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Recognizing the Cumulative Burden of Childhood Adversities Transforms Science and Practice for Trauma and Resilience

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The Adverse Childhood Experiences (ACEs) studies transformed our understanding of the true burden of trauma. Notable elements of Felitti and colleagues' findings include the influence of adversity on many physical as well as psychological problems and the persistence of impacts decades after the traumas occurred. In this article, we make the case that the most revolutionary finding was the discovery of a strong dose-response effect, with marked increases in risk observed for individuals who reported four or more adversities. Over the past two decades, our understanding of the cumulative burden of trauma has expanded further, with recognition that experiences outside the family, including peer victimization, community violence, and racism, also contribute to trauma dose. Recent research has provided evidence for the pervasiveness of trauma, which we now realize affects most people, even by the end of adolescence. Extensive scientific evidence has documented that more than 40 biopsychosocial outcomes, including leading causes of adult morbidity and mortality, are associated with adverse childhood experiences, measured by dose. We summarize the state of science and explain how ACEs built a movement for uncovering mechanisms responsible for these relationships. Perhaps unexpectedly, the pervasiveness of trauma also expands our understanding of resilience, which is likewise more common than previously recognized. Emerging research on positive childhood experiences and poly-strengths suggests that individual, family, and community strengths may also contribute to outcomes in a dose-response relationship. We close with an agenda for research, intervention, and policy to reduce the societal burden of adversity and promote resilience.

Public Significance Statement

The Adverse Childhood Experiences (ACEs) studies and related research have revealed that victimization and trauma are more common than previously known, and that trauma dose, in the form of the number of types of adversities, is strongly associated with more than 40 biopsychosocial outcomes. In turn, the recognition of the pervasiveness of trauma is contributing to a reconceptualization of resilience, which is likewise more common than previously recognized. All individuals, families, and communities need to know how to cope with trauma and overcome adversity, as well as recognize the role we all play in prevention.

Keywords: ACEs, polyvictimization, poly-strengths, resilience, health disparities

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The first publication from the Adverse Childhood Experiences study (ACEs; Felitti et al., 1998) began a quiet revolution that transformed public understanding of the true burden of adversity and markedly influenced research, practice, and policy. Using brief questions about several childhood adversities, including caregiver maltreatment and household exposures to intimate partner violence (IPV), substance misuse, mental illness, and incarceration, Felitti and colleagues showed a strong dose-response relationship between the number of different types of adversities and many medical problems, including heart disease, stroke, and cancer, as well as psychological and behavioral difficulties. Drawing from multidisciplinary scholarship, we build on this work to: (a) outline the historical and continued impacts of ACEs research; (b) make a case for cumulative dose as the most transformative element of this research; (c) describe how a focus on dose has driven insights about mechanisms; (d) inform our understanding of pathways to resilience; and (e) develop research, practice, and policy implications based on these insights. As a hub science that connects to many other disciplines (Boyack et al., 2005; Cacioppo, 2007), psychology is uniquely positioned to identify the ways that trauma intersects with many biopsychosocial domains, improving our capacities to promote recovery and prevention.

The 20th Century Lens on Trauma and Victimization

Before Felitti and colleagues' research, it was not news that child maltreatment is bad for you. Child welfare providers and activists worked for years to raise awareness about, and address problems associated with, child maltreatment. Scholars had published hundreds of articles on the negative effects of childhood adversities. Professionals and the public had been surprised, even shocked, by improvements in epidemiology during the late 1980s and early 1990s that revealed many adversities were more common than previously envisioned. Thus, in some respects, the ACE studies were an extension of well-established research findings (e.g., Briere & Runtz, 1990; Kendall-Tackett et al., 1993). However, elements of Felitti and colleagues' approach harbored the seeds of revolution.

Aside from a few notable exceptions (e.g., Margolin, 1998; Straus et al., 1990), before the first ACEs publication, research on child maltreatment, IPV, and similar problems was primarily conducted in disciplinary "silos," with little communication across specializations (Hamby & Grych, 2013). However, these problems are all forms of *trauma*, that is events leading to threats or actual harm and injury, humiliating and shaming, or witnessing harm to others (Comas-Díaz et al., 2019). Despite these shared elements, it was common for researchers to specialize in just one type of trauma or adversity (a broader term that incorporates other stressful life events and conditions, such as poverty). The siloed approach meant that adversities were typically considered individually, such as studies indicating approximately 6% of children experienced caregiver assault and more than one in four adolescent and emerging adult women had experienced rape (Koss et al., 1987; Straus et al., 1990).

