were limited by English language, availability of full text, and pertinence to children under the age of 12, there were no limitations on date of publication. Articles were reviewed and organized by theme including: classifications and definitions of stress, stress theories applicable to children, and methods to measure stress in children younger than 12. Results were then analyzed and compiled as a narrative overview (Green et al., 2006).

Definitions and classifications of stress

Stressors are understood as any demand that an individual judges to be overwhelming to their resources (Lazarus & Folkman, 1984). Therefore stress is the individual's response to a wide variety of demands. Broadly, stress can be categorized as chronic or acute. Chronic stress in children has been defined as the process by which any stressor results in a prolonged release of primary mediators such as cortisol and places the child at risk for negative secondary outcomes (Condon et al., 2020). Ongoing bullying (Cheetham-Blake et al., 2019), violence in neighborhoods (Yonas et al., 2012), or family instability (Scaramella et al., 2008), for example, can cause chronic stress in children. In contrast, acute stress results in a temporary response with a return to homeostasis after the resolution of a single psychologically or physically threatening event (McEwen & Wingfield, 2003). Acute stress happens quickly and ends quickly, generally occurring in reaction to an unexpected event. For example, in children, an argument with a friend may trigger acute stress (Cheetham-Blake et al., 2019).

Stress duration and response—In both chronic and acute stress, the body's response is aimed at maintaining homeostasis. Most categories of stress induce similar physiological responses activated by the influences of two systems: the autonomic nervous system and the hypothalamic pituitary adrenal (HPA) axis (McEwen & Stellar, 1993; Selye, 1984). The autonomic nervous system consists of the sympathetic nervous system, responsible for the fight or flight response and the parasympathetic nervous system, responsible for visceral control such as digestion, respiratory rate, and heart rate reactivity (Evans et al., 2013; McEwen, 2007). The autonomic nervous system response occurs following acute stress, while the HPA axis is associated with both acute and chronic stress (Evans et al., 2013; McEwen, 2007). The stress response can be characterized as "appropriate," supporting well-being and enabling a child to meet a challenge, or "inappropriate," triggering impairments in growth, development, and in mental and physical health (Charmandari et al., 2012). This inappropriate stress response is also known as allostatic load or, in more severe cases, allostatic overload (McEwen, 2013).

In addition to the categories of acute and chronic stress, there are designations of stress identified by the primary response: physiological, psychological, and perceived stress. These categories are interrelated and can each be considered chronic or acute. *Physiological stress* can be regarded as the degree and direction of a child's physiologic response to a stressor

(Rosenthal-Dichter, 1996). Manifestations of physiological stress can include increased heart rate and blood pressure, sleeplessness, surges in blood sugar, pain, dizziness, and rises in stress hormones such as cortisol (Bevans et al., 2018; Vanaelst et al., 2012). These manifestations are the body's attempt to maintain homeostasis through the HPA axis, central nervous system (CNS), and immune system. The physiological stress response may be activated by physical stimuli in disease processes, physical injury, even classroom noise (Wålinder et al., 2007), but also in response to psychological or perceived stress.

Psychological stress is distinguished from physiological stress by Lazarus (1993) as the "personal meaning…what an individual defines as a harm, threat, challenge or benefit (p. 4)." Psychological stressors for children may include bullying or shame, but these may vary with the child's age and development. Evidence suggests that as children age and their cognitive aptitudes mature, their ability to manage stress improves (Muldoon, 2003; Rew et al., 2012; Sharrer & Ryan-Wenger, 2002).

Perceived stress overlaps with other types of stress and is defined as how one appraises situations that affect them as stressful and may include physical, psychological, actual, and anticipated aspects of stress (Cohen et al., 1983). For example, perceived stress may center around personal conflict, anxiety, fear, and grief. Perceived stress is sometimes used interchangeably with psychological stress, but there are some differences. While psychological stress is commonly measured by the occurrence of stressful events, perceived stress is viewed as an individual's perceived response to real or imagined stressors. It is important to note here the physical stressors which may impact perception of stress; these include trauma, toxic environments, and illness (Rosenthal-Dichter, 1996; Shonkoff et al., 2012). Perceived stress may stem from life events such as personal conflicts, anxiety, fear, grief, and most recently the COVID-19 pandemic, presenting excessive demands resulting in the person losing the ability to cope (Cohen et al., 2016; Lazarus & Folkman, 1984; Liu & Doan, 2020). If the person is unable to resolve or adapt to a stressful situation, the body may be overwhelmed and cannot maintain homeostasis. Consequently, problems may arise that can affect a person physically, mentally, and behaviorally.

High risk stress—Stress may also be categorized as toxic or traumatic. Toxic stress occurs when children are exposed to severe, ongoing threats to stability such as poverty or violence often without the buffer of protective factors in their environment (Condon et al., 2018). Toxic stress can shape a child's neuroendocrine-immune system, increasing risk for negative adult health outcomes such as hypertension, insulin resistance, obesity, and cardiovascular disease (Johnson et al., 2013).

Among often noted areas of toxic stress are adverse childhood events (ACEs) including child abuse, child neglect, and household dysfunction (parental drug abuse, alcoholism, or mental illness, domestic violence, parental divorce or incarceration)(Felitti et al., 1998) as well as social risk factors such as experiencing poverty, racism, or bullying (Cronholm et al., 2015). Adverse childhood events can lead to poor health outcomes in childhood such as language delays, behavior problems, injuries and obesity, and are closely linked to negative health effects in adulthood including heart disease, depression, stroke, cancer, alcoholism, and illicit drug use (Arpawong et al., 2022; Burke et al., 2011; Felitti et

al., 1998; Marie-Mitchell & Kostolansky, 2019). Whether early toxic stress affects health outcomes in childhood or later in adulthood depends on factors that can mitigate the stress such as prompt identification, referral to community services, and strengthening the parent-child relationship (Marie-Mitchell & Kostolansky, 2019).

Similarly, traumatic stress has been defined as the responses of a child to "events that threaten the life or physical integrity of the child or someone critically important to the child" (American Academy of Pediatrics, 2014, p. 3). Examples of traumatic stress in children include such events as surviving a school shooting or car accident, the death of a parent, being separated from a parent hospitalized with COVID, or being orphaned. Here again, there is overlap, as toxic stress developing in response to a trauma may be categorized as traumatic stress. Traumatic stress or toxic stress can also be considered chronic stress.

Stress may be heightened or altered in children and families in the midst of widespread events such as national disasters or pandemics (Brown et al., 2020; Liu & Doan, 2020; United Nations International Children's Emergency Fund UNICEF, 2020). Since stress likely emerges from everyday stressors that children face (school work and environment, friends, home life, concern about serious illness), it is reasonable to expect that the COVID-19 pandemic's comprehensive impact on daily life and routines has negatively impacted mental and physical health in children and adolescents (Browne et al., 2021; Ghosh et al., 2020; Rome et al., 2020; UNICEF, 2020). Children continue to experience these stressors and many may experience intensified daily stressors as students adapt to different modes of learning and social distancing guidelines. Some children, such as those from single-parent or low-income homes, may be more at-risk for experiencing high levels of stress associated with the COVID-19 pandemic (Fegert et al., 2020; Ghosh et al., 2020; UNICEF, 2020). Limited access to resources needed to sustain distance learning, childcare, nutrition, and a consistent home environment may have overburdened these families. To compound this burden, resources and support services to alleviate stressors may not be readily available to children and families as communities adjust to the pandemic's socioeconomic effects. Chronic daily stressors, coupled with lack of support and resources, can result in toxic stress (Willard et al., 2016), or stress contagion, a term that has been posited to describe chronic stress experienced by children secondary to the COVID-19 pandemic (Liu & Doan, 2020).

Theories that guide stress research in children

Research addressing stressors and stress in children has been limited, yet there has been an increased focus on children especially with the COVID-19 pandemic (Kushner et al., 2016; Roos et al., 2020). As the body of literature grows, researchers may refer to existing stress theories as guides in explaining and predicting relationships among the myriad of variables related to stress. The theories presented here provide frameworks for examining aspects of stress including: physiological or psychological adaptation to stress, coping with stress, holistic care, and family functioning in the face of stress.

Selye's stress theory—Hans Selye began his work on the General Adaptation Syndrome, a generalized stress response, in the first half of the twentieth century (Selye,

1956). The theory addressed the physiologic response of the body to a stressor and included the stages of alarm, resistance, and exhaustion. Individuals normally function in a state of homeostasis but when they encounter a stressor that exceeds their ability to adapt, a physiologic alarm response is initiated. If the stress continues, the body reacts in an attempt to return to homeostasis or enters the resistance stage. If the stressor persists and the body cannot respond, a state of exhaustion ensues in which there is permanent damage to the system or death occurs (Selye, 1956). Although primarily a physiological theory, Selye also introduced the concept of coping or adapting to stress (Selye, 1984).

