# Karolinska Interpersonal Violence Scale Predicts Suicide in Suicide Attempters

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***Background:*** Both childhood trauma and violent behavior are important risk factors for suicidal behavior. The aim of the present study was to construct and validate a clinical rating scale that could measure both the exposure to and the expression of violence in childhood and during adult life and to study the ability of the Karolinska Interpersonal Violence Scale (KIVS) to predict ultimate suicide in suicide attempters.

***Method:*** A total of 161 suicide attempters and 95 healthy volunteers were assessed with the KIVS measuring exposure to violence and expressed violent behavior in childhood (between 6–14 years of age) and during adult life (15 years or older). The Buss-Durkee Hostility Inventory (BDHI), "Urge to act out hostility" subscale from the Hostility and Direction of Hostility Questionnaire (HDHQ), and the Early Experience Questionnaire (EEQ) were used for validation. All patients were followed up for cause of death and a minimum of 4 years from entering in the study.

***Results:*** Five patients who committed suicide within 4 years had significantly higher scores in exposure to violence as a child, in expressed violent behavior as an adult, and in KIVS total score compared to survivors. Suicide attempters scored significantly higher compared to healthy volunteers in 3 of the 4 KIVS subscales. There were significant correlations between the subscales measuring exposure to and expression of violent behavior during the life cycle. BDHI, Urge to act out hostility, and EEQ validated the KIVS.

***Conclusions:*** Exposure to violence in childhood and violent behavior in adulthood are risk factors for completed suicide in suicide attempters. Behavioral dysregulation of aggression is important to assess in clinical work. The KIVS is a valuable new tool for case detection and long-term clinical suicide prevention.

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A recent World Health Organization report provided a 1-year worldwide estimate of one million people dying from suicide.[1] Attempted suicide is 10 to 40 times more frequent than completed suicide and is one of the strongest predictors of subsequent suicide.[2] Another suicide predictor is homicidal behavior. In a recent long-term, population-based study of 167 Swedish homicide offenders followed up for 26 years, over 17% of the homicide offenders committed suicide.[3] The well-documented association between suicide and the serotonin system has been suggested to be mediated by aggression dyscontrol.[4] Murderers who had made suicide attempts had significantly lower mean serotonin metabolite 5-hydroxyindoleacetic acid (5-HIAA) levels in the cerebrospinal fluid (CSF) than murderers without suicidal behavior.[5]

Assessment of risk is important for suicide prevention, and suicide attempters are an obvious clinical high-risk group.[2] Additional predictors are needed to assist the clinician in focusing on suicide attempters most at risk. Even though CSF 5-HIAA level was a better predictor of early suicide than scores on the Beck Suicide Intent Scale (SIS) or the Beck Hopelessness Scale (BHS) in male suicide attempters,[6] it is strongly influenced by previous medication and therefore impractical for clinical use.

Psychological autopsy studies have found higher levels of aggression in individuals who die by suicide than in living psychiatric control subjects,[7,8] and impulsivity-aggression is a putative mediator of suicide risk.[9] Both childhood exposure to violence and aggressive behavior are considered important risk factors for suicidal behavior.[10] Early relationships in childhood are believed to determine neurobiological organization and subsequent social interaction patterns.[11] Traumatic experiences may not only have immediate effects on a child's behavior but also increase vulnerability to mental disorders, including suicidal behavior, in adulthood.[11–13]

There is a need for validated assessment tools for violence exposure and expression of violent behavior that can be easily administered in a nonintrusive way. Earlier studies have used different scales to assess childhood trauma (for example, the Childhood Trauma Questionnaire[14]) and lifetime aggression (for example, the Brown-Goodwin History of Aggression,[15] or the Buss-Durkee Hostility Inventory[16]). Previous scales do not differentiate well between aggressive acts on one hand and aggressive thoughts and feelings on the other. Since the evidence that links serotonin and suicidal behavior is mainly concerned with acts, and not with thoughts or feelings, we hypothesized that it might be important to make the same type of differentiation in the assessment of aggression, that is, to focus on violent acts.

The aim of the present study was to construct and validate a clinical rating scale that could measure both the exposure to and the expression of violence in childhood and during adult life and to assess the ability of this scale to predict ultimate suicide in suicide attempters.



