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Authors

Fisher, Helen L
Caspi, Avshalom
Moffitt, Terrie E
[et al.](#)

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Measuring adolescents' exposure to victimization: The Environmental Risk (E-Risk) Longitudinal Twin Study

Helen L. Fisher¹, Avshalom Caspi^{1,2,3}, Terrie E. Moffitt^{1,2,3}, Jasmin Wertz¹, Rebecca Gray¹, Joanne Newbury¹, Antony Ambler¹, Helena Zavos¹, Andrea Danese^{1,4,5}, Jonathan Mill^{1,6}, Candice L. Odgers⁷, Carmine Pariante⁸, Chloe C. Wong¹, and Louise Arseneault¹

¹MRC Social, Genetic & Developmental Psychiatry Centre, Institute of Psychiatry, Psychology & Neuroscience, King's College London, London UK

²Department of Psychology and Neuroscience, Duke University, Durham, NC, USA

³Department of Psychiatry and Behavioral Sciences, Duke University Medical School, Durham, NC, USA

⁴Department of Child & Adolescent Psychiatry, Institute of Psychiatry, Psychology & Neuroscience, King's College London, London UK

⁵National & Specialist Clinic for Child Traumatic Stress and Anxiety Disorders, South London & Maudsley NHS Foundation Trust, London, UK

⁶University of Exeter Medical School, University of Exeter, Exeter, UK

⁷Sanford School of Public Policy, Duke University, Durham, NC, USA

⁸Department of Psychological Medicine, Institute of Psychiatry, Psychology & Neuroscience, King's College London, London UK

Abstract

This paper presents multilevel findings on adolescents' victimization exposure from a large longitudinal cohort of twins. Data were obtained from the Environmental Risk (E-Risk) Longitudinal Twin Study, an epidemiological study of 2,232 children (1,116 twin pairs) followed to 18 years of age (with 93% retention). To assess adolescent victimization we combined best practices in survey research on victimization with optimal approaches to measuring life stress and traumatic experiences, and introduce a reliable system for coding severe victimization. One in three children experienced at least one type of severe victimization during adolescence (crime victimization, peer/sibling victimization, internet/mobile phone victimization, sexual victimization, family violence, maltreatment, or neglect), and most types of victimization were more prevalent amongst children from low socioeconomic backgrounds. Exposure to multiple victimization types was common, as was re-victimization; over half of those physically maltreated in childhood were also exposed to severe physical violence in adolescence. Biometric twin

Address correspondence and reprint requests to: Louise Arseneault, MRC SGDP Centre, Institute of Psychiatry, Psychology & Neuroscience, 16 De Crespigny Park, London SE5 8AF, UK; louise.arseneault@kcl.ac.uk; Tel: +44 (0)20-7848-0647; Fax: +44 (0)20-7848-0866.

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analyses revealed that environmental factors had the greatest influence on most types of victimization, while severe physical maltreatment from caregivers during adolescence was predominantly influenced by heritable factors. The findings from this study showcase how distinct levels of victimization measurement can be harmonized in large-scale studies of health and development.

Keywords

adolescence; assessment; gene-environment correlation; maltreatment; violence

Introduction

Children exposed to various forms of victimization during childhood have repeatedly been shown to have a range of adverse physical, social, cognitive and mental health outcomes (Gilbert et al., 2009) and we are now beginning to appreciate that such early life stressors have implications for health and well-being across the lifespan (Cicchetti & Tucker, 1994; Danese et al., 2009; Currie & Widom, 2010; Moffitt & the Klaus Grawe ThinkTank, 2013; Norman et al., 2012; Takizawa, Maughan, & Arseneault, 2014; Widom, Czaja, Bentley, & Johnson, 2012). Although much research has focused on victimization exposure during the early stages of childhood, adolescence is also a time of major emotional, physical, social and neurodevelopmental change (Cromer, 2011; Luciana, 2013) suggesting that victimization during this period could have equally important ramifications for normative development. Moreover, as adolescents spend an increasing proportion of their time outside of the home environment, compared to when they were children, they are also likely to experience a greater variety of victimization exposures. Thus it is important to measure exposure to a range of possible victimization experiences during this key transition period and examine their immediate and longer-term consequences in affected individuals.

However, there is no current consensus about the optimal method for assessing exposure to such victimization experiences. Reports obtained from social services, medical or police records are advocated to be the most objective source of information on victimization exposure (Widom, 1988). However, these capture only a fraction of victimization cases as most cases do not come to the attention of such services (Widom, Czaja, & DuMont, 2015) and those that do may over-represent children from poorer backgrounds (Pelton, 1978) or more extreme cases of physical abuse or neglect (Groeneveld, & Giovannoni, 1977). Therefore, in order to obtain more complete rates of victimization it is necessary to question individuals directly. There is an ongoing tension in research utilizing self-report measures of victimization between employing self-report checklists or questionnaires versus more comprehensive interview measures (Monroe, 2008). Interview-based assessments of stressful or traumatic events are considered to be superior to self-report checklists or structured questionnaires (Brown, 1989; Dohrenwend, 2006; Gorman, 1993; Monroe, 2008; Paykel, 2001), as interviews are believed to be less influenced by respondent bias and subjective interpretation of questionnaire items (Dohrenwend, 2006; Grant, Compas, Thurm, McMahon, & Gipson, 2004; Hepp et al., 2006; Monroe & McQuaid, 1994), thus providing more precision and reliability when measuring relevant exposures. Nonetheless, published

research into childhood and adolescent stress exposure has predominantly utilized self-report checklists or questionnaires (Grant et al., 2004). Resistance to using interviews has mainly revolved around the considerable time and resources required to administer these forms of assessment (Dohrenwend, 2006). Thus interview-based measures have often been considered unfeasible for large-scale epidemiological studies. Hence, in order for the field to move forward a compromise needs to be reached between these two levels of measurement: (1) self-report questionnaires and checklists derived from large-sample survey methodology, with their greater cost-effectiveness and scalability, versus (2) interview-based measures of victimization derived from small-sample clinical methodology, with their more in-depth coverage and investigator-based rating systems.

In this paper we describe adolescent victimization in a large-scale epidemiological twin study using a method that combined a standardized survey with a more in-depth contextual coding system. Specifically, we started by adapting the Juvenile Victimization Questionnaire (JVQ) (Finkelhor, Hamby, Turner, & Omrod, 2011; Hamby, Finkelhor, Ormrod, & Turner, 2004) as a clinical interview. The JVQ is a standardized questionnaire that has been used to obtain a wide range of self-reported victimization experiences from large samples of adolescents in both the United Kingdom (U.K.; Radford, Corral, Bradley, & Fisher, 2013) and United States (U.S.; Finkelhor, Hamby, Ormrod, & Turner, 2005). However, the data derived from the JVQ are essentially a count of the items the respondent endorses and may lack sufficient detail to determine the severity of victimization experienced or to evaluate the context in which the victimization occurred. These missing features are considered to be desirable to grasp the fuller picture of victimization exposure (Brown, 1974; Brown & Harris, 1978). Severity of exposure, in particular, has been shown to predict later psychopathology (Clemmons, Walsh, DiLillo, & Messman-Moore, 2007; Fergusson, Boden, & Horwood, 2008; Schilling, Aseltine, & Gore, 2008). Therefore, we utilized the existing questions from the JVQ but administered these as part of an interview in which respondents provided detailed descriptions of their victimization experiences. These descriptions were coded by an independent panel of expert raters using a coding system adapted from the Childhood Experience of Care and Abuse interview (Bifulco, Brown, & Harris, 1994; Bifulco, Brown, Neubauer, Moran, & Harris, 1994), which provides standardized anchor points for determining severity of exposure within the relevant context. It is hoped that our pragmatic approach to blending two leading traditions in the assessment of victimization will enable future researchers to more fully explore the role of multiple types of victimization in the etiology of physical and mental health.

This paper has two main aims. Firstly, we detail this combined approach to assessing adolescent victimization and present the reliability of its implementation in a longitudinal cohort of twin children. Secondly, we report initial findings concerning the prevalence of different types of severe victimization using this combined assessment method, along with their co-occurrence (poly-victimization), and recurrence from childhood to adolescent victimization (re-victimization), and we examine how demographic factors influence variability in exposure. We also exploit the twin design of our study to explore the relative genetic and environmental influences on exposure to each type of adolescent victimization experience.

Method

Study cohort

Participants were members of the Environmental Risk (E-Risk) Longitudinal Twin Study, which tracks the development of a birth cohort of 2,232 British children. The sample was drawn from a larger birth register of twins born in England and Wales in 1994–95 (Trouton, Spinath, & Plomin, 2002). Full details about the sample are reported elsewhere (Moffitt & E-Risk Study Team, 2002). Briefly, the E-Risk sample was constructed in 1999–2000, when 1,116 families (93% of those eligible) with same-sex 5-year-old twins participated in home-visit assessments. This sample comprised 55% monozygotic (MZ) and 45% dizygotic (DZ) twin pairs; sex was evenly distributed within zygosity (49% male). Families were recruited to represent the U.K. population of families with newborns in the 1990s, on the basis of residential location throughout England and Wales and mother's age. Teenaged mothers with twins were over-selected to replace high-risk families who were selectively lost to the register through non-response. Older mothers having twins via assisted reproduction were under-selected to avoid an excess of well-educated older mothers.