Lazarus & Folkman transactional theory of stress and coping—Lazarus's early work with the concepts of stress and coping began in the 1950s (Lazarus et al., 1952). Later work evolved to include the concept of appraisal and subsequent emotions. According to Lazarus and Folkman's transactional theory of stress and coping, individuals are constantly appraising stimuli within their environment (Lazarus & Folkman, 1984). This appraisal process generates emotions, and when stimuli are appraised as threatening, challenging, or harmful (e.g., stressors), the resultant distress initiates coping strategies to manage emotions or attempt to directly address the stressor itself. Coping processes produce an outcome (e.g., a change to the person-environment relationship), which is reappraised as favorable, unfavorable, or unresolved. Transactional explanations of stress emphasize the cognitive-phenomenological processes that enable individuals to attribute meaning to their environment, focusing on the dynamic nature of the transaction in which stress may arise (Lazarus & Folkman, 1984).

McEwen's theory of allostasis and allostatic load—The theory of allostatic load is based on allostasis, or the ability to change as needed during elevated or reduced levels of stress (McEwen, 1998). Allostasis is needed for the body to maintain homeostasis, and when the adaptive systems are too frequently or not effectively turned on and off, it leads to allostatic load (McEwen, 1998). This theory evolved from Selye's general adaptation syndrome (McEwen, 2005). Allostatic load occurs when chronic and repeated stressors are compounded by unexpected stressful events that lead to the failure of the adaptive syndrome (McEwen, 2005). Evidence suggests that allostatic load is the physiological mechanism behind the relationship between stress in childhood and poor health outcomes like atherosclerosis, obesity, hypertension, and immunosuppression in adulthood (McEwen, 2005).

Neuman's systems theory—Neuman's Systems Model is a holistic care model in which the individual is viewed as a human being with five components; spiritual, physiological, psychological, sociocultural, and developmental (Neuman, 2002). In this model, stressors are viewed as forces that act upon the system and can cause instability. These occur either as intrapersonal stressors, occurring within the client system; interpersonal stressors, occurring closely outside the client system; or extrapersonal stressors, occurring outside the client system (Neuman, 2002). Within this model, stressors are neutral, but the person's perceptions of the stressors cause a positive or negative outcome (Neuman, 2002).

Family stress model—The family stress model focuses on economic stress and family functioning (Masarik & Conger, 2017). Originally developed in 1994, the model demonstrates how economic hardships or pressures can work to sap resources parents have to spend on relationships within the family and on parenting (Conger & Elder, 1994). Disrupted relationships between parents and decreased parenting resilience can result in harsh discipline or inconsistency. This behavior then can lead to child and adolescent adjustment problems and stress. The original model focused on adolescents and addressed impacts of economic pressures. The model has since been used in research on impacts of other stressors on families and children of all ages, such as natural disasters, remarriage, teen parents, children with disabilities and others (Bluth et al., 2013; Derlan et al., 2019; Laxman et al., 2019; Lowe et al., 2012). In addition, researchers have identified risk and protective factors that can exacerbate or moderate the impact of family stress on children. For example, parental social support and effective coping strategies can help mitigate stress effects in families (McConnell et al., 2011; Wadsworth et al., 2013), while financial stress and community hardship can worsen stress in families (White et al., 2015).

Life course perspective—Developed in the 1960s, the life course perspective, also known as the life approach, is a multidisciplinary paradigm that involves examining the lives of individuals from social, cultural and structural contexts. Sometimes noted as life course theory, this approach examines lives of individuals from the perspective of continuity and change, the interrelationships between social structures, and the relationships among time and place as contexts for development (Elder, 1994; Elder et al., 2003). Early life events are examined as part of later life decisions or events such as disease incidence, involvement in crime, or marriage; the implication being that what happens early in life can affect later development and later periods of life. While individuals may be able to make decisions about their paths in life, those decisions are constrained by what is available to the individual both socially and culturally (Elder et al., 2003).

Roy's adaptation model—In 1964, Sr. Calista Roy developed the initial iteration of Roy's Adaptation Model that expanded on the theories of Selye's General Adaptation syndrome, Helson's Adaptation Theory, and Coping Theory of Lazarus and Maslow. This stress response theory includes the concepts of stress, stressor, and adaptation or coping with stress (Roy, 2009). Stressors are viewed as focal (internal and external demands that present to the individual), contextual (situational internal and external demands), and residual (factors that can affect the current situation but may not be apparent) stimuli that elicit control of stress through coping or adaptation (Roy, 2009). Coping processes can be either automatic or involve psychological processes that are a function of perception, emotion, and judgment (Roy, 2009). The four modes of adaptation are physiologic functioning (maintaining biological integrity), self-concept (maintaining psychological integrity), role functioning (maintaining social integrity and performing societal duties), and interdependence (seeking and maintaining relationships with others) (Roy, 2009). Attempts to adapt result in either effective or ineffective responses; effective responses result in health while ineffective responses result in illness.

Expanded biobehavioral interaction model—The expanded biobehavioral interaction model, developed by Kang and colleagues in 2010, addresses individual, environmental, psychosocial and behavioral domains that can individually and interactively affect biological (physiological) responses that influence health and health outcomes. Responses in the biological domain typically mediate relationships among the other four domains (individual, environmental, psychosocial, and behavioral) with health and health outcomes, but can also moderate the influence of the four domains. In the model, the bidirectionality between the factors and health and health outcomes is also considered (Kang et al., 2010). Stress, a psychological factor, can impact the biological response of inflammation which may undergird health outcomes of cancer, heart disease, and pulmonary disease.

Measurements of stress

Just as there are variations to the stress response and theories describing stress, so too, are there variations in methods or instruments measuring stress in children. The nature of childhood development necessitates adaptation of instruments to accommodate age and cognitive ability of children. The existing measures of stress address physiological, psychological, and observational components. The challenge in stress measurement in children lies in establishing reliability and validity within a specific age group but also in measuring the concept in different age groups. The following section highlights existing stress measures used with children.

Physiological stress measures—The human mind-body interaction described in Kang's Biobehavioral Interaction Model (Kang et al., 2010) reflects relationships that can be explored between subjective (perceived) and objective (physiological) markers for stress. Physiological stress can be measured using proxy autonomic measures of the sympathetic-adrenal-medullary system such as heart rate/heart rate variability, respiratory rate, blood pressure, body temperature and galvanic skin response (Figueroa-Fankhanel, 2014). Biofeedback is commonly used to assess for these acute changes, or, in the case of the neonate and young infant, changes can be assessed in facial expression, extremity movements, and cardiorespiratory values (Chiera et al., 2020). While more convenient, these measures lack specificity to sources of stress such as pain, light, or noise. Physiological stress may also be measured using biomarkers such as catecholamines (norepinephrine and epinephrine) and cortisol. Of these, cortisol may be the most feasible and commonly used biomarker of stress.

Ideally, collection of physiological stress measures should be performed by the researcher or research assistant who is trained in strict adherence to the study protocol; however, innovative methods incorporating parental involvement or telehealth have allowed for collection of physiological measures of stress at a distance and may support continuing research during the pandemic or in situations where the researcher cannot collect specimens in the community.

Cortisol—The stress response often results in the release of corticotropin-releasing factor, and cortisol (Chrousos & Gold, 1992). In addition to being released in response to stressors, cortisol follows a diurnal rhythm where it typically peaks 30–45 min after waking in the

morning and falls steadily throughout the day with the lowest cortisol level noted between midnight and waking (Miller et al., 2017). While there are individual variations in diurnal rhythm, cortisol is the most commonly used biomarker to assess HPA axis function and stress.

Cortisol can be measured in a variety of ways: serum, saliva, hair, urine, skin, nail clippings, and most recently in tears (Ku et al., 2020). Use of each of these mediums has various benefits and limitations. While serum and saliva can be used to evaluate short- and long-term changes in cortisol through repeated sampling (El-Farhan et al., 2017; Hellhammer et al., 2009), hair cortisol levels reflect a retrospective average and may better represent chronic, rather than acute, stress.

Salivary cortisol.—Salivary cortisol analysis may be used to assess acute and chronic stress response patterns. To examine acute stress responses, salivary cortisol samples can be obtained in response to an acute stressor, such as the Trier Social Stress Test (TSST) (Birkett, 2011). Cortisol levels spike in response to acute stressors; however, blunted cortisol levels during an acute stressor may indicate dysfunction of the HPA axis and abnormal acute stress response. Similarly, salivary cortisol may be used to evaluate the chronic stress response pattern. Multiple salivary samples can be obtained over the course of a day or several days to evaluate the cortisol awakening response (CAR) and the diurnal rhythm of cortisol. Alterations in the CAR and diurnal rhythm of cortisol are thought to reflect chronic changes in cortisol and HPA axis activities. This phenomenon is commonly evidenced by a blunted CAR or by increases in cortisol levels from morning to afternoon levels rather than the anticipated decrease and diurnal pattern in cortisol (Miller et al., 2017).