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## METHOD

### The Karolinska Interpersonal Violence Scale (KIVS)

The Karolinska Interpersonal Violence Scale contains 4 rating scales assessing exposure to violence and expressed violent behavior in childhood (between 6–14 years of age) and during adult life (15 years or older). The scales are presented in Appendix 1. The ratings are based on a semistructured interview. Questions refer to "serious events that may have happened to you during your lifetime." The items were scored 0–5. Interviews and ratings (0–5 for each subscale, total 20) were performed and assessed by trained clinicians.

### Reliability and Validity Measures

An interrater reliability analysis was performed to determine consistency between 2 raters. The second rater watched and rated blindly videotaped patient interviews performed by the first rater. The Buss-Durkee Hostility Inventory [BDHI],[16] "Urge to act out hostility" subscale from the Hostility and Direction of Hostility Questionnaire (HDHQ)[17] and the Early Experience Questionnaire (EEQ)[18] were used for validation of the Karolinska Interpersonal Violence Scale (Swedish version). The EEQ includes 7 items that reflect aggressive behavior prior to the age of 12 years and 8 buffer items regarding family and neighborhood, selected from scales measuring childhood adjustment.

### Study Setting

Two subject groups participated in the study: (1) patients having their clinical follow-up after a suicide attempt at the Suicide Prevention Clinic at the Karolinska University Hospital who participated in 2 studies of biologic and psychological risk factors for suicidal behavior and (2) healthy volunteers specially recruited for the study. The Regional Ethical Review Board in Stockholm approved the study protocols (Dnr 93-211 and Dnr 00-194), and the participants signed informed consent forms.

### Participants

***Patients.*** A total of 161 suicide attempters (63 men and 98 women) who were administered the KIVS were enrolled in the study. Inclusion criteria were a recent suicide attempt (a time limit of 1 month), fair capacity to communicate verbally and in writing in the Swedish language, and an age of 18 years or older. Exclusion criteria were schizophrenia spectrum psychosis, dementia, mental retardation, and intravenous drug abuse.

A suicide attempt was defined as a self-destructive act with some degree of intent to die. Suicide attempt method was defined violent according to the criteria of Träskman et al.[19] Thirty-two patients (20%) had used a violent suicide attempt method. The mean age of patients was 35 years (SD = 12.1; range, 18–69). The mean age did not differ between men and women. The participants were interviewed by a trained psychiatrist using the Structured Clinical Interview for *DSM-IV* Axis I Disorders (SCID-I), Research Version,[20] to establish *DSM-IV* diagnosis. Trained clinical psychologists established Axis II diagnoses with a SCID II interview.[21] Ninety-four percent of participants had at least 1 current Axis I psychiatric diagnosis.

Seventy-eight percent of patients fulfilled criteria for mood disorders (unipolar; major depressive disorder, single episode or recurrent; bipolar disorder, depressed; or dysthymic disorder); 5%, for adjustment disorder; and 5%, for anxiety disorders (half of them [2.5%] with posttraumatic stress disorder). Three percent of patients had a substance-related disorder. Twenty-five percent of the patients had a comorbid lifetime diagnosis of substance-related disorder (83% with alcohol dependence). Among Axis II diagnoses, 59 patients (36.6%) fulfilled criteria for a personality disorder, 47% of them in Cluster B.

Assessment of mortality. All patients were followed up for mortality and cause of death. All deaths that occurred between study enrollment and January 2009 were included. The patients who died within the follow-up period were identified, and the causes of death were obtained from Statistics Sweden, which keeps the National Swedish Cause of Death Register for the National Board of Health and Welfare. Nine suicides, 3 women and 6 men, were ascertained from the death certificates. The follow-up time ranged between 4 and 15 years (mean = 9.5 years). Time between inclusion in study and suicide ranged between 609 and 4,352 days (mean = 1,610 days, or 4.4 years). All patients were followed up at least 4 years, 5 of 9 suicides occurred within 4 years from the inclusion in the study. To account for the variable period of observation for different members of the cohort after 4 years, these 5 suicides were analyzed separately.

***Healthy volunteers.*** Ninety-five healthy volunteers (38 men and 57 women) were recruited for this study and screened by a psychiatrist to verify the absence of current mental disorder. The mean age for healthy volunteers was 40 years (SD = 11; range, 18–63).

