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Youth exposure to violence involving a gun: evidence for adverse childhood experience classification

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Abstract Adverse childhood experiences (ACEs) have historically included child maltreatment, household dysfunction, and other critical issues known to impact children negatively. Although youth experiences with violence are broadly captured in some ACE measures, youth exposure to violence involving a gun has not been included specifically in the operationalizing, and therefore scientific study, of ACEs. There are numerous implications of this omission, including limiting access to ACE interventions that are currently available and resources for individuals who have been exposed to gun violence. Thus, and given the persistent prevalence of gun violence in the US, we conducted a systematic review of the literature over the past two decades on the assessment of and response to ACEs and gun violence. Eighty-one journal articles across four search engines met our inclusion criteria. Our findings provide evidence that youth gun violence exposure should be classified as an ACE. In addition to increasing access to resources for youth affected by gun violence, these findings may improve the likelihood of funding and research into gun violence, with direct implications for prevention and intervention efforts.

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Introduction

Adverse childhood experiences

Adverse childhood experiences (ACEs), including child maltreatment, household dysfunction and domestic violence, persist as a public health challenge in the United States (SAMHSA, 2018; Forster, Gower, McMorris, & Borowsky, 2017; Wade et al., 2014). In a national sample, nearly two-thirds of adults in the US (62%) report at least one ACE (Merrick, Ford, Ports, & Guinn, 2018). Among youth, Black and Hispanic children remain disproportionately at-risk for ACEs (Blodgett & Lanigan, 2018; Wade et al., 2014), and systemic factors such as poverty and community violence exacerbate this risk (Walling, Eriksson, Putnam, & Foy, 2011). Most of the scientific literature conceptualizes ACEs as stressful or traumatic events that impact the healthy development of children through adolescence and into adulthood (SAMHSA, 2018). Historically, research on ACEs had focused on child maltreatment, sexual abuse, household mental illness, and family members who have been incarcerated, but now ACEs are understood to include a range of events, including youth experiences with bullying, experience with the juvenile justice system, and parental absence (Blodgett & Lanigan, 2018; Garrido, Weiler, & Taussig, 2018; Mersky, Janczewski, & Topitzes, 2017; Wade et al., 2014).

The cumulative and long-term influence of ACEs on multiple harmful and risky behaviors has been well established (Boullier & Blaire, 2019; Hughes, Hardcastle, & Bellis, 2016). Research has confirmed that ACEs

increase a person's risk for an extraordinary number of poor physical and mental health outcomes including hypertension, depressive disorders, alcohol dependence, illicit drug use, self-harm behaviors, chronic sleep disturbance, poor oral health, and premature mortality (Brown et al., 2017; Ports et al., 2017; Hall, Belcher, Accardo, Minhas, & Briggs, 2016; Iniguez & Stankowski, 2016; Bright, Alford, Hinojosa, Knapp, & Fernandez-Baca 2015; Kerker et al., 2015; Roos et al., 2013; Miller, Blau, Christopher, & Jordan 2012; Miller et al. 2012; Mingione, Heffner, Blom, & Anthenelli 2012; Anda et al., 2008; Rothman, Edwards, Heeren, & Hingson 2008; Schilling, Aseltine, & Gore, 2007; Chapman et al., 2004; Koss et al., 2003). ACEs have also been shown to impact neural and molecular physiology (Berens, Jensen, & Nelson, 2017), with the likelihood of these negative outcomes increasing as the number of ACEs increases (Dong et al., 2004). The impact of the toxic stress typically associated with ACEs on a child's brain development and neurological functioning is also well-documented (Noble, Houston, Kan, Bookheimer, Sowell 2012). Recent research has even established a clear relationship between an increased number of ACEs and poor academic outcomes in children (Blodgett & Lanigan, 2018). Similar to many other public health issues, ACES disproportionately impact minority youth. Nationally, data illustrate that 61% of Black children and 51% of Hispanic children have experienced at least one ACE in comparison to 40% of White children (Sacks & Murphey, 2018). Further, Black and Hispanic children living in low-income communities are disproportionately at-risk for ACEs (Blodgett & Lanigan, 2018; Wade et al., 2014).

Impact of ACEs on youth development

Many of these adverse outcomes manifest during early through late adolescence (Casey, Jones, & Hare, 2008). It is well established that there is a relationship between ACEs and an increased likelihood of engagement in risky behaviors among adolescents (Hughes et al., 2016). The "ACE Pyramid" (Centers for Disease Control and Prevention, 2018a) that draws on the broad body of ACE research articulates the chain of events stemming from ACEs if left untreated or unaddressed and follows the course of a lifespan: (1) social, emotional, and cognitive impairment; (2) adoption of health-risk behaviors; (3) disease, disability, and social problems; (4) ultimately leading to early death. ACEs often lead to prolonged stress among children, disrupted adjustment, and inability to regulate emotions (Blodgett & Lanigan, 2018; Hughes et al., 2016). These challenges can lead to immediate problem behaviors (ranging from displays of internalizing behaviors (such as depressive symptoms) and externalizing behaviors (such as increased aggression)), and numerous long-term poor health outcomes noted above (Lee & Bax, 2000). Thus, if ACEs are not comprehensively assessed, particularly during childhood or adolescence when opportunity for intervention is most important, and if protective factors (for example, in the form of various family, school, and/or community supports (Blodgett & Lanigan, 2018)) are not made available after that assessment, then youth who have had ACEs remain at heightened risk for a range of problem behaviors both in the immediacy and long-run.

Gun violence exposure

Gun violence is a persistent public health issue in the US. Each year, approximately 100,000 American are injured with a firearm, with over 17,000 of these individuals being children (ages 0–18 years) (Centers for Disease Control and Prevention, 2016; Branas, Richmond, Culhane, Ten-Have, Wiebe 2009). Thirty-eight thousand of these individuals die as a result of their firearm injuries (Centers for Disease Control and Prevention, 2016). However, these statistics don't reflect the broader spectrum of gun violence experiences and exposure; for example, witnessing gunfire, hearing gunshots, and/or losing a friend or family member to firearm related injuries or death (Bieler & La Vigne, 2014; Bingenheimer, Brennan, & Earls, 2005; Luthar & Goldstein, 2004; Garbarino, Bradshaw, & Vorrasi, 2002).

If we do broaden the definition of "gun violence" to include this range of experiences, then the scope and reach of gun violence in communities across the US becomes even more alarming. For example, research on community gun violence using a national sample has shown that approximately 8% of youth (ranging in age from 2 to 17 years) know at least one friend and/or family member within the past year who had been shot with a firearm (Turner, Finkelhor, & Henly, 2018). It is important that we include this in our understanding of gun violence exposure since research has shown that certain forms of gun violence can be thought of as a social contagion, spreading via peer-to-peer networks (Branas, Jacoby, & Andreyeva 2017). Thus, individuals are often more likely to be injured or killed with a firearm if someone they know has also been injured or killed with a firearm (Green, Horel, & Papachristos, 2017). Additional work has illustrated that within low-income urban minority communities, 9% of young children report being exposed to gun violence (whether in the form of hearing gun shots or having a family member who died by gunshot) (Agrawal, Arevalo, Castillo, Lucas 2018). It should be noted that this latter work draws on a sample of children whose mean age was 5 years; had this study focused on and/or included older youth, the prevalence of gun violence exposure in all

likelihood, would have been exponentially higher (Agrawal et al., 2018).