At follow up, the study sample represents the full range of socioeconomic conditions in the U.K., as reflected in the families' distribution on a neighborhood-level socioeconomic index (ACORN [A Classification of Residential Neighbourhoods], developed by CACI Inc. for commercial use in Great Britain) (Odgers, Caspi, Russell, et al., 2012). ACORN uses census and other survey-based geodemographic discriminators to classify enumeration districts (~150 households) into socioeconomic groups ranging from "wealthy achievers" (Category 1) with high incomes, large single-family houses, and access to many amenities, to "hard pressed" neighborhoods (Category 5) dominated by government-subsidized housing estates, low incomes, high unemployment, and single parents. ACORN classifications were geocoded to match the location of each E-Risk study family's home (Odgers, Caspi, Bates, Sampson, & Moffitt, 2012). E-Risk families' ACORN distribution closely matches that of households nation-wide: 25.6% of E-Risk families live in "wealthy achiever" neighborhoods compared to 25.3% nationwide; 5.3% vs. 11.6% live in "urban prosperity" neighborhoods; 29.6% vs. 26.9% live in "comfortably off" neighborhoods; 13.4% vs. 13.9% live in "moderate means" neighborhoods; and 26.1% vs. 20.7% live in "hard-pressed" neighborhoods. E-Risk underrepresents "urban prosperity" neighborhoods because such households are likely to be childless.

Follow-up home visits were conducted when the children were aged 7 (98% participation), 10 (96% participation), 12 (96% participation), and, most recently in 2012–2014, at 18 years (93% participation). There were 2,066 children who participated in the E-Risk assessments at age 18, comprising 55% MZ and 45% DZ twin pairs, with a reasonably even split between genders (47% male). The average age of the twins at the time of the assessment was 18.4 years ($SD = 0.36$); all interviews were conducted after the 18th birthday. There were no differences in socioeconomic status (SES) assessed when the cohort was initially defined ($\chi^2 = 1.37, p = 0.24$), age-5 IQ scores ($t = 1.09, p = 0.28$), or age-5 internalizing or externalizing behavior problems ($t = 0.50, p = 0.62$ and $t = 0.49, p = 0.62$, respectively), between those who did and did not take part at age 18. Home visits at ages 5, 7, 10, and 12 years included

assessments with participants as well as their mother (or primary caretaker); the home visit at age 18 included interviews only with the participants. Each twin participant was assessed by a different interviewer.

The Joint South London and Maudsley and the Institute of Psychiatry Research Ethics Committee approved each phase of the study. Parents gave informed consent and twins gave assent between 5–12 years and then informed consent at age 18.

Assessment of victimization exposure between ages 12–18

Juvenile Victimization Questionnaire interview—At age 18, participants were interviewed face-to-face about exposure to a range of adverse experiences between 12–18 years using the Juvenile Victimization Questionnaire (JVQ) (Finkelhor et al., 2011; Hamby et al., 2004), adapted as a clinical interview. The JVQ has good psychometric properties (Finkelhor et al., 2005) and was used in the U.K. National Society for the Prevention of Cruelty to Children (NSPCC) national survey (Radford et al., 2011; Radford et al., 2013), thereby providing important benchmark values for comparisons with our cohort. Our adapted JVQ comprised 45 questions covering different forms of victimization grouped into 7 categories: Crime Victimization, Peer/Sibling Victimization, Internet/Mobile Phone Victimization, Sexual Victimization, Family Violence, Maltreatment, and Neglect. The interview schedule used in this study is provided in Supplementary Materials I.

Within each pair of twins in our cohort, co-twins were interviewed separately by a different research worker and were assured of the confidentiality of their responses. The participants were advised that confidentiality would only be broken if they told the research worker that they were in immediate danger of being hurt, and in such situations the project leader would be informed and would contact the participant to discuss a plan for safety.

Each JVQ question was asked for the period ‘since you were 12’ and participants were given the option to say ‘yes’ or ‘no’ as to whether each type of victimization had occurred in the reporting period. Consistent with the JVQ manual (Finkelhor et al., 2011; Hamby et al., 2004), participants were coded as 1 if they reported any experience within each type of victimization category or 0 if none of the experiences within the category were endorsed. If an experience was endorsed within a victimization category, follow-up questions were asked concerning how old the participant was when it (first) happened, whether the participant was physically injured in the event, whether the participant was upset or distressed by the event; and how long it went on for (by marking the number of years on a Life History Calendar; Caspi et al., 1996). In addition, the interviewer wrote detailed notes based on the participant’s description of the worst event. If multiple experiences were endorsed within a victimization category, the participant was asked to identify and report about their worst experience.

Victimization dossiers—All information from the JVQ interview was compiled into victimization dossiers. Using these dossiers, each of the seven victimization categories was rated by an expert in victimology (Dr Helen Fisher) and 3 other members of the E-Risk team who were trained on using the rating criteria. Ratings were made using a 6-point scale: 0=not exposed, then 1–5 for increasing levels of severity. The anchor points for these ratings

were adapted from the coding system used for the Childhood Experience of Care and Abuse interview (CECA; Bifulco, Brown, & Harris, 1994; Bifulco, Brown, Neubauer et al., 1994), which has good inter-rater reliability (Bifulco, Brown, & Harris, 1994; Bifulco, Brown, Lillie, & Jarvis, 1997). The CECA is a comprehensive semi-structured interview whose standardized coding system attempts to improve the objectivity of ratings by basing them on the coder's perspective (rather than relying on the participant's judgment) and focusing on concrete descriptions rather than perceptions or emotional responses to the questions, together with considering the context in which the adverse experience occurred.

In our adapted coding scheme the anchor points of the scale differ for each victimization category, with some focused more on the severity of physical injury that is likely to have been incurred during victimization exposure (Crime Victimization, Family Violence, Maltreatment), while others are more focused on the frequency of occurrence of victimization (Peer/Sibling Victimization and Internet/Mobile Phone Victimization), the physical intrusiveness of the event (Sexual Victimization), or the pervasiveness of the effects of victimization (Neglect). (Given that our sample comprises twins, we also coded if any of the victimization events experienced by each twin had been perpetrated by their co-twin as it is possible that growing up with a genetically related, same-age child could increase or decrease sibling victimization rates.) Finally, we evaluated whether each participant was exposed to *any physical violence*, whether in the family, by peers, or by people in the wider environment, based on the entire dossier of victimization experiences. This 'Any Physical Violence' exposure variable was also rated on a 6-point scale: 0=not exposed, then 1–5 for increasing levels of severity, with severity linked to frequency of occurrence of non-injurious physical attacks at the lower end of the scale (1–3) and then the likelihood of incurring an injury and the seriousness of this injury indicating severity at the upper end of the scale (4–5). This rating included both violence directed towards the participants themselves as well as violence they witnessed between other people. A copy of our coding scheme is provided in Supplementary Materials II. Each twin's dossier was evaluated separately and we did not use information provided in the co-twin's dossier about their own or shared victimization experiences to rate direct or witnessed violence exposure for the target twin.

Reliability—The first 26 violence dossiers were coded by all raters to provide training on the use of the severity rating scales and to develop consistency in the application of the anchor points to real-life experiences. Rating discrepancies were discussed by the group and consensus ratings agreed upon. Inter-rater reliability was conducted on the next 90 dossiers (approximately 4% of the total sample) with four raters independently scoring all of these dossiers. High levels of inter-rater reliability were achieved for the severity ratings for all forms of victimization: Crime Victimization (*intra-class correlation coefficient [ICC] = 0.89, $p < 0.001$*), Peer/Sibling Victimization (*ICC = 0.91, $p < 0.001$*), Internet/Mobile Phone Victimization (*ICC = 0.90, $p < 0.001$*), Sexual Victimization (*ICC = 0.87, $p < 0.001$*), Family Violence (*ICC = 0.93, $p < 0.001$*), Maltreatment (*ICC = 0.90, $p < 0.001$*), Neglect (*ICC = 0.74, $p < 0.001$*), and Any Physical Violence exposure (*ICC = 0.82, $p < 0.001$*). The remaining dossiers were divided between the four raters in a series of batches of around 100 each and the raters met at the end of rating each batch to discuss difficult ratings and to

reach consensus about any uncertain cases. A random selection of 20 dossiers from each batch of 400 rated (5 per rater per batch) was independently rated by a psychologist with expertise in interviewing children and adolescents. Any discrepancies of 2 points or more on any of the scales were discussed with the rating team and a consensus reached about the final ratings. In addition, all dossiers with ratings of 4 or 5 for Any Physical Violence exposure were independently reviewed by a child psychologist and any discrepancies discussed with the main rating team and a consensus reached about the final Any Physical Violence exposure rating.

For reporting purposes in this article, the ratings for each type of victimization were then grouped into three classes: 0 – no exposure (score of 0), 1 – some exposure (score of 1, 2 or 3), and 2 – severe exposure (score of 4 or 5) due to small numbers for some of the rating points. Combining ratings of 4 and 5 is also consistent with previous studies using the CECA, which have collapsed comparable scale values to indicate presence of ‘severe’ abuse (e.g., Bifulco, Brown, & Harris, 1994; Bifulco et al., 1997; Bifulco, Brown, Moran, Ball, & Campbell, 1998; Fisher, Bunn, Jacobs, Moran, & Bifulco, 2011).