### Statistical Methods

Characteristics of the population were described by using the mean, the median, and the range for quantitative variables. For the correlation studies between KIVS subscale ratings and KIVS total ratings and BDHI, HDHQ, and EEQ ratings as well as for interrater reliability, Pearson partial correlation coefficients were used. Most of the variables were positively skewed (ie, many low ratings). Therefore, nonparametric statistics was applied for between-group comparisons, patients vs healthy controls, and suicide victims vs survivors.

To account for the variable period of observation for different members of the cohort, we assessed the suicide risk within 4 years from entering the study. Survival analysis of suicide risk (Kaplan-Meier) was calculated as the ratio of the number of suicides occurring during each time interval to the number of cases at risk, ie, that entered the respective interval alive. Time censoring for survival analysis: all participants were followed up at least 4 years except for those who died earlier.

A logistic regression analysis was performed to control for comorbid substance abuse diagnosis and personality

disorder diagnosis. An ad hoc receiver-operating characteristic (ROC) analysis was used to find optimal thresholds for KIVS subscales to predict suicide. ROC curves and tables were created for KIVS subscales to establish the optimal cut-off values. ROC areas under the curves (AUCs) were calculated as a measure of the diagnostic performance, and differences were calculated and tested according to the methods of Hanley and McNeil.[22] The cutoff point that optimized sensitivity (proportion of patients correctly identified) and specificity (proportion of controls correctly identified) was used.[23] Pearson $\chi^2$ and Fisher exact test were used for cross tabulations of categorical variables. Statistical analyses were performed using JMP VI software (SAS Institute Inc, Cary, North Carolina). The *P* value was set at < .05.

## RESULTS

### Reliability and Validity Measurements

The interrater reliability for the KIVS subscales were as follows: expressed violent behavior in childhood $r = 0.91$, $P < .0001$ (N = 15); exposure to violence as child $r = 0.93$, $P < .0001$ (N = 15); expressed violent behavior in adulthood $r = 0.92$, $P < .0001$ (N = 15); and exposure to violence as adult $r = 0.95$, $P < .0001$ (N = 15).

**Table 1. Correlations Between KIVS Subscales and the BDHI Subscales, EEQ, and HDHQ's "Urge to Act Out Hostility" Subscale**

| | KIVS Subscale | | | | |
|---|---|---|---|---|---|
| Scale | Expressed Violent Behavior During Childhood | Exposure to Violence During Childhood | Expressed Violent Behavior as Adult | Exposure to Violence as Adult | KIV Total |
| BDHI | | | | | |
| Assault | 0.19 | 0.13 | 0.39‡ | 0.34† | 0.38‡ |
| Indirect hostility | 0.19 | 0.25* | 0.26* | 0.30† | 0.36‡ |
| Irritability | 0.11 | 0.42§ | 0.08 | 0.12 | 0.26* |
| Negativism | 0.20 | 0.10 | 0.13 | 0.18 | 0.21 |
| Resentment | 0.14 | 0.42§ | 0.34† | 0.27* | 0.43§ |
| Suspicion | −0.09 | 0.28† | 0.09 | 0.21 | 0.19 |
| Verbal hostility | 0.04 | 0.003 | 0.26* | 0.31† | 0.28† |
| Guilt | −0.06 | 0.26* | 0.17 | 0.17 | 0.19 |
| EEQ | 0.31† | 0.18 | 0.18 | 0.15 | 0.27* |
| HDHQ subscale "Urge to act out hostility" | 0.10 | 0.34† | 0.31† | 0.29† | 0.38‡ |

*$P < .05$. †$P < .01$. ‡$P < .001$. §$P < .0001$.
Abbreviations: BDHI = Buss-Durkee Hostility Inventory, EEQ = Early Experience Questionnaire, HDHQ = Hostility and Direction of Hostility Questionnaire, KIVS = Karolinska Interpersonal Violence Scale.