Further, many studies of that era considered only psychological and behavioral consequences of trauma (e.g., anxiety, aggression), seldom assessing physical health outcomes. An influential 1993 review of the consequences of child sexual abuse did not identify research on any physical health effects other than "somatic complaints" (Kendall-Tackett et al., 1993). Although we note that the lines between physical, psychological, and behavioral effects are not sharp, these conventions in categorizing outcomes and designing studies unintentionally created other silos, by ignoring cross-cutting health effects and comorbidities. Finally, although at the time of the original ACE study there was some research on the effects of trauma lasting into adulthood (e.g., Walker et al., 1995), much of the literature on consequences focused on children or college students (Briere & Runtz, 1990; Kendall-Tackett et al., 1993; Margolin, 1998).

The ACEs Revolution: Innovations of the ACE Studies

In the context of 1990s science, the ACEs findings were remarkable. Striking features of the first publication included a large, mature sample with an average age of 56 and including people up to age 92 (Felitti et al., 1998). It

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surprised many that the effects of childhood adversity might persist for decades. Analyses with this older sample opened the possibility of exploring physical health outcomes that are rare in childhood but constitute huge public health burdens. Felitti and colleagues found significant associations between childhood adversity and typically adult-onset conditions such as ischemic heart disease, cancer, chronic bronchitis, and emphysema. Although the homogeneity of the original ACE sample is a limitation (predominantly White, college educated, and insured), it showed that childhood adversity is common even among relatively privileged segments of the population; more than half the sample (52%) reported at least one ACE. Subsequent work includes many other populations and examines ACE impacts on more than 40 health conditions (Brockie et al., 2018; Gilbert et al., 2015; Merrick et al., 2019; Shonkoff & Garner, 2011). Long-term detrimental socioeconomic outcomes, such as high school noncompletion and adult unemployment, are also associated with ACEs (Metzler et al., 2017).

As striking as these findings are, the most revolutionary aspect of the ACE study is the novel and powerful way of conceptualizing adversity as cumulative. Instead of examining each indicator of adversity separately—17 questions on different types of child abuse and family problems—they created a single index score. Although such scores were not unknown, this was one of the first times, if not the first, that a strong dose-response effect between childhood adversities and adult outcomes was identified, with marked increases in health risk observed for individuals who reported multiple adversities, especially those reporting four or more (Felitti et al., 1998). The strength of these dose effects was higher than for many known risk factors for these conditions, such as diet and exercise.

The Pervasiveness of Trauma

Since this seminal work was published, several conceptual frameworks have reinforced the importance of the dose-response effect, while also demonstrating the need to look beyond the family system to assess the full burden of trauma. Polyvictimization research shows the importance of incorporating peer and community victimization into measures of dose (Finkelhor et al., 2007). Scholars have also called for incorporating experiences of discrimination, exposure to community violence, and socioeconomic status into our understanding of trauma and adversity (Cronholm et al., 2015; Wade et al., 2017, 2014). More broadly, we need to address systemic adversities that can create ongoing or repeated exposures to trauma for entire communities, such as poverty, community violence, and racism (Comas-Díaz et al., 2019; W. Ellis & Dietz, 2017). The complex trauma construct emerged from clinical work, but likewise emphasizes the impact of multiple experiences of victimization (e.g., Cohen et al., 2012).

Using these broader lenses, newer research has shown that even higher percentages of the population have experienced violence or other traumas than suggested in the first ACE publication. Trauma and victimization rates of 80% and greater have been found using both conventional and more comprehensive measures (Cronholm et al., 2015; Elm, 2020; Hamby, Grych, et al., 2018; Hamby et al., 2020; Merrick et al., 2017). Including a wider range of lifetime adversities, such as the death of a loved one, pushes rates above 98% (Hamby, Grych, et al., 2018; Hamby et al., 2020). Nationally representative research on U.S. youth has produced rates of adversity from 46–61%, which is notable given the average age of these samples is under 10 (Finkelhor et al., 2009; Rubinstein et al., 2020). There have been recent calls to further expand this work; for example, to include the burden created by historical trauma and systemic oppression within the cumulative trauma framework (Hamby et al., 2020), potentially shifting doses even higher for many people, particularly those impacted by colonization.

Research outside the United States has found similar rates of adversity. The World Health Organization's (WHO) ACE-International Questionnaire (ACE-IQ) assesses the traditional family focused ACEs along with other stressors such as exposure to war, bullying, and collective violence (WHO, 2018). Rates with the ACE-IQ measure have ranged from 77% to 99% in countries as diverse as the Netherlands, Saudi Arabia, and Malawi (Almuneef et al., 2016; Kidman et al., 2019; van der Feltz-Cornelis et al., 2019). Using the polyvictimization framework or similar approaches, several international studies have found lifetime rates of victimiza-

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tion between 64% and 86%, even for adolescent samples (Aho et al., 2016; Chan, 2013; Cyr et al., 2013; Gonzalez-Mendez et al., 2018; Méndez-López & Pereda, 2019; Pereda et al., 2014; Soler et al., 2012). Most notably, many of these studies come from wealthy democracies with substantial social welfare safety nets and lower rates of poverty and crime than the United States (e.g., Canada, the Netherlands, Spain, and Sweden).

