

Association of Cumulative Childhood Adversity and Adolescent Violent Offending With Suicide in Early Adulthood

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[+ Supplemental content](#)

IMPORTANCE Childhood adversity (CA) is associated with an increased risk of suicide in young adulthood that might be explained by maladaptive trajectories during adolescence. Although adolescent violent offending is linked with suicide, little is known about its role in the association between CA and suicide.

OBJECTIVE To examine whether adolescent violent offending mediates the association between CA and suicide in early adulthood.

DESIGN, SETTING, AND PARTICIPANTS This population-based, longitudinal cohort study with a follow-up time spanning 5 to 9 years included 476 103 individuals born in Sweden between 1984 and 1988. The study population was prospectively followed up from 20 years of age until December 31, 2013, with respect to suicide. Data analysis was performed from January 1, 1984, to December 31, 2013.

EXPOSURES Register-based CAs included parental death, parental substance abuse and psychiatric disorder, parental criminal offending, parental separation, public assistance reciprocity, child welfare intervention, and residential instability. Adolescent violent offending was defined as being convicted of a violent crime between the ages of 15 and 19 years.

MAIN OUTCOMES AND MEASURES Estimates of risk of suicide after 20 years of age (from 2004 if born in 1984 and from 2008 if born in 1988) until the end of 2013 were calculated as incidence rate ratios (IRRs) with 95% CIs using Poisson regression analysis. Adjustments were made for demographics and psychiatric disorder. In addition, binary mediation analysis with logistic regression was used.

RESULTS A total of 476 103 individuals (231 699 [48.7%] female) were included in the study. Those with a conviction for violent offending had been exposed to all CAs to a greater extent than those with no violent offending. Cumulative CA was associated with risk of suicide in nonconvicted (adjusted IRR, 2.4; 95% CI, 1.5-3.9) and convicted youths, who had a higher risk of suicide (adjusted IRR, 8.5; 95% CI, 4.6-15.7). Adolescent violent offending partly mediated the association between CA and suicide.

CONCLUSIONS AND RELEVANCE Individuals with a history of CA who also engage in violent offending in adolescence have a high risk of suicide. Interventions to prevent externalizing behavior during childhood and increased support to youths with delinquent behavior may have the potential to prevent suicide related to CA.

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Despite the overall decrease in suicide rates in most Western countries during recent decades, no similar decrease has been observed among adolescents and young adults.^{1,2} In fact, suicide is ranked as one of the leading causes of death among those aged 15 to 29 years,¹⁻⁴ and in the United States, suicide in young people is increasing.^{1,3}

Identification of risk factors for suicide early during the life course has important implications for designing effective public health interventions.^{1,2} Previous studies⁵⁻¹¹ have indicated that childhood adversities (CAs) are particularly detrimental because of their association with suicide. Usually, CA is denoted by a range of indicators, such as parental divorce, death in the family, substance abuse and criminality in the home, poverty, residential instability, and parental psychopathologic disorders.¹²

Among different mechanisms through which exposure to CA may be associated with later suicide risk, adolescent criminal offending has been suggested as one pathway.¹³⁻¹⁵ Certain maladaptive behavioral patterns, such as childhood aggression and impulsivity, that are more prevalent among young suicide attempters¹⁶⁻¹⁹ and young individuals with delinquent behavior²⁰ may also be more prevalent among those who have experienced CA.²¹⁻²⁴ Subsequently, studies²⁵⁻²⁸ have found significantly higher prevalence rates of CA among young individuals with delinquent behavior, particularly those engaged in violent offending.

The association between adolescent offending and later risk of attempted and completed suicide is well established, and the risk is higher among those engaged in violent offending.²⁹⁻³⁵ The association appears to be 2-way, with self-harm also predicting violent offending.

Some studies^{15,16} have placed adolescent violent offending as a possible link between cumulative CA and later suicidal behavior. These studies^{15,16} have focused on the mediating effect of factors related to violent behavior, such as personality traits, and none of them concerned completed suicides or were population-based. The current register-based study used a large cohort of approximately 476 000 individuals born in Sweden between 1984 and 1988 to test the following hypotheses: (1) exposure to cumulative CA and adolescent violent offending is associated with high risk of suicide in young adulthood and (2) the association between cumulative CA and suicide is mediated by adolescent violent offending.