Hair cortisol.—While salivary cortisol has been more commonly used in research with children, hair cortisol concentration (HCC) is also a feasible stress biomarker in both infants and children (Bates et al., 2017; Romero-Gonzalez et al., 2018). Analysis of hair (each cm. reflects prior month's secretion) determines average cortisol secretion over a time period (Short et al., 2016). Hair samples for cortisol analysis have been successfully collected in community samples and at home by parents of young children (Anand et al., 2020, Condon et al., 2020; Kornelsen et al., 2019; & Pauli-Pott et al., 2017). Collection of hair samples from children requires developmentally appropriate and flexible protocols as well as attention to parental concerns. Estimates of normal ranges of hair cortisol concentrations in healthy children have been established and may vary by age (Noppe et al., 2014; Vanaelst et al., 2012).

Fingernail cortisol.—Cortisol obtained through fingernails has also been an emerging biomarker of chronic stress in infants and children. Nails may be more easily obtained from individuals, including infants and children, who do not have sufficient hair or are not able to participate in hair collection (Liu & Doan, 2019). Similar to hair, determining the average growth rate for nails is important for determining duration of cortisol exposure.

Other cortisol measures.—Recently, other non-invasive measures of chronic stress have been explored, such as skin cortisol, which may be promising for use in neonates. In the study by D'Agata et al. (2019), skin cortisol was correlated with cumulative stress in the

NICU. Other, more invasive measures for cortisol in children include urine and serum. All of these methods (hair, urine, serum) have been tested for feasibility in clinical pediatric studies, however, some results have shown lack of hair and urine cortisol correlation with serum despite correlation with stressful experiences (Reinehr et al., 2014; Suavé et al., 2007; Stalder et al., 2017; Vanaelst et al., 2012).

Behavioral stress measures

Stress varies according to stage of psychosocial and neurophysiological development (Skinner, 2016). Temperament also plays a role in stress reactivity (Skinner, 2016). For example, children exhibiting a more difficult temperament since birth appear to be more vulnerable to stressors such as negative parenting (Slagt et al., 2016) and may be more likely to exhibit stress reactions (Ohrt et al., 2020). One approach to measuring or assessing stress in infants and children is through observation of health and behavior (see Table 1).

Subjective stress measures

Given the multi-level nature of stress, it may be useful for a clinician or health researcher to include perceptions from the child. Thus, instruments to measure child stress accurately may use child self-reported ratings of stress, parent proxy reports of child stress, or interviews with child and/or parents conducted by clinicians (see Table 2). Several of the more generic stress measures listed in Table 2 such as the PROMIS scales, the Perceived Stress Scale for Children, the Feel Bad Scale, and the Coddington Life Events Scale have been the preferred instruments used in research in pediatric populations to measure stress or stress responses to an event or intervention. Further, these instruments have been most commonly used in community, school, and primary care settings rather than hospital settings and assess chronic, rather than acute stressors experienced by children.

Parents tend to offer a subjective report that clinicians would not be able to obtain from the child. However, parents are not aware of the child's lived experience and may not be able to provide an accurate report (Conijn et al., 2020). On the other hand, even though the child can offer their experiences, responses could be limited by developmental stage and ability to comprehend the questions being asked (Conijn et al., 2020). This issue of child cognitive appraisal can be seen in studies where child report of stress or anxiety does not correlate with parent (proxy)-report (Egberts et al., 2018; Wachtel et al., 1994) and has underpinnings in the Transactional Theory of Stress and Coping (Lazarus & Folkman, 1984). Tools to measure child stress must be validated in specific target age groups and designed for child (self) report when possible.

Implications for practice

It is vital that healthcare providers and clinicians recognize and measure stress in children. The American Academy of Pediatrics and the community of pediatric healthcare providers and clinicians have long recognized the significance of child stress and the implications for child health (American Academy of Pediatrics and the Committee on Psychosocial Aspects of Child and Family Health, Committee on Early Childhood, Adoption, and Dependent Care, and Section on Developmental and Behavioral Pediatrics, 2016; Centers

for Disease Control and Prevention, 2021). The most recent recommendations suggest increased advocacy for screening and treatment on the part of the community of pediatric healthcare providers and clinicians, and incorporation of screening for stress in children; however, there is yet to be a clear consensus on frequency or method of universal screening.

Some instruments used in research are not designed for use in screening. Of those that could serve as screening tools, few have been studied for this use. The PROMIS Psychological Stress and Physical Stress Experiences tools, the Perceived Stress Scale for Children, and the Feel Bad Scale have potential for use as screening instruments in primary care; however, use is limited by the age of the child being screened. Further, some children may struggle with phrases and terms used in these tools, such as “overwhelmed” and “under pressure” used in the PROMIS psychological stress tool, due to age and developmental differences.

In practice, many pediatric healthcare providers and clinicians do not routinely use tools to screen for stress in children but instead complete a full assessment and gain a full history of the patient and family, watching for indicators of stress in their lives such as physical growth, academic or behavior problems (Condon et al., 2019). While there are some stress screening tools geared toward adolescents, and several stress screening tools for anxiety and trauma, very few stress screening tools are appropriate for children younger than 12 years old. Primary care providers may use broad symptom checklists to screen for stress along with other issues. These may include the Pediatric Symptom Checklist (PSC; Jellinek & Murphy, 2022) and the Strengths and Difficulties Questionnaire (SDQ; Goodman & Goodman, 2009). Providers may also screen for specific types of stress with a tool such as the Addressing Social Key Questions for Health Questionnaire (ASK Tool). The latter is designed to screen for unmet social needs, resilience, and adverse childhood experiences (ACEs) (Selvaraj et al., 2019). Similarly, the Pediatric ACEs and Related Life-events Screener (PEARLS), is a brief prospective questionnaire designed for parent report of their child’s exposure to experiences in the three main ACEs domains (Abuse, Neglect, and Household Challenges) as well as related experiences that include “exposure to discrimination, food insecurity, housing instability, community violence, physical illness/disability of a caregiver, death of a caregiver, and forced separation from caregiver” (Thakur et al., 2020, p. 4).

Implications for research

Pediatric stress researchers consider chronologic age, developmental stages, and delays in growth and development when evaluating, developing, and testing stress measures. Consequently, researchers developing pediatric stress screening tools and measurements need to consider incorporating age or developmentally appropriate scales. The addition of biomarkers such as cortisol continues to be an area of growth in stress research in children. Given the age of some of the stress instruments and recognition of new stressors in children, researchers may also want to consider developing new, culturally-sensitive, developmentally-appropriate stress instruments. While the PROMIS instruments were developed more recently, they may not adequately assess all types of stress experienced by children. Researchers should also consider using mixed methods to better understand stress in children. Mixed methods would allow children to report their individual experiences of

stress in addition to using previously developed stress measurement tools. Lastly, although the focus of this paper is on assessing stress rather than its management, coping strategies for stress in children also need to be considered. The implications of coping with stress may make the difference in a stress becoming toxic or managed.

Limitations

It is important to note that this narrative overview is non-systematic and not all encompassing. We have chosen to include the most commonly used definitions, frameworks, and measures related to child stress research that appear in literature. With tremendous growth in literature on stress research in children, we anticipate that new techniques and tools to measure stress in children will continue to emerge. Additionally, there are inherent limitations in the measurement of stress in children younger than eight, since children may not be able to self-report stress until they are eight (Ryan-Wenger et al., 2012). Developmentally appropriate language and attainment of abstract reasoning are important components to consider when developing survey tools to measure stress in children, and may help explain why there are few surveys to measure stress in children younger than seven. Further, a general tool to measure stress in children may not be appropriate for children of all ages due to developmental differences.

Conclusions

While major events such as the COVID-19 pandemic and multiple school shootings have brought a new focus to stress in children, children may experience perceived or actual stress on a daily basis. Despite rising evidence that children are often affected by threatening events and life circumstances, healthcare providers and clinicians often fail to assess their levels of stress in different settings. In actuality, stress is a normal part of a child's life and includes common, developmental stressors of daily life and those emerging from atypical or traumatic experiences. This review may be used by researchers and clinicians to identify sources and manifestation of stress in children to improve health surveillance and outcomes.

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References

Aldwin C.(2007). Stress, coping, and development: An integrative perspective. The Guilford Press.

