

Specific traumatic events elevate the risk of a suicide attempt in a 10-year
longitudinal community study on adolescents and young adults

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Abstract

Background. Traumatic events (TEs) have been associated with suicide attempts (SAs). However, the empirical status of some TEs is inconclusive. This also concerns community adolescents and young adults, known to be a high-risk group for SAs. We examined associations between (a) a range of prior TEs (physical attack, rape/sexual abuse, serious accident, and witnessing somebody else experiencing a TE) and a subsequent SA, and (b) the number of prior TEs and an SA, and (c) we estimated attributable proportions of SAs, in relation to each TE.

Method. Over a 10-year period the Early Developmental Stages of Psychopathology (EDSP) study prospectively assessed community members, aged 14–24 years at baseline. Starting with 3021 subjects, each individual was assessed up to four times. Assessment was based on the Munich-Composite International Diagnostic Interview. Temporal associations were estimated using the Cox model with time-dependent covariates. Attributable proportions were based on the results of the Cox models.

Results. All four TEs elevated the risk for a subsequent SA, adjusting for confounders. Highest risk was found for the combined TE rape/sexual abuse. Results showed that 56–90% of SAs could be attributed to TEs in the exposed group; on the population level, attributable proportions ranged between 6.9% and 23.5%.

Conclusions. Different TEs have been shown to elevate the risk of an SA in a young community sample. Our results suggest that both health professionals and health policy decision makers consider specific TEs and the number of prior TEs as risk factors for SAs.

Keywords: suicide attempt, adolescents and young adults, traumatic event, community sample, prospective design, attributable fraction

Introduction

Reducing suicide rates has long been an important goal [1]. Unfortunately, despite 50 years of research, that goal is far from being met, as global suicide records indicate [2]. Previous suicide attempts (SAs) have been consistently reported as being “by far” the strongest risk factor for suicide and suicide reattempts [1]. Another consistent finding is that age 15–29 years represents the so-called high-risk period for the first lifetime SA [1]. Therefore, reducing SA rates might help reduce suicide rates, not only but especially in adolescents and young adults. To this end, identifying risk factors for SA in this age group is warranted. Past research has generated a long list of such factors, some more conclusive than others.

Traumatic events (TEs) belong to the inconclusive set of purported risk factors (for recent and current reviews and meta-analyses see [3–9]). Possible reasons for the inconclusive results include differences in sample size (insufficient power), sample origin (community vs. selective), study design (cross-sectional vs. longitudinal), and the set of confounders, as well as heterogeneous measurements of both TEs and SAs.

One more reason might be that TEs increase the risk of suicide ideation (SI) but not the risk of progressing from SI to SA, as reported by Stein et al. [10], using data from a cross-sectional study on adults across 21 nations. The Integrated Motivational-Volitional model (IMV) of suicidal behavior provides a possible explanation [11], which is empirically supported by several studies [12]. The central component of the IMV is entrapment, i.e. the experience of defeat/humiliation from which there is no escape, which is suggested to be the key driver of SI onset [12]. Recurrent, involuntary, and intrusive distressing memories of the TE might invoke the feeling of being entrapped, which might lead to SI. Sustained SI and additional factors might then increase the likelihood of a subject to attempt suicide, e.g. SI plus the feeling of being a burden to others and a reduced fear of death, which are central components of the Interpersonal Theory of Suicide (IPTS) by Joiner [13].

Of all the different TEs it is childhood/adolescent sexual abuse and physical abuse that

have most often been reported to increase the risk of an SA (e.g., [14–17]). Also the number of experienced TEs has consistently been reported to increase the risk of an SA among the young (see, e.g., [5, 15, 18, 19]). With respect to two other TEs, serious accidents and witnessed trauma, we have found no study reporting serious accidents as a specific risk factor for SA in a *young* community sample. In a 5-year follow-up prospective study, Nrugham et al. [20] reported on witnessing violent life events in a subsample of adolescents and young adults with low versus high scores on a screening instrument for depression. Also in adult community or patient samples the two TEs have very rarely been reported to be associated with SA (for serious or life-threatening accidents see [10, 21]; for witnessed trauma see [10, 15, 21–23]).