An accurate estimate of trauma burden is critical because the focus on family and household traumas alone fails to capture the true dose, and thus does not allow us to assess the full impact of trauma on health. This is especially true for marginalized populations who experience high levels of discrimination and community stressors (Wade et al., 2014). It is time we acknowledged that exposure to victimization and other adversities affects almost everyone.

Beyond "Victim" and "Nonvictim" Dichotomies

For decades, most trauma research simply grouped people into "victim" and "nonvictim" categories (Hamby & Grych, 2013). However, many people experience multiple types of trauma. In the first ACEs study, one in four people reported multiple ACEs, and many of the strongest associations with health problems were from the subsample reporting four or more ACEs (Felitti et al., 1998). In a nationally representative survey of youth, 49% reported two or more different types of victimization (Finkelhor et al., 2011). A broader lens to trauma research reveals that the nonvictim category is often a misnomer. For example, a study on teen dating violence might intend to compare teen dating violence victims to nonvictims. However, it is likely that they are comparing victims of teen dating violence, bullying, and exposure to domestic violence to people who are victims of bullying and exposure to domestic violence, but not teen dating violence. Of course, the reality is more complex, because there are so many possible combinations of adversity, but the key point is that few people in the so-called nonvictim category will truly be nonvictims. The group of individuals who have not experienced adversity is small and assessing dose across a range of adversities is more informative than simply grouping people dichotomously on a single trauma.

The Robustness of Research on the Trauma Dose-Response Relationship

ACEs and related research have established that trauma dose is a powerful predictor of many biopsychosocial outcomes. This relationship is robust to variations in measures of trauma dose and for a wide range of outcomes. Many measures of trauma dose are consistently correlated with outcomes, including the original set of family problems, those limited to victimizations, and those with a broad array of adversities. Further, even within these categories, varying approaches have produced similar results. For example, the original research team used multiple approaches to assess family focused trauma; specifically, childhood neglect was included only in Wave 2 of the original ACE studies (Dong et al., 2004; Felitti et al., 1998). Other approaches to capturing trauma dose, such as a recent study of multiple concealable stigmas (Reinka et al., 2020), obtained results that are largely consistent with prior work.

Outcomes, too, have been measured in various ways, and although significant associations have not been found for every examined outcome in every study, there are significant associations between ACEs dose and over 40 biopsychosocial outcomes (Gilbert et al., 2015). A meta-analytic review identified significant associations between number of ACEs experienced and every outcome included in the analysis (Hughes et al., 2017). Many of these findings are robust to variation in outcome measures, such as different measures of trauma or mood symptoms. Longitudinal and multimethod studies (not relying solely on self-report) have added further support to the importance of adverse childhood experiences on adult health (e.g., Schilling et al., 2007; Tani et al., 2020).

The Impact of Cumulative Versus Single Traumas

An underappreciated aspect of research on trauma dose are the questions raised about the relative importance of cumulative dose, as defined by exposure to multiple types of adversity, versus particularly traumatic or chronic experiences of a single type, such as sexual abuse, bullying, or

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neglect. Using the polyvictimization framework, multiple studies, including some with nationally representative samples, have compared polyvictimization to monovictimization (Hamby & Grych, 2013), finding that polyvictimization is a stronger predictor of psychopathology than even chronic or severe experiences of a single type (Finkelhor et al., 2007; Lätsch et al., 2017; Turner et al., 2010b; also see Haahr-Pedersen et al., 2020 for a recent review). Indeed, in some large studies, the association between individual victimization types and measures of distress disappears when accounting for polyvictimization (Finkelhor et al., 2007; Turner et al., 2010b).

Further, evidence suggests that the most widely used ACE items, which focus exclusively on family problems, not only underestimate trauma exposure, but also are a weaker predictor of functioning than broader measures. One nationally representative study of youth found that a revised index, omitting some original ACE constructs and adding peer and community violence, accounted for 34% of the variance in trauma symptoms, compared with 21% for items representing the original ACE constructs (Finkelhor et al., 2013). A second nationally representative sample showed similar findings, with R^2 improving from 34% to 42% when peer and community exposures were added to original ACE adversities in a model predicting psychological distress (Finkelhor et al., 2015).