Impact of gun violence exposure on youth development

Like ACEs, the impact of exposure to violence involving a gun on youth development is significant. Recent research has demonstrated that youth who witnessed a friend and/or family being injured or shot via a firearm within the past 2 years are more likely to experience symptoms of trauma (Turner et al., 2018). And as in the case of ACEs, exposure to violence, including violence involving a gun, is associated with the onset of posttraumatic stress (Thompson & Massat, 2005). Two separate studies have confirmed that exposure to violence during childhood (including both witnessing a shooting and/or being shot with a firearm) are associated with long-term poor chronic health outcomes (such as hypertension) as well as a significant increase in likelihood that they will be a perpetrator of violent crime during adolescence (Ford & Browning, 2014; Bingenheimer et al., 2005). Research has also shown that among a nationally representative sample of high school aged youth, those who report recent firearm possession are more susceptible to a range of risk factors (including, but not limited to, increased substance use, increased likelihood of having poor indicators of mental health, and increased likelihood of having been previously victimized) (Ruggles & Rajan, 2014). Although there is limited work on these different forms of gun violence exposure, the existing research points to the importance of broadening our definition of gun violence to include experiences that may contribute to emotional or psychological trauma, but that are not currently captured via existing measures. Indeed, most research studies focus primarily on injury or death by a gun. However, in understanding the impact of gun violence exposure on youth development and other long-term outcomes, other forms of violence involving a gun need to be included.

Purpose

It is clear that we can draw a number of comparisons between youth exposure to violence involving a gun and ACEs, especially in terms of their respective significant and negative impact on a range of outcomes, often manifesting in early adolescence and continuing through adulthood. Yet, most assessment tools and interventions for ACEs do not include exposure to violence involving a gun in their operationalization of "ACE". There are numerous implications of this omission, including limiting access to ACE interventions and resources for youth and adults who have been exposed to gun violence during early childhood, and missing critical opportunities for prevention and intervention for those youth who are found to have had a gun violence based ACE. As such, the purpose of this paper is to conduct a systematic review of the available peer-reviewed literature over the past two decades on the assessment of and response to ACEs and youth gun violence and then use the existing evidence to determine whether it is reasonable to classify youth gun violence exposure as an ACE.

Methods

We conducted a systematic review of peer-reviewed research articles from January 1, 1998 through March 7, 2019 on (1) the assessment of and response to ACEs in the context of violence exposure and (2) the assessment of and response to youth exposure to violence with a gun to determine whether youth gun violence exposure should be reasonably classified as an ACE. We also reviewed these articles with the intent of guiding a more comprehensive definition of "exposure to violence involving a gun" to consider the inclusion of a broader spectrum of experiences with firearms (including injury from, witnessing, hearing gunshots, and/or knowing a friend or family member who had been shot with a gun).

Search strategy

The following search engines were used to identify peer-reviewed journal articles: PubMed, Science Direct, and Columbia University Libraries/Information Services (CLIO). Google Scholar was also used as an adjunct to these academic search engines to ensure that no peer-reviewed journal article was missed. We initially determined a set of broad categories that were critical to this systematic review and within each category identified a set of terms and suitable synonyms (see Table 1). It should be noted that a total of 1548 articles on ACEs were available across all four search engines and 288 articles were identified that addressed some aspect of ACES and violence more broadly. The following Boolean and/or search strategy was applied to each search engine:

1. "Adverse Childhood Experiences" AND "Firearm".
2. "Adverse Childhood Experiences" AND "Gun" AND "Violence".
3. "Adverse Childhood Experiences" AND "Violence" AND ("Assessment" OR "Screening").
4. "Adverse Childhood Experiences" AND ("Firearm" OR "Gun") AND "Violence" AND "Intervention".
5. "Adverse Childhood Experiences" ("Firearm" OR "Gun") AND "Violence" AND "Prevention".

Table 1 Summary of search terms

Primary Keywords	Developmental Stage	Assessment	Response	Setting
Adverse Childhood Experiences *or* ACE	Child(ren)	Assessment	Intervention	Clinic
Firearm *or* Gun	Adolescent	Screening	Prevention	Community
Violence	Youth	*Other possible terms:* Tool, Measure		Emergency Department
				Hospital
				School

6. ("Adverse Childhood Experiences" AND "Violence" AND "Intervention") AND ("Adolescent" OR "Youth" OR "Children").
7. ("Firearm" OR "Gun") AND "Violence" AND ("Assessment" OR "Screening") AND ("Adolescent" OR "Youth" OR "Children").
8. ("Firearm" OR "Gun") AND "Violence" AND "Intervention" AND ("Adolescent" OR "Youth" OR "Children").

Inclusion/exclusion criteria

As noted above, we focused our search regarding available screening tools and interventions for youth ranging in age from 0 to 18 years to include "violence" (instead of only "gun violence" or "firearm violence"). We took this approach because there was relatively limited research in the specific area of assessment of and interventions available in direct response to youth exposure to violence involving a gun. Our objective was to gain a better understanding on how other forms of violence are captured in existing ACE measures and responses, and thus provide some insight on how best to incorporate gun violence in future ACE discussions. In addition, we were interested in all available ACE screening and intervention efforts for youth, so that we did not limit our search by a specific setting. We did, however, delimit the scope of this effort to include only peer-reviewed journal articles published within the past two decades (January 1998–March 7, 2019) and those that were published in English. This time span was selected because the landmark study about ACEs conducted by the Centers for Disease Control and Prevention and Kaiser Permanente was published in 1998 and informed much of the existing best practices regarding ACE screening and response (Felitti et al., 1998). It therefore seemed reasonable to build our systematic review from this date forward. Lastly, we also limited our article search to U.S.-based studies, given the unique characteristics (including prevalence, policy, and available funding mechanisms) of gun violence in the U.S. Quantitative, qualitative, and mixed-methodology studies were included. Excluding duplicates, a total of 109 articles were initially identified. Ultimately 81 articles that met our inclusion criteria were included in our review.

Results

A systematic review of 20 years of research on assessment of and response to ACEs and to youth exposure to violence involving guns period confirmed that youth experiences with gun violence are not explicitly included as an ACE in current screening tools, nor in the interventions and support services made available to individuals who have had ACEs. One exception is the research by Finkelhor and colleagues (2013) that supports the need to expand ACEs to include a wider range of experiences, including community violence. Specifically, this work operationalizes "community violence" to include three experiences that may include a firearm—witnessing an assault, having someone close murdered, or witnessing a murder (Finkelhor, Shattuck, Turner, & Hamby 2013).

Current practices range from screening for ACEs among adults and children alike to interventions that subsequently respond to the short- and long-term poor health outcomes that emanate from or occur in response to ACEs (Finkelhor, 2018; Flanagan et al., 2018; Bethell et al., 2017). Nearly all of these practices, however, appear to occur separately from efforts in direct response to youth exposure to gun violence. Furthermore, while there are some intervention and response efforts available to support individuals who have been exposed to gun violence and/or are at-risk for future gun violence, they are not nearly as prevalent or as easily available as those for ACEs. Thus, building gun violence exposure into the definition of ACEs would allow youth who have been exposed to some form of gun violence to have access to a broader range of intervention efforts and support at various life stages.