Methods

Study Population

The study population was defined as all individuals born in Sweden between 1984 and 1988 ($n = 503\,851$) as recorded in the Medical Birth Register. This register contains data on all births in Sweden since 1973. Owing to a high proportion of missing data, those who were adopted ($n = 330$) and those who emigrated before 20 years of age ($n = 11\,954$) were excluded. We also excluded those who died before their 20th birthday ($n = 4809$) because we did not have information on violent offending for these individuals. Those who were granted a disability pension before 23 years of age were also excluded

Key Points

Question Does adolescent violent offending mediate the association between childhood adversity and early adulthood suicide?

Findings In this population-based cohort study of 476 103 young adults, individuals with a history of childhood adversity who were convicted of violent offending had an 8-fold higher risk of suicide compared with those not convicted after adjusting for important background factors and psychiatric disorder. Adolescent violent offending partly mediated the association between childhood adversity and suicide.

Meaning Interventions to prevent externalizing behavior during childhood and increased support to youths with delinquent behavior may have the potential to prevent suicide associated with childhood adversity.

($n = 10\,269$, mainly persons with severe learning disabilities or multiple disabilities). Finally, we excluded 386 individuals for whom we lacked parental information. Our final analytical sample included 476 103 individuals. The study population was prospectively followed up from 20 years of age until December 31, 2013, with respect to suicide. Data analysis was performed from January 1, 1984, to December 31, 2013. The unique Swedish personal identity number was used to link this cohort to multiple health care and administrative registers (eTable 1 in the Supplement).³⁶ This study was approved by the ethical review board of Stockholm, Sweden. In accordance with the Swedish Personal Data Act of 1998 (www.datainspektionen.se/in-english/legislation/the-personal-data-act/) and the decision of the ethical review board, we did not obtain informed consent from the study participants. All study data were anonymized.

Measures

Indicators of CA

The CA indicators (Table 1) were selected based on prior research demonstrating that they had significant adverse health and social implications.^{5,13,37-40} We included 8 CAs that occurred between birth and 14 years of age: parental death, parental substance abuse, substantial parental criminal offending, parental psychiatric disorder, parental separation, public assistance reciprocity, substantial child welfare intervention before 12 years of age (out-of-home care), and residential instability. To assess cumulative exposure to the studied CAs, the total number of CAs was summed and grouped into 0, 1, 2, 3, and 4 or more CAs. Each indicator was weighted equivalently in the analyses.

Adolescent Violent Offending

In contrast to many other European countries, Sweden has few individuals younger than 18 years in prison, even though the age of criminal responsibility is 15 years.⁴⁰ The political consensus in Sweden has, during several decades, agreed on keeping offending youths out of prisons to avoid the risk of becoming apprentices in crime. Thus, the standard procedure for courts is to give cases of youths suspected of delinquency to

Table 1. Definitions and Classification of Childhood Adversity

Childhood Adversity	Definition	ICD Classification	Data Source
Parental death	Parental death	NA	Causes of Death Register
Parental suicide	Parental suicide	ICD-9: 950-59, 980-89; ICD-10: X60-84, Y10-34	Causes of Death Register
Parental substance abuse	At least 1 hospitalization for alcohol and/or narcotic-related substance abuse	ICD-9: 291, 303, 304.0-304.9, 305.0, 305.2-305.7, 305.9; ICD-10: F10-F19	National Patient Register
Substantial parental criminal offending	At least 1 parent sentenced to prison, probation, or forensic psychiatric care	NA	Register of Court Convictions
Parental psychiatric disorder	At least 1 hospitalization for psychiatric disorder (excluding substance abuse-related disorders)	ICD-9: 290-319; ICD-10: F00-F99	National Patient Register
Parental separation	Having separated parents	NA	Longitudinal Integration Database for Health Insurance and Labor Market Studies
Household living on public assistance	Public assistance during at least 1 y, when >50% of the yearly income constituted public assistance	NA	Total Enumeration Income Survey
Substantial child welfare intervention	At least 1 placement in out-of-home care before age 12 y	NA	Child Welfare Register
Residential instability	≥3 Changes in place of residence	NA	Total Population Register

Abbreviations: ICD-9, *International Classification of Diseases, Ninth Revision*; ICD-10, *International Statistical Classification of Diseases and Related Health Problems, Tenth Revision*; NA, not applicable.

the social services without any other legal sanctions imposed on the individual offender.⁴⁰

We retrieved all conviction data for violent crimes between the ages of 15 and 19 years from the Register of Court Convictions. Violent crime was defined as homicide, assault, robbery, arson, any sexual offense (rape, sexual coercion, child molestation, indecent exposure, or sexual harassment), illegal threats, or intimidation⁴¹ (burglary and other property offenses and drug offenses were excluded).