Studies of posttraumatic stress disorder (PTSD) onset after known traumas also support the importance of trauma dose. One surprising finding of trauma research is that many people do not develop PTSD or other psychological disorders even after horrific trauma exposures. For example, shortly after the 9/11 terrorist attacks, clinical levels of PTSD were found in 20% of people who lived closest to the World Trade Center, with rates under 10% in other parts of lower Manhattan (Galea et al., 2002). Just 6 months later, rates were under 1% for most New Yorkers (Galea et al., 2003). In one 9/11 study, prior trauma was a better predictor of PTSD than having a friend killed or losing one's job in the attack (Galea et al., 2002). Although other characteristics are associated with PTSD onset, prior trauma exposure is the strongest or one of the strongest predictors in research with diverse populations including accident victims (Gabert-Quillen et al., 2012), veterans (Van Voorhees et al., 2012), and disaster victims (Tang et al., 2014).

The Mechanisms Underlying the Impact of Trauma Dose

Findings on the impact of cumulative trauma and adversity have helped propel the search for mechanisms involved in biopsychosocial impacts. Recognizing the interconnections among forms of trauma has advanced our understanding of mechanisms, including how the experience of one adversity often increases the risk for others (Hamby & Grych, 2013). For example, many forms of victimization are interrelated, including some that are not typically seen as connected, such as exposure to interparental violence and peer relational aggression (Hamby et al., 2010), or property crime and sexual victimization (Finkelhor et al., 2009). Unfortunately, the siloed approach of most 20th century research (Hamby & Grych, 2013) kept scientists from appreciating the dose-response relationship between adversity and biopsychosocial outcomes, and hindered researchers from recognizing the high degree of overlap among risk and protective factors across all types of trauma. Not only does one type of adversity increase risk for other types, but other vulnerabilities, such as limited access to health care and underfunded schools, can exacerbate the risks conferred by ACEs. These vulnerabilities increase the likelihood of experiencing trauma and limit opportunities for recovery from adversity. Instead of reinventing the wheel in the search for risk factors for each type of adversity, the ACEs approach has drawn attention to commonalities among forms of adversity.

ACEs affect physical and psychological aspects of childhood development through many pathways, such as direct physiological responses including repeated adaptation to stressor exposures, "wear and tear" of the body, and biological embedding (Geronimus et al., 2006; Hertzman, 2012; McEwen & Seeman, 1999). Overworking physiology because of childhood stressor exposure occurs across neuroendocrine (e.g., hypothalamic—pituitary—adrenal [HPA axis]), immune, and metabolic systems, and may be particularly harmful to developing stress response systems (B. Ellis & Del Giudice, 2014; Slopen et al., 2013; Wesarg et al., 2020). These processes impact cortisol reactivity and

inflammation, which are known contributors to numerous physical health conditions, including Type 2 diabetes (Berens et al., 2017; Coelho et al., 2014). Further, emerging research suggests that epigenetic changes, such as DNA methylation, may result from ACEs exposure (Park et al., 2019), influencing the long-term health of individuals and potentially acting as pathways for transmitting effects of trauma across generations.

In terms of psychological and social impacts, many harms emerge via indirect processes that persist long after the traumatic incident has ended. Some of the biological ramifications may produce psychological symptoms. For example, allostatic load (assessed with biomarkers of chronic stress) may contribute to symptoms of depression (Rodriquez et al., 2020). Unjustly, it also appears likely that some traumatic responses can trigger a cascade of biopsychosocial problems that create vicious cycles (Masten & Cicchetti, 2010). For example, biological stress responses can lead to self-medication with drugs and alcohol (Hinnant et al., 2015), which in turn can cause further biopsychosocial harms, such as aggravating inflammation, contributing to depressive symptoms, or harming interpersonal networks needed for recovery and thriving. The effects of physiological breakdown can lead to diseases such as diabetes, introducing further stressors related to disease management (Elm, 2020). These mechanisms can contribute to revictimization too, as seen in higher rates of peer victimization among youth with mental health issues (Turner et al., 2010a, 2011). Social harms can contribute to further poor outcomes, as when family violence negatively impacts employment and housing stability (Tolman & Wang, 2005). These vicious cycles are likely instigated or exacerbated by limited access to care or support for more adaptive trauma responses.

Implications of the Cumulative Burden of Trauma for Resilience

What the Pervasiveness of Trauma Means for the Pervasiveness of Resilience

Although statistics on victimization and adversity are certainly grim, the implications are not uniformly negative, as ACEs are not deterministic. One underappreciated ramification of research on ACEs is that resilience, or recovery from trauma, must also be far more common than formerly recognized, as captured by Masten's compelling phrase for resilience, "ordinary magic" (Masten, 2001). Despite the high costs of adversity, many people manage to overcome such burdens and achieve well-being, using individual, family, and community assets and resources. The principle of multifinality is important, as reports of well-being abound in individuals exposed to ACEs (e.g., Hamby, Grych, et al., 2018). This is also supported by an extensive literature on posttraumatic growth (e.g., Schaefer et al., 2018; Tedeschi & Calhoun, 1996).