**Table 2. Karolinska Interpersonal Violence Scale (KIVS) Ratings in 161 Suicide Attempters and 95 Healthy Volunteers**

| | Suicide Attempters | | | | Healthy Volunteers | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Rating | Mean | Median | SD | Range | Mean | Median | SD | Range | Statistic |
| Expressed violent behavior during childhood (6–14 years of age) | 0.72 | 1 | 0.78 | 0–5 | 0.58 | 1 | 0.77 | 0–4 | $Z = -1.7$, $P < .086$ |
| Expressed violent behavior as adult (> 15 years of age) | 1.25 | 1 | 1.2 | 0–5 | 0.43 | 0 | 0.74 | 0–3 | $Z = -5.6$, $P < .0001$ |
| Exposure to violence during childhood (6–14 years of age) | 2.00 | 2 | 1.4 | 0–5 | 1.30 | 0 | 0.92 | 0–5 | $Z = -6.2$, $P < .0001$ |
| Exposure to violence as adult (> 15 years of age) | 2.10 | 2 | 1.5 | 0–5 | 0.98 | 0 | 1.40 | 0–5 | $Z = -5.7$, $P < .0001$ |
| KIV total | 6.00 | 6 | 3.5 | 0–15 | 2.90 | 2 | 2.96 | 0–17 | $Z = -7.0$, $P < .0001$ |

**Table 3. Correlations Between the Karolinska Interpersonal Violence Scale (KIVS) Subscales Measuring Exposure to and Expression of Violent Behavior in Suicide Attempters (n = 161)**

| | Expressed Violent Behavior During Childhood | Expressed Violent Behavior as Adult | Exposure to Violence as Adult | Expressed Violent Behavior Total |
|---|---|---|---|---|
| Exposure to violence during childhood | 0.19† | 0.27‡ | 0.41§ | |
| Expressed violent behavior during childhood | | 0.35§ | 0.20† | |
| Exposure to violence total | | | | 0.41§ |

†$P < .01$. ‡$P < .001$. §$P < .0001$.

The correlations between the KIVS subscales and the BDHI scales (assault, indirect hostility, irritability, negativism, resentment, suspicion, verbal hostility and guilt), EEQ, and Urge to act out hostility subscale are shown in Table 1. Expressed violent behavior during childhood showed a significant correlation to EEQ ($r = .31$, $P < .006$).

### Suicide Attempters and Healthy Volunteers

As expected, suicide attempters scored significantly higher compared to healthy volunteers in 3 of 4 KIVS subscales as well as KIVS total scores, Table 2. However, there was no significant difference in the ratings of expressed violent behavior as child between the suicide attempters and healthy volunteers ($Z = -1.7$, $P < .086$). When analyzing male suicide attempters and healthy volunteers separately, male suicide attempters had a higher rating of expressed violent behavior as a child ($Z = -2.4$, $P < .018$).

There were significant correlations between the subscales measuring exposure to and expression of violent behavior. The correlations between the KIVS subscales in suicide attempters are shown in Table 3. Gender-specific correlations are shown in Table 4.

In suicide attempters, there was a significant difference between men and women in expressed violent behavior during childhood ($Z = 4.5$, $P < .0001$), men having higher ratings compared to women. There were no gender differences in ratings of other subscales. The correlations between the KIVS ratings and age were nonsignificant. The



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**Table 4. Gender-Specific Correlations Between the Karolinska Interpersonal Violence Scale (KIVS) Subscales Measuring Exposure to and Expression of Violent Behavior in Suicide Attempters (n = 161)[a]**

| | Exposure to Violence During Childhood | Expressed Violent Behavior During Childhood | Exposure to Violence as Adult | Expressed Violent Behavior as Adult |
|---|---|---|---|---|
| Exposure to violence during childhood | | **0.30*** | **0.41‡** | **0.35†** |
| Expressed violent behavior during childhood[b] | 0.14 | | **0.25*** | **0.42‡** |
| Exposure to violence as adult | 0.41§ | 0.16 | | **0.49§** |
| Expressed violent behavior as adult | 0.24* | 0.32† | 0.38§ | |

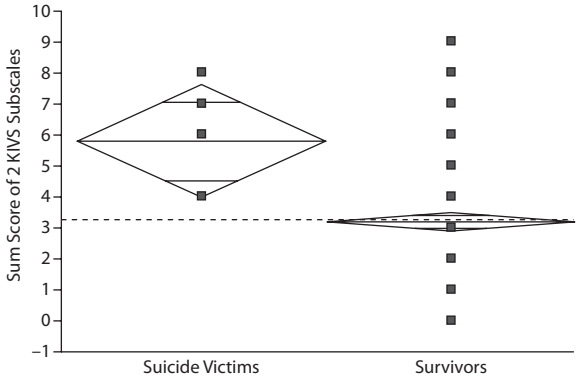
[a]**Bolded** values represent men; nonbolded, women.
[b]There was a significant difference between men and women in expressed violent behavior during childhood ($Z = 4.5$, $P < .0001$), men having higher ratings compared to women. There were no gender differences in ratings of other subscales.
*$P < .05$. †$P < .01$. ‡$P < .001$. §$P < .0001$.