Childhood socioeconomic status

Participants’ family socioeconomic status (SES) was defined using a standardized composite of parents’ income, education and social class ascertained at childhood phases of the study, which loaded significantly onto one latent factor (Trzesniewski, Moffitt, Caspi, Taylor, & Maughan, 2006). The latent factor was divided in tertiles. Thus, of participants who were interviewed at age 18, 33% were characterized as living in a low-SES situation during childhood.

Measures of victimization exposure up to age 12

Exposure to several types of victimization was assessed repeatedly when the children were 5, 7, 10, and 12 years of age and dossiers have been compiled for each child with cumulative information about exposure to domestic violence between the mother and her partner; frequent bullying by peers; physical maltreatment by an adult (including sexual abuse); and physical neglect. At each assessment age, mothers were interviewed about each type of adversity. The E-Risk team has previously reported evidence on the reliability and validity of the measures of domestic violence (Moffitt et al., 1997), bullying (Arseneault et al., 2006; Shakoor et al., 2011) and physical maltreatment (Jaffee, Caspi, Moffitt, Polo-Tomas et al., 2004; Jaffee, Caspi, Moffitt, Polo-Tomas, & Taylor, 2007) and all the measures are outlined briefly below.

Physical domestic violence—Mothers reported about perpetration by and victimization of 12 forms of physical violence (e.g., slapping, hitting, kicking, strangling) from the Conflict Tactics Scale (Straus, 1990), on three assessment occasions during the child’s first decade of life (when the children were 5, 7, and 10 years of age). Reports of either perpetration or victimization constituted evidence of physical domestic violence. Families in which no physical violence took place were coded as 0 (55.2%); families in which physical violence took place on one occasion were coded as 1 (28.0%); and families in which physical violence took place on multiple occasions were coded as 2 (16.8%).

Bullying by peers—Experiences of victimization by bullies were assessed using both mothers' and children's reports. During the interview, the following standard definition of bullying was read out: "*Someone is being bullied when another child (a) says mean and hurtful things, makes fun, or calls a person mean and hurtful names; (b) completely ignores or excludes someone from their group of friends or leaves them out on purpose; (c) hits, kicks, or shoves a person, or locks them in a room; (d) tells lies or spreads rumours about them; and (e) other hurtful things like these. We call it bullying when these things happen often, and when it is difficult to make it stop. We do not call it bullying when it is done in a friendly or playful way.*" Mothers were interviewed when children were 7, 10, and 12 years old and asked whether either twin had been bullied by another child, responding never, yes, or frequently. We combined mothers' reports at child age 7 and 10 to derive a measure of victimization during primary school. Mothers' reports when the children were 12 years old indexed victimization during secondary school. During private interviews with the children when they were 12 years old, the children indicated whether they had been bullied by another child during primary or secondary school. When a mother or a child reported victimization, the interviewer asked them to describe what happened. Notes taken by the interviewers were later checked by an independent rater to verify that the events reported could be classified as instances of bullying operationally defined as evidence of (a) repeated harmful actions, (b) between children, and (c) where there is a power differential between the bully and the victim (Shakoor et al., 2011). Although inter-rater reliability between mothers and children was only modest ($kappa = 0.20-0.29$), reports of victimization from both informants were similarly associated with children's emotional and behavioural problems, suggesting that each informant provides a unique but meaningful perspective on bullying involvement (Shakoor et al., 2011). We thus combined mother and child reports of victimization to capture all instances of bullying victimization for primary and secondary school separately: reported as not victimized by both mother and child; reported by either mother or child as being occasionally victimized; and reported as being occasionally victimized by both informants or as frequently victimized by either mother or child or both (Bowes et al., 2013). We then combined these primary and secondary school ratings to create a bullying victimization variable for the entire childhood period (5–12 years). Children who were never bullied in primary or secondary school or occasionally bullied during one of these time periods were coded as 0 (55.5%); children who were occasionally bullied during primary and secondary school, or frequently bullied during one of these time periods were coded as 1 (35.6%); and children who were frequently bullied at both primary and secondary school were coded as 2 (8.9%).

Physical harm by an adult—When the twins were aged 5, 7, 10 and 12 their mothers were interviewed about each twins' experience of intentional harm by an adult. At age 5 we used the standardized clinical protocol from the MultiSite Child Development Project (Dodge, Bates, & Pettit, 1990; Lansford et al., 2002). At ages 7, 10, and 12 this interview was modified to expand its coverage of contexts for child harm. Interviews were designed to enhance mothers' comfort with reporting valid child maltreatment information, while also meeting researchers' responsibilities for referral under the U.K. Children Act. Specifically, mothers were asked whether either of their twins had been intentionally harmed (physically or sexually) by an adult or had contact with welfare agencies. If caregivers endorsed a

question, research workers made extensive notes on what had happened, and indicated whether physical and/or psychological harm had occurred. Under the U.K. Children Act, our responsibility was to secure intervention if maltreatment was current and ongoing. Such intervention on behalf of E-Risk families was carried out with parental cooperation in all but one case. No families left the study following intervention.

Over the years of data collection, the study developed a cumulative profile for each child, comprising the caregiver reports, recorded debriefings with research workers who had coded any indication of maltreatment at any of the successive home visits, recorded narratives of the successive caregiver interviews, and information from clinicians whenever the Study team made a child-protection referral. The profiles were reviewed at the end of the age-12 phase by two clinical psychologists. Initial inter-rater agreement between the coders exceeded 90%, and discrepantly coded cases were resolved by consensus review. These were coded as: 0 = no maltreatment at any age; 1 = probable maltreatment at any age; and 2 = definite maltreatment at any age. There were 15.4% of children coded as probably being exposed to physical harm and 5.7% as definitely physically harmed by 12 years of age.

Physical neglect—The cumulative observations of the physical state of the home environment documented by the research workers during home visits to the twins at ages 5, 7, 10 and 12 were reviewed by two raters for evidence of physical neglect. This was defined as any sign that the caretaker was not providing a safe, sanitary, or healthy environment for the child. This included the child not having proper clothing or food, as well as grossly unsanitary home environments. (However, this did not include a family living in a crime-ridden neighborhood for economic reasons.) Initial inter-rater agreement between the coders exceeded 85%, and discrepantly coded cases were resolved by consensus review. Children with no evidence of physical neglect were coded as 0 (90.9%), those for whom there was an indication of minor physical neglect were coded as 1 (7.1%), and where there was evidence of severe physical neglect the children were coded as 2 (2.0%).

Results

Prevalence of victimization in adolescence

Table 1 presents the rates of victimization between ages 12–18 years, as reported by the E-Risk study participants at age 18. Over half of the participants reported exposure to Crime Victimization (51.7%) and to some form of Peer/Sibling Victimization (58.7%). However, only 15.4% ($N = 318$) reported that their co-twin had been one of the perpetrators. Approximately 1 in 5 participants reported exposure from age 12 to 18 to Internet/Mobile Phone Victimization (20.6%) and to Family Violence (19.3%) and slightly less reported Sexual Victimization (16.4%) or Maltreatment (14.8%). A smaller percentage of participants reported Neglect (6.4%).

For comparison purposes, Table 1 also presents the lifetime rates of victimization for 11–17 year-olds across the U.K. collected by the NSPCC in 2009 (Radford et al., 2011). Although the two studies differed in important ways (e.g., we conducted face-to-face interviews whereas the NSPCC survey used a computerized self-report version of the JVQ; we inquired about victimization over the past 6 years whereas the NSPCC survey provides lifetime rates;

our study participants are 18 years old whereas the NSPCC survey involved 11–17 year olds), the prevalence rates of victimization are broadly comparable. The exceptions to this were Maltreatment and Neglect, which were reported less often by our participants. This is likely to be due to our prevalence rates being limited to adolescence, while the NSPCC survey captured both childhood and adolescent exposure which could account for the higher rates in that survey.

Table 1 documents high rates of victimization according to the participants' reports, but these experiences are difficult to interpret without any discrimination as to whether they were mild or severe. Moving beyond the survey responses in Table 1, Table 2 presents information about the severity of victimization experiences as derived from evaluation and coding of the victimization dossiers compiled for our study participants. All findings presented in the remainder of this article refer to victimization experiences as coded 4 or 5 for severity.

Approximately a quarter (24.4%) of adolescents were exposed to severe levels of violence ('Any Physical Violence') between ages 12–18 years; that is, to incidents directed towards themselves or that they witnessed involving other people that were likely to result in physical injuries or were life-threatening. Turning to specific types of severe victimization experiences, just under one-fifth reported exposure to severe forms of Crime Victimization (19.2%) and 15.6% reported being frequently victimized by a peer or sibling. Exposure to severe and/or frequent Family Violence was reported by 12.1% of the participants, and Internet/Mobile Phone Victimization by 6.4% of the adolescents. Severe maltreatment (3.3%), contact sexual abuse (2.6%), and extreme neglect (2.2%) were the least common types of victimization in this sample during adolescence. The rates of exposure to victimization were almost identical among MZ and DZ twin participants in our cohort (see Supplementary Material III).