Finally, after searching the literature for associations between specific TEs and SAs among community adolescents and young adults, we found only five studies and two meta-analyses [4, 14–16, 24–26] that determined attributable fractions on the population level. However, such proportions were derived from so-called interpersonal TEs, for instance, sexual abuse, or from TEs with a broad social background, for instance, community violence. Currently there are no such estimates available for other TEs, such as a serious accident or witnessed trauma. Also, when informing health policies, aside from the population level, there is another important level to consider, namely, the group that is exposed to the risk factor of interest. However, after searching the literature, we were not able to find reports of attributable fractions on the exposed-group level in community samples, irrespective of the life period being covered.

Using data from the 10-year prospective-longitudinal Early Developmental Stages of Psychopathology (EDSP) study, we set out

1. to estimate the longitudinal association of specific TEs and subsequent SAs,
2. to estimate the dose–response relationship between the number of prior TEs and subsequent SAs, and

3. to estimate the proportion of SAs that can be attributed to specific TEs, among both the exposed group and the total population.

Method

The EDSP study prospectively observed adolescents and young adults, ages 14–24 years at baseline, for up to 10 years. It included four assessments, starting in 1994 (baseline $N = 3021$, response = 70.9%) and followed by T1 ($N = 1228$, response = 88%, range 1.2–2.1 years after baseline), T2 ($N = 2548$, response = 84.3%, range 2.8–4.1 years after baseline), and T3 ($N = 2210$, response = 73.2%, range = 7.3–10.6 years after baseline). At baseline, T2, and T3, subjects from the full sample were assessed; at T1 a subsample of those 14–17 years old at baseline was assessed. Subjects were selected from the government registries of the greater Munich area, Germany; 14- to 15-year-olds were sampled at twice the probability of 16- to 21-year-olds, whereas 22- to 24-year-olds were sampled at half the probability. Sample weights were generated to account for this sampling scheme. Further details of the EDSP study methods, design, and sample characteristics have been presented elsewhere [27–29]. The EDSP project was reviewed by the Ethics Committee of the Medical Faculty at the Technische Universität Dresden. All participants provided informed consent.

All assessments were made in face-to-face interviews, using the computer-assisted Munich-Composite International Diagnostic Interview (DIA-X/M-CIDI) [30]. The DIA-X/M-CIDI was constructed for the standardized assessment of symptoms, syndromes, and diagnoses of DSM-IV disorders. At baseline the DIA-X/M-CIDI lifetime version was used. At each of the three follow-up assessments the DIA-X/M-CIDI was modified to obtain information about the period between the previous and the current assessment. TEs were assessed at the beginning of the section covering the DSM-IV criteria for post-traumatic stress disorder (PTSD). In particular, eight specified TEs (war experience, physically attacked, raped, sexually abused as a child, natural disasters, serious accidents, imprisoned/taken hostage/kidnapped, and witnessed somebody else experience a TE) and one open category of

TE were assessed. In the current report we used only the eight specified TEs that adhere to the DSM-IV PTSD criterion A1. For more detailed information on how TEs were assessed in the EDSP study, see [31]. The DSM-IV disorders were obtained using DIA-X/M-CIDI algorithms. Psychometric quality criteria such as test–retest reliability and validity for the full DIA-X/M-CIDI have been reported elsewhere [32, 33]. Age and sex were assessed in the sociodemographic section of the M-CIDI. SAs were assessed in the depression section of the DIA-X/M-CIDI with the question “Have you ever attempted suicide?” (lifetime version at baseline) and “Have you attempted suicide?” (interval version at follow-up). At baseline and T1 only the individuals who acknowledged having had a period of at least 2 weeks with a continuously depressed mood, low energy, or loss of interest [these are the stem questions for major depressive disorder (MDD)] were asked this question. At T2 and T3 a modification was introduced in the depression section to ensure that all individuals were asked questions regarding SA (T2: lifetime, T3: since the last assessment), irrespective of whether the stem questions for MDD were confirmed or denied. Since at baseline and T1 not all individuals were asked about SA, we cannot rule out that in some cases the reported SA at T2 or T3 was not the first lifetime SA.