American Academy of Pediatrics (2014). Adverse childhood experiences and the lifelong consequences of trauma. https://www.google.com/url?q=https://www.aap.org/en-us/documents/ttb_aces_consequences.pdf&sa=D&source=editors&ust=1623154879093000&usg=AOvVaw3LAynWow-kTtNBckIuEsBD.

American Academy of Pediatrics and the Committee on Psychosocial Aspects of Child and Family Health, Committee on Early Childhood, Adoption, and Dependent Care, and Section on Developmental Policy statement: Early childhood adversity, toxic stress, and the role of the pediatrician: Translating developmental science into lifelong healthand Behavioral Pediatrics (2016). . Pediatrics, 129(1), e224–e231. 10.1542/peds.2011-2662.

Anand K, Rovnaghi CR, Rigdon J, Qin F, Tembulkar S, Murphy LE, ... Tylavsky FA (2020). Demographic and psychosocial factors associated with hair cortisol concentrations in preschool children. Pediatric Research, 87(6), 1119–1127. 10.1038/s41390-019-0691-2. [PubMed: 31791042]

Arpawong TE, Mekli K, Lee J, Phillips DF, Gatz M, & Prescott CA (2022). A longitudinal study shows stress proliferation effects from early childhood adversity and recent stress on risk for depressive symptoms among older adults. Aging & Mental Health, 26(4), 870–880. 10.1080/13607863.2021.1904379. [PubMed: 33784211]

Atkinson I, Jamieson B, Khoury J, Ludmer L, & Gonzalez A.(2016). Stress physiology in infancy and childhood: Cortisol flexibility, attunement, and coordination. Journal of Neuroendocrinology, 28(8), 1–12. 10.1111/jne.12408.

Bates R, Salsberry P, & Ford J.(2017). Measuring stress in young children using hair cortisol: The state of the science. Biological Research for Nursing, 19(5), 499–510. 10.1177/1099800417711583. [PubMed: 28617035]

Bevans KB, Gardner W, Pajer KA, Becker B, Carle A, Tucker CA, & Forrest CB (2018). Psychometric evaluation of the PROMIS® pediatric psychological and physical stress experiences measures. Journal of Pediatric Psychology, 43(6), 678–692. 10.1093/jpepsy/jsy010. [PubMed: 29490050]

Birkett MA (2011). The Trier Social Stress Test protocol for inducing psychological stress. Journal of Visualized Experiments : JoVE, 56, 3238. 10.3791/3238.

Blount RL, Simons LE, Devine KA, Jaaniste T, Cohen LL, Chambers CT, & Hayutin LG (2008). Evidence-based assessment of coping and stress in pediatric psychology. Journal of Pediatric Psychology, 33(9), 1021–1045. 10.1093/jpepsy/jsm071. [PubMed: 17938147]

Bluth K, Roberson PE, Billen RM, & Sams JM (2013). A stress model for couples parenting children with autism spectrum disorders and the introduction of a mindfulness intervention. Journal of Family Theory and Review, 5(3), 194–213. 10.1111/jftr.12015. [PubMed: 24795780]

Brown SM, Doom JR, Lechuga-Peña S, Watamura SE, & Koppels T.(2020). Stress and parenting during the global COVID-19 pandemic. Child Abuse & Neglect, 110(Pt 2), Article 104699. 10.1016/j.chiabu.2020.104699.

Browne N, Snethen J, Greenberg C, Frenn M, Kilanowski J, Gance-Cleveland B, Burke P, & Lewandowski L.(2021). When pandemics collide: The impact of COVID-19 on childhood obesity. Journal of Pediatric Nursing, 56, 90–98. 10.1016/j.pedn.2020.11.004. [PubMed: 33293199]

de Bruin E, Sieh D, Zijlstra B, & Meijer A.(2018). Chronic childhood stress: Psychometric properties of the chronic stress questionnaire for children and adolescents (CSQ-CA) in three independent samples. Child Indicators Research, 11, 1389–1406. 10.1007/s12187-017-9478-3.

Burke N, Hellman J, Scott B, Weems C, & Carrion V.(2011). The impact of adverse childhood experiences on an urban pediatric population. Child Abuse and Neglect, 35, 408–413. 10.1016/j.chiabu.2011.02.006. [PubMed: 21652073]

Burns CE, Dunn AM, Brady MA, Starr NB, & Blosser C.(2020). Pediatric primary care: A handbook for nurse practitioners (7th ed.). Saunders.

Byrne T.(2011). Stressor experience in primary school-aged children: Development of a scale to assess profiles of exposure and effects on psychological well-being. International Journal of Stress Management, 18(1), 88–111. 10.1037/a0021577.

Centers for Disease Control and Prevention (2021). What is children's mental health? https://www.cdc.gov/childrensmentalhealth/basics.html.

Chang Y, Feng J, Chang H, Chang Y, & Lee C.(2020). The impacts of maternal childhood adversity, stress, and mental health on child development at 6 months in Taiwan: A follow-up study. Development and Psychopathology, 1–10. 10.1017/S0954579420000267.

Charmandari E, Acherrmann J, Carel J, Soder O, & Chrousos G.(2012). Stress response and child health. Science Signaling, 5(248), mr1. 10.1126/scisignal.2003595.

Cheetham-Blake T, Family H, & Turner-Cobb J.(2019). 'Every day I worry about something': A qualitative exploration of children's experiences stress and coping. British Journal of Health Psychology, 24(4), 931–952. https://doi-org.elib.uah.edu/10.111/bjhp.12387. [PubMed: 31449737]

Chiera M, Cerritelli F, Casini A, Barsotti N, Boschiero D, Cavigioli F, ... Manzotti A.(2020). Heart rate variability in the perinatal period: A critical and conceptual review. Frontiers in Neuroscience, 14, Article 561186. 10.3389/fnins.2020.561186.

Chrousos GP, & Gold PW (1992). The concepts of stress and stress system disorders: Overview of physical and behavioral homeostasis. Journal of the American Medical Association, 267(9), 1244–1252. [PubMed: 1538563]

Coddington RD (1972). The significance of life events as etiologic factors in the diseases of children-II a study of a normal population. Journal of Psychosomatic Research, 16(3), 205–213. [PubMed: 5072914]

Cohen S, Gianaros PJ, & Manuck SB (2016). A stage model of stress and disease. Perspectives on Psychological Science, 11(4), 456–463. 10.1177/1745691616646305. [PubMed: 27474134]

Cohen S, Kamarck T, & Mermelstein (1983). A global measure of perceived stress. Journal of Health and Social Behavior, 24(4), 385–396. 10.2307/2136404. [PubMed: 6668417]

Compas BE, Connor-Smith JK, Saltzman H, Thomsen AH, & Wadsworth ME (2001). Coping with stress during childhood and adolescence: Problems, progress and potential in theory and research. Psychological Bulletin, 127(1), 87–127. 10.1037/0033-2909.127.1.87. [PubMed: 11271757]

Condon E, Tobon A, Mayes L, & Sadler L.(2020). Accessibility and feasibility of hair and salivary biomarker collection among multiethnic school-age children. Maternal and Child Health Journal, 24, 865–874. 10.1007/s10995-020-02926-2. [PubMed: 32356128]

Condon EM, Holland ML, Slade A, Redeker NS, Mayes LC, & Sadler LS (2019). Associations between maternal caregiving and child indicators of toxic stress among multiethnic, urban families. Journal of Pediatric Health Care, 33(4), 425–436. 10.1016/j.pedhc.2018.12.002. [PubMed: 30683581]

Condon EM, Sadler LS, & Mayes LC (2018). Toxic stress and protective factors in multi-ethnic school age children: A research protocol. Research in Nursing & Health, 41(2), 97–106. 10.1002/nur.21851. [PubMed: 29441597]

Conger RD, & Elder GH (1994). Families in troubled times: Adapting to change in rural America. Aldine de Gruyter.