Table 2 also presents the prevalence of each victimization type by gender and the association between gender and exposure to severity of victimization during adolescence. When calculating these associations using ordinal logistic regression, we accounted for the non-independence of the twin observations using the Huber-White variance estimator (Williams, 2000). This adjusts the estimated standard errors in each test to account for the dependence in the data. Overall, males were exposed to more severe levels of physical violence than females (see Table 2) and there were sex differences in the other types of victimization experienced by adolescents. Whereas exposure to Crime and Peer/Sibling Victimization was more common among males, exposure to Internet/Mobile Phone Victimization, Sexual Victimization and Maltreatment was more common among females. Adolescent males and females did not differ in their exposure to Family Violence or Neglect.

Participants from low-SES backgrounds were more like to experience severe exposure to nearly all types of victimization, including Crime, Family Violence, Maltreatment, and Neglect (Table 3). However, they were only slightly more likely to be victimized by peers or siblings and there was no social gradient in exposure to Internet/Mobile Phone or Sexual Victimization.

Poly-victimization: Are adolescents likely to be exposed to multiple types of severe victimization?

We tested the co-occurrence of different types of severe victimization during adolescence by estimating the odds of being exposed to one type of severe victimization given exposure to another type of victimization. The positive manifold in Table 4 reveals that participants who were exposed to one type of severe victimization in adolescence were much more likely to have been exposed to multiple other types of severe victimization. Four findings stand out. First, adolescents who experienced intra-familial types of victimization were more likely to also experience victimization outside of the family home. Second, participants who were cyber/mobile-technology victims were also more likely to be exposed to victimization in the physical world. Third, the experience of neglect was not only strongly associated with physical maltreatment by adults but was also linked to multiple other types of victimization. Finally, these associations were independent of socioeconomic disparities in victimization exposure. That is, poly-victimization was not simply a function of concentrated exposure to violence among adolescents growing up in socioeconomically deprived circumstances.

To investigate the level of poly-victimization (that is, of experiencing multiple types of severe victimization) during adolescence, we summed the number of different types of severe victimization experiences encountered by each participant. Around a third of participants experienced at least one of the seven types of severe victimization in adolescence (35.4%). Of these, almost half (46.0%) were exposed to multiple different types of severe victimization (Figure 1A). Female participants (18.0%) were slightly more likely to have been classified as experiencing poly-victimization than male participants (14.5%) (Figure 1B).

We further examined the phenomenon of poly-victimization by adopting a person-centered approach to adolescents' victimization experiences. Latent Class Analysis (LCA) is a person-centered analytical approach that classifies individuals into groups or classes based on a profile of variables, in this case exposure versus no exposure to the seven types of severe victimization. To ensure replicability of results, we randomly selected one twin from each family to include in initial analyses; the remaining twin was reserved for replication. Additionally, since we were interested in the profiles of individuals who were victimized, we excluded participants who did not experience any severe forms of victimization. These selection criteria resulted in two subsamples of $N = 364$ and $N = 365$ individuals. LCA was conducted in MPlus v7.3. In each subsample, we examined fit statistics for 2 to 6 groups (Table 5). In the first subsample, the 4-class solution was the preferred solution; in the second subsample, both the 4- and 5-class solutions were acceptable. Upon further examination of the profiles in the second subsample, we opted to retain the more parsimonious solution. Final membership classification was determined using the complete sample of $N = 729$ individuals in a 4-class model that simultaneously accounted for twin-clustering. The model fit well: Entropy = 0.85; Lo-Mendell-Rubin Adjusted Likelihood Ratio Test for 3 vs. 4 classes = 113.88, $p < 0.001$; Lo-Mendell-Rubin Adjusted Likelihood Ratio Test for 4 vs. 5 classes = 38.65, $p = 0.233$.

The four groups were defined by unique victimization profiles (Table 6). The first group was defined by exposure to crime; 84% of individuals classified into this group experienced exposure only to Crime Victimization and the remaining 16% experienced one other type of victimization (Maltreatment, Sexual Victimization or Internet/Mobile Phone Victimization). The second group was defined by exposure to Family Violence; 60% of individuals classified into this group experienced exposure only to Family Violence; 20% experienced Family Violence and Crime Victimization; 13% experienced Family Violence and other forms of victimization. The remaining groups were defined by profiles of poly-victimization. Specifically, the third group was defined by Peer/Sibling Victimization in which the vast majority of adolescents also experienced at least one other form of victimization, and the fourth group of adolescents experienced multiple varieties of victimization.

Re-victimization: Are victimized children likely to be re-victimized in adolescence?

Cohort members who were exposed to domestic violence, bullied by peers, physically harmed by an adult, or neglected as a child were significantly more likely (a) to be exposed to severe violence in adolescence, (b) to experience each of the different types of severe victimization in adolescence, and (c) to experience poly-victimization (that is, they were exposed to a greater variety of different types of victimization) (Table 7). Victimization in early life did not simply show homotypic continuity, a term that we apply here to refer to the continuity of similar experiences. Rather, every type of severe victimization in childhood was broadly related to both the same and other, different, types of severe victimization throughout adolescence.

Turning to exposure to severe physical violence in adolescence, we observe remarkable continuity in the lives of children and adolescents, whether looking forward or looking backward. In a follow-forward longitudinal analysis, Figure 2A shows that 36.6% of children who were exposed to repeated episodes of domestic violence; 39.9% who were frequently bullied; 54.9% who were physically harmed; and 51.4% who were neglected grew up to be exposed to severe physical violence in adolescence. In a follow-back longitudinal analysis, Figure 2B shows that of adolescents who were exposed to severe physical violence, 25.7% had experienced repeated exposure to domestic violence during childhood, 14.5% were frequently bullied during childhood, 13.3% were physically harmed, and 3.6% were neglected. Only a small proportion of those exposed to severe physical violence in adolescence had not experienced any of these severe forms of victimization in childhood (13.2%). Broadly speaking, victimization is not something that goes away with time and is not something that often comes out of nowhere; it is a stable experiential pattern in the lives of many young people.

Genetic and environmental contributions to adolescent victimization

Table 8 shows the polychoric within-pair correlations for monozygotic (MZ) twins and dizygotic (DZ) twins separately for their exposure to each type of victimization during adolescence. Comparing MZ and DZ correlations allows us to estimate the relative contributions of genetic and environmental factors to variation in participants' exposure to adolescent victimization. We examined the genetic and environmental influences on severity

of victimization by decomposing variation in each form of victimization into that explained by additive genetic (A), shared environmental (C; common to both twins), and nonshared environmental (E; unique to each twin) factors. Victimization severity was treated as ordinal and we used the threshold model for liabilities (Neale & Cardon, 1992) to parameterize the model. In this case, the measured ordered categorical variables have no freely estimated residual variances and are represented as normally-distributed latent response variables underlying the categorical outcome; the standard ACE variance and covariance restrictions are placed on these latent variables. ACE models were estimated in MPlus v7.3.

The parameter estimates varied by type of victimization (see Table 8). We observed the largest genetic influences on Maltreatment and Neglect, followed by Crime Victimization, Peer/Sibling Victimization, and Internet/Mobile Phone Victimization. Nonshared environmental influences were pronounced on all forms of victimization, suggesting that unique events and experiences were likely to put a given adolescent in harm's way; this was especially the case with regard to peer, cyber, and sexual victimization. In contrast to what is often reported in behavioural genetics, we detected consistent and substantial shared environmental influences on adolescents' victimization experiences, suggesting that growing up in certain families and communities does, indeed, contribute to increased victimization risk.

Discussion

The aim of this report was to integrate best practices in survey research with optimal approaches to measuring human life stress, in the service of advancing the study of children's and adolescents' victimization experiences. Specifically, we combined (1) a widely-used self-report questionnaire (Finkelhor et al., 2011; Hamby et al., 2004) with (2) an investigator-based rating system adapted from a comprehensive interview about stressful and traumatic childhood events (Bifulco, Brown, & Harris, 1994). This combined method was successfully implemented with 2,066 18-year-olds who are participants in a nationally-representative longitudinal twin cohort study. We demonstrated that our pragmatic approach of combining the brevity of a self-report questionnaire with the relative objectivity of a standardized investigator-based coding system can be successfully applied to characterize the severity of multiple types of adolescent victimization experiences with high levels of inter-rater reliability. By utilizing the optimal features of both assessment traditions we are hopeful that this combined tool will bring both greater rigor and richness to the measurement of victimization in a manner that is scalable to large population-based studies.

Our approach is not without limitations. First, we relied on adolescents to tell us about their own victimization experiences, and such self-reports may be biased (Dohrenwend, 2006; Grant et al., 2004; Hepp et al., 2006). However, we tried to minimize subjectivity by (a) conducting a face-to-face interview which provided the opportunity for the respondent and interviewer to clarify that the questions were understood as they were intended to be (Hardt & Rutter, 2004; Schwarz, 2007), and (b) using an investigator-based standardized coding system to rate the severity of victimization experiences (Brown, 1974; Brown & Harris, 1978). Second, given time constraints, our interview only queried details about each participant's 'worst experience' within each victimization category. Third, it should be noted

that even more fine-grained information could be elicited in the context of our combined method. For instance, more details about the victim's relationship with the perpetrator and the number of reoccurrences of the same victimization exposure may be important to evaluate in developmental psychopathology (Fisher et al., 2010; Matta Oshima, Jonson-Reid, & Seay, 2014; Thornberry, Ireland, & Smith, 2001). Finally, we used a face-to-face interview and it is possible that some individuals may be less likely to disclose when questioned in person due to embarrassment (Della Femina, Yeager, & Lewis, 1990). However, similar rates of abuse have been reported for self-report and interview-based versions of the same measure (Bifulco, Bernazzani, Moran, & Jacobs, 2005). We welcome application of this assessment method in other studies to further test its feasibility, reliability and ease-of-use, and to extend its scope.