Current practice: screening for ACEs

Most existing ACE screening efforts take place in healthcare settings, with some recent work exploring the feasibility of assessing ACEs in schools and home settings (Forster et al., 2017; Johnson et al., 2017; Bright, Knapp,

Hinojosa, Alford, & Bonner 2016; McLennan & MacMillan, 2016; Bright et al., 2015; Hornor, 2015; Marie-Mitchell & O'Connor, 2013). A review of available assessment tools yielded over a dozen instrument variations (Braveman et al., 2018; Bethell et al., 2017), with recommendations for ACEs to be assessed at a range of points throughout a person's lifespan (Flanagan et al., 2018; Bethell et al., 2017). However, regardless of setting or age range, the general assessment process was fairly similar across all tools. Most ACEs are assessed as a binary (yes/no) variable, with the understanding that each "yes" response refers to having that particular experience, regardless of the number of times that experience may have occurred (Bethell et al., 2017; Baglivio & Epps, 2016). The number of ACEs assessed in a given questionnaire ranges anywhere from 6 to 20 types of ACEs and a score based on the cumulative number of different ACEs is computed. Perhaps the most widely used ACE assessment tool stems from the landmark 1998 ACE study (Felitti et al., 1998). This tool comprises 10 items on a number of events (including child maltreatment, divorced parents, and having a family member engaging in substance use). Since then, several tools have been designed around the core elements of this particular screening measure. It should be noted that the reliability and validity of these screening tools are generally high (Bethell et al., 2017). It is also worth noting that among youth, the research shows that if an individual has reported experiencing at least one ACE, they are almost certain to report another ACE. This reinforces the value of screening for ACEs as an important first step in effectively responding to the impact of ACEs (Baglivio & Epps, 2016). Although there is abundant evidence in support of assessing ACEs during adulthood (Flanagan et al., 2018; Schuessler-Fiorenza et al., 2016; Brown, Perera, Masho, Mezuk, & Cohen 2015; Cambron, Gringeri, & Vogel-Ferguson, 2014; Schuessler-Fiorenza, Xie, & STineman, 2014; Montgomery, Cutuli, Evans-Chase, Treglia, & Culhane 2013; De Ravello, Abeita, & Brown, 2008; Dube, Anda, Felitti, Edwards, & Williamson 2002), from a long-term prevention perspective it would make most sense to invest in ACE screening and intervention efforts during childhood and adolescence.

Although the nature of the ACEs captured via current screening tools varies, typically they include the following categories of experiences: child maltreatment (including verbal abuse, physical abuse, sexual abuse, and/or neglect), meeting of basic needs (or inability thereof), residential instability, divorced parents, death of a primary caregiver, family member engaging in substance use, family member with poor mental health, and/or incarcerated family member (Bethell et al., 2017). Newer ACE measures have included additional events (either by adding to this list or replacing some of the original items with new items) (Blodgett & Lanigan, 2018; Baglivio & Epps, 2016). For example, recent work has made the case for including bullying, Child Protective Services (CPS) involvement, death of friend(s), death of sibling(s), experience with the foster care system, experience with the juvenile justice system, repeated caregiver transitions, repeated school transitions, and community violence (Blodgett & Lanigan, 2018; Garrido et al., 2018; Mersky et al., 2017; Finkelhor et al., 2013). More recent recent research on inter-generational trauma has highlighted the need for adversity measures to include family financial problems, food insecurity, homelessness, parental absence, and violent crime victimization (Mersky et al., 2017).

While it is very important to include these events as an ACE, gun violence exposure is not included as an explicit experience in any of the existing measures. Some of the items currently included in ACE screening tools could serve as a proxy for gun violence exposure (for example, death of a primary caregiver, a friend, or sibling), and as noted earlier, the more recent operationalizing of community violence in work by Finkelhor and colleagues (2013) includes experiences that may involve firearm exposure. However, these proxy measures are insufficient and assessing gun violence exposure specifically and explicitly is important so that opportunities to respond effectively to the unique physical and emotional traumatic experience of firearm violence are not missed.

Current practice: screening for gun violence exposure

Though not explicitly assessed in any of the existing ACE measures, research confirmed the importance of screening for firearm exposure among youth (Chung et al., 2016) as well as the relationship between an increased number of ACEs and an individual's likelihood for engaging in and/or being a victim of future violence, including gun violence (Wamser-Nanney, Nanney, Conrad, & Constans 2019; Academy on Violence and Abuse, 2018; Forster et al., 2017; Hilton, Ham, & Green, 2016; Fox et al., 2015; Leeb, Barker, & Strine, 2007). In a sample of adult women, a direct association was established between ACEs and indicators of home safety (including possession of a loaded firearm) (Dallaire, Woddards, & Kelsey, 2018). Thus, and from a violence prevention standpoint, it seems reasonable to consider gun violence exposure as an ACE during screening processes (for example during routine health screenings) when opportunities for intervention and resource allocation are most readily available.

Our review of the existing research demonstrated that there is only one tool [*SaFETy Score* (Goldstick et al., 2017)] available that is focused entirely on assessing youth exposure to gun violence. This brief screening measure,

intended for use by emergency department physicians, has been effective as a predictor for future gun violence risk, which is encouraging (Goldstick et al., 2017). This is particularly important as youth injured via a firearm and treated in an emergency department are typically not provided support services following their injury (for example via the trauma unit of a hospital) (Cunningham, Vaidya, Walton, & Maio 2005). There are also several additional tools that screen for youth violence exposure more broadly, however, we only identified two screening scales that captured any form of gun violence exposure during childhood: (1) the Violence Prevention Emergency Tool 2 (VPET 2) (Rogers et al., 2012), also designed for emergency department settings and (2) the Violence Exposure Scale for Children—Revised (VEX-R), designed as a self-report screening tool for young children (ages 4–10 years) (Joseph, Augustyn, Cabral, & Frank 2006; Fox & Leavitt, 1995). The VPET 2 includes one item that is specific to gun violence exposure ("have you ever seen a person shoot another person with a real gun"?) and two other questions that refer to weapons more generally (Rogers et al., 2012). The VEX-R asks if a child has seen someone "point a gun or knife" (Joseph et al., 2006; Fox & Leavitt, 1995). While it is encouraging to see some elements of gun violence exposure being captured in a few assessment tools, these efforts are limited.

Current practice: interventions and response to ACEs

The responses to the aforementioned ACE screenings are typically meant to help clinicians make appropriate referrals (for example, to a social worker, a grief counseling program, or an early intervention resource) (Finkelhor, 2018). There are many evidence-based interventions available that address a wide-range of the health issues linked to ACEs (Finkelhor, 2018). Examples of such efforts include the primary prevention of ACEs via family-centered approaches that aim to work with pregnant women to promote a mother's physical and mental well-being (Bethell et al., 2016). There are also group interventions available specifically for families who have had multiple ACEs and are intended both to respond to the impact of ACEs and reduce the likelihood of future ACE occurrences (Bethell et al., 2016; Murphy et al., 2015). Further, there is strong evidence to support child and adolescent-focused interventions that integrate components of behavioral health with clinical services (Asarnow, Rozenman, Wiblin, & Zeltzer 2015). Lastly, and among youth in educational settings who have had ACEs, research has shown that strengths-based interventions that focus on fostering resilience (for example, via safe, stable, and nurturing relationships) can be very effective (Chandler, Roberts, & Chiodo 2015).