Conijn J, Smits N, & Hartman E.(2020). Determining at what age children provide sound self-reports: An illustration of the validity-index approach. Assessment, 27(7), 1604–1618. 10.1177/1073191119832655. [PubMed: 30829047]

Cronholm P, Forke C, Wade R, Bair-Merritt D, & Harkins-Swartz M, Pachter ML, , & Fein J. (2015). Adverse childhood experiences: Expanding the concept of adversity. American Journal of Preventive Medicine, 49(3), 354–361. 10.1016/j.amepre.2015.02.001. [PubMed: 26296440]

D'Agata AL, Roberts MB, Ashmeade T, Kane B, Dutra SVO, Kane B, & Groer MW (2019). Novel method of measuring chronic stress for preterm infants: Skin cortisol. Psychoneuroendocrinology, 102, 204–211. 10.1016/j.psyneuen.2018.12.223. [PubMed: 30583244]

De Luca Canto G, Singh V, Conti P, Dick BD, Gozal D, Major PW, & Flores-Mir C.(2015). Association between sleep bruxism and psychosocial factors in children and adolescents: A systematic review. Clinical Pediatrics, 54(5), 469–478. 10.1177/0009922814555976. [PubMed: 25385932]

Derlan CL, Umaña-Taylor AJ, Updegraff KA, Jahromi LB, & Fuentes S.(2019). A prospective test of the family stress model with Mexican-origin adolescent mothers. Journal of Latina/o Psychology, 7(2), 105–122. 10.1037/lat0000109. [PubMed: 31777845]

Doom J, & Gunnar M.(2015). Stress in infancy and early childhood: Effects on development. In Wright J(Ed.), International encyclopedia of the social and behavioral sciences (pp. 577–582) (2nd ed.). Elsevier. 10.1016/B97086-8-23012-2.

Dufton LM, Dunn MJ, Slosky LS, & Compas BE (2011). Self-reported and laboratory- based responses to stress in children with recurrent pain and anxiety. Journal of Pediatric Psychology, 36(1), 95–105. 10.1093/jpepsy/jsq070. [PubMed: 20736388]

Egberts MR, van de Schoot R, Geenen R, & Van Loey N.(2018). Mother, father and child traumatic stress reactions after paediatric burn: Within-family co-occurrence and parent-child discrepancies in appraisals of child stress. Burns: Journal of the International Society for Burn Injuries, 44(4), 861–869. 10.1016/j.burns.2018.01.003. [PubMed: 29657096]

Elder GH (1994). Time, human agency, and social change. Social Psychology Quarterly, 57, 4–15. 10.2307/2786971.

Elder GH, Johnson MK, & Crosnoe R.(2003). The emergence and development of life course theory. In Mortimer J, & Shanahan M.(Eds.), Handbook of the life course (pp. 3–19) (1st ed.). Kluwer Academic/Plenum.

El-Farhan N, Rees DA, & Evans C.(2017). Measuring cortisol in serum, urine, and saliva- are our assays good enough? Annals of Biochemistry, 54(3), 308–322. 10.1177/0004563216687335.

Essau CA, Olaya B, Bokszczanin A, Gilvarry C, & Bray D.(2013). Somatic symptoms among children and adolescents in Poland: A confirmatory factor analytic study of the Children Somatization Inventory. Frontiers in Public Health, 1, 72. 10.3389/fpubh.2013.00072. [PubMed: 24400299]

Evans B, Greaves-Lord K, Euser A, Tulen J, Franken I, & Huizink A.(2013). Determinants of physiological and perceived physiological stress reactivity in children and adolescents. PlosOne, 8(4). 10.1371/journal.pone.0061724.

Farver JAM, Natera LX, & Frosch DL (1999). Effects of community violence on inner-city preschoolers and their families. Journal of Applied Developmental Psychology, 20(1), 143–158. 10.1016/S0193-3973(99)80008-2.

Fegert J, Vitiello B, Plener P, & Clemens V.(2020). Challenges and burden of the Coronavirus 2019 (COVID-19) pandemic for child and adolescent mental health: A narrative review to highlight clinical and research needs in the acute phase and the long return to normality. Child and Adolescent Psychiatry and Mental Health, 14(20), 1–11. 10.1186/s13034-020-00329-3. [PubMed: 31956339]

Felitti VJ, Anda RF, Nordenberg D, Williamson DF, Spitz AM, Edwards V, ... Marks JS (1998). Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults. The adverse childhood experiences (ACE) study. American Journal of Preventive Medicine, 4, 245–258. 10.1016/s0749-3797(98)00017-8.

Figueroa-Fankhanel F.(2014). Measurement of stress. Psychiatric Clinics, 37(4), 455–487. [PubMed: 25455061]

Ghosh R, Dubey M, Chatterjee S, & Dubey S.(2020). Impact of COVID-19 on children: Special focus on the psychosocial aspect. Minerva Pediatrica, 72(3), 226–235. 10.23736/S0026-4946.20.05887-9. [PubMed: 32613821]

Goodman A, & Goodman R.(2009). Strengths and difficulties questionnaire as a dimensional measure of child mental health. Journal of the American Academy of Child and Adolescent Psychiatry, 48(4), 400–403. 10.1097/CHI.0b013e3181985068. [PubMed: 19242383]

Green BN, Johnson CD, & Adams A.(2006). Writing narrative literature reviews for peer-reviewed journals: Secrets of the trade. Journal of Chiropractic Medicine, 5(3), 101–117. 10.1016/S0899-3467(07)60142-6. [PubMed: 19674681]

Hellhammer D, Wüst S, & Kudielka B.(2009). Salivary cortisol as a biomarker in stress research. Psychoneuroendocrinology, 34(2), 163–171. 10.1016/j.psyneuen.2008.10.026. [PubMed: 19095358]

Hill DC, Moss RH, Sykes-Muskett B, Conner M, & O'Connor DB (2018). Stress and eating behaviors in children and adolescents: Systematic review and meta-analysis. Appetite, 123, 14–22. 10.1016/j.appet.2017.11.109. [PubMed: 29203444]

Jellinek M, & Murphy M.(2022). Pediatric symptom checklist. Massachusetts General Hospital. https://www.massgeneral.org/psychiatry/treatments-and-services/pediatric-symptom-checklist.

Johnson S, Riley A, Granger D, & Riis J.(2013). The science of early toxic stress for pediatric practice and advocacy. Pediatrics, 131. 10.1542/peds.2012-0469.

Kang D, Rice M, Park N, Turner-Henson A, & Downs C.(2010). Stress and inflammation: A biobehavioral approach for nursing research. Western Journal of Nursing Research, 32(6), 730–760. 10.1177/0193945909356556. [PubMed: 20624936]

Kanner AD, Feldman SS, Weinberger DA, & Ford ME (1987). Uplifts, hassles, and adaptational outcomes in early adolescents. The Journal of Early Adolescence, 7(4), 371–394.

Kassam-Adams N.(2006). The Acute Stress Checklist for Children (ASC-kids): Development of a child self-report measure. Journal of Traumatic Stress, 19(1), 129–139. 10.1002/jts.20090. [PubMed: 16568466]

Kenardy JA, Spence SH, & Macleod AC (2006). Screening for posttraumatic stress disorder in children after accidental injury. Pediatrics, 118(3), 1002–1009. 10.1542/peds.2006-0406. [PubMed: 16950991]

Kornelsen E, Buchan MC, Gonzalez A, & Ferro MA (2019). Hair cortisol concentration and mental disorder in children with chronic physical illness. Chronic Stress (Thousand Oaks, Calif.), 3 2470547019875116. 10.1177/2470547019875116.

Ku M, Kim J, Won JE, Kang W, Park YG, Park J, ... Park JU (2020). Smart, soft contact lens for wireless immunosensing of cortisol. Science. Advances, 6(28), eabb2891. 10.1126/sciadv.abb2891.

Kushner M, Barrios C, Smith V, & Dougherty L.(2016). Physiological and behavioral vulnerability markers increase risk to early life stress in pre-school aged children. Journal of Abnormal Child Psychology, 44(5), 859–870. 10.1007/s10802-015-0087-7. [PubMed: 26424217]

Laxman D, Higginbotham B, MacArthur S, & Lee C.(2019). A test of the family stress model using a remarriage sample. Journal of Divorce and Remarriage, 60(7), 518–536. 10.1080/10502556.2019.1586230.

Lazarus R, & Folkman S.(1984). Stress, appraisal, and coping. Springer Publishing Company, Inc.

Lazarus RS (1993). From psychological stress to the emotions: A history of changing outlooks. Annual Review of Psychology, 44, 1–21. 10.1146/annurev.ps.44.020193.000245.