Prevalence of adolescent victimization

Traditionally each type of victimization measured by the JVQ is considered to have been experienced if a participant endorses at least one item in the relevant section (Finkelhor et al., 2011; Hamby et al., 2004). Using this scoring method, we found that the estimated prevalence rates of victimization exposure between 12–18 years in our cohort of 18-year-olds were broadly comparable to rates reported by the U.K. NSPCC in a cross-sectional survey of 11–17 year-olds (Radford et al., 2011). We found slightly lower rates of Maltreatment and Neglect in our sample, which likely reflects the fact that the NSPCC survey inquired about victimization experiences from birth onwards whereas we only inquired about experiences occurring between ages 12–18 years. We found higher rates of Internet/Mobile Phone Victimization in our sample, which could be accounted for by the fact that this type of victimization occurs more often in adolescence than in childhood and that it may be on the rise (our data collection period occurred a few years after the NSPCC survey was conducted) (Jones, Mitchell, & Finkelhor, 2012). Despite discrepancies in study design, the reported rates of the different types of victimization in E-Risk and in the U.K. NSPCC survey are reassuringly similar.

As others have commented (Gilbert et al., 2009), a concerning proportion of children and adolescents are victimized. According to the survey administered to our research participants, close to 73% percent of adolescents have been exposed to some form of victimization. According to our rating of system of severity, approximately 1 in 3 adolescents were classified as having experienced at least one type of severe victimization between ages 12–18 years (Crime Victimization, Peer/Sibling Victimization, Internet/Mobile Phone Victimization, Sexual Victimization, Family Violence, Maltreatment, or Neglect). These results imply that victimization surveys capture both severe as well as more minor experiences and that there is considerable heterogeneity in the victimization experiences captured in surveys of youth. This discrepancy does not imply that one estimate is better or worse. Both the survey and clinical parent-measures that we drew upon were themselves designed to be fit for their original purpose, and had documented reliability and validity. Our offspring measure showed 'hybrid vigor', blending the best advantages of both established approaches to documenting and studying victimization. The higher, survey count is required for estimating the size of the problem for prevention planning. At the prevention stage, before an incident occurs, it is not possible to know how serious the incident will

become, and all forms of victimization should be prevented. After an incident occurs, and when researchers seek to carry out research to inform post-victimization treatment, it is necessary to discriminate the severity of the victimization. Such refinement to exposure measurement is fundamental to a better understanding of the sequelae of stress and to studies that seek to reliably identify and replicate resiliency factors, whether in the genome, in supportive relationships, or in the wider community (Monroe & Reid, 2008).

Re-victimization from childhood through adolescence

A striking finding from our longitudinal analysis is that victims of childhood maltreatment are victimized again in adolescence. This phenomenon of re-victimization has been documented before (e.g., Widom, Czaja, & Dutton, 2008; Radford et al., 2013), but much of the evidence about re-victimization comes from cross-sectional studies that collect victims' retrospective reports about their childhood experiences or from studies that rely on cases identified by child protection agencies. Moreover, many studies tend to focus narrowly on victims of specific experiences (e.g., sexual abuse or assault). Using prospective data and guarding against single-source reporting biases, here we show that victimization experiences in childhood, as reported by primary caregivers, are strongly predictive of self-reports of experiences of victimization occurring in adolescence. Two findings stand out. First, children who suffer one type of victimization are likely to experience diverse forms of victimization at later points in adolescence. Second, adolescents who are exposed to severe physical violence are likely to have experienced diverse forms of victimization at earlier points in development. These results point to three conclusions: victimization (a) shows considerable continuity in the lives of children and adolescents; (b) it does not remain true to type during the first two decades of life; and (c) there does not appear to be a specific 'gateway' via certain types of childhood victimization to re-victimization (Finkelhor, Ormrod, & Turner, 2007).

In terms of theory, the phenomenon of re-victimization demands more vigorous attention, not only so that we may understand how it comes about, but so that we may also be better able to predict and prevent it. Multiple explanations have been invoked to account for the phenomenon of re-victimization, ranging from ecological systems theory (e.g., environmental factors that create victimization vulnerability are stable over victims' lives) to psychological theories (e.g., learned helplessness), but few studies directly test multiple and competing explanations.

In terms of research design, evidence of re-victimization calls attention to the need to reliably assess victimization experiences across multiple developmental periods. For example, much research attention is currently focused on biological pathways linking early life stress to later health (Moffitt & the Klaus Grawe ThinkTank, 2013). But if re-victimization is as ubiquitous as our data show, it suggests that theorizing about sensitive periods needs to be balanced by the possibility that many of the effects attributable to the biological embedding of early life stress may actually operate by increasing exposure to additional forms of victimization and creating a greater cumulative stress load.

In terms of preventing re-victimization, our findings suggest that efforts should be focused on children physically abused by their caregivers. In our sample over half of those

physically maltreated in childhood were exposed to severe physical violence in adolescence. This is consistent with previous studies that have suggested maltreated children are particularly vulnerable to being victimized again and to experience other forms of victimization including physical assault (Radford et al., 2013; Widom et al., 2008). Targeting interventions at children identified as having been maltreated by an adult may thus reduce re-victimization rates in adolescence, but this hypothesis requires testing.

Poly-victimization amongst adolescents

Victimologists have noted that poly-victimization is a neglected component of children's victimization experiences, and our findings amplify the call to broaden the focus in developmental psychopathology to the wider range of experiences in which victimization events occur (Finkelhor et al. 2007). Evidence of poly-victimization complicates research that seeks to specify the effects of victimization and to develop intervention and treatment programs. Most research that traces the consequences of victimization, and most theoretical explanations of such putative effects, are organized around a single type of victimization (e.g., bullying, physical abuse, sexual victimization, neglect). But the majority of severe victimization experiences in our cohort occurred to youth who experienced at least one other type of victimization. Whereas some youth were only victimized by crime and other youth were only exposed to violence between family members, only a minority of youth solely experienced victimization by peers, and practically no youth experienced instances of maltreatment, sexual victimization, or neglect that were not embedded in the context of other victimization experiences.

We see parallels between the challenge posed by poly-victimization and the now-familiar challenge posed by co-morbidity. A persistent challenge in mental-health research and treatment is the co-existence of two or more conditions or disorders; in community samples almost half of individuals who meet diagnostic criteria for one disorder meet diagnostic criteria for another disorder, and the rates are higher in clinical samples (Clark, Watson, & Reynolds, 1995; Newman et al., 1996). Among the implications of such high-rates of comorbidity is that (a) studying 'pure' cases may offer an unrepresentative picture of the disorder; (b) it is very difficult to identify disorder-specific causes, correlates, and sequelae when disorders co-occur at such high rates, and (c) transdiagnostic approaches to mental health deserve more attention (Caspi et al., 2014). In parallel, we suggest three implications for victimization research. First, most 'pure' instances of victimization may not represent the developmental landscape or experiential history of victimization. Second, it will be challenging for researchers to identify correlates and sequelae that are unique to particular victimization experiences. When claims of specificity are sought, empirical verification may need to include not only unexposed controls, but controls that have been exposed to other forms of victimization. Third, treatment options must attend to the ubiquitous experience of poly-victimization, on top of pervasive re-victimization. In fact, it may be that the most expedient approach to interrogating the psychological and physical consequences of victimization and to developing treatment options is to attend to the cumulative experience of such exposures.

Genetic and environmental influences on victimization exposure

Traditional research treats victimization as an environmental exposure that threatens healthy development. But the unidirectional environment→person connection has been challenged by evidence that many putative environmental exposures are, to some extent, under genetic control (Plomin & Bergeman, 1991). Specifically, genetically-informative designs (twin and adoption studies) that have been used to decompose variation in measures of the environment suggest that differences between individuals in their child-rearing experiences, in their relationships with peers, and even in their risk of being exposed to stressful life events are partially heritable (Plomin, 1994; Kendler & Baker, 2007). Models in victimology (e.g., lifestyle-exposure theory) recognize that victimization is not evenly distributed in the population and that there exist both high-risk places and high-risk persons. Initial research into the genetic origins of adolescent victimization showed that genetic factors may account for up to 50% of the variation in criminal victimization (e.g., being threatened with a knife; Beaver et al., 2009; Beaver et al., 2013), but victimization was difficult to disentangle from perpetration. Although some believe that seeking to identify the causes of victimization is tantamount to blaming the victim, we think that our twin study provides a unique vantage point for exploring the causes of victimization by systematically surveying multiple types of victimization. The results pointed to a highly nuanced view of adolescent victimization, with meaningful differences in the origins of different types of experiences and with implications for understanding genetic and environmental influences on adolescent development.