Data analysis

To analyze longitudinal associations between TEs and SAs, all cases with a baseline SA ($N = 69$) were removed from the overall sample, resulting in $N = 2952$ subjects. Observations were organized according to the four EDSP assessment waves; for example, a subject being assessed for the last time at wave n was represented by n lines of data. The only exception to that rule was the report of an SA prior to wave n , which then reduced the number of lines for that subject accordingly. Thus, TEs being reported after an SA were automatically excluded. TEs were counted when they were reported either prior to or within the same assessment wave as the first reported SA.

Data were weighted by sex, age group, and geographic location at baseline to be representative of the original sampling frame. These weights were applied throughout all data analyses. Analyses were performed using R 3.3.3 [34], including the survey [35] and survival [36] packages. As predictors we used the following TEs: (1) being physically attacked, (2) a variable combining the two TEs rape and sexual abuse as a child, (3) serious accident, and (4) witnessing somebody else experience a TE. Other TEs (war experience, imprisoned/taken hostage/kidnapped, and natural disasters) could not be analyzed separately, due to an insufficient number of cases. However, they were used in analyzing the association between the number of prior TEs and subsequent SAs. Also, each reported TE was counted—that is, multiple occurrences of a single TE category were possible. As outcome we used the dichotomous variable SA. Finally, as both TE and SA prevalence often differ between males and females (for SAs see [37]; for TEs see [38]), in addition to our main analyses we tested for sex interaction effects.

To analyze the data we used the Cox hazard model with time-dependent covariates. Time units were represented by the assessment waves of the EDSP study. Each subject therefore had a maximum number of four time units, that is, maximally four rows in the long data format. In each Cox model we adjusted for the covariates “any other prior TE” (reported at least one time unit prior to the predictor TE), “any DSM-IV mental disorder” (diagnosed prior to or within the same time unit as the predictor TE), sex, and age cohort (ages 14–17 years vs. 18–24 years at baseline), the latter two covariates being time independent. Using the above-mentioned confounders was suggested both by the literature (e.g., [26]) and by our own previous publications (for sex see [39], and for any DSM-IV mental disorder see [40, 41]).

For the estimation of attributable proportions, we estimated the population attributable fraction (PAF) and the attributable fraction (AF). Both estimates denote the proportion of outcome cases (here: SAs) that would not have occurred if the risk factors (here: TEs) were both causal and had not occurred. The difference between the two estimates is the population

they refer to: The PAF refers to the population level, the AF to the group being exposed to the specific risk factor.

For estimating the PAF and its 95% confidence interval (CI) we used a method proposed by Natarjan et al. [42] for complex surveys, which we have used previously and described in an earlier publication [43]. The AF was computed by adapting the method to obtain the PAF, that is, by excluding the multiplier (the cumulative lifetime incidence of TEs among those with an SA) from the formula. To estimate the AF 95% CI we also adapted the PAF method accordingly.

Results

Cumulative lifetime incidence of SAs and demographics

As already reported in a previous publication [43], the cumulative lifetime incidence of SA at T3 was 5.5%. Estimates were higher for females (6.6%) than for males (4.4%; odds ratio, OR = 1.5, 95% CI 1.08–2.18). The demographic variables sex, educational level, and social class of the baseline sample ($N = 3021$) can be seen in table 1, with percentages being based on the EDSP sample weights. Further demographic and psychological variables can be seen in Beesdo-Baum et al. [27], including supplements, and in Lieb et al. [28].

Table 1. Sex, educational level, and social class of the EDSP baseline sample ($N = 3021$)

Sex	N (%wt)	Educational level	N (%wt)	Social class	N (%wt)
Male	1533 (50.7)	low	443 (14.7)	low	24 (1.0)
Female	1488 (49.3)	middle	740 (24.5)	middle	2841 (94.0)
		high	1748 (57.9)	high	96 (3.2)
		other	90 (3.0)	none	60 (1.9)

%wt percentage based on sample weights

Cumulated lifetime incidence of specific TEs

Of the 3021 subjects assessed, 513 reported having been physically attacked (16.3%, males 23.8%, females 8.9%, OR = 0.3, 95% CI 0.2–0.4). A total of 139 subjects reported that

they had been raped or sexually abused (5.2%, males 0.6%, females 9.6%, OR = 16.8, 95% CI 8.0–35.1). While 399 subjects reported having experienced a serious accident (13.7%, males 17.4%, females 10.0%, OR = 0.5, 95% CI 0.4–0.7), 310 reported having witnessed somebody else experiencing a TE (10.2%, males 14.1%, females 6.3%, OR = 0.4, 95% CI 0.3–0.6). The remaining three TEs, war experience, imprisoned/taken hostage/kidnapped, and natural disasters, were reported by 0.7%, 1.8%, and 0.4%, respectively.