Lazarus RS, Deese, & Osler SF (1952). The effects of psychological stress upon performance. Psychological Bulletin, 49, 293–317. [PubMed: 12983450]

Lewis CE, Siegel JM, & Lewis MA (1984). Feeling bad: Exploring sources of distress among pre-adolescent children. American Journal of Public Health, 74, 117–122. 10.2105/AJPH.74.2.117. [PubMed: 6691520]

Liu CH, & Doan SN (2019). Innovations in biological assessments of chronic stress through hair and nail cortisol: Conceptual, developmental, and methodological issues. Developmental Psychobiology, 61(3), 465–476. 10.1002/dev.21830. [PubMed: 30740655]

Liu CH, & Doan SN (2020). Psychosocial stress contagion in children and families during the COVID-19 pandemic. Clinical Pediatrics, 59, 853–855. 10.1177/0009922820927044. [PubMed: 32462929]

Lowe SR, Rhodes JE, & Scoglio AJ (2012). Changes in marital and partner relationships in the aftermath of Hurricane Katrina: An analysis with low-income women. Psychology of Women Quarterly, 36(3), 286–300. 10.1177/0361684311434307. [PubMed: 23125478]

Marie-Mitchell A, & Kostolansky R.(2019). A systematic review of trials to improve child outcomes with adverse childhood experiences. American Journal of Preventive Medicine, 56(5), 756–764. 10.1016/j.amepre.2018.11.030. [PubMed: 30905481]

Masarik AS, & Conger RD (2017). Stress and child development: A review of the Family Stress Model. Current Opinion in Psychology, 13, 85–90. 10.1016/j.copsyc.2016.05.008. [PubMed: 28813301]

McConnell D, Breitkreuz R, & Savage A.(2011). From fFinancial hardship to child difficulties: Main and moderating effects of perceived social support. Child: Care, Health and Development, 37(5), 679–691. 10.1111/j.1365-2214.2010.01185.x. [PubMed: 21143271]

McEwen B.(2005). Stressed or stressed out: What is the difference? Journal of Psychiatry and Neuroscience, 30(5), 315–318. [PubMed: 16151535]

McEwen B.(2007). Physiology and neurobiology of stress and adaptation: Central role of the brain. Physiological Reviews, 87(3), 873–904. 10.1152/physrev.00041.2006. [PubMed: 17615391]

McEwen B.(2013). The brain on stress: Toward an integrative approach to brain, body, and behavior. Perspectives on Psychological Science, 8(6), 673–675. 10.1177/174569161350690. [PubMed: 25221612]

McEwen B, & Stellar E.(1993). Stress and the individual. Mechanisms leading to disease. Archives of Internal Medicine, 153(18), 2093–2101. 10.1001/archinte.1993.00410180039004. [PubMed: 8379800]

McEwen B, & Wingfield J.(2003). The concept of allostasis and allostatic load. Hormones and Behavior, 43(1), 2–15. [PubMed: 12614627]

McEwen BS (1998). Stress, adaption, and disease. Allostasis and allostatic load. Annals of the New York Academy of Sciences, 840, 33–44. 10.1111/j.1749-6632.1998.tb09546.x. [PubMed: 9629234]

Miller K, Margolin G, Shapiro L, & Timmons A.(2017). Adolescent life stress and the cortisol awakening response: The moderating roles of attachment and sex. Journal of Research on Adolescence, 27(1), 34–48. 10.1111/jora.12250. [PubMed: 28498534]

Mongillo E, Briggs-Gowan M, Ford J, & Carter A.(2009). Impact of traumatic life events in a community sample of toddlers. Journal of Abnormal Child Psychology, 37, 455–468. 10.1007/s10802-008-9238-z. [PubMed: 19034643]

Muldoon O, & Trew K.(1995). Patterns of stress appraisal in a conflict environment: A Northern Irish study. Children's Environments, 12(1), 49–56.

Muldoon OT (2003). Perceptions of stressful life events in Northern Irish school children- A longitudinal study. Journal of Child Psychology and Psychiatry and Allied Health Disciplines, 44(2), 193–201. 10.1111/1469-7610.00113.

Munsey C.(2010, January). The kids aren't all right. Monitor on Psychology, 41(1). http://www.apa.org/monitor/2010/01/stress-kids.

Nelson S, Burns M, & Logan D.(2021). The clinical utility of a Brief Psychological Stress measure (patient-reported outcomes measurement information system) in youth with chronic pain. Pain Medicine, 22(1), 91–99. 10.1093/pm/pnaa263. [PubMed: 32914177]

Neuman B.(2002). The Neuman systems model. In Neuman B, & Fawcett J.(Eds.), The Neuman systems model (pp. 3–42) (4th ed.). Prentice Hall.

Noppe G, van Rossum EFC, Vliegenhart J, Koper JW, & van den Akker ELT (2014). Elevated hair cortisol concentrations in children with adrenal insufficiency on hydrocortisone replacement therapy. Clinical Endocrinology, 81(6). 10.1111/cen.12551.

Ohrt TK, Perez M, Liew J, Hernández JC, & Kimberly YY (2020). The influence of temperament on stress-induced emotional eating in children. Obesity Science & Practice, 6(5), 524–534. 10.1002/osp4.439.

Olive LS, Abhayaratna WP, Byrne D, Telford RM, Berk M, & Telford RD (2020). Depression, stress and vascular function from childhood to adolescence: A longitudinal investigation. General Hospital Psychiatry, 62, 6–12. 10.1016/j.genhosppsych.2019.10.001. [PubMed: 31739158]

Osika W, Friberg P, & Wahrborg P.(2007). A new short self-rating questionnaire to assess in children. International Journal of Behavioral Medicine, 14(2), 108–117. 10.1007/BF03004176. [PubMed: 17926439]

Parfenoff S, & Jose P.(1989). Measuring daily stress in children [paper presentation]. Kansas City, MO, United States: Biennial Meeting of the Society for Research in Child Development April 27–30.

Pauli-Pott U, Schlob S, Ruhl I, Skoluda N, Nater U, & Becker K.(2017). Hair cortisol concentration in preschoolers with attention-deficit/hyperactivity symptoms- roles of gender and family adversity. Psychoneuroendocrinology, 86, 25–33. 10.1016/j.psyneuen.2017.09.002. [PubMed: 28910602]

Perrin S, Meiser-Stedman R, & Smith P.(2005). The Children's Revised Impact of Event Scales (CRIES): Validity as a screening instrument for PTSD. Behavioural and Cognitive Psychotherapy, 33(4), 487–498. 10.1017/S1352465805002419.

Reinehr T, Kulle A, Wolters B, Knop C, Lass N, Welzel M, & Holterhus P.(2014). Relationships between 24-hour urinary free cortisol concentrations and metabolic syndrome in obese children. The Journal of Clinical Endocrinology & Metabolism, 99(7), 2391–2399. 10.1210/jc.2013-4398. [PubMed: 24670085]

Rew L, Principe C, & Hannah D.(2012). Changes in stress and coping during late childhood and adolescence. Journal of Child and Adolescent Psychiatric Nursing, 25(3), 130–140. 10.1111/j.1744-6171.2012.00336.x. [PubMed: 22830511]

Röder I, Boekaerts M, & Kroonenberg PM (2002). The Stress and Coping Questionnaire for Children (school version and asthma version): Construction, factor structure, and psychometric properties. Psychological Reports, 91(1), 29–36. 10.2466/pr0.2002.91.1.29. [PubMed: 12353795]

Rome ES, Dinardo PB, & Isaac VE (2020). Promoting resiliency in adolescents during a pandemic: A guide for clinicians and parents. Cleveland Clinic Journal of Medicine, 87 (10), 613–618. 10.3949/ccjm.87a.20055. [PubMed: 33004322]

Romero-Gonzalez B, Caparros-Gonzalez RA, Delgado-Puertas P, & Peralta-Ramirez MI (2018). Newborn infants' hair cortisol levels reflect chronic maternal stress during pregnancy. PLoS One, 13(7), Article e0200279. 10.1371/journal.pone.0200279.

Roos LE, Salisbury MR, Penner-Goeke L, Cameron EE, Protudjer J, Giuliano RJ, Afifi T, & Reynolds K.(2020, September 4). Supporting families to protect child health: Parenting quality and household needs during the COVID-19 Pandemic. 10.31234/osf.io/u5xzw.

Rosenthal-Dichter C.(1996). The pediatric physiologic stress response: A concept analysis. Scholarly Inquiry from Nursing Practice, 10(3), 211–234.

Roy C.(2009). The Roy Adaptation model (3rd. ed.). Pearson Education.

Ryan-Wenger NA, Wilson VL, & Broussard AG (2012). Stress, coping, and health in children. In Rice VH(Ed.), Handbook of stress, coping, and health: Implications for nursing research, theory, and practice (pp. 226–253). Sage Publications, Inc.

Saxe GN, & Bosquet M.(2004). Child stress disorders checklist-screening form (CSDC-SF) (v. 1.0–3/04). National Child Traumatic Stress Network and Boston University School of Medicine.

Scaramella L, Sohr-Preston S, Mirabile S, Robison S, & Callahan K.(2008). Parenting and children's distress reactivity during toddlerhood: An examination of direction of effects. Social Development, 17(3), 578–595. 10.1111/j.1467-9507.2007.00439.x.

Selvaraj K, Ruiz MJ, Aschkenasy J, Chang JD, Heard A, Minier M, ... Bayldon B.(2019). Screening for toxic stress risk factors at well-child visits: The addressing social key questions for health study. The Journal of Pediatrics, 205, 244–249. 10.1016/j.peds.2018.09.004. [PubMed: 30297291]

Selye H.(1956). The stress of life. McGraw-Hill.