Current practice: interventions and response to gun violence

Like ACEs, there is a compelling need to have resources available following the gun violence exposure screening process for the specific purpose of supporting youth—and ultimately adults as well—who have been directly exposed to gun violence. Currently, the interventions available in direct response to youth exposure to gun violence are hospital-based interventions that aim to support victims of gun violence and help reduce their likelihood of re-injury (Chong et al., 2015). In addition, some research has shown the efficacy of a brief intervention effort in an emergency department setting, specifically for youth, and with the goal of reducing the prevalence of violent aggression more broadly (Carter et al., 2016). There are also community-based efforts, often known as "violence disruptors", that have been designed to break cycles of violence and support individuals who have been exposed to firearm violence in communities that are disproportionately impacted by this issue (Thomas, Leite, & Duncan, 1998). While these efforts are very much needed, and some have even been shown to be cost-effective (Chong et al., 2015), they are limited in their scope and availability. It is likely that if gun violence exposure were included as an ACE, individuals would have increased and earlier access to far more resources. Since it has been shown that there is a relationship between multiple ACEs and subsequent gun violence exposure, integrating gun violence into the conversation on ACEs suggests that we could more effectively address and respond to clusters of risk behaviors if gun violence were included as an ACE.

Operationalizing gun violence exposure

As we consider the screening of and response to exposure to violence involving a gun, the question of how gun violence exposure is operationalized is extremely important. Although most research in the area of gun violence prevention focuses broadly on injury from or death by firearm, our review confirms that there is a need to capture the spectrum of experiences with gun violence, particularly when seeking to understand the impact of such experiences on a range of critical health outcomes and on youth development. As described earlier, previous research has spoken to how exposure to gun violence occurs across a spectrum: hearing gunshots, witnessing gunfire, and being injured by a firearm—they all have implications for a child's health, development, and well-being (Bieler & La Vigne, 2014; Bingenheimer et al., 2005; Luthar & Gold-

stein, 2004; Garbarino et al., 2002). Work on youth exposure to gunfire in the vicinity of schools confirmed that the existence of gunfire in and around school buildings can impact youth outcomes (Bieler & La Vigne, 2014). And more recently, research has addressed the impact of neighborhood disorder and community violence on poor child health outcomes, as well as the nature of how gun violence spreads within social networks, which together confirm the importance of assessing a range of gun violence experiences (including identifying the number of friends who carry a gun, indicating how often one has heard gunshots, and identifying how often someone has been threatened with a gun) (Wang & Maguire-Jack, 2018; Wright et al., 2017; Tracy, Braga, & Papachristos, 2016). Thus, we propose that youth gun violence exposure include the following experiences: injury from a gun, being threatened by a gun, witnessing gunfire, hearing gunshots, knowing a friend or family member who has been shot, and having close friends or a sibling who carry a gun. We are also interested in screening for these experiences regardless of location, as we know youth gun violence exposure can-and does—occur in homes, schools, and more generally within one's neighborhood.

Classifying gun violence exposure as an ACE

In sum, and as noted earlier by definition, ACEs are considered stressful or traumatic events that impact the healthy development of children through adolescence and into adulthood (SAMHSA, 2018). The review of the existing literature confirms that gun violence exposure falls well within this definition. Further, research illustrates multiple similarities between the nature of gun violence exposure and other ACEs, the impact of gun violence exposure and ACEs on a range of critical health outcomes, and on the need for interventions and resources to support individuals who have had ACES, and similarly for individuals who have been exposed to gun violence in some form. This collective body of work provides reasonable evidence that supports classifying youth gun violence exposure as an ACE.

Discussion

We systematically reviewed the available peer-reviewed literature over the past two decades to understand the current assessment of and response to ACEs in relation to youth gun violence. The intent of this systematic review is to explore the existing evidence to determine whether it is reasonable—indeed, even critical—to classify youth exposure to violence involving a gun as an ACE.

Implications for ACE screening efforts

The key conclusions stemming from this paper are threefold: (1) the importance of including gun violence exposure as an ACE in future screening tools; (2) the importance of broadening the definition of gun violence exposure to include exposure to violence involving a gun (injury from, witnessing, hearing gunshots, and/or knowing a friend or family member who was shot), and (3) the importance of expanding the notion of who should conduct such screenings to increase the reach of existing screening efforts. The majority of current tools assessing ACEs among children and adolescents are assessed in clinical settings and rely on parent report of their child's experiences (Bethell et al., 2017). While this remains a widely-used form of assessment, the accuracy of these assessment tools has been called into question, in part due to the difficulty in controlling social desirability biases among parents (Blodgett & Lanigan, 2018). To overcome this limitation, researchers have recently shown the value of having school personnel, for example, assess ACEs among their students, which has the added benefit of capturing a much broader subset of youth in non-clinical settings (Blodgett & Lanigan, 2018). This emerging focus on where and who should collect ACE data is particularly relevant given the presence of firearms in school settings (Rajan & Branas, 2018). However, it should be noted that recent work has also cautioned against widespread ACE screening until the full scope of available responses are understood and in place (Finkelhor, 2018).

In addition to capturing exposure to violence involving a gun via ACE screening measures, it is also worth considering whether ACE assessment tools should aim to account for frequency of experiences in addition to the range of different types of experiences. Despite calls by the American Academy of Pediatrics for pediatricians to screen consistently for firearms in the home, assess exposure to community gun violence, educate caregivers about firearm safety, and incorporate conversations about gun safety into adolescent well visits (American Academy of Pediatrics, 2018) recent work has shown that few pediatricians do so (Kerker et al., 2016). Rather than place the onus entirely on physicians to conduct screenings, and in line with recent ACE research (Blodgett & Lanigan, 2018), it may be both possible and practical for other practitioners (for example, school personnel or school nurses) to play important roles in ACE screening efforts to help support existing clinical screening efforts.

Implications for ACE interventions

In addition to expanding screening efforts, it is equally as important to ensure that youth exposed to gun violence are directed to appropriate and comprehensive support ser-

vices. To help reduce the burden on hospitals, clinics, schools and other sites of practice that may be the location of these interventions (particularly those situated within low-income communities), it may be worth integrating support for youth exposed to gun violence with existing services as another option. For example, given the established relationship between gun violence and engagement in other adolescent problem behaviors (substance use, indicators of poor mental health, and school difficulties) and gun violence (Perez, Jennings, & Baglivio 2018), intervening on these behavioral correlates of gun violence could be helpful for long-term gun violence reduction. There may be greater efficiency in using resources in this manner. Including exposure to gun violence with other types of ACEs may lead to a more comprehensive assessment, and thus, greater accuracy in designing and implementing interventions that are truly effective.