Suicide

The study population was prospectively followed up from 20 years of age until December 31, 2013, with respect to suicide. Suicide was defined by the presence of *International Statistical Classification of Diseases and Related Health Problems, Tenth Revision* codes X60 to X84 or as death with undetermined intent (codes Y10-Y34) as the underlying cause of death in the causes of death register. The latter reduces spatial and secular trends in detecting and classifying cases of suicide when intent was indeterminable.⁴²

Confounders

Several confounding factors related to parental demographic and socioeconomic circumstances were included. Parental country of birth was categorized as Sweden (both parents Swedish-born), mixed (one Swedish-born), other Nordic (Denmark, Finland, Norway, or Iceland), other European Union, and non-European Union. Highest parental educational attainment, measured when the child was 15 years of age, was classified as compulsory school (≤9 years), secondary school (10-12 years), and university or college (>12 years).

Early psychiatric disorder, including substance abuse, self-harm, and antisocial behavior, is associated with adolescent criminal offending^{30,43} and suicide.¹⁰ Psychiatric disorder up until 20 years of age was obtained from the National Patient Register.

Statistical Analysis

Statistical analyses were conducted using SAS, version 9.4 (SAS Institute Inc) and Stata, version 13 (StataCorp). Multivariate analyses were performed using Poisson regression models of time to suicide. We assessed person-years at risk by totaling the years that the individuals were living in Sweden during the follow-up period (entry date defined as the date of the 20th birthday and exit date as the date of suicide, date of death from other causes, date of emigration, or the end of follow-up [December 31, 2013]). We examined the association between indicators of CA and suicide in adulthood in 4 regression models. Model 1 was adjusted for sex and birth year. Model 2 was further adjusted for parental country of birth and parental educational level. In model 3, psychiatric disorder before 20 years of age was included. In model 4, all CAs were included simultaneously.

To establish whether violent offending mediates the association between CA and suicide, a series of regression analyses were performed as suggested by Baron and Kenny.⁴⁴ We first regressed the hypothesized mediator (violent offending) on the independent variable (ie, cumulative CA). Second, the dependent variable (ie, suicide) was regressed on the independent variable. Third, the dependent variable was regressed on the independent variable and the hypothesized mediator. Separate coefficients for each equation were estimated, and mediation was considered to occur if the association be-

Table 2. Cohort Characteristics and Prevalence of Childhood Adversity by Sex and Exposure to Adolescent Violent Offending