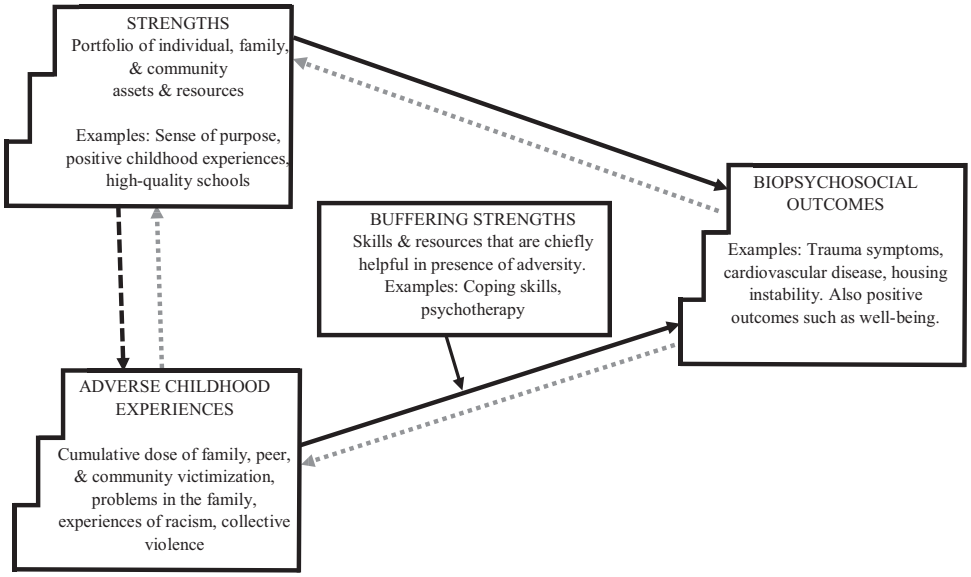
Resilience after adversity has garnered substantial empirical attention (Yoon et al., 2020), but the diversity of approaches to resilience has limited progress. Some researchers subscribe to the bounce-back model of resilience, which is considered an individual-level ability to recover quickly from adversity (Bruneau et al., 2003). From this lens, resilience is a relatively stable personal trait (Lee et al., 2013). Other resilience researchers have conceptualized resilience as an outcome or process of positive adaptation across multiple domains (Cicchetti, 2013). Relatedly, some view resilience through a social-ecological framework and define it as one's capacity to individually and collectively navigate social, psychological, physical, and cultural resources that sustain well-being (Ungar, 2004; Ungar et al., 2013). These various approaches are not equally useful for addressing the importance of trauma dose.

Like early trauma research, past resilience research typically focused on specific exposures such as bereavement, rape, and disasters (e.g., Bonanno et al., 2007, 2004; Steenkamp et al., 2012). These lines of research often assume, implicitly or explicitly, a pretrauma state; however, we now know this view is largely mistaken. Even by age 2, one in three toddlers have been exposed to trauma (Turner, Finkelhor, et al., 2010). By adolescence, as noted previously, many estimates worldwide suggest at least 70–80% of youth have been exposed to victimization (e.g., Aho et al., 2016), with total adversity exposure likely greater than 98% (Hamby et al., 2020). Conceptualizations of resilience that assume a "before" state of nonexposure are inherently problematic. Despite these challenges, resilience research has found that many protective factors can reduce the impact of both familial and nonfamilial ACEs. These include contemporaneous supports, such as strong parental attachment (Gunnar, 2017). Of even greater promise, there are indications that interventions that increase a sense of purpose or prosocial actions may reduce the physiological response to prior stressors, even years after the stressor occurred (Nelson-Coffey et al., 2017; Seeman et al., 2020).