**Table 5. Correlations Between the Karolinska Interpersonal Violence Scale (KIVS) Subscales Measuring Exposure to and Expression of Violent Behavior in Healthy Volunteers (n = 95)**

| | Expressed Violent Behavior During Childhood | Expressed Violent Behavior as Adult | Exposure to Violence as Adult | Expressed Violent Behavior Total |
|---|---|---|---|---|
| Exposure to violence during childhood | 0.28† | 0.34‡ | 0.33‡ | |
| Expressed violent behavior during childhood | | 0.40§ | 0.36‡ | |
| Exposure to violence total | | | | 0.49§ |

†$P < .01$. ‡$P < .001$. §$P < .0001$.

**Figure 1. Distribution of the Sum Score of the 2 Predictive Karolinska Interpersonal Violence Scale Subscales in Suicide Victims and Survivors**




subscale intercorrelations for healthy volunteers are shown in Table 5. There were no gender differences in ratings of KIVS subscales in healthy volunteers.

### Suicides

Nine suicides (5.6%): 3 women (3.1%) and 6 men (9.5%) ($P = .084$, Fisher exact test) occurred during the mean follow-up time of 9.5 years (range, 4–15 years). All patients were followed up at least 4 years. Five suicides, 1 woman and 4 men, occurred within 4 years, and subsequent analysis concerns the patients who committed suicide within 4 years of entering the study.

The 5 patients who committed suicide within 4 years had significantly higher KIVS scores of exposure to violence as a child ($Z = 2.0$, $P < .042$), expressed violent behavior as an adult ($Z = 2.4$, $P < .015$), KIVS total expressed violence scores ($Z = 2.1$, $P < .037$), and KIVS total scores ($F = 2.1$, $P < .038$) than survivors (N = 156). There was a trend for total exposure scores to be higher in suicide victims compared to survivors ($Z = 1.8$, $P < .079$).

Figure 1 shows the distribution of the sum score of the 2 predictive KIVS subscales: exposure to violence as a child and expressed violent behavior as an adult in suicide victims and survivors.

To estimate which cutoff score of exposure to violence as a child optimally predicts suicide, we analyzed the ROC curves and the ROC tables for the 5 suicide victims. The ROC analysis revealed that a cutoff score of 3 gave specificity of 65% and sensitivity of 80%. The positive predictive value was 7% and the area under the curve (AUC) was 0.76. Corresponding figures for expressed violent behavior as an adult: a cutoff score of 3 gave specificity of 88% and sensitivity of 60%. The positive predictive value was 14% and the AUC was 0.80.

Survival analysis of the cumulative suicide risk over 4 years was 3.2%. Using median split of scores of the KIVS subscales' exposure to violence as a child and expressed violent behavior as an adult, the suicide risk at 2 years was 2.6% for those with KIVS rating above median vs 0% for below median ($P < .24$, NS), and at 4 years was 6.2% vs 0% ($P = .035$).

Standard logistic regression analyses were conducted with each of the 2 predictive KIVS subscales (exposure to violence as a child and expressed violent behavior as an adult) and the following factors: comorbid substance abuse diagnosis, comorbid personality disorder diagnosis, and gender as predictors of suicide. The regression model with exposure to violence as a child showed a trend to reach statistical significance, $\chi^2_4 = 8.6$, $P = .08$. Exposure to violence as a child was the only statistically significant predictor of suicide in the regression model, Table 6. The regression model with expressed violent behavior as an adult was significant, $\chi^2_4 = 11.4$, $P = .02$. The expressed violent behavior as an adult was the only statistically significant predictor for suicide in the regression model, Table 7.