Public health framework: prevention and intervention

Like all public health issues, long-term solutions for both the prevention and reduction of gun violence includes a multifaceted effort that draws on policy, environmental, and community-level factors. Comprehensively screening for individual exposure to gun violence and providing subsequent intervention resources and support are also critical. Broadly speaking, the prevention of and response to specific ACEs (such as child maltreatment) has drawn on existing literature that advocates for an integrated systems approach (Jenkins, Tilbury, Mazerolle, Hayes 2017; Miller, Blau, et al. 2012). For example, instead of punitive responses to poor parenting practices, there has been a call to provide more support for parents under undue stress, support aspects of their engagement with their children (Beardslee, Docherty, Yang, & Pardini 2019), and advocate for policy changes that support families and increase protective factors. There have been analogous recommendations by gun violence prevention experts to address the prevention of and response to gun violence exposure in a systems-oriented way. For example, instead of over-policing low-income neighborhoods or arming schoolteachers with firearms, investing in the cleaning of neglected spaces in urban settings by removing blight (Kondo, Andreyeva, South, MacDonald, & Branas 2018), increasing the presence of mental health support services in schools (Garbarino et al., 2002), expanding the role of school-based health centers to address the impact of ACEs among students (Arenson, Hudson, Lee, & Lai 2019), encouraging physicians to ask about community exposure to gun violence (particularly for those youth in urban settings) and counseling their patients on safe firearm storage (Roszko, Ameli, Carter, Cunningham, & Ranney 2016; Albright & Burge, 2003), and implementing reasonable policy changes that limit access to firearms by high-risk subgroups (Kaufman, Morrison, Branas, & Wiebe 2018; Santaella-Tenorio, Cerda, Villaveces, & Galea 2016) together would likely contribute to reduced rates of gun violence exposure among youth. Thus, and as we think about conceptualizing gun violence exposure as an ACE, we can, and should also think about the prevention of and response to gun violence exposure by drawing on public health models used with other ACEs.

Limitations

There are limitations of this work that must be considered when interpreting the results presented here. One of the primary limitations of this study is that, although a large number of journal articles were reviewed, the field of gun violence prevention has been historically and deeply underfunded (Rajan, Branas, Hargarten, & Allegrante 2018; Alcorn 2016). As such, there is a limited amount of available peer-reviewed research in this field. In addition, we restricted our review to research conducted in the U.S. From a practice and policy perspective, it made the most sense to consider existing US-based ACE screening and intervention models and the implications for including gun violence in these tools and programs, as gun violence is a more common phenomenon in the U.S. than elsewhere. Further, access to healthcare in the U.S. is different than in other countries. However, future research should consider exploring the robust body of international research on ACEs.

In addition, it is important to note that our systematic review focused on the term “adverse childhood experience” and not other synonyms of ACEs (such as “trauma” or “anxiety disorder”). This is an important limitation to consider as the term “adverse childhood experience” has been used broadly and with more frequently in the peer-reviewed literature only recently. This is in spite of the critical study on ACEs published by Felitti and colleagues in 1998 that helped lay the groundwork for much of the present work on ACEs (Felitti et al., 1998). Future research should therefore consider including other ACE synonyms when seeking to capture the full context for how ACEs are currently operationalized. Another limitation is that while we operationalized exposure to violence involving a gun to capture a range of experiences with firearms, we did exclude firearm possession. As existing research has established a relationship between gun carrying among youth and increased violence (Spano, Pridemore, & Bolland, 2012; Molnar et al., 2004) future work on ACE screenings might consider expanding our present definition of gun violence exposure to also include gun possession. Lastly, while there are notably more interventions and

resources available for ACES than for direct response to youth exposure to violence involving a gun, the ability for clinicians, educators, and other professionals to make referrals following ACE screenings is contingent upon a community's resources and an individual's access to such interventions. Thus, we need to ensure equitable access to interventions aimed at responding to the impact of ACEs is needed.

Implications for gun violence prevention research funding

Classifying exposure to violence involving a gun as an ACE would likely have significant implications for federal funding for research in this area. As noted earlier, there has been a lack of substantive federal funding for gun violence prevention research for over two decades (Rajan et al., 2018; Branas, Wiebe, Schwab, & Richmond 2005). This has had significant implications on the availability of research (Alcorn, 2016) and consequently evidence-based interventions and support services for individuals exposed to gun violence. As is the case with other public health issues, federal funding would support the rigorous scientific study of gun violence and provide resources for translational and information dissemination efforts both to prevent and more effectively respond to this issue. By contrast, ACEs are currently one of the lead funding priority areas for the Centers for Disease Control and Prevention (CDC); indeed, their most recent operating plan reports allocating $7,250,000 for the study of child maltreatment (Centers for Disease Control and Prevention, 2018b). Other agencies (for example, the National Institutes of Health and the Substance Abuse and Mental Health Services Administration) have followed the CDC's lead. If youth gun violence exposure were classified as an ACE, the level of resources for better understanding and subsequently responding to this issue would increase significantly.

Conclusions

This systematic review of research over the course of two decades confirms the critical importance of classifying youth exposure to violence involving a gun as an ACE, of broadening the definition of gun violence exposure to include a broader spectrum of youth experiences with gun violence, and of expanding the notion of who should conduct such screenings to increase the reach of both existing screening and intervention efforts.

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Compliance with ethical standards

Conflict of interest Sonali Rajan, Charles C. Branas, Dawn Myers, and Nina Agrawal declare that they have no conflict of interest.

Human and animal rights and Informed consent This article is a systematic review of existing peer-reviewed research and did involve the collection of data from human subjects nor review of any raw data involving human subjects. As such, and consistent with Teachers College, Columbia University IRB protocol, informed consent was not required (nor sought).

References

Academy on Violence and Abuse. (2018). *Gun Violence Statement.* Retrieved from: http://www.avahealth.org/who_we_are/news-archives.html/article/2018/04/03/ava-gun-violence-statement. Accessed 26 Nov 2018.

Agrawal, N., Arevalo, S., Castillo, C., Lucas, A.T. (2018). Effectiveness of the 'Asking Saves Kids' gun violence prevention campaign in an urban pediatric clinic. *Pediatrics*, *142*. https://pediatrics.aappublications.org/content/142/1_MeetingAbstract/730

Albright, T. L., & Burge, S. K. (2003). Improving firearm storage habits: Impact of brief office counseling by family physicians. *Journal of the American Board of Family Medicine, 16,* 40–46.

Alcorn, T. (2016). Trends in research publications about gun violence in the United States, 1960 to 2014. *JAMA Internal Medicine, 177,* 124–126.

American Academy of Pediatrics. (2018). *Bright Futures Guidelines*. Retrieved from: https://brightfutures.aap.org/materials-and-tools/tool-and-resource-kit/Pages/default.aspx. Accessed 21 Nov 2018.

Anda, R. F., Brown, D. W., Dube, S. R., Bremner, J. D., Felitti, V. J., & Giles, W. H. (2008). Adverse childhood experiences and chronic obstructive pulmonary disease in adults. *American Journal of Preventive Medicine, 34,* 396–403.

Arenson, M., Hudson, P.J., Lee, N., & Lai, B. (2019). The evidence on school-based health centers: A review. Global Pediatric Health. https://doi.org/10.1177/2333794X19828745.

Asarnow, J. R., Rozenman, M., Wiblin, J., & Zeltzer, L. (2015). Integrated medical-behavioral care compared with usual primary care for child and adolescent behavioral health: A meta-analysis. *JAMA Pediatrics., 169,* 929–937.