Variable	Women, No. (%)		Men, No. (%)		Total, No. (%)	
	Total (n = 231 699)	Violent Conviction (n = 1616)	Total (n = 244 404)	Violent Conviction (n = 7533)	Total (N = 476 103)	Violent Conviction (n = 9149)
Characteristics						
Parental educational level (years of education)						
9	15 787 (6.8)	243 (15.0)	16 354 (6.7)	1070 (14.2)	32 141 (6.8)	1313 (14.4)
10-12	115 297 (49.8)	1046 (64.7)	121 718 (49.8)	4836 (64.2)	237 015 (49.8)	5882 (64.3)
>12	99 009 (42.7)	320 (19.8)	104 625 (42.8)	1603 (21.3)	203 634 (42.8)	1923 (21.0)
Missing	1606 (0.7)	7 (0.4)	1707 (0.7)	24 (0.3)	3313 (0.7)	31 (0.3)
Parental country of birth						
Both born in Sweden	192 985 (83.3)	1202 (74.4)	203 456 (83.2)	5322 (70.6)	396 441 (83.3)	6524 (71.3)
Mixed	24 131 (10.4)	262 (16.2)	25 483 (10.4)	1174 (15.6)	49 614 (10.4)	1436 (15.7)
Other Nordic ^a	4639 (2.0)	60 (3.7)	5098 (2.1)	260 (3.5)	9737 (2.0)	320 (3.5)
European Union	3364 (1.5)	26 (1.6)	3517 (1.4)	196 (2.6)	6881 (1.4)	222 (2.4)
Non-European Union	6580 (2.8)	66 (4.1)	6850 (2.8)	581 (7.7)	13 430 (2.8)	647 (7.1)
Indicators of childhood adversity						
Parental death	5332 (2.3)	87 (5.4)	5733 (2.3)	309 (4.1)	11 065 (2.3)	396 (4.3)
Parental suicide	1074 (0.5)	22 (1.4)	1175 (0.5)	80 (1.1)	2249 (0.5)	102 (1.1)
Parental substance abuse	7010 (3.0)	183 (11.3)	7347 (3.0)	736 (9.8)	14 357 (3.0)	919 (10.0)
Substantial parental criminality	9561 (4.1)	271 (16.8)	10 115 (4.1)	1154 (15.3)	19 676 (4.1)	1425 (15.6)
Parental psychiatric disorder	11 746 (5.1)	191 (11.8)	12 466 (5.1)	806 (10.7)	24 212 (4.5)	997 (10.9)
Parental separation	56 169 (24.2)	802 (49.6)	58 263 (23.8)	3221 (42.8)	114 432 (24.0)	4023 (44.0)
Public assistance reciprocity	10 234 (4.4)	304 (18.8)	10 710 (4.4)	1307 (17.4)	20 944 (4.4)	1611 (17.6)
Child welfare intervention	2995 (1.1)	129 (8.0)	3447 (1.4)	499 (6.6)	6442 (1.4)	628 (6.9)
Residential instability	3082 (1.3)	82 (5.1)	3016 (1.2)	294 (3.9)	6098 (1.3)	376 (4.1)
No. of indicators of childhood adversity						
0	159 794 (69.0)	561 (34.7)	169 489 (69.3)	3142 (41.7)	329 283 (69.2)	3703 (40.5)
1	49 850 (21.5)	530 (32.8)	51 720 (21.2)	2441 (32.4)	101 570 (21.3)	2971 (32.5)
2	14 289 (6.2)	247 (15.3)	14 878 (6.1)	1088 (14.4)	29 167 (6.1)	1335 (14.6)
3	4747 (2.0)	152 (9.4)	5132 (2.1)	571 (7.6)	9879 (2.1)	723 (7.9)
≥4	3019 (1.1)	126 (7.8)	3185 (1.3)	491 (6.5)	6204 (1.3)	617 (6.7)
Suicide from age 20 y	155 (0.1)	7 (0.4)	468 (0.2)	74 (0.1)	623 (0.1)	81 (0.9)

^a Denmark, Finland, Norway, and Iceland.

tween the independent and dependent variables could be partially or totally accounted for by the hypothesized mediator and if significant indirect effects were demonstrated.⁴⁵ We assessed the statistical significance of the mediation effect using the binary mediation command in Stata.⁴⁶ The binary mediation command computes the indirect effect of a mediating variable using standardized coefficients.⁴⁶ The CI and statistical test of significance for the proportion mediated were estimated using bootstrapping with 5000 replications. Because self-harm was associated with suicide and violent behavior, we performed sensitivity analyses in which we stratified the cohort based on history of care for self-harm and repeated the analyses.

Results

A total of 476 103 individuals (231 699 [48.7%] female) were included in the study. Cohort characteristics of the study population, by sex and exposure to adolescent violent offending,

are presented in Table 2. A total of 146 820 (30.8%) were exposed to at least 1 CA. The most prevalent CAs were parental separation (114 432 [24.0%]) and parental psychiatric disorder (24 212 [5.1%]). eTable 2 in the Supplement gives the number of individuals who had experienced the 8 different CAs and a combination thereof. Among female participants, 1616 (0.7%) had been convicted of violent offending between the ages of 15 and 19 years. The corresponding number for male participants was 7533 (3.1%). It was more common among convicted individuals to have parents born outside Sweden and to have parents with lower levels of education. Individuals exposed to CA were more likely to be convicted of violent offending during adolescence in multivariate models (eTable 3 in the Supplement). During the follow-up, 623 individuals (0.1%) died by suicide (149 [23.9%] were classified as undetermined intent).