One resilience framework that incorporates the cumulative burden of trauma is the Resilience Portfolio Model (Grych et al., 2015; Hamby et al., 2018). Seen from the perspective of ACEs and other research that document the near universal exposure to trauma, resilience is best considered an ongoing process that will be needed over a lifetime and involves the full social ecology. The portfolio model is consistent with Rutter's approach (Rutter, 2012), in that resilience is not a trait that can be measured directly, but a process that requires assessment of adversities, strengths, and outcomes (see Figure 1). In Figure 1, the ACEs framework is represented by the ACEs and outcomes polygons, showing the dose-response relationship between them. The Resilience Portfolio Model builds on this by also showing

Figure 1

Adverse Childhood Experiences and Strengths Contribute to Biopsychosocial Outcomes in Dose-Response Relationships



Note. Solid arrows show that adverse childhood experiences (ACEs) and strengths contribute to outcomes, as has been focus of ACEs and resilience research. Many factors have bidirectional relationships (dotted gray arrows), which contribute to vicious (or virtuous) cycles. The dashed arrow represents prevention—greater strengths can also reduce exposure to ACEs. Copyright Sherry Hamby; reprinted by permission.

the association of strengths with ACEs (and, in the full model, adverse adult experiences) and outcomes. Vicious cycles (or virtuous) are represented by bidirectional relationships (dotted arrows). The Resilience Portfolio Model also shows how prevention and intervention can be integrated, as the dashed arrow in Figure 1 illustrates the preventive effect, indicating how increasing strengths can insulate people from (at least some) exposures.

Emerging Conceptions of Dose in Resilience Research

Like research on the dose-response relationship of ACEs, the Resilience Portfolio Model underscores the need to assess a wide range of resources and assets available to individuals, families, and communities exposed to adversity. Comparable with the construct of polyvictimization, this model introduces the concept of *poly-strengths*, a construct that captures the totality (dose) of an individual's protective factors across three categories of strengths: regulatory, interpersonal, and meaning making (Hamby, Grych, et al., 2018). A study of young adults exposed to ACEs showed that higher resilience was associated with greater spirituality, greater emotional intelligence, and support from friends, highlighting regulatory and interpersonal elements of the portfolio (Howell & Miller-Graff, 2014). Additional strengths associated with resilient outcomes under this model include purpose, optimism, religious involvement, emotion regulation, emotion awareness, psychological endurance, compassion, generativity, and community support; with the sum score of poly-strengths associated with well-being in a sample of over 2,500 adolescents and adults (Hamby, Grych, et al., 2018).

In a related line of work, emerging research on *positive childhood experiences* (PCEs) has also suggested a dose-response relationship between PCEs and outcomes, finding that they can attenuate or prevent the negative health outcomes associated with ACEs. For example, Bethell and colleagues (2019) found a dose-response association between positive childhood experiences and adult mental and relational health problems, even in the presence of ACEs. Similarly, Slopen et al. (2017) found a dose-response relationship between positive childhood experiences and cardiovascular health. In Figure 1, this hypothesized dose-response relationship is illustrated by the solid arrow between strengths and biopsychosocial outcomes.

How Strengths Help People Exposed to Trauma

All people and communities need the capacity to navigate the near-inevitable ups and downs of life. Further, they need resources that help them build good lives, versus tools to specifically address trauma, whether they have experienced one or many adversities. Resilience scholars often speak

about the "buffering" effects of protective factors, which function something like umbrellas or airbags—handy in rainstorms or car accidents, but not much use otherwise (Masten & Powell, 2003). Statistically, buffering effects are examined via moderation, often analyzed using interaction terms. The buffering idea fits conventional thinking about psychotherapy, hotlines, and many health care and criminal justice services; see Figure 1 for how these are represented in the model. However, buffering is not a very good description of most psychosocial strengths. In the Resilience Portfolio Model, most psychosocial strengths are viewed more like Swiss Army knives—useful in a lot of situations. It is generally good to have regulatory skills, interpersonal connections, and meaning making, regardless of your trauma dose; in other words, an additive model (Masten & Powell, 2003; see solid arrow between strengths and outcomes in Figure 1). The additive model functions something like a scale, with outcomes resulting from the balance of strengths and adversities (Grych et al., 2015).

Trauma Dose and the Question of Inoculation

Another much-hypothesized process in resilience literature is *inoculation*. Operating like some vaccines, the idea behind inoculation is that exposure to stressors develops coping skills and promotes better functioning (Grych et al., 2015). The *steeling* concept is similar (Rutter, 2012). If these processes are operating, the optimal score on adversity measures is not zero, but rather low levels of exposure. Statistically, this is represented by a curvilinear relationship between trauma dose and outcome (Grych et al., 2015). Data on trauma dose call the utility of these concepts into question. Felitti and colleagues' work (Felitti et al., 1998) showed a strong linear dose-response relationship between exposure and numerous outcomes, with no evidence of inoculation. In the years since, this dose-response relationship has been found repeatedly for dozens of biopsychosocial outcomes. Polyvictimization research includes an even wider array of exposures, including some that have been historically considered less severe, such as peer aggression and witnessing violence, and still finds a clear linear dose-response relationship (Turner, Finkelhor, et al., 2010). One adversity exposure is worse than zero, two is worse than one, and three is worse than two. By allowing a comparison between multiple levels of exposure, trauma dose research underscores the need to insulate people from even low levels of trauma. This is a clear example of how the findings from research on trauma dose can advance work on resilience.