Baglivio, M. T., & Epps, N. (2016). The interrelatedness of adverse childhood experiences among high-risk juvenile offenders. *Youth Violence and Juvenile Justice, 14,* 179–198.

Beardslee, J., Docherty, M., Yang, V.J.H., Pardini, D. (2019). Parental disengagement in childhood and adolescent male gun carrying. *Pediatrics*, *143*(4), 1–8. https://pediatrics.aappublications.org/content/pediatrics/143/4/e20181552.full.pdf.

Berens, A. E., Jensen, S. K. G., & Nelson, C. A. (2017). Biological embedding of childhood adversity: From physiological mechanisms to clinical implications. *BMC Medicine, 15,* 135.

Bethell, C. D., Carle, A., Hudziak, J., Gombojav, N., Powers, K., Wade, R., et al. (2017). Methods to assess adverse childhood experiences of children and families: Toward approaches to

promote child well-being in policy and practice. *Academic Pediatrics, 17,* S51–S69.

Bethell, C., Gombojav, N., Solloway, M., & Wissow, L. (2016). Adverse childhood experiences, resilience, and mindfulness-based approaches: Common denominator issues for children with emotional, mental, or behavioral problems. *Child and Adolescent Psychiatric Clinics of North America*, *25*(2), 139–156.

Bieler, S., & La Vigne, N. (2014). *Close-range gunfire around DC schools*. Washington: Urban Institute.

Bingenheimer, J. B., Brennan, R. T., & Earls, F. J. (2005). Firearm violence exposure and serious violent behavior. *Science, 308,* 1323–1326.

Blodgett, C., & Lanigan, J. D. (2018). The association between adverse childhood experience (ACE) and school success in elementary school children. *School Psychology Quarterly, 33,* 137–146.

Boullier, M., & Blaire, M. (2019). Adverse childhood experiences. *Pediatrics and Child Health, 28,* 132–137.

Branas, C. C., Jacoby, S., & Andreyeva, E. (2017). Firearm violence as a disease—"hot people" or "hot spots"? *JAMA Internal Medicine, 177,* 333–334.

Branas, C. C., Richmond, T. S., Culhane, D. P., TenHave, T. R., & Wiebe, D. J. (2009). Investigating the link between gun possession and gun assault. *American Journal of Public Health, 99,* 2034–2040.

Branas, C. C., Wiebe, D., Schwab, C., & Richmond, T. (2005). Getting past the "f" word in federally funded public health research. *Injury Prevention, 11,* 191.

Braveman, P., Heck, K., Egerter, S., Rinki, C., Marchi, K., & Curtis, M. (2018). Economic hardship in childhood: A neglected issue in ACE studies? *Maternal and Child Health Journal, 22,* 308–317.

Bright, M. A., Alford, S. M., Hinojosa, M. S., Knapp, C., & Fernandez-Baca, D. E. (2015). Adverse childhood experiences and dental health in children and adolescents. *Community Dentistry and Oral Epidemiology, 43,* 193–199.

Bright, M. A., Knapp, C., Hinojosa, M. S., Alford, S., & Bonner, B. (2016). *Maternal and Child Health Journal, 20,* 843–853.

Brown, N. M., Brown, S. N., Briggs, R. D., German, M., Belamarich, P. F., & Oyeku, S. O. (2017). Associations between adverse childhood experiences and ADHD diagnosis and severity. *Academic Pediatrics, 17,* 349–355.

Brown, M. J., Perera, R. A., Masho, S. W., Mezuk, B., & Cohen, S. A. (2015). Adverse childhood experiences and intimate partner aggression in the US: sex differences and similarities in psychosocial mediation. *Social Science and Medicine, 131,* 48–57.

Cambron, C., Gringeri, C., & Vogel-Ferguson, M. B. (2014). Physical and mental health correlates of adverse childhood experiences among low-income women. *Health and Social Work, 39,* 221–229.

Carter, P. M., Walton, M. A., Zimmerman, M. A., Chermack, S. T., Roche, J. S., & Cunningham, R. M. (2016). Efficacy of a universal brief intervention for violence among urban emergency department youth. *Academic Emergency Medicine, 23,* 1061–1070.

Casey, B. J., Jones, R. M., & Hare, T. A. (2008). The adolescent brain. *Annals of the New York Academy of Sciences, 1124,* 111–126.

Centers for Disease Control and Prevention. (2016). *Fatal Injury Data.* Retrieved from https://www.cdc.gov/injury/wisqars/fatal.html. Accessed 2 Nov 2018.

Centers for Disease Control and Prevention. (2018a). *ACE Pyramid*, Retrieved from: https://www.cdc.gov/violenceprevention/acestudy/index.html. Accessed 2 Nov 2018.

Centers for Disease Control and Prevention. (2018b). *FY 2019 Operating Plans.* Retrieved from https://www.cdc.gov/budget/fy2019/operating-plans.html. Accessed 2 Nov 2018.

Chandler, G. E., Roberts, S. J., & Chiodo, L. (2015). Resilience intervention for young adults with adverse childhood experiences. *Journal of the American Psychiatric Nurses Association, 21,* 406–416.

Chapman, D. P., Whitfield, C. L., Felitti, V. J., Dube, S. R., Edwards, V. J., & Anda, R. F. (2004). Adverse childhood experiences and the risk of depressive disorders in adulthood. *Journal of Affective Disorders, 82,* 217–225.

Chong, V. E., Smith, R., Garcia, A., Lee, W. S., Ashley, L., Marks, A., et al. (2015). Hospital-centered violence intervention programs: A cost-effectiveness analysis. *American Journal of Surgery, 209,* 597–603.

Chung, E. K., Siegel, B. S., Garg, A., Conroy, K., Gross, R. S., Long, D. A., et al. (2016). Screening for determinants of health among children and families living in poverty: A guide for clinicians. *Current Problems in Pediatric and Adolescent Health Care, 46,* 135–153.

Cunningham, R. M., Vaidya, R. S., Walton, M., & Maio, R. F. (2005). Training emergency medicine nurses and physicians in youth violence prevention. *American Journal of Preventive Medicine, 29,* 220–225.

Dallaire, D. H., Woodards, A., & Kelsey, C. (2018). Impact of parental incarceration on neonatal outcomes and newborn home environments: A case-control study. *Public Health, 165,* 82–87.

De Ravello, L., Abeita, J., & Brown, P. (2008). Breaking the cycle/mending the hoop: Adverse childhood experiences among incarcerated American Indian/Alaska Native women in New Mexico. *Health Care for Women International, 29,* 300–315.

Dong, M., Anda, R. F., Felitti, V. J., Dube, S. R., Williamson, D. F., Thompson, T. J., et al. (2004). The interrelatedness of multiple forms of childhood abuse, neglect, and household dysfunction. *Child Abuse and Neglect, 28,* 771–784.

Dube, S. R., Anda, R. F., Felitti, V. J., Edwards, V. J., & Williamson, D. F. (2002). Exposure to abuse, neglect, and household dysfunction among adults who witnessed intimate partner violence as children: Implications for health and social services. *Violence and Victims, 17,* 3–17.