Table 3 presents the crude and multiaadjusted incidence rate ratios (IRRs) with 95% CIs for suicide by adolescent violent offending and exposure to CAs. In the absence of adolescent violent offending, CAs except for parental death, residential in-

Table 3. Incidence Rate Ratios (95% CIs) for Risk of Suicide by Adolescent Violent Offending and Exposure to Childhood Adversity

Variable	Model 1 ^a		Model 2 ^b		Model 3 ^c		Model 4 ^d	
	No Violent Offending	Violent Offending	No Violent Offending	Violent Offending	No Violent Offending	Violent Offending	No Violent Offending	Violent Offending
Parental death								
No	1 [Reference]	5.7 (4.5-7.3)	1 [Reference]	5.2 (4.1-6.7)	1 [Reference]	3.0 (2.3-3.9)	1 [Reference]	2.6 (2.0-3.4)
Yes	1.2 (0.7-2.0)	12.5 (5.9-26.4)	1.1 (0.7-1.9)	10.9 (5.1-23.1)	1.0 (0.6-1.7)	5.6 (2.6-11.9)	0.9 (0.5-1.4)	4.1 (1.9-8.9)
Parental suicide								
No	1 [Reference]	5.9 (4.7-7.5)	1 [Reference]	5.4 (4.2-6.9)	1 [Reference]	3.1 (2.4-4.0)	1 [Reference]	2.7 (2.1-3.5)
Yes	2.4 (1.1-5.4)	14.0 (3.5-56.3)	2.2 (1.0-4.9)	12.7 (3.2-51.2)	1.8 (0.8-3.9)	6.8 (1.7-27.3)	1.4 (0.6-3.3)	4.7 (1.2-19.1)
Parental substance abuse								
No	1 [Reference]	5.2 (4.0-6.9)	1 [Reference]	4.9 (3.7-6.4)	1 [Reference]	2.9 (2.2-3.9)	1 [Reference]	2.8 (2.1-3.7)
Yes	3.7 (2.8-4.9)	17.2 (11.1-26.7)	3.3 (2.5-4.4)	14.8 (9.5-23.1)	2.6 (2.0-3.5)	6.8 (4.3-10.7)	2.2 (1.6-3.1)	5.7 (3.5-9.3)
Substantial parental criminality								
No	1 [Reference]	5.5 (4.2-7.2)	1 [Reference]	5.1 (3.9-6.7)	1 [Reference]	3.0 (2.3-4.0)	1 [Reference]	2.8 (2.1-3.7)
Yes	2.4 (1.7-3.2)	10.7 (6.9-16.6)	2.1 (1.6-2.9)	9.3 (5.9-14.4)	1.7 (1.3-2.3)	4.6 (3.0-7.3)	1.2 (0.9-1.7)	3.1 (1.9-5.0)
Parental psychiatric disorder								
No	1 [Reference]	6.2 (4.9-8.0)	1 [Reference]	5.7 (4.4-7.4)	1 [Reference]	3.4 (2.6-4.4)	1 [Reference]	3.0 (2.3-3.9)
Yes	2.1 (1.5-2.7)	6.5 (3-12.7)	1.9 (1.5-2.6)	5.9 (3.0-11.4)	1.5 (1.2-2.1)	2.7 (1.4-5.3)	1.2 (0.9-1.6)	1.8 (0.9-3.5)
Parental separation								
No	1 [Reference]	5.6 (4.0-7.8)	1 [Reference]	5.2 (3.7-7.3)	1 [Reference]	3.0 (2.2-4.3)	1 [Reference]	2.7 (1.9-3.8)
Yes	1.6 (1.3-1.9)	8.2 (6.0-11.4)	1.5 (1.2-1.8)	7.4 (5.3-10.2)	1.3 (1.1-1.6)	4.0 (2.8-5.5)	1.2 (1.0-1.5)	3.3 (2.3-4.7)
Public assistance reciprocity								
No	1 [Reference]	5.5 (4.2-7.3)	1 [Reference]	5.2 (3.9-6.9)	1 [Reference]	3.1 (2.3-4.1)	1 [Reference]	2.9 (2.2-3.9)
Yes	2.9 (2.2-3.8)	10.7 (7.1-16.3)	2.7 (2.0-3.5)	9.5 (6.2-14.6)	2.1 (1.6-2.8)	4.7 (3.1-7.3)	1.6 (1.1-2.2)	3.5 (2.2-5.5)
Child welfare intervention								
No	1 [Reference]	6.0 (4.7-7.7)	1 [Reference]	5.6 (4.3-7.2)	1 [Reference]	3.3 (2.6-4.3)	1 [Reference]	2.9 (2.2-3.7)
Yes	2.9 (1.8-4.6)	6.8 (3.1-15.3)	2.5 (1.6-3.9)	5.8 (2.6-13.0)	1.5 (0.9-2.4)	2.3 (1.0-5.2)	0.9 (0.5-1.4)	1.2 (0.5-2.9)
Residential instability								
No	1 [Reference]	5.9 (4.6-7.5)	1 [Reference]	5.4 (4.2-6.9)	1 [Reference]	3.1 (2.4-4.0)	1 [Reference]	2.7 (2.1-3.5)
Yes	0.9 (0.4-2.2)	8.3 (3.1-22.3)	0.8 (0.3-2.0)	6.9 (2.6-18.5)	0.6 (0.3-1.5)	3.4 (1.3-9.1)	0.5 (0.2-1.2)	2.5 (0.9-6.7)