Thirty-two patients (20%), 18 men (29%) and 14 women (14%) had used a violent suicide attempt method ($P = .023$, Fisher exact test). Suicide attempters with a violent suicide attempt method had significantly higher scores of expressed

**Table 6. Childhood Exposure to Violence and Predictors of Suicide in Patients Who Completed Suicide Within 4 Years[a]**

| Predictor | $\chi^2$ | *P* Value | Odds Ratio |
|---|---|---|---|
| Exposure to violence as child | 4 | .045 | 2.3 |
| Comorbid substance abuse diagnosis | 0.5 | .49 | 0.7 |
| Comorbid personality disorder diagnosis | 0.1 | .99 | 1.0 |
| Gender | 3.4 | .066 | 0.3 (female) |

[a] $\chi^2_4 = 8.6$, $P = .079$.

**Table 7. Violence Expressed as an Adult and Predictors of Suicide in Patients Who Completed Suicide Within 4 Years[a]**

| Predictor | $\chi^2$ | *P* Value | Odds Ratio |
|---|---|---|---|
| Expressed violence as adult | 5.5 | .019 | 3.7 |
| Comorbid substance abuse diagnosis | 1.8 | .18 | 0.3 |
| Comorbid personality disorder diagnosis | 0.7 | .40 | 0.6 |
| Gender | 2.9 | .096 | 0.4 (female) |

[a] $\chi^2_4 = 11.4$, $P = .022$.

violent behavior as an adult ($Z = 2.6$, $P < .01$) as well as lifetime violence expression scores ($Z = 2.6$, $P < .009$) than suicide attempters who had used a nonviolent suicide attempt method.

## DISCUSSION

In the present study, we assessed the lifetime exposure to violence and expressed violent behavior by using a new clinical rating scale, the Karolinska Interpersonal Violence Scale (KIVS), in suicide attempters and healthy volunteers. To our knowledge, this is the first study to use a combined structured clinical instrument in assessing exposure to violence and expressed violent behavior during the life cycle. Both the exposure and expression were assessed during the semistructured interviews by trained clinicians. The interrater reliability was high. The Buss-Durkee Hostility Inventory, "Urge to act out hostility" subscale from the HDHQ, and the EEQ were used for validation of the KIVS subscales. Most of the correlations between the KIVS total scores and BDHI scales were significant, and expressed violent behavior during childhood showed a significant correlation to EEQ, which measures aggressive behavior before the age of 12.

Interestingly, the patients who committed suicide within 4 years had significantly higher scores of exposure to violence as a child and in expressed violent behavior as an adult than survivors regardless of comorbid substance abuse or personality disorder diagnosis. Furthermore, suicide victims scored higher in KIVS total expressed violence and in KIVS total score. Violent behavior in the last year of life was a significant predictor of suicide in the study of Conner et al.[24] Psychological autopsy studies have found higher levels of aggression in individuals who die by suicide than in living psychiatric control subjects.[7,8] Depressed patients who had attempted suicide had significantly higher scores of retrospectively assessed childhood trauma and aggression traits than depressed patients who had never attempted suicide.[25] In the study of Botsis et al,[26] the exposure to family violence and behavioral problems in patients correlated with suicide and violence risk measures. In a recent population-based birth cohort study,[10] those who were frequently bullying others and those who were frequently the victims of bullying at the age of 8 were at significantly higher risk for later suicidal behavior (suicide attempts or completed suicide) before age of 25 compared with children who were not involved in bullying behavior. Impulsive-aggressive behaviors represent an intermediate endophenotype of suicide,[27] and recent research has pointed out the role of abuse in the familial transmission and elicitation of impulsive-aggressive behavior in suicide.[28]

Greater lifetime aggression is associated with nonfatal suicide attempts in prospective and cross-sectional studies,[29] and is also particularly associated with attempts with higher medical lethality.[30] More severe lifetime externally directed aggression predicts future suicide attempts.[29] In classification and regression tree (CART) analysis, lifetime aggression was the strongest predictor of having ever made a suicide attempt.[31] To the best of our knowledge, ours is the first study to show that both exposure to violence in childhood and expressed violent behavior in adulthood predict completed suicide in suicide attempters. It should be noted that corporal punishment of children has been criminalized in Sweden since 1979 and is commonly seen as nonaccepted behavior.