Research, Clinical, and Policy Implications

Research Implications: The Next Generation of ACEs Science

As a hub science (Boyack et al., 2005; Cacioppo, 2007), psychology is well positioned to integrate insights across biological, psychological, and social aspects of ACEs. Recognizing trauma dose as the key insight can guide further developments in research, practice, and policy.

Capturing the True Burden of Trauma

One area needing further investigation is the set of items used to assess trauma dose, which should be comprehensive, efficient, and systematically constructed. As argued throughout this article, the adverse experiences included in the original questionnaire were too limited in scope, with an overemphasis on the family system. The original ACEs measure was adapted from existing measures, not developed via a comprehensive strategy (e.g., systematic review of the adversity literature, factor analysis; Finkelhor, 2018). The utility of some commonly included items is questionable. For example, divorce can be a response to family trauma, not a trauma itself, and can even be protective for health outcomes in the context of highly conflictual homes (Barile et al., 2015). Divorce is also not culturally relevant to some populations. Regarding the ACE item on parental incarceration, it is not clear whether parental absence because of incarceration is harder on children than other losses, such as the death of a parent, which is not captured by traditional ACEs measures.

Even more problematically, many consequential adversities are omitted from common ACEs measures. There is extensive evidence that peer and community violence add substantially to individuals' trauma burden (Haahr-Pedersen et al., 2020). Other adversities warrant consideration. For example, cybervictimization and financial strain explain significantly more variance in trauma symptoms and health-related quality of life than in-person polyvictimization alone (Banyard et al., 2017; Hamby, Blount, et al., 2018; Hamby, Grych, et al., 2018).

Addressing the Burden of Racism and Other Forms of Oppression

Of all omissions to ACEs assessments, the systematic underestimation of the trauma burden endured by people of color and other marginalized and oppressed groups is most objectionable. We need to move beyond the limitations of the early ACEs research, which was based on a predominantly White, middle class, insured, U.S. sample. That lens has resulted in a centering of traumas in the family system, but the health burdens of racial trauma are substantial (Comas-Díaz et al., 2019). Prior important work has added items on experiences of racism, and, in the ACE-IQ, exposure to war and collective violence (e.g., Almuneef et al., 2016; Wade et al., 2014). Future ACEs research should expand the study of these experiences and work toward pathways to racial equity.

Beyond Rates and Consequences

The large body of research on ACEs and trauma dose calls for a more integrated approach to the study of rates, risk factors, protective factors, and consequences. Psychology, through its links with other disciplines, is well suited for

leading multidisciplinary teams. Many vulnerabilities increase adversity risk, and more research on mechanisms can explain interconnections among adversities and the diversity of biopsychosocial impacts. Just as we need more work identifying the most important traumas to best capture the true burden, so too we need more work identifying the most important malleable psychosocial strengths that can ameliorate the biopsychosocial consequences of adversity. Using poly-strengths, positive childhood experiences, or other frameworks (Bethell et al., 2019; Hamby, Grych, et al., 2018), future research should assess strengths as well as adversities.

Clinical Implications: Incorporating Insights About Trauma Dose

Regarding clinical implications, one preliminary caveat is that not everyone exposed to ACEs needs mental health treatment (Elm, 2020). As noted previously, most people who are exposed to trauma do not meet clinical criteria for PTSD or other mental health problems, and Finkelhor (2018) cautions that ACE scores are not equivalent to posttraumatic stress symptoms. One advantage of the ACEs model is the separation of exposures and consequences, and this sort of unpacking is essential for improving prevention and intervention.

As we adopt a more holistic framework, we can be more effective at preventing trauma and ameliorating negative effects when trauma does occur. Providers should recognize that, regardless of presenting problem, most people referred to services have probably experienced trauma, very likely multiple types (Graham-Bermann et al., 2011). Interventions that focus on single forms of trauma have shown limitations when participants' full history of adversity is assessed. For example, the Nurse Family Partnership Program (Olds et al., 1997), which was developed to address child maltreatment and has shown success in preventing this specific form of trauma, has not documented positive effects for other forms of adversity (e.g., children's exposure to domestic violence). Further, the treatment effects of the Nurse Family Partnership Program on child maltreatment decrease as participants' reports of domestic violence increase (Eckenrode et al., 2000), suggesting that programs targeting single forms of adversity have less benefit for individuals experiencing polyvictimization. Some therapeutic approaches are incorporating insights about trauma dose. For example, trauma-focused cognitive–behavioral therapy and narrative exposure therapy have been adapted to incorporate multiple traumas in the trauma narrative (Cohen et al., 2012; Robjant & Fazel, 2010).