Felitti, V. J., Anda, R. F., Nordenberg, D., Williamson, D. F., Spitz, A. M., Edwards, V., et al. (1998). Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults. *American Journal of Preventive Medicine, 14,* 245–258.

Finkelhor, D. (2018). Screening for adverse childhood experiences (ACEs): Cautions and suggestions. *Child Abuse and Neglect, 85,* 174–179.

Finkelhor, D., Shattuck, A., Turner, H., & Hamby, S. (2013). Improving the adverse childhood experiences study scale. *JAMA Pediatrics, 167,* 70–75.

Flanagan, T., Alabaster, A., McCaw, B., Stoller, N., Watson, C., & Young-Wolff, K. C. (2018). Feasibility and acceptability of screening for adverse childhood experiences in prenatal care. *Journal of Women's Health, 27,* 903–911.

Ford, J. L., & Browning, C. R. (2014). Effects of exposure to violence with a weapon during adolescence on adult hypertension. *Annals of Epidemiology, 24,* 193–198.

Forster, M., Gower, A. L., McMorris, B. J., & Borowsky, I. W. (2017). Adverse childhood experiences and school-based victimization and perpetration. *Journal of Interpersonal Violence*. https://doi.org/10.1177/0886260517689885.

Fox, N. A., & Leavitt, L. A. (1995). *the violence exposure scale for children-VEX*. College Park, Maryland: Department of Human Development, University of Maryland.

Fox, B. H., Perez, N., Cass, E., Baglivio, M. T., & Epps, N. (2015). Trauma changes everything: Examining the relationship between adverse childhood experiences and serious, violent, and chronic juvenile offenders. *Child Abuse and Neglect, 46,* 163–173.

Garbarino, J., Bradshaw, C. P., & Vorrasi, J. A. (2002). Mitigating the effects of gun violence on children and youth. *The Future of Children, 12,* 72–85.

Garrido, E. F., Weiler, L. M., & Taussig, H. N. (2018). Adverse childhood experiences and health-risk behaviors in vulnerable early adolescents. *The Journal of Early Adolescence, 38,* 661–680.

Goldstick, J. E., Carter, P. M., Walton, M. A., Dahlberg, L. L., Sumner, S. A., Zimmerman, M. A., et al. (2017). Development of the SaFETy score: A clinical screening tool for predicting future firearm violence risk. *Annals of Internal Medicine, 166,* 707–714.

Green, B., Horel, T., & Papachristos, A. V. (2017). Modeling contagion through social networks to explain and predict gunshot violence in Chicago, 2006 to 2014. *JAMA Internal Medicine, 177,* 326–333.

Hall, T. S. B., Belcher, H. M. E., Accardo, J., Minhas, R., & Briggs, E. C. (2016). Trauma exposure and sleep disturbance in a sample of youth from the national child traumatic stress network core data set. *Sleep Health, 2,* 123–128.

Hilton, N. Z., Ham, E., & Green, M. M. (2016). Adverse childhood experiences and criminal propensity among intimate partner violence offenders. *Journal of Interpersonal Violence*. https://doi.org/10.1177/0886260516674943.

Hornor, G. (2015). Childhood trauma exposure and toxic stress: what the PNP needs to know. *Journal of Pediatric Health Care, 29,* 191–198.

Hughes, K., Hardcastle, K., & Bellis, M. A. (2016). The impact of adverse childhood experiences on health: a systematic review and meta-analysis. *Injury Prevention, 22,* A105.

Iniguez, K. C., & Stankowski, R. V. (2016). Adverse childhood experiences and health in adulthood in a rural population-based sample. *Clinical Medicine and Research, 14,* 126–137.

Jenkins, B. Q., Tilbury, C., Mazerolle, P., & Hayes, H. (2017). The complexity of child protection recurrence: The case for a systems approach. *Child Abuse and Neglect, 63,* 162–171.

Johnson, K., Woodward, A., Swenson, S., Weis, C., Gunderson, M., Deling, M., et al. (2017). Parents' adverse childhood experiences and mental health screening using home visiting programs: A pilot study. *Public Health Nursing, 34,* 522–530.

Joseph, N. P., Augustyn, M., Cabral, H., & Frank, D. A. (2006). Preadolescents' report of exposure to violence: Association with friends' and own substance use. *Journal of Adolescent Health, 38,* 669–674.

Kaufman, E. J., Morrison, C. N., Branas, C. C., & Wiebe, D. J. (2018). State firearm laws and interstate firearm deaths from homicide and suicide in the United States: A cross-sectional analysis of data by county. *JAMA Internal Medicine, 178,* 692–700.

Kerker, B. D., Storfer-Isser, A., Szilagyi, M., Stein, R. E., Garner, A. S., O'Connor, K. G., et al. (2016). Do pediatricians ask about adverse childhood experiences in pediatric primary care? *Academic Pediatrics, 16,* 154–160.

Kerker, B. D., Zhang, J., Nadeem, E., Stein, R. E., Hurlburt, M. S., Heneghan, A., et al. (2015). Adverse childhood experiences and mental health, chronic medial conditions, and development in young children. *Academic Pediatrics, 15,* 510–517.

Kondo, M. C., Andreyeva, E., South, E. C., MacDonald, J. M., & Branas, C. C. (2018). Neighborhood interventions to reduce violence. *Annual Review of Public Health, 39,* 253–271.

Koss, M. P., Yuan, N. P., Dightman, D., Prince, R. J., Polacca, M., Sanderson, B., et al. (2003). Adverse childhood experiences and alcohol dependence among seven Native American tribes. *American Journal of Preventive Medicine, 25,* 238–244.

Lee, C. M., & Bax, K. A. (2000). Children's reactions to parental separation and divorce. *Pediatrics and Child Health, 5,* 217–218.

Leeb, R. T., Barker, L. E., & Strine, T. W. (2007). The effect of childhood physical and sexual abuse on adolescent weapon carrying. *Journal of Adolescent Health, 40,* 551–558.

Luthar, S. S., & Goldstein, A. (2004). Children's exposure to community violence: Implications for understanding risk and resilience. *Journal of Clinical Child and Adolescent Psychology, 33,* 499–505.

Marie-Mitchell, A., & O'Connor, T. G. (2013). Adverse childhood experiences: Translating knowledge into identification of children at risk for poor outcomes. *Academic Pediatrics, 13,* 14–19.

McLennan, J. D., & MacMillan, H. L. (2016). Routine primary care screening for intimate partner violence and other adverse psychosocial exposures: What's the evidence? *BMC Family Practice, 3,* 103.

Merrick, M. T., Ford, D. C., Ports, K. A., & Guinn, A. S. (2018). Prevalence of adverse childhood experiences from the 2011–2014 Behavioral Risk Factor Surveillance System in 23 States. *JAMA Pediatrics, 172,* 1038–1044.

Mersky, J. P., Janczewski, C. E., & Topitzes, J. (2017). Rethinking the measurement of adversity: Moving toward second-generation research on adverse childhood experiences. *Child Maltreatment, 22,* 58–68.

Miller, B. D., Blau, G. M., Christopher, T. O., & Jordan, P. E. (2012a). Sustaining and expanding systems of care to provide mental health services for children, youth, and families across America. *American Journal of Community Psychology, 49,* 566–579.