Turning to genetic effects, we found that Crime Victimization, Peer/Sibling Victimization, and Internet/Mobile Phone Victimization showed significant, but modest heritabilities. Interestingly, Maltreatment was under stronger genetic influence, suggesting that heritable characteristics of the victims influence their likelihood of being physically maltreated in adolescence, either because these characteristics evoke maltreatment from adults or lead them to end up in risky situations. This is intriguing because a previous report from our group found that maltreatment up to 12 years of age in the current sample was largely influenced by environmental factors shared between the twins with almost no effect of genetic factors (Jaffee, Caspi, Moffitt, & Taylor, 2004). It is difficult to know whether this difference reflects a developmental shift or a methodological difference. On the one hand, it is conceivable that these forms of victimization during adolescence are more often an adults' response to adolescent instigation than are such experiences in childhood. On the other hand, our analysis of maltreatment up to age 12 years relied on interviews conducted with the twins' mothers, whereas our analysis of maltreatment in adolescence relied on interviews with the twins' themselves. This could potentially have led to the different results we found regarding genetic influence on maltreatment in these two developmental periods. We are not able to disentangle these alternative interpretations. Finally, and in marked contrast to other forms of victimization, Sexual Victimization in adolescence was not under significant genetic influence and was mostly explained by unique environmental risk factors, specific to each twin in a pair.

Turning to the environment, our findings contribute to a nascent re-assessment of socialization research pointing to the importance of shared environmental influences on adolescent development (Burt, 2009). A long-standing controversy set in motion by

behavioral geneticists is the claim that most of the similarity between siblings is due to genetic effects and that most of the differences between siblings are due to environmental effects; that is, shared environmental experiences do not create similarities between siblings. At its extreme, this evidence has been used to challenge the notion that families and communities are the most important factors in children's development (Harris, 1998). Our data suggest otherwise, and show that family-wide shared risk factors accounted for 10%–40% of the variance in adolescents' victimization experiences. One possible reason for our evidence that shared environmental factors give rise to similar victimization experiences may have to do with our measurement approach. Most studies that have examined genetic influences on environmental experiences have relied on self-reports of the environment. In fact, estimates of genetic influence on measures of the environment are much smaller in studies that have measured the environment via more direct means (e.g., using observational measures). This has led to the suggestion that the so-called 'nature of nurture' may to some extent reflect individuals' heritable propensity to perceive the environment in particular ways (Plomin, 1994). In our research, we have taken a middle course, using an investigator-based system to determine and interpret the environmental experience. A second possibility relates to the fact that we measured severe victimization experiences. Whereas mild exposures may be less influenced by variation in the 'average expectable' environment, grossly substandard or dysfunctional environments may shape extreme experiences (Scarr, 1993). Finally, and relatedly, whereas historically most twin studies have not deliberately or adequately sampled the extreme ranges of adversity, we sought to ensure that the full range of contemporary Western children's environments was adequately sampled. Restriction of environmental range may have led previous studies to underestimate the importance of shared environmental experiences.

The findings about genetic and environmental effects on victimization have two implications. First, it appears that much of the variation in victimization experiences is the result of being exposed to risky environments, and not the product of victims' heritable characteristics. Identifying these environmental risk factors should be a priority in order to hasten preventative interventions. Second, many adolescents growing up in the same households and neighborhoods are differentially exposed to victimization. Such discordance offers an important opportunity for basic science. It is clear that etiologic studies that seek to understand environmental effects on mental and physical health need to account for genetic factors on environmental experiences. Studies of differentially-exposed twins provide unique purchase on unconfounded genetic and environmental effects on health (van Dongen et al. 2013), especially in relation to better understanding the consequences of violence victimization.

Many young people who are mistreated by an adult, victimized by bullies, criminally assaulted, or who witness domestic violence react by developing behavioral, emotional, or learning problems. Increasingly, it is emerging that such adverse experiences can lead to hidden physical alterations inside a child's body, alterations that may have adverse effects on life-long health. This evidence has encouraged stress-biology research and intervention science to join forces to tackle the problem of victimization (Moffitt & the Klaus Grawe ThinkTank, 2013). Both basic and translational science will be advanced by flexible and rich measurement tools that can be widely applied in different settings. Here we have

documented the feasibility of combining a widely-used self-report questionnaire with an investigator-based rating system to characterize victimization experiences. Too often research on important problems is stymied by measurement impediments created by disciplinary preferences (survey researchers vs. clinical scientists) and imposed by practical considerations (e.g., insufficient time). We hope that the combined approach that we have introduced, borrowing on two valuable traditions for measuring victimization, will offer converging opportunities for scientists and practitioners of all stripes to coordinate their efforts.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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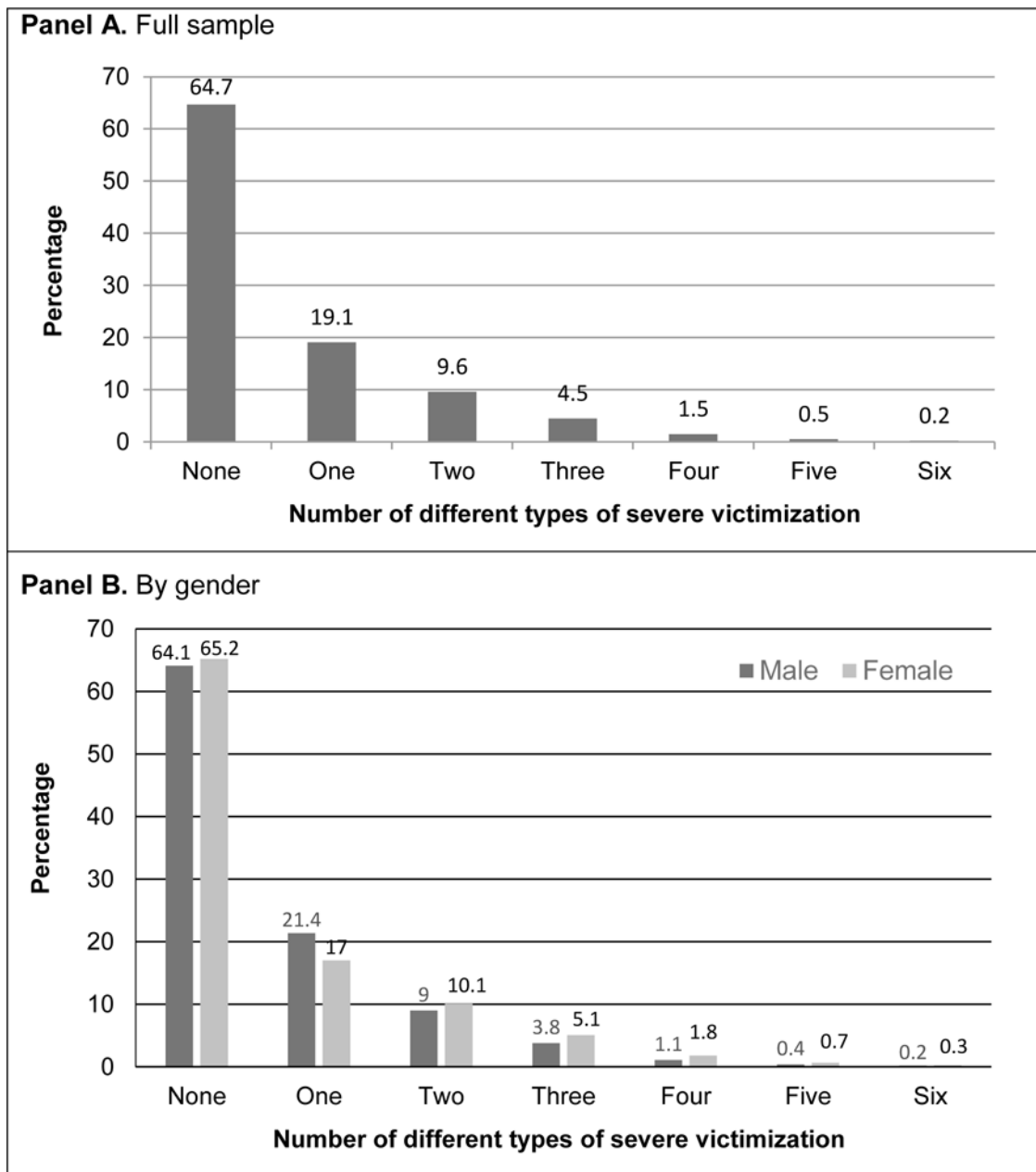


Figure 1. Number of different types of severe victimization experienced by adolescents in the full sample (Panel A; N=2066) and among males (N = 981) and females (N = 1085) (Panel B).