Selye H.(1984). The stress of life. McGraw-Hill.

Sharrer VW, & Ryan-Wenger NA (2002). School-aged children's self-reported stress symptoms. Pediatric Nursing, 28, 21–27.

Shonkoff J, Garner A, Siegel B, Dobbins M, Earls M, Garner A, McGuinn L, Pascoe J, & Wood D.(2012). The lifelong effects of early childhood adversity and toxic stress. Pediatrics, 129(1), e232–e246. 10.1542/peds.2011-2663. [PubMed: 22201156]

Short SJ, Stalder T, Marceau K, Entringer S, Moog NK, Shirtcliff EA, ... Buss C.(2016). Correspondence between hair cortisol concentrations and 30-day integrated daily salivary and weekly urinary cortisol measures. Psychoneuroendocrinology, 71, 12–18. 10.1016/j.psyneuen.2016.05.007. [PubMed: 27235635]

Skinner EA (2016). The development of coping: Stress, neurophysiology, social relationships, and resilience during childhood and adolescence. Springer.

Slagt M, Dubas JS, Deković M, & van Aken MA (2016). Differences in sensitivity to parenting depending on child temperament: A meta-analysis. Psychological Bulletin, 142(10), 1068–1110. 10.1037/bul0000061. [PubMed: 27513919]

Stalder T, Steudte-Schmiedgen S, Alexander N, Klucken T, Vater A, Wichmann S, Kirschbaum C, & Miller R.(2017). Stress-related and basic determinants of hair cortisol in humans: A meta-analysis. Psychoneuroendocrinology, 77, 261–274. 10.1016/j.psyneuen.2016.017. [PubMed: 28135674]

Suavé B, Koren G, Walsh G, Tokmakejian S, & Stan H.(2007). Measurement of cortisol in human hair as a biomarker of systemic exposure. Clinical and Investigative Medicine, 30(5), E183–E191. 10.25011/cim.v30i5.2894. [PubMed: 17892760]

Suurland J, van der Heijden KB, Huijbregts S, van Goozen S, & Swaab H.(2018). Infant parasympathetic and sympathetic activity during baseline, stress and recovery: Interactions with prenatal adversity predict physical aggression in toddlerhood. Journal of Abnormal Child Psychology, 46(4), 755–768. 10.1007/s10802-017-0337-y. [PubMed: 28782091]

Thakur N, Hessler D, Koita K, Ye M, Benson M, Gilgoff R, Bucci M, Long D, & Burke Harris N.(2020). Pediatrics adverse childhood experiences and related life events screener

(PEARLS) and health in a safety-net practice. Child Abuse & Neglect, 108, 104685. 10.1016/j.chiabu.2020.104685. [PubMed: 32898839]

UNICEF (2020, May 18). Coronavirus anxiety: Parenting tips to help children. https://www.unicefusa.org/stories/coronavirus-anxiety-parenting-tips-help-children/37267.

Vanaelst B, De Vriendt T, Huybrechts I, Rinaldi S, & De Henauw S.(2012). Epidemiological approaches to measure childhood stress. Paediatric and Perinatal Epidemiology, 26, 280–297. 10.1111/j.1365-3016.2012.01258.x. [PubMed: 22471688]

Wachtel J, Rodrigue JR, Geffken GR, Graham-Pole J, & Turner C.(1994). Children awaiting invasive medical procedures: Do children and their mothers agree on child's level of anxiety? Journal of Pediatric Psychology, 19(6), 723–735. 10.1093/jpepsy/19.6.723. [PubMed: 7830213]

Wadsworth, Rindlaub L, Hurwich-Reiss E, Rienks S, Bianco H, & Markman HJ (2013). A longitudinal examination of the adaptation to poverty-related stress model: Predicting child and adolescent adjustment over time. Journal of Clinical Child and Adolescent Psychology, 42(5), 713–725. 10.1080/15374416.2012.755926. [PubMed: 23323863]

Wålinder R, Gunnarsson K, Runeson R, & Smedjie G.(2007). Physiological and psychological reactions in relation to classroom noise. Scandinavian Journal of Work, Environment & Health, 33(4), 260–266. 10.5271/sjweh.1141.

Walker LS, Beck JE, Garber J, & Lambert W.(2009). Children's Somatization Inventory: Psychometric properties of the revised form (CSI-24). Journal of Pediatric Psychology, 34(4), 430–440. 10.1093/jpepsy/jsn093. [PubMed: 18782857]

White B.(2014). The Perceived Stress Scale for Children: A pilot study in a sample of 153 children. International Journal of Pediatrics and Child Health, 2, 45–52. 10.12974/2311-8687.2014.02.02.4.

White RMB, Liu Y, Nair RL, & Tein J-Y. (2015). Longitudinal and integrative tests of family stress model effects on Mexican origin adolescents. Developmental Psychology, 51(5), 649–662. 10.1037/a0038993. [PubMed: 25751100]

Willard V, Long A, & Phipps S.(2016). Life stress vs. traumatic stress: The impact of life events on psychological functioning in children with and without serious illness. Psychological Trauma Theory Research Practice and Policy, 8(1), 63–71. 10.1037/tra0000017. [PubMed: 26766295]

Williamson DE, Birmaher B, Ryan ND, Shiffrin TP, Lusky JA, Protopapa J, ... Brent DA (2003). The stressful life events schedule for children and adolescents: Development and validation. Psychiatry Research, 119(3), 225–241. 10.1016/s0165-1781(03)00134-3. [PubMed: 12914894]

World Health Organization (2020, September). Adolescent mental health. https://www.who.int/news-room/fact-sheets/detail/adolescent-mental-health.

Yonas MA, Lange NE, & Celedon JC (2012). Psychosocial stress and asthma morbidity. Current Opinion in Allergy and Clinical Immunology, 12(2), 202–210. 10.1097/ACI.0B013E32835090C9. [PubMed: 22266773]

Zengin-Bolatkale H, Conture EG, Walden TA, & Jones RM (2018). Sympathetic arousal as a marker of chronicity in childhood stuttering. Developmental Neuropsychology, 43(2), 135–151. 10.1080/87565641.2018.1432. [PubMed: 29412003]

Table 1

Manifestations of stress in children.

Age Group	Manifestations of Stress Reactions
Infant 0–11 months)	Unpredictable physiological rhythms including vital signs, crying, feeding, sleep; failure to thrive; psychomotor delays (Aldwin, 2007; Burns et al., 2020; Chang et al., 2020; Skinner, 2016)
Toddler (1–3 years)	Emotional lability/temper tantrums; gastrointestinal symptoms; repetitive behaviors; increased fears; sleep disturbance; increased aggression (Mongillo et al., 2009; Suurland et al., 2018)
Preschooler (3–5 years)	Sleep disturbance; developmental regression; fears; worries about safety; nightmares (Burns et al., 2020; Farver et al., 1999)
School-age (6–12 years)	Sleep disturbance; repetitive themes in play; impaired concentration or academic performance, persistent stuttering, somatic complaints such as recurrent abdominal pain; unhealthy eating habits; sleep bruxism (Burns et al., 2020; De Luca Canto et al., 2015; Dufton et al., 2011; Hill et al., 2018; Zengin-Bolatkale et al., 2018)

Table 2

Surveys and tools to measure psychological and perceived stress in children.

Instrument	Ages (Years); Completed by	Concept(s) Measured	Items, Format, & Scoring	Psychometric Properties	References /Resources
Coddington Life Events Scale (CLES)	0–5; parent-report 6–12; parent-report or child-report (assisted) 13–19; child-report	Assess the occurrence of specific events that may impact a child's growth and adjustment over the last year	30 to 50-items depending on version	Test-retest reliability (r = 0.69) Convergent, content, and predictive validity established	(Blount et al., 2008; Coddington, 1972)
Stressful Life Events Schedule for Children and Adolescents (SLES)	< or = 12; child-report, parent-report via interview 13+; child-report via interview	Measures the occurrence and impact of stressors experienced by children and adolescents over the last year	61-items in the child-report version; 77-items in the parent and adolescent version Likert scale and interview questions	Concurrent and divergent validity established Informant validity established through interviews with parents Test-retest reliability (ICC = 0.68–0.93)	(Williamson et al., 2003)
Child Stress Disorders Checklist (CSDC)	2–18; Observer-report (Caregivers, nurses, teachers, social workers)	Used to identify children at risk for having or developing Acute Stress Disorder (ASD) and/or Posttraumatic Stress Disorder (PTSD)	10-items; Yes/No and Likert scale There is also a 4-item screening short form (CSDC-SF)	Test-retest reliability (r = 0.77), internal consistency (α = 0.84) and inter-rater reliability (r = 0.49)	(Saxe & Bosquet, 2004) https://www.nctsn.org/measures/child-stress-disorders-checklist https://www.nctsn.org/measures/child-stress-disorders-checklist-screening-form
Perceived Stress Scale for Children (PSS-C)	5–18; Child-report	Measures perceived stress over the last week	14-items, likert scale with images The first item is not scored and 7-items are reverse scored. Scores range from 0 to 39 with higher scores indicating higher stress perception.	Discriminant validity established between typical youth and children clinically diagnosed with anxiety and stress disorders	(White, 2014)
Children's Stress Questionnaire (CSQ)	7+; Child-report	Measures perceived stress from commonly reported childhood stressors over the past year	50-items; likert scale and dichotomous responses with multiple subscales (hassles, relationship with parents, transition and change, school problems, and	For the full scale: internal reliability (α = 0.902–0.926) and predictive validity	(Byrne, 2011; Olive et al., 2020)