^a Adjusted for sex and birth year.^d Model 3 with additional adjustments for all childhood adversities simultaneously.^b Model 1 with additional adjustments for parental country of birth and parental educational level.^c Model 2 with additional adjustments for psychiatric disorder before 20 years of age.

stability, and childhood welfare intervention were associated with risk of suicide (parental death: IRR, 1.0; 95% CI, 0.6-1.7; parental substance abuse: IRR, 2.6; 95% CI, 2.0-3.5; parental criminality: IRR, 1.7; 95% CI, 1.3-2.3; parental psychiatric disorder: IRR, 1.5; 95% CI, 1.2-2.1; parental separation: IRR, 1.3; 95% CI, 1.1-1.6; public assistance: IRR, 2.1; 95% CI, 1.6-2.8; child welfare intervention: IRR, 1.5; 95% CI, 0.9-2.4; and residential instability: IRR, 0.6; 95% CI, 0.3-1.5) (Table 3). All CAs entailed a high risk of suicide among individuals who were convicted for violent offending in adolescence (parental death: IRR, 5.6; 95% CI, 2.6-11.9; parental substance abuse: IRR, 6.8; 95%

CI, 4.3-10.7; parental criminality: IRR, 4.6; 95% CI, 3.0-7.3; parental psychiatric disorder: IRR, 2.7; 95% CI, 1.4-5.3; parental separation: IRR, 4.0; 95% CI, 2.8-5.5; public assistance: IRR, 4.7; 95% CI, 3.1-7.3; child welfare intervention: IRR, 2.3; 95% CI, 1.0-5.2; and residential instability: IRR, 3.4; 95% CI, 1.3-9.1) (Table 3). The highest IRR was observed for convicted with a history of parental substance abuse (multiadjusted IRR, 6.8; 95% CI, 4.3-10.7). The IRRs decreased when all CAs were included in the same model (model 4).

In a graded manner, cumulative exposure CA was associated with higher IRR for suicide regardless of adolescent crimi-

Table 4. Incidence Rate Ratios (95% CIs) for Risk of Suicide by Adolescent Violent Offending and Exposure to Cumulative Childhood Adversity

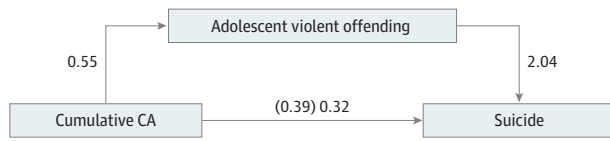
No. of Childhood Adversities	Model 1 ^a		Model 2 ^b		Model 3 ^c	
	No Violent Offending	Violent Offending	No Violent Offending	Violent Offending	No Violent Offending	Violent Offending
0	1 [Reference]	6.4 (4.1-9.9)	1 [Reference]	6.1 (4.0-9.5)	1 [Reference]	4.2 (2.7-6.5)
1	1.5 (1.3-1.9)	7.3 (4.5-11.7)	1.5 (1.2-1.8)	6.8 (4.2-11.0)	1.3 (1.1-1.7)	4.1 (2.5-6.6)
2	2.4 (1.9-3.2)	15.8 (9.9-25.1)	2.3 (1.7-3.0)	14.5 (9.1-23.1)	1.9 (1.4-2.5)	8.4 (5.2-13.4)
3	2.8 (1.9-4.3)	15.7 (8.4-29.5)	2.6 (1.7-4.0)	14.1 (7.5-26.6)	2.0 (1.3-3.0)	7.0 (3.7-13.2)
≥4	4.1 (2.6-6.4)	20.6 (11.3-37.5)	3.6 (2.3-5.7)	18.2 (9.9-33.4)	2.4 (1.5-3.9)	8.5 (4.6-15.7)

^a Adjusted for sex and birth year.