Specific DSM-IV TEs as risk factors for an SA

All four TEs we analyzed increased the risk of an SA, adjusted for confounders. As shown in Table 1, rape/sexual abuse had the highest hazard ratio (HR) at 9.6, followed by being physically attacked (HR = 3.8), serious accident (HR = 3.1), and witnessing someone else experiencing a TE (HR = 2.3). Of the four reported TEs there was one significant interaction effect with sex ($HR_{\text{female/male}} = 0.2$, 95% CI 0.04–0.51). Males who reported being raped/sexually abused were at increased risk of a subsequent SA (HR = 69.9, 95% CI 21.8–224.0) compared to females who reported being raped/sexually abused (HR = 5.7, 95% CI 2.8–11.3).

Table 2. Risk associations between a prior traumatic event and a subsequent suicide attempt, adjusted for sex, age cohort, any other prior traumatic event, and any prior/concurrent DSM-IV mental disorder

Traumatic Event	HR	95% CI	AF	95% CI	PAF	95% CI
Physically attacked	3.8	(2.3–6.2)	73.5	(53.4–85.0)	23.5	(10.8–37.2)
Rape/sexual abuse	9.6	(4.7–19.3)	89.6	(76.8–95.3)	19.7	(8.8–31.1)
Serious accident	3.1	(1.7–5.7)	67.9	(36.5–83.8)	14.2	(3.7–26.6)
Witnessed trauma	2.3	(1.1–4.5)	56.0	(5.6–79.6)	6.9	(0.2–16.2)

HR Hazard ratio; *CI* confidence interval; *AF* attributable fraction; *PAF* population attributable fraction

Number of DSM-IV TEs as a risk factor for an SA

An increase in the number of prior TEs was positively associated with a subsequent SA. Compared to those with no prior TE, one prior TE increased the SA risk by 110% (HR =

2.1, 95% CI 1.2–3.7), two prior TEs led to an increased risk of 120% (HR = 2.2, 95% CI 1.08–4.5), and three or more prior TEs increased the SA risk by 380% (HR = 4.8, 95% CI 2.5–9.2). Overall a linear trend was observed (HR = 2.9, 95% CI 1.8–4.6); that is, on average the risk of a subsequent SA linearly increased with each increasing number of TEs. All analyses were adjusted for sex, age cohort, and any prior or concurrent DSM-IV mental disorder.

Attributable fractions

As can be seen in Table 1, the AF ranged between 89.6% (rape/sexual abuse) and 56% (witnessing someone else experiencing a TE); the PAF ranged between 23.5% (being physically attacked) and 6.9% (witnessing someone else experiencing a TE).

Discussion

We reported on four specific TEs, which all increased the risk of an SA in a community sample of adolescents and young adults. Also, the higher the number of prior TEs the higher the risk of an SA. The analysis of attributable proportions showed that, among subjects exposed to a TE, between 56% and 90% of SAs were attributable to the respective TE. On the population level, between 6.9% and 23.5% were attributable to the respective TE.

Our result regarding the TE of being physically attacked (HR = 3.8) is in line with previous work using large community samples of both adults and adolescents, for example, Afifi et al. [15], Bruffaerts et al. [44], and Gomez et al. [17], who reported adjusted ORs for physical abuse between 2.4 (adults) and 5.8 (adolescents). Equally, our result regarding rape/sexual abuse (HR = 9.6) is in line with previous work, [7, 17, 44] where ORs ranged between 3.8 in adult samples and 9.8 in samples of adolescents/young adults. However, we are not aware of another study reporting an interaction effect between this TE and sex. Fergusson et al. [24] tested an interaction effect, which was not significant, between

childhood sexual abuse and sex for a 30-year longitudinal birth cohort study of over 900 adolescents and young adults. Our interaction effect suggested males are at higher risk of an SA than females if they have experienced rape or sexual abuse. Though speculative, this finding might suggest that males and females cope differently with this highly disturbing experience. Notably, a similar pattern (higher risk estimates and larger CIs in males than in females) can be seen in Molnar et al. [25], who reported risk estimates of rape and sexual molestation prior to age 18 for males and females, separately, due to multiple significant interaction terms in their data.