Instrument	Ages (Years); Completed by	Concept(s) Measured	Items, Format, & Scoring	Psychometric Properties	References /Resources
			family dissonance) Scores range from 50 to 250 with higher scores indicating children were more upset about stressors		
Child Trauma Screening Questionnaire (CTSQ)	7–16; Child-report	Used to screen and identify children at-risk for developing PTSD following a potentially traumatic event	10-items; dichotomous (Yes/No) responses A cut-off score of 5 is used to predict PTSD	Cronbach's α = 0.69 Convergent and discriminant validity found in clinical samples	(Kenardy et al., 2006) https://www.nctsn.org/measures/child-trauma-screening-questionnaire
Children's Revised Impact of Events Scale (CRIES)	7–18; Child-report	Measures intrusion and avoidance symptoms related to PTSD	13-item and 8-item versions; likert scale Scores higher than 17 (on the 8-item version) and 30 (on the 13-item version) indicate the child may suffer from PTSD	CRIES-13 Sensitivity = 0.91 Specificity = 0.65 Positive Predictive Value =0.84 CRIES-8 Sensitivity = 0.94 Specificity = 0.59 Positive Predictive Power = 0.83	(Perrin et al., 2005) https://www.corc.ulcnet/outcome-experience-measures/child-revised-impact-of-events
Stress Events Perceptions Scale	8–11; Child-report	Measures stressors in different domains of children's lives (home, school, peers, etc.). Items related to political violence and conflicts (specific to Northern Ireland) were also included in the tool.	24-items; likert scale Higher scores indicated children were more bothered by stressful events	Cronbach's α = 0.63–0.84, depending on subscale (trauma, everyday, & misdemeanors)	(Muldoon, 2003; Muldoon &Trew, 1995)
Stress and Coping Questionnaire for Children	8–12; Child-report	Measures children's emotional responses and coping strategies. The instrument varies based on specific stressors, but common stressors measured are problems with	2 to 4-items related to situational descriptions; 5-items on frequency and emotional response; 14-items on coping responses; likert scale	Internal consistency (α = 0.60–0.78)	(Röder et al., 2002) https://www.researchgate.net/profile/Irma-Roeder/publication/260833575_The_stress_and_coping_questionnaire_for_children_School_version_and_Background_and_Questionnaire/links/00b4953274525077740000000/The-stress-and-questionnaire-for-children-School-version-and-asthma-version-Background-and-Ques

Instrument	Ages (Years); Completed by	Concept(s) Measured	Items, Format, & Scoring	Psychometric Properties	References /Resources
		school work and asthma			
Feel Bad Scale (FBS)	8–12; Child-report	Assesses the magnitude and frequency of stressful events in the child's life	40-items; likert scale Higher scores indicate increased frequency and magnitude of stressful events	Internal consistency (α = 0.82) in a ethnically diverse sample of children Construct validity supported by factor analysis	(Lewis et al., 1984)
PROMIS Psychological Stress Experiences	8–17; Child-report *Parent-report options for children 5–7 or unable to complete	Measures psychological stress reactions over the last 7 days including feeling overwhelmed, perceived lack of control of capacity to manage one's life, and cognitive-perceptual disruption	19-items; likert scale There are also 4-item and 8-item short forms Higher scores indicate more psychological stress experiences	Internal consistency (α = 0.87–0.95; dependent on form version) Test-retest reliability (IIC = 0.70–0.72; dependent on form version) Concurrent validity with the perceived stress scale (*r* = .0.76–0.80; dependent on form version)	(Bevans et al., 2018) https://www.healthmeasures.net/index.php?option=com_instruments&view=measure&id=588&Itemid=992 Nelson et al. (2021) https://www.healthmeasures.net/index.php?option=com_instruments&view=measure&id=539&Itemid=992
PROMIS Physical Stress Experiences	8–17; Child-report *Parent-report options for children 5–7 or unable to complete	Measures physical experiences and responses associated with stress such as agitation pain, arousal, and gastrointestinal distress over the last 7 days	26-items; likert scale There are also 4-item and 8-item short forms Higher scores indicate more physical stress experiences	Internal consistency (α = 0.81–0.95; dependent on form version) Test-retest reliability (IIC = 0.68–0.70; dependent on form version)	(Bevans et al., 2018) https://www.healthmeasures.net/index.php?option=com_instruments&view=measure&id=555&Itemid=992 https://www.healthmeasures.net/index.php?option=com_instruments&view=measure&id=607&Itemid=992
Children's Somatization Inventory-24 (CSI-24)	8–17; Child-report	Used to measure physical stress by assessing the severity of nonspecific somatic symptoms (e.g., headache, chest pain, dizziness) over the past 2 weeks	24-items; likert scale Scores range from 0 to 140, with higher scores indicating more physical symptoms	Good internal consistency (Cronbach's alpha = 0.87–0.91; Walker et al., 2009; Essau et al., 2013)	(Walker et al., 2009)
Acute Stress Checklist for Children (ASC-kids)	8–17; Child-report	Measures acute stress responses within 1 month following a potentially	29-items; likert scale Higher scores indicate more stress symptomatology	Cronbach's alpha = 0.85–0.86 Test-retest reliability = 0.76–0.83	(Kassam-Adams, 2006) https://istss.org/clinical-resources/assessing-trauma/acute-stress-checklist-for-children

Instrument	Ages (Years); Completed by	Concept(s) Measured	Items, Format, & Scoring	Psychometric Properties	References /Resources
		traumatic event			
Children's Hassles Scales (CHS) and Children's Uplifts Scale (CUS)	8–17; Child-report	CHS measures the frequency and intensity of daily stressors over the past month CUS measures the frequency and effects of good things experienced daily by children over the past month	25-items on each subscale; likert scale (CHS/CUS) Scores range from 0 to 100 with higher scores indicating increased frequency and/or intensity. *The subscales may be administered and scored together or separately.	Internal consistency estimates for the high-order CHS and CUS scales are >0.85 Predictive validity established with emotional distress/ wellbeing and social adjustment	(Blount et al., 2008; Kanner et al., 1987; Parfenoff & Jose, 1989) https://files.eric.ed.gov/fulltext/ED314206.pdf
Stress in Children Questionnaire (SiC)	9–12; Child-report	Screens for psychosocial stress in children with two dimensions (psychological and somatic)	21-items; likert scale Higher scores indicating a higher degree of stress	Good internal consistency (Cronbach's alpha = 0.86) and shows strong association with the scales of the Beck Youth Inventories of Emotional and Social Impairment (BYI;	(Osika et al., 2007)
Responses to Stress Questionnaire	9+; Child-report *Parent-report options for children younger than 9 or unable to complete	Measures frequency of stressors and involuntary stress responses; also measures coping methods There are multiple versions related to various sources of stress. Examples include: childhood cancer, parental cancer, COVID-19, academic issues, family stress, etc.	57+ items; likert scale Includes a check-list of stressors (varies per specific scale) and stress response (57 items). Higher scores indicate more frequent stressors and use of coping strategies	Varies based on specific tool; but internal consistencies for the RSQ-childhood cancer total stressor scores ranged from α = 0.83 to 0.91	https://my.vanderbilt.edu/stressandcoping/rsq/
Chronic Stress Questionnaire	10–20; Child-report	Assesses self-reported chronic stress	17-items; likert scale	Reliability was good in a variety of	(de Bruin et al., 2018)

Instrument	Ages (Years); Completed by	Concept(s) Measured	Items, Format, & Scoring	Psychometric Properties	References /Resources
for Children and Adolescents (CSQ-CA)		levels in children and adolescents over the last 3 months	Scores range from 17 to 68 with higher scores indicating more stress	samples (α = 0.80–0.88); convergent and divergent validity was demonstrated with other measures (internalizing and externalizing symptoms)	