Miller, E., Levenson, R., Herrera, L., Kurek, L., Stofflet, M., & Marin, L. (2012b). Exposure to partner, family, and community violence: gang-affiliated Latina women and risk of unintended pregnancy. *Journal of Urban Health, 89,* 74–86.

Mingione, C. J., Heffner, J. L., Blom, T. J., & Anthenelli, R. M. (2012). Childhood adversity, serotonin transporter (5-HTTLPR) genotype, and risk for cigarette smoking and nicotine dependence in alcohol dependent adults. *Drug and Alcohol Dependence, 123,* 201–206.

Molnar, B. E., Miller, M. J., Azrael, D., & Buka, S. L. (2004). Neighborhood predictors of concealed firearm carrying among children and adolescents: results from the project on human development in Chicago neighborhoods. *Archives of Pediatrics and Adolescent Medicine, 158,* 657–664.

Montgomery, A. E., Cutuli, J. J., Evans-Chase, M., Treglia, D., & Culhane, D. P. (2013). Relationship among adverse childhood experiences, history of active military service, and adult outcomes: homelessness, mental health, and physical health. *American Journal of Public Health, 103,* S262–S268.

Murphy, A., Steele, H., Bate, J., Nikitiades, A., Allman, B., Bonuck, K., et al. (2015). Group attachment-based intervention: Trauma-informed care for families with adverse childhood experiences. *Family & Community Health, 38,* 268–279.

Noble, K. G., Houston, S., Kan, E., Bookheimer, S. Y., & Sowell, E. R. (2012). Neural correlates of socioeconomic status in the developing human brain. *Developmental Science, 15,* 516–527.

Perez, N. M., Jennings, W. G., & Baglivio, M. T. (2018). A path to serious, violent, chronic delinquency: The harmful aftermath of adverse childhood experiences. *Crime and Delinquency, 64,* 3–25.

Ports, K. A., Lee, R. D., Raiford, J., Spikes, P., Manago, C., & Wheeler, D. P. (2017). Adverse childhood experiences and health and wellness outcomes among Black Men who have Sex with Men. *Journal of Urban Health, 94,* 375–383.

Rajan, S., & Branas, C. C. (2018). Arming schoolteachers: What do we know? Where do we go from here? *American Journal of Public Health, 108,* 860–862.

Rajan, S., Branas, C. C., Hargarten, S., & Allegrante, J. P. (2018). Funding for gun violence research is key to the health and safety of the nation. *American Journal of Public Health, 108,* 194–195.

Rogers, S. C., Borrup, K., Parikh, C., Saleheen, H., Lapidus, G., & Smith, S. (2012). Can a youth violence screening tool be used in a pediatric emergency department setting? *Journal of Trauma and Acute Care Surgery, 73,* S243–S247.

Roos, L. E., Mota, N., Afifi, T. O., Katz, L. Y., Distasio, J., & Sareen, J. (2013). Relationship between adverse childhood experiences and homelessness and the impact of axis I and II disorders. *American Journal of Public Health, 103,* S275–S281.

Roszko, P. J., Ameli, J., Carter, P. M., Cunningham, R. M., & Ranney, M. L. (2016). Clinician attitudes, screening practices, and interventions to reduce firearm-related injury. *Epidemiologic Reviews, 38,* 87–110.

Rothman, E. F., Edwards, E. M., Heeren, T., & Hingson, R. W. (2008). Adverse childhood experiences predict earlier age of drinking onset: Results from a representative US sample of current or former drinkers. *Pediatrics, 122,* e298–e304.

Ruggles, K. V., & Rajan, S. (2014). Gun possession among American youth: A discovery-based approach to understand gun violence. *PLoS ONE, 9,* e111893.

Sacks, V., & Murphey, D. (2018). *The prevalence of adverse childhood experiences, nationally, by state, and by race or ethnicity*. Retrieved from: https://www.childtrends.org/publications/prevalence-adverse-childhood-experiences-nationally-state-race-ethnicity. Accessed 3 Nov 2018.

Santaella-Tenorio, J., Cerda, M., Villaveces, A., & Galea, S. (2016). What do we know about the association between firearm legislation and firearm-related injuries? *Epidemiologic Reviews, 38,* 140–157.

Schilling, E. A., Aseltine, R. H., Jr., & Gore, S. (2007). Adverse childhood experiences and mental health in young adults: A longitudinal survey. *BMC Public Health, 7,* 30.

Schuessler-Fiorenza, S. M., Eslinger, J. G., Zimmerman, L., Scaccia, J., Lai, B. S., Lewis, C., et al. (2016). Adverse childhood experiences, support, and the perception of ability to work in adults with disability. *PLoS One, 11,* e0157726.

Schuessler-Fiorenza, S. M., Xie, D., & Stineman, M. (2014). Adverse childhood experiences and disability in US adults. *Journal of Injury, Function, and Rehabilitation, 6,* 670–680.

Spano, R., Pridemore, W. A., & Bolland, J. (2012). Specifying the role of exposure to violence and violent behavior on initiation of gun carrying: a longitudinal test of three models of youth gun carrying. *Journal of Interpersonal Violence, 27,* 158–176.

Substance Abuse and Mental Health Services Administration (SAMHSA). (2018). *Adverse childhood experiences*. Retrieved from https://www.samhsa.gov/capt/practicing-effective-prevention/prevention-behavioral-health/adverse-childhood-experiences. Accessed 5 Mar 2019.

Thomas, S. B., Leite, B., & Duncan, T. (1998). Breaking the cycle of violence among youth living in metropolitan Atlanta: A case history of kids alive and loved. *Health Education and Behavior, 25,* 160–174.

Thompson, T., & Massat, C. R. (2005). Experiences of violence, post-traumatic stress, academic achievement, and behavior problems of urban African-American children. *Child and Adolescent Social Work Journal, 22,* 367–393.

Tracy, M., Braga, A. A., & Papachristos, A. V. (2016). The transmission of gun and other weapon-involved violence within social networks. *Epidemiologic Reviews, 38,* 70–86.

Turner, H. A., Finkelhor, D., & Henly, M. (2018). Exposure to family and friend homicide in a nationally representative sample of youth. *Journal of Interpersonal Violence*. https://doi.org/10.1177/0886260518787200

Wade, R., Shea, J. A., Rubin, D., & Wood, J. (2014). Adverse childhood experiences of low-income urban youth. *Pediatrics, 134,* e13.

Walling, S. M., Eriksson, C. B., Putnam, K. M., & Foy, D. W. (2011). Community violence exposure, adverse childhood experiences, and posttraumatic distress among urban development workers. *Psychological Trauma: Theory, Research, Practice, and Policy, 3,* 42–49.

Wamser-Nanney, R., Nanney, J. T., Conrad, E., & Constans, J. I. (2019). Childhood trauma exposure and gun violence risk factors among victims of gun violence. *Psychological Trauma, 11,* 99–106.

Wang, X., & Maguire-Jack, K. (2018). Family and environmental influences on child behavioral health: The role of neighborhood disorder and adverse childhood experiences. *Journal of Developmental and Behavioral Pediatrics, 39,* 28–36.

Wright, A. W., Austin, M., Booth, C., & Kliewer, W. (2017). Systematic review: Exposure to community violence and physical health outcomes in youth. *Journal of Pediatric Psychology, 42,* 364–378.