The findings of many previous studies that the number of prior TEs is a risk factor for a subsequent SA (e.g., [15, 19, 44, 45]) is confirmed by our study, with risk estimates of 2.6 and 5.5 well within the previously reported range of 2.3 to 6.4 (adults) and 2.3 to 5.4 (adolescents). Notably, Borges et al.'s [45] reported risk estimates for exactly one, two, and three or more TEs in a representative sample of 3005 Mexican adolescents are remarkably similar to our results, with exactly one and exactly two TEs being almost identical to one another (2.3 and 2.4 vs. our result of 2.1 and 2.2), and with three or more TEs being higher (5.4 vs. our result of 4.8).

The TE serious accident has never been reported as a specific risk factor for SA in a community sample of adolescents and young adults. Instead, whenever it was assessed, it was part of a composite variable [45] or subsumed in the number of TEs [19]. However, this particular TE might be of considerable importance. In a study of survivors of life-threatening accidents, Grossman et al. [46] reported that 15- to 24-year-olds had the highest accident rate (60%), compared to 25- to 44-year olds (29%) and to those older than 45 years (12%), and traffic accidents, one type of life-threatening accident, are the leading cause of death for 15- to 29-year-olds [1]. Together, this suggests that there might be a considerable number of accident survivors in this age group who, if not sufficiently supported after such an event, might attempt suicide some time later. Our results show that survivors of serious accidents

had more than threefold the risk of an SA compared to their counterparts who had not had a serious accident.

As for the TE of having witnessed somebody else experiencing a TE, we found just one study, by Nrugham et al. [20], that followed up on a subsample of 252 “mainly depressed” adolescents and young adults for 5 years. The authors reported no association with a subsequent SA. Again, as with serious accidents, witnessing a TE yielded a significant risk estimate in our study, with adolescents and young adults having a more than twofold risk of an SA compared with the nonexposed group. The Nrugham et al. [20] study cannot be compared to our study, as they are too different, for example, in sample size (252 vs. 3021), sample origin (screened depressive vs. community), and measurement of the TEs (constructed with interviewer’s scores vs. direct self-report by study subjects). We found two studies of interest when we turned to adult studies. Afifi et al. [15] reported the witnessing of domestic violence to be a risk factor for SA in women (1.8-fold) yet not in men, using a representative U.S. sample of almost 5700 adults. Other than childhood abuse (sexual and physical), witnessing domestic violence was the only TE reported in the study. Choi et al. [22] found domestic violence not to be a risk factor for SA in an adult U.S. sample, using a case-control design. Our result of a 1.8-fold risk of an SA in adolescents and young adults in the community therefore awaits replication by other studies.

Our estimates of attributable proportions indicate potential prevention effects, that is, prevention of the outcome as a consequence of preventing the causal risk factor beforehand. Of course we cannot infer causality from an observational study. Nonetheless, the two measures, AF and PAF, implicitly assume causality, thereby offering an impression of potential prevention effects, that is, the proportion of SAs that might be prevented if the TE, for example, child sexual abuse [47], sexual assault [48], or child maltreatment [49], was prevented beforehand.

On the level of the target population of our study, we estimated AFs between 6.9%

and 23.5%. The two highest estimates of 23.5% for being physically attacked and 19.7% for rape/sexual abuse are comparable to other PAFs reported in the literature, being between 9% and 25% (e.g., [14, 15, 22, 24, 25]). Our results being at the upper end of the range can be explained both with differing rates of the respective TEs, which influence the PAF result, and with restrictions concerning the life period to which the TE item refers (childhood vs. childhood/adolescence/young adulthood). Our PAF estimate of 14.2% for the TE serious accident is preliminary and awaits replication. The PAF for the TE witnessing someone else experiencing a TE in our study (6.9%) can be compared only indirectly with the results from Afifi et al. [15], who reported a possible 10% reduction in SAs among adult females if witnessing domestic violence had been prevented from ever occurring and it being causal for the SA. The PAF was not reported for adult males, as their risk estimate did not reach significance.