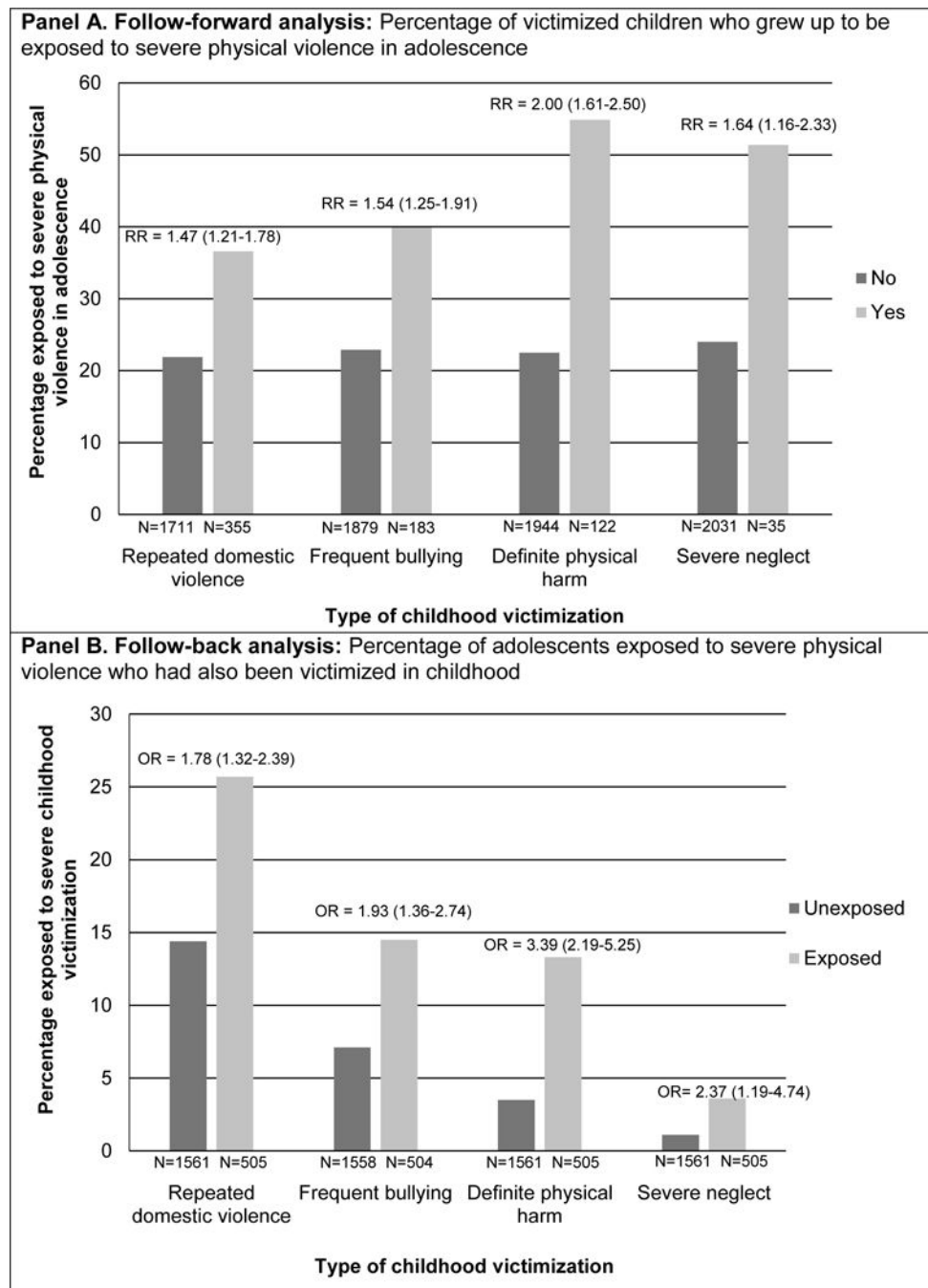


Figure 2. Violence exposure in adolescence: Looking forward (Panel A) and looking backward (Panel B) in the lives of victimized youth. Associations between childhood victimization and adolescent violence exposure are expressed as relative risks (RR) and between adolescent violence exposure and previous childhood victimization as odds ratios (OR) with 95% confidence intervals adjusted for sex, socioeconomic status, and the non-independence of twin observations.

Table 1

Prevalence of adolescent victimization experiences amongst E-Risk participants and respondents in the National Society for the Prevention of Cruelty to Children survey

Type of victimization ^a	E-Risk sample ^b (N=2066)	NSPCC national sample ^c (N=2275)
	n (%)	n (%) ^d
Crime Victimization	1067 (51.7)	1437 (62.2)
Peer/Sibling Victimization	1212 (58.7)	1471 (64.9)
Internet/Mobile Phone Victimization	425 (20.6)	319 (13.3)
Sexual Victimization	338 (16.4)	285 (16.5)
Family Violence	398 (19.3)	342 (19.8)
Maltreatment	306 (14.8)	358 (20.7)
Neglect	132 (6.4)	229 (13.3)

E-Risk, Environmental Risk Longitudinal Twin Study. NSPCC, National Society for the Prevention of Cruelty to Children.

^aWe report whether any victimization experience was reported, within each type of victimization.

^bVictimization between ages 12–18 reported by 18 year-olds in the E-Risk Study.

^cLifetime victimization reported by 11–17 year-olds from across the United Kingdom, taken from Radford et al. (2011).

^dThese percentages are weighted back to the U.K. population to compensate for unequal sampling probabilities, and unequal responses by age group, gender, housing tenure, working status, region, and ethnic group (see Radford et al., 2011 for full details).

Table 2
 Distribution of the severity of adolescent victimization experiences among males and females in the E-Risk study.

Type of victimization	Severity rating			Males vs. females OR (95% CI)	p value
	Never n (%)	Some / occasional n (%)	Severe / frequent n (%)		
Any physical violence					
All	984 (47.6)	577 (27.9)	505 (24.4)		
Boys	379 (38.6)	316 (32.2)	286 (29.2)	0.54 (0.44–0.65)	<0.001
Girls	605 (55.8)	261 (24.1)	219 (20.2)		
Crime					
All	999 (48.4)	670 (32.4)	397 (19.2)		
Boys	378 (38.5)	369 (37.6)	234 (23.9)	0.49 (0.41–0.60)	<0.001
Girls	621 (57.2)	301 (27.7)	163 (15.0)		
Peer/Sibling					
All	873 (42.3)	870 (42.1)	323 (15.6)		
Boys	366 (37.3)	484 (49.3)	131 (13.4)	0.82 (0.68–0.99)	0.043
Girls	507 (46.7)	386 (35.6)	192 (17.7)		
Internet/mobile					
All	1645 (79.7)	286 (13.9)	133 (6.4)		
Boys	826 (84.2)	125 (12.7)	30 (3.1)	1.79 (1.41–2.27)	<0.001
Girls	819 (75.6)	161 (14.9)	103 (9.5)		
Sexual					
All	1813 (87.8)	198 (9.6)	53 (2.6)		
Boys	896 (91.3)	76 (7.8)	9 (0.9)	1.94 (1.44–2.63)	<0.001
Girls	917 (84.7)	122 (11.3)	44 (4.1)		
Family violence					
All	1677 (81.3)	136 (6.6)	250 (12.1)		
Boys	799 (81.5)	62 (6.3)	119 (12.1)	1.03 (0.79–1.33)	0.844
Girls	878 (81.1)	74 (6.8)	131 (12.1)		

Type of victimization	Severity rating			Males vs. females OR (95% CI)	p value
	Never n (%)	Some / occasional n (%)	Severe / frequent n (%)		
Maltreatment					
All	1783 (86.4)	213 (10.3)	67 (3.3)		
Boys	872 (89.0)	76 (7.8)	32 (3.3)	1.50 (1.13–2.00)	0.006
Girls	911 (84.1)	137 (12.7)	35 (3.2)		
Neglect					
All	1937 (93.9)	80 (3.9)	46 (2.2)		
Boys	928 (94.7)	34 (3.5)	18 (1.8)	1.31 (0.86–1.20)	0.207
Girls	1009 (93.2)	46 (4.3)	28 (2.6)		

CI, confidence interval; OR, proportional odds ratios derived from ordinal logistic regression adjusted for the non-independence of twin observations.

Table 3
 Distribution of the severity of adolescent victimization experiences as a function of socioeconomic status (SES)

Type of victimization	Severity rating			Low vs. Medium/high SES OR (95% CI)	p value
	Never n (%)	Some / occasional n (%)	Severe / frequent n (%)		
Any physical violence					
Low	274 (39.7)	186 (26.9)	231 (33.4)	1.77 (1.44–2.18)	<0.001
Medium/high	710 (51.6)	391 (28.4)	274 (19.9)		
Crime					
Low	290 (42.0)	220 (31.8)	181 (26.2)	1.60 (1.30–1.97)	<0.001
Medium/high	709 (51.6)	450 (32.7)	216 (15.7)		
Peer/Sibling					
Low	267 (38.6)	299 (43.3)	125 (18.1)	1.27 (1.04–1.54)	0.017
Medium/high	606 (44.1)	571 (41.5)	198 (14.4)		
Internet/mobile					
Low	540 (78.2)	99 (14.3)	52 (7.5)	1.16 (0.91–1.49)	0.229
Medium/high	1105 (80.5)	187 (13.6)	81 (5.9)		
Sexual					
Low	596 (86.3)	66 (9.6)	29 (4.2)	1.27 (0.94–1.71)	0.116
Medium/high	1217 (88.6)	132 (9.6)	24 (1.8)		
Family violence					
Low	536 (77.6)	47 (6.8)	108 (15.6)	1.45 (1.12–1.89)	0.005
Medium/high	1141 (83.2)	89 (6.5)	142 (10.4)		
Maltreatment					
Low	570 (82.5)	82 (11.9)	39 (5.6)	1.66 (1.24–2.22)	0.001
Medium/high	1213 (88.4)	131 (9.6)	28 (2.0)		
Neglect					
Low	625 (90.5)	37 (5.4)	29 (4.2)	2.33 (1.53–3.55)	<0.001

Type of victimization	Severity rating			Low vs. Medium/high SES OR (95% CI)	p value
	Never n (%)	Some / occasional n (%)	Severe / frequent n (%)		
Medium/high	1312 (95.6)	43 (3.1)	17 (1.2)		

CI, confidence interval; OR, proportional odds ratios derived from ordinal logistic regression adjusted for the non-independence of twin observations.