We also need strengths-based perspectives that incorporate individual, family, and sociocultural factors to promote resilience in the midst of adversity (Howell et al., 2018). A risk orientation perpetuates health disparities by solely highlighting difficulties in the individual or family system. More people have overcome trauma than we have previously acknowledged. We need to recognize that many psychologists and health care providers are also survivors. There is untapped wisdom about resilience and pathways to thriving despite adversity that could inform practice. Studies suggest that one's portfolio of strengths has similar or greater impacts on current functioning than one's trauma burden, even in highly victimized samples (Hamby, Grych, et al., 2018; Hamby et al., 2020). Further, a resilience-oriented approach to ACEs may be less stigmatizing, as it recognizes healthy adaptation following adversity. For multiply traumatized individuals, promising strengths-based interventions include those that increase sense of purpose and prosocial acts, which can reduce physiological stress responses (Nelson-Coffey et al., 2017; Seeman et al., 2020). Mindfulness improves many aspects of wellbeing, in part by reducing cognitive and emotional reactivity and increasing meaning (Gu et al., 2015; Manco & Hamby, 2020). More attention to racial trauma and other collective, ongoing oppressions is needed too, including investing in community resilience and social justice interventions. By highlighting the relationship between adversity and resilience, we can promote health and health equity via strengths-based framing and intervention.

Policy Implications: Rethinking and Reshaping Our Work

The importance of trauma dose calls for reorganization of our work. All of us who may have been trained in a specific adversity need to embrace a broader identity as trauma professionals. Unfortunately, many journals, conferences, funding agencies, and grants still focus on single types of trauma. Thus, resources continue to be siloed into narrow avenues of exploration, limiting our capacity to advance science and reduce the burden of trauma. Thus, resources should be allocated to broader approaches that address multiple types of adverse childhood experiences, or for that matter, adverse adulthood experiences. Such a perspective shift will allow psychology to strengthen our status as a hub science.

This conceptual framework is already reshaping policy directions, with calls from the National Institutes of Health, the Centers for Disease Control and Prevention (CDC), and the American Psychological Association (APA) all emphasizing the need to study multiple and co-occurring adversities. Federal efforts to prevent early adversity have adopted strengths-based framing in a comprehensive public health approach to prevention (e.g., CDC's Essentials for Childhood and HHS's vision for child welfare: Creating the Conditions for Strong, Thriving Families and Communities where Children are Free from Harm). By bringing together scientists and practitioners across disciplines, these efforts will begin to erode siloes that have kept the field from advancing for far too long. Notably, some key funding agencies have begun to require a polyvictimization approach to trauma research. For example, CDC grants for preventing violence and violence-related injuries require that applicants address at least two forms of violence.

By tying funding with polyvictimization, this agency is shifting public attention and research dollars to the full burden of trauma.

Other actions should also be considered, such as broadening the scope (and renaming) journals devoted to specific forms of violence. Graduate and postdoctoral programs should make explicit commitments to comprehensively cover trauma and resilience in their curricula. Further, APA and other professional organizations can develop continuing education programs to alert providers to the latest science and discontinue programs that take a siloed approach. Psychology could become more involved in reducing inequality, because steps such as increasing the minimum wage may reduce the burden of trauma (Kaufman et al., 2020). We need to shift the scientific narrative around adversity, and then, too, around the prevention of adversity.

Conclusion

Science and practice move slowly, but 20 years into the ACEs revolution, we are starting to fully realize the cumulative effects of adversity, including not only family problems but peer victimization, community violence, and racism. We now know that even by the end of childhood, most people are exposed to trauma and adversity, and that the cumulative dose, in the form of the number of types of adversities, is strongly associated with leading causes of death and morbidity. The dose-response concept has advanced understanding of the interconnections and mechanisms surrounding adversities and their impacts. Further, recognizing the pervasiveness of trauma is contributing to a reconceptualization of resilience, which is likewise more common than previously known. Emerging evidence, using constructs such as positive childhood experiences and poly-strengths, suggests that strengths, like adversities, may also contribute to biopsychosocial outcomes in a dose-response fashion. Promising future directions include identifying strengths and other factors that can reduce or mitigate adversity; turning to prosocial, mindfulness, and other interventions that promote thriving; advocating for policies that dismantle siloes and support multidisciplinary, integrative work on trauma and resilience; and championing social justice as the foundation of psychological health. We are poised to make significant advances in our ability, as a field and as a society, to reduce the burden of trauma and support wellbeing.

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