^c Model 2 with additional adjustments for psychiatric disorder before 20 y of age.

^b Model 1 with additional adjustments for parental country of birth and parental education.

Figure. Model of the Association Among Childhood Adversity (CA), Violent Offending, and Suicide



Logistic regression coefficients are as follows: $\beta_0 = -4.32$, $\beta_1 = 0.55 \times$ cumulative CA, for the association of cumulative CA with adolescent violent offending; $\beta_0 = -6.77$, $\beta_1 = 2.04 \times$ adolescent violent offending, for the association of adolescent violent offending with suicide; $\beta_0 = -6.89$, $\beta_1 = 0.39 \times$ cumulative CA, for total effect (association of cumulative CA with suicide); and $\beta_0 = -6.94$, $\beta_1 = 0.32 \times$ cumulative CA for direct effect (association of cumulative CA with suicide). The value in parentheses is the coefficient for the direct (ie, unmediated) path. $P < .001$ for all associations.

nal offending (Table 4). Compared with those with no CAs and no adolescent violent offending, individuals with 4 or more CAs had a 21-fold elevated risk of suicide (IRR, 20.6; 95% CI, 11.3-37.5). A large part of the elevated risk was associated with psychiatric disorder (Table 4); the IRR decreased to 8.5 (95% CI, 4.6-15.7). The corresponding IRR among nonconvicted youths was 2.4 (95% CI, 1.5-3.9).

In the mediation (first step) analyses (Figure), cumulative CA (independent variable) was associated with violent offending (mediator) ($\beta_1 = 0.54$, $P < .001$). In the second step, cumulative CA (independent variable) was associated with suicide (dependent variable) ($\beta_1 = 0.39$, $P < .001$). In the third step, which included all 3 variables, the association of cumulative CA (independent variable) with suicide (dependent variable) decreased but remained significant ($\beta_1 = 0.32$, $P < .001$). The mediation analysis further estimated the indirect effect to be 0.03 (95% CI, 0.03-0.04), indicating a small but significant mediation effect of violent offending. Associations between cumulative CA and violent offending are presented in eTable 3 in the Supplement.

Both CA and violent offending were associated with increased risk of suicide in the subset of individuals without earlier care for self-harm, and the IRRs were higher compared with those for the whole study cohort (sensitivity analyses) (eTables 4 and 5 in the Supplement). The associations were weaker in the subset of individuals with a history of self-harm ($n = 5194$, of whom 68 later died by suicide).

Discussion

The present study examined the associations among cumulative CA, adolescent criminal offending, and early adulthood suicide by using Swedish data on a total population cohort of 476 103 individuals. Our findings indicate that adolescent violent offenders often have a history of CA. Furthermore, violent offenders with indicators of adversity in their childhood have a high risk of suicide. The risk is increased 8-fold for violent offenders with a history of cumulative exposure to CA. Last, we observed evidence of mediation of the association between CA and suicide in young adulthood by adolescent violent offending.

The positive associations between multiple types of CAs and adolescent violent offending observed in our study are in line with previous research.^{13,25-28} In particular, parental criminal behavior has been indicated as a key risk factor for offspring offending.¹³ In our cohort, 15.6% of violent offenders had grown up with incarcerated parents compared with 4.1% in the total cohort. Furthermore, our findings revealed that violent offenders more often had experienced cumulative CA, which has been reported by others.^{23,26}

A previous study⁵ found that CA is associated with suicide in early adulthood, especially when accumulated. The current study extends existing research by taking into account the role of adolescent violent offending. Interpersonal violence and violent criminal offending have been identified as risk factors for suicide, although the mechanisms underlying these associations are not fully clear.²⁹⁻³² To our knowledge, the current study is the first to examine the mediating role of violent offending in the association between CA and completed suicide in the general population. One recent study¹⁵ based solely on a cohort of youths in the juvenile justice system examined the association between CA and suicide attempts and the mediating role of adolescent problem behaviors in this population. The study¹⁵ found an association between cumulative CA and suicide attempts in young offenders that was partly mediated by aggression and impulsivity.