Survival analysis of the cumulative suicide risk revealed that high KIVS scores did not predict short-term suicide risk; rather, it was at 4 years the finding was significant, indicating that high scores of exposure to violence as a child or expressed violent behavior as adult place suicide attempters in a higher long-term risk category for an eventual suicide. Our analysis of all 9 suicides (data not shown) was very similar even though the conclusions cannot be drawn due to differences in time at risk.

Violent suicide attempters reported significantly higher scores in expressed violent behavior as adult. Violent suicide method was associated with a higher level of lifetime aggression and a higher level of impulsivity.[7] Since the early work of Åsberg et al,[32] suicide method has been used in neurobiologic studies of suicide attempters to select subjects who are more likely to have low indexes of serotonergic neurotransmission, which in turn tend to correlate with higher levels of aggression. Childhood trauma may have an effect on central monoamine function as an adult.[33]

Moreover, it was found, as hypothesized, that suicide attempters had significantly higher KIVS total scores for exposure to violence and expressed violent behavior than healthy volunteers. Suicide attempters scored significantly higher compared to healthy volunteers in expressed violent behavior as an adult and exposure to violence as a child and as an adult, but there was no significant difference in the ratings of expressed violent behavior as a child between the suicide attempters and healthy volunteers. These findings are well in line with the literature reporting that childhood trauma is a potent risk factor for developing depression or other mental health problems in adulthood,[34] particularly in response to additional stress, as well as suicidal behavior. The experience of any childhood adversity increases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the risk of attempted suicide in childhood, adolescence, or adulthood 2- to 5-fold.[35] Several externalizing phenotypes have shown positive associations with suicide attempts. In a recent study,[36] disruptive disorders, conduct problems, and childhood aggression—self-reported tendencies to engage in acts of violent character like bullying or threats of violence—contributed to the variance in suicide attempts with childhood abuse history. These traits are related to impulsivity-aggression, a putative mediator of suicide risk.[9]

There were significant correlations between all subscales measuring exposure to and expression of violent behavior in suicide attempters. Exposure to violence in childhood predicted exposure to violence in adulthood, fitting well and confirming the findings of earlier studies concerning revictimization, or the notion that individuals who experience victimization in childhood are at increased risk for subsequent victimization at some point in their lives.[37] Gladstone et al[38] reported the contributory role of childhood sexual abuse to deliberate self-harm and the significance of childhood physical abuse for recent interpersonal violence in depressed women.

Exposure to violence in childhood predicted violent behavior as an adult both in patients and in healthy volunteers. Early traumatization is commonly regarded as a causal or mediating risk factor for aggressive and violent behavior.[39] A study by Krischer and Sevecke[40] reported an association between early physical, but also emotional, traumatic experience and psychopathy measured with the Psychopathy Checklist—Youth Version in detained boys. Osvath et al[41] noted a significant relationship between childhood trauma and Spielberger trait anger in suicide attempters. Brodsky et al[42] reported that both childhood abuse and aggression and impulsivity scores were associated with suicide attempts in depressed patients and concluded that childhood abuse may be a risk factor for the development of aggression and impulsivity as well as suicide attempts. Significant correlations between childhood trauma and aggression measured with the Brown-Goodwin Assessment for Lifetime History of Aggression (BGLHA) and the Childhood Trauma Questionnaire were found in 2 samples of suicide attempters and recently in male prisoners.[43,44] Our findings are in agreement with these studies.

We found a significant difference between men and women in expressed violent behavior during childhood, men having higher ratings compared to women. There were no gender differences in ratings of other subscales. Expressed violent behavior during childhood did not correlate to the exposure to violence as an adult in women with recent suicide attempt. There were no gender differences in ratings of KIVS subscales in healthy volunteers. Men are more violent than women in the general population, but this has not been found to be the case among psychiatric inpatients.[45] There was no difference in lifetime aggression measured with BGLHA between male and female mood disorder patients,[46] and another study[47] reported that women with persistent depressive disorder had higher scores than men on all Aggression factors, especially in Hostility scores measured with the Aggression Questionnaire-Revised Swedish Version (AQ-RSV). The reasons for these exceptions are not fully elucidated. In a recent study,[48] severe mental illness per se did not predict future violence; it was associated instead with historical (past violence, physical abuse), clinical (substance abuse, perceived threats), dispositional (age, gender, income), and contextual (unemployment, recent divorce, victimization) factors.