Table 4

The co-occurrence of different types of severe victimization experienced by adolescents

Type of victimization experienced in adolescence	Crime Victimization OR (95% CI)	Peer/Sibling Victimization OR (95% CI)	Internet/Mobile Victimization OR (95% CI)	Sexual Victimization OR (95% CI)	Family Violence OR (95% CI)	Maltreatment OR (95% CI)	Neglect OR (95% CI)
Crime Victimization	–	3.84 (3.36–4.39)	3.52 (3.00–4.12)	3.37 (2.77–4.10)	2.28 (1.96–2.66)	3.48 (2.89–4.19)	2.83 (2.16–3.72)
Peer/Sibling Victimization	4.16 (3.61–4.80)	–	5.10 (4.22–6.17)	3.66 (2.99–4.50)	2.08 (1.78–2.44)	2.50 (2.09–2.99)	2.04 (1.59–2.60)
Internet/Mobile Phone Victimization	3.55 (3.03–4.16)	5.04 (4.16–6.11)	–	3.32 (2.74–4.01)	1.70 (1.43–2.02)	2.32 (1.94–2.77)	1.76 (1.38–2.25)
Sexual Victimization	4.22 (3.41–5.22)	4.37 (3.46–5.51)	3.87 (3.07–4.88)	–	2.35 (1.85–2.98)	3.88 (2.99–5.04)	3.23 (2.39–4.38)
Family Violence	2.02 (1.78–2.30)	1.80 (1.59–2.03)	1.59 (1.38–1.84)	1.94 (1.64–2.30)	–	3.40 (2.90–3.99)	3.52 (2.82–4.40)
Maltreatment	4.37 (3.52–5.43)	2.46 (2.03–2.98)	2.48 (2.04–3.03)	3.74 (2.92–4.81)	5.15 (4.03–6.58)	–	7.45 (5.63–9.85)
Neglect	3.16 (2.39–4.20)	1.98 (1.58–2.47)	1.93 (1.54–2.42)	2.88 (2.10–3.93)	4.84 (3.53–6.64)	7.62 (5.66–10.24)	–

Proportional odds ratios (OR) derived from ordinal logistic regressions are adjusted for sex, socioeconomic status, and the non-independence of twin observations. CI, confidence interval.

Table 5
Fit-statistics for the Latent Class Analysis in two random subsamples of victimized adolescents in the E-Risk study

No. of Classes	Log likelihood	AIC	BIC	Likelihood Ratio χ^2		Entropy	Lo-Mendell-Rubin Adjusted Likelihood Ratio Test		
				Estimate	df		p-value	Estimate	p value
Sub-Sample 1 (N = 364)									
2	-1168.690	2367.380	2425.838	256.011	112	0.000	1.000	70.033	0.0000
3	-1129.765	2305.530	2395.164	178.160	104	0.000	0.758	76.235	0.0311
4	-1091.393	2245.877	2366.689	102.508	96	0.306	0.882	74.082	0.0000
5	-1079.323	2236.646	2388.635	77.276	88	0.786	0.947	24.708	0.5349
6	-1068.729	2231.459	2414.625	56.089	80	0.981	0.947	20.747	0.2559
Sub-Sample 2 (N = 365)									
2	-1150.498	2330.996	2389.494	221.985	111	0.000	0.700	90.810	0.0043
3	-1103.049	2252.098	2341.796	117.056	102	0.146	0.865	92.929	0.0000
4	-1078.066	2218.133	2339.029	87.100	96	0.731	0.857	48.929	0.0055
5	-1068.598	2215.197	2367.293	68.164	88	0.942	0.822	18.543	0.0362
6	-1061.276	2216.553	2399.848	53.520	80	0.990	0.923	14.340	0.2377

AIC, Akaike Information Criteria; BIC, Bayesian Information Criteria; df, degrees of freedom; E-Risk, Environmental Risk Longitudinal Twin Study.

Table 6

Percentage of adolescents experiencing each type of victimization in the 4 classes/groups of victimization

Type of Victimization	Crime-Related Victimization (N = 189)	Family Violence Victimization (N = 158)	Poly-Victimization I (N = 328)	Poly-Victimization II (N = 54)
Crime Victimization	100%	28%	36%	87%
Peer/Sibling Victimization	0%	0%	92%	39%
Internet/Mobile Phone Victimization	9%	6%	30%	15%
Sexual Victimization	2%	1%	9%	31%
Family Violence	0%	100%	16%	70%
Maltreatment	5%	5%	0%	91%
Neglect	0%	7%	2%	50%

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Table 7

Continuity of victimization from childhood to adolescence: Every type of victimization in childhood is broadly related to both the same and other, different types of victimization throughout adolescence

Type of victimization in childhood	Type of victimization in adolescence								
	Any Physical Violence RR (95% CI)	Crime Victimization RR (95% CI)	Peer/Sibling Victimization RR (95% CI)	Internet/Mobile Victimization RR (95% CI)	Sexual Victimization RR (95% CI)	Family Violence RR (95% CI)	Maltreatment RR (95% CI)	Neglect RR (95% CI)	Poly-victimization RR (95% CI)
Physical domestic violence	1.23 (1.15–1.31)	1.16 (1.09–1.25)	1.08 (1.02–1.15)	1.20 (1.05–1.37)	1.41 (1.20–1.66)	1.55 (1.37–1.75)	1.68 (1.43–1.96)	1.83 (1.43–2.35)	1.29 (1.17–1.41)
Bullying by peers	1.26 (1.17–1.35)	1.28 (1.19–1.37)	1.31 (1.23–1.40)	1.44 (1.28–1.63)	1.72 (1.44–2.06)	1.30 (1.12–1.50)	1.67 (1.41–1.99)	1.80 (1.38–2.34)	1.46 (1.33–1.61)
Physical harm by an adult	1.29 (1.20–1.38)	1.25 (1.16–1.34)	1.15 (1.07–1.23)	1.24 (1.06–1.46)	1.52 (1.23–1.88)	1.56 (1.36–1.80)	1.86 (1.55–2.22)	2.14 (1.68–2.72)	1.43 (1.30–1.58)
Physical neglect	1.21 (1.09–1.35)	1.20 (1.07–1.34)	1.08 (0.97–1.20)	1.30 (1.04–1.63)	1.32 (0.98–1.79)	1.18 (0.93–1.49)	1.63 (1.24–2.14)	1.87 (1.34–2.61)	1.21 (1.03–1.41)

Relative risks (RR) are adjusted for sex, socioeconomic status, and the non-independence of twin observations.

Within-pair polychoric correlations and genetic and environmental parameter estimates for univariate models of severity of adolescent victimization

Table 8

Type of Victimization	Cross-Twin Correlation		Standardized Variance Components					
	r	(95% CI)	A ²	(95% CI)	C ²	(95% CI)	E ²	(95% CI)
Any Physical Violence			0.23	(0.05–0.55)	0.33	(0.16–0.57)	0.43	(0.3–0.51)
Monozygotic	0.57	(0.49–0.65)						
Dizygotic	0.45	(0.35–0.55)						
Crime Victimization			0.31	(0.10–0.63)	0.23	(0.06–0.51)	0.46	(0.38–0.54)
Monozygotic	0.54	(0.46–0.62)						
Dizygotic	0.39	(0.28–0.49)						
Peer/Sibling Victimization			0.34	(0.12–0.66)	0.13	(0.00–0.46)	0.54	(0.45–0.62)
Monozygotic	0.47	(0.38–0.55)						
Dizygotic	0.30	(0.19–0.41)						
Internet/Mobile Phone Victimization			0.25	(0.01–0.81)	0.17	(0.00–0.67)	0.57	(0.45–0.70)
Monozygotic	0.42	(0.30–0.55)						
Dizygotic	0.30	(0.14–0.46)						
Sexual Victimization			0.28	(0.00–0.99)	0.19	(0.00–0.81)	0.53	(0.37–0.69)
Monozygotic	0.47	(0.30–0.63)						
Dizygotic	0.33	(0.14–0.52)						
Family Violence			0.17	(0.00–0.71)	0.42	(0.17–0.77)	0.41	(0.30–0.52)
Monozygotic	0.59	(0.47–0.70)						
Dizygotic	0.50	(0.36–0.64)						
Maltreatment			0.71	(0.61–0.80)	–	(–)	0.30	(0.20–0.39)
Monozygotic	0.72	(0.62–0.82)						
Dizygotic	0.25	(0.05–0.45)						
Neglect			0.47	(0.10–1.00)	0.29	(0.01–0.91)	0.25	(0.13–0.37)
Monozygotic	0.76	(0.63–0.88)						
Dizygotic	0.52	(0.30–0.75)						

A, additive genetic; C, shared environment; CI, confidence interval; E, nonshared environment; r, polychoric correlation.

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