Our findings shed further light on the mechanisms underlying the link between CA and death from suicide. One possible mechanism is that exposure to adversity early in life causes emotional dysregulation (poorly modulated emotional response)⁴⁷ and subsequently maladaptive behaviors,

such as aggression, hostility, and violence, as a means for reducing negative emotion.^{6,27,48} Furthermore, a less supportive and adverse early-life environment might deter an individual's self-esteem and self-worth, which in turn are related to reactive aggression and antisocial behavior.⁴⁹ Aggression, impulsivity, and violence are linked to violent crime and suicide and may thus play an important role in explaining the association between CA and suicidal behavior. Alternatively, a negative life course trajectory during adolescence, such as one that includes violent delinquency, may reinforce the negative consequences of CA on an individual's interpersonal functioning, reduce social support, and hinder successful transitioning to adult life, resulting in heightened suicide risk during young adulthood. The risk of suicide was even higher among individuals exposed to CA without a history of self-harm in our study, supporting the notion that adolescent violent offending represents a circle of adversity and negative life trajectory that increases the risk of suicide rather than being a marker of previous psychiatric disorder or personality traits related to suicidal behavior.

Last, research indicates that most children and youths in correctional settings have 1 or more mental disorders.³⁰ In our cohort, 23.6% of those convicted of violent offending had been diagnosed with a psychiatric disorder before their 20th birthday compared with 7.0% in the total cohort (eTable 6 in the Supplement). Adjustment for psychiatric disorder largely attenuated but did not fully explain the association between CA and suicide among convicted youths. Because our definition of psychiatric disorder included only diagnosed cases, we cannot rule out the possibility that psychiatric disorder among youths with delinquent behavior who are exposed to cumulative adversity are less often diagnosed and given proper treatment compared with others in the population and that this might affect suicide risk in this group.

With these lines of reasoning, our findings have some important implications. Efforts that target the excess suicide risk among disadvantaged children should take a life course approach. Apart from interventions during early childhood, particularly those that target emotional regulation, aggression, and impulsivity, our findings highlight a need for interventions during adolescence, including prevention of juvenile delinquency. Young individuals who engage in violent criminality and have a history of cumulative exposure to CA are a group with markedly high risk of suicide independent of their history of self-harm and/or psychiatric disorder. This group can be identified through their contacts in the corrections settings and the health care system and, thus, benefit from targeted suicide prevention interventions and improved overall support. Furthermore, screening for psychiatric disorder should be especially meticulous in this group.

Last, our study indicates that antisocial behavior, resulting in violent offending, may be considered a link between CA and suicide. In the 1980s, Patterson et al⁵⁰ formulated a model

of parent-child interactions in families in which children develop antisocial behavior. This model proposes that parents in families with children who act out tend to be noncontingent and therefore unsuccessful when attempting to reinforce prosocial behavior and discourage negative behavior. A variety of preventive interventions based on parent training programs have been developed from this model and similar theory, typically targeting children in late preschool or early school age in socially adverse neighborhoods. Lundahl et al⁵¹ included 63 controlled studies in a meta-analysis of such parent training programs and found considerable evidence of positive short-term effects. More recent studies^{52,53} have found family preventive interventions aimed at the prevention of delinquency and substance abuse to have positive long-term effects on suicidal ideation. In addition, prevention programs aimed at reducing aggressive, disruptive behavior in children may delay or prevent suicide ideation.⁵⁴ Our study suggests that these parent training programs could also be useful in preventing suicide in children growing up with adversity. Future long-term follow-up studies of parent training programs should also include suicidal behavior as an outcome to prove this point.

Strengths and Limitations

This study has several strengths, including the longitudinal, population-based design and use of national registers with high completeness and validity. Most existing CA studies^{12,55} have been based on self-reported information entailing risk of recall bias. Despite these strengths, our findings should be interpreted in the context of the following limitations. First, the range of CAs is far from exhaustive, and we did not assess the severity, duration, or sequencing of any of these CAs. Several of the CAs capture only the most severe cases (parental substance abuse, parental psychiatric disorder, substantial parental criminality), which should be considered when interpreting the results. Another limitation is that we did not examine the fluidity of CAs but rather, as done by others,⁵⁶ treated them as discrete life events. However, the consistency of our results with other studies and the large cohort with high-quality data lend confidence to the validity of our findings.

Conclusions

This study found that one of the mediators of the well-established link between CA and suicide in young adulthood is adolescent violent criminality. Young adults with a history of violent delinquency during adolescence and cumulative exposure to CA have a high risk of suicide, which should be considered by professionals in social and health services. Reducing the excess suicide risk related to CA might benefit from interventions to prevent antisocial behavior and improved support to youths with delinquent behavior.

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