On the level of those being exposed to a specific TE, AFs ranged between 56% and 90%. Although there are no other AFs in the literature to which we could compare our results, we want to emphasize the use of them at this point. This emphasis is also supported by a recent review by Zalsman et al. [50] on suicide prevention strategies, which recommends future suicide prevention research “focus on specific targeted populations,” for example, populations that are at increased risk of being exposed to traumatic experiences. The recommendation by Zalsman et al. [50] also stressed “that each specific risk group might need a tailored preventive approach,” which might also be true of TEs, in terms of type of event, duration of exposure, age and sex of the trauma victim, and sociocultural background [51].

Our finding of rape/childhood sexual abuse apparently being more predictive of an SA than other TEs warrants an explanation. It might be possible that TEs differently evoke the feeling of being entrapped in one’s recurrent thoughts and memories of the TE [12], as explained in the introduction of this report. If this was true, further possible consequences of the TE, e.g. decline in mental and/or physical health, might be more likely for victims of some

specific TEs compared to other TEs. Further factors might be hypothesized to ensue with different likelihoods according to the specific TE, e.g. a strong perception of being a burden to others and a reduced fear of death, which the Interpersonal Theory of Suicide (IPST) [13] posits to contribute to what Joiner [13] terms “acquired capability of suicide”.

The results of this study have both theoretical and practical implications. Future research should address the risk of specific TEs for future SAs in adolescents and young adults. TEs that have been investigated rarely in the past, e.g. serious accidents and trauma witness, might be of particular interest, in order to accumulate robust evidence whether or not such TEs qualify as independent risk factors for SA in the young general community. Furthermore, testing some of the suggested causal mechanisms between TEs and SA might be interesting, e.g. whether specific TEs show similar or different associations to the magnitude of perceived fear of death [13], explicitly including in such research the category of multiple experiences of TEs. Practically, our results may encourage practitioners to routinely ask their clients for the experience of specific TEs, even if the reason for consultation might not be such an experience, and to inquire about SI and SA whenever a TE question has been confirmed.

Taken together, our results support the view that specific TEs should be put on the list of potent risk factors for SA (see also Bruffaerts et al. [52]). Additionally, when considering TEs as risk factors for SA, there is consistent evidence, including from our study, that the number of TEs can be regarded as a risk factor for subsequent SA in its own right.

The present study has the following limitations. First, for some subjects the first reported SA might not have been the first lifetime SA. Since we do not know the exact number of such subjects, we could not adjust our analyses for a previous SA. Second, we were not able to estimate the effect of three of eight TEs on the risk of SAs, due to an insufficient number of cases, and third, we had to combine the two TEs, rape and sexual abuse, for the same reason. Fourth, the AFs and PAFs are estimates, which inherently contain

causal assumptions, which is why they must be interpreted with caution. Fifth, the TEs in this study are specific, in terms of how they were assessed in section N of the DIA-X/M-CIDI.

Theoretically, they could be further specified, e.g. subdividing a serious accident into car and non-car accidents. However, with SA having a low base rate, practically this requires a much higher sample size, in order to maintain sufficient statistical power. Sixth, we didn't ask all suicide attempters of their intent to die as a result of their SA, which is why we can't evaluate whether intent to die was greater than zero in SA cases.

The strengths of this study are the following. First, we used data that were prospectively assessed for a period of 10 years, with the vast majority (> 70%) being assessed up to and including the last wave of the study. Second, we adjusted our analyses for sex, age cohort, any other prior TE, and any mental disorder being present either prior to or within the same assessment wave as the incident TE used as predictor. Third, in addition to the two TEs being reported most frequently in the literature (sexual abuse and physical abuse), we reported two TEs that have either never (serious accidents) or just once (witnessed trauma) been reported for community adolescents and young adults. Fourth, we reported PAFs for a young community sample, which are reported rarely for some TEs and which have never been reported for serious accidents. Fifth, to the best of our knowledge, we have been the first to report AFs for a young community sample in the context of specific TEs and SA.

Conflict of Interest

The authors declare they have no conflict of interests.

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