An interrater reliability analysis was performed to determine consistency between 2 raters using videotaped patient interviews. The interrater reliability was high. By definition, semistructured instruments give latitude in how the question is ascertained. It would have been of interest to see whether KIVS interviews administered by 2 raters evaluating the same patient were also highly correlated. Higher rates in self-reports of violence or another type of stigmatized behavior whether experienced by a victim or caused by a perpetrator have been reported in comparison to clinical interviews and it would be of interest to study if Karolinska Interpersonal Violence Scale subscales can even be used as a self-report instrument.

There has been a lack of violence assessment instruments in clinical suicide risk assessment. In construction of the Karolinska Interpersonal Violence Scale, we wanted to differentiate between violent acts performed in childhood and those that the subject had committed as an adult. Another focus was whether the subjects had been exposed to violent behavior from others, either as children or as adults. As earlier research has shown, the exposure to violence and expression of violent behaviors are clearly associated with each other; an instrument measuring both aspects in the clinical context could be of great value. Our findings indicate that both exposure to violence and expressed violent behavior are important to assess in clinical work and in research. KIVS measures both exposure to violence and expressed violent behavior, is easy to apply in clinical settings, and is a valuable new tool for case detection and clinical long-term suicide prevention. To study if the KIVS can be considered as a behavioral proxy to low serotonergic neurotransmission is worth another study.

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## REFERENCES

1. World Health Organization. *Third Milestones of a Global Campaign for Violence Prevention Report 2007: Scaling Up*. Geneva, Switzerland: WHO; 2007.
2. Tidemalm D, Langstrom NS, Lichtenstein P, et al. Risk of suicide after suicide attempt according to coexisting psychiatric disorder: Swedish cohort study with long term follow-up. *BMJ*. 2008;337:a2205.
3. Jokinen J, Forslund K, Nordström A-L, et al. Suicide risk after homicide in Sweden. *Arch Suicide Res*. 2009;13(3):297–301.
4. Asberg M. Neurotransmitters and suicidal behavior: the evidence from

cerebrospinal fluid studies. *Ann N Y Acad Sci*. 1997;836:158–181.
5. Lidberg L, Belfrage H, Bertilsson L, et al. Suicide attempts and impulse control disorder are related to low cerebrospinal fluid 5-HIAA in mentally disordered violent offenders. *Acta Psychiatr Scand*. 2000;101(5):395–402.
6. Samuelsson M, Jokinen J, Nordström A-L, et al. CSF 5-HIAA, suicide intent and hopelessness in the prediction of early suicide in male high-risk suicide attempters. *Acta Psychiatr Scand*. 2006;113(1):44–47.
7. Dumais A, Lesage AD, Alda M, et al. Risk factors for suicide completion in major depression: a case-control study of impulsive and aggressive behaviors in men. *Am J Psychiatry*. 2005;162(11):2116–2124.
8. McGirr A, Renaud J, Bureau A, et al. Impulsive-aggressive behaviours and completed suicide across the life cycle: a predisposition for younger age of suicide. *Psychol Med*. 2008;38(3):407–417.
9. Turecki G. Dissecting the suicide phenotype: the role of impulsive-aggressive behaviours. *J Psychiatry Neurosci*. 2005;30(6):398–408.
10. Klomek AB, Sourander A, Niemelä S, et al. Childhood bullying behaviors as a risk for suicide attempts and completed suicides: a population-based birth cohort study. *J Am Acad Child Adolesc Psychiatry*. 2009;48(3):254–261.
11. Perry BD, Pollard R. Homeostasis, stress, trauma, and adaptation: a neurodevelopmental view of childhood trauma. *Child Adolesc Psychiatr Clin N Am*. 1998;7(1):33–51, viii.
12. Heim C, Nemeroff CB. The role of childhood trauma in the neurobiology of mood and anxiety disorders: preclinical and clinical studies. *Biol Psychiatry*. 2001;49(12):1023–1039.
13. Lee R. Childhood trauma and personality disorder: toward a biological model. *Curr Psychiatry Rep*. 2006;8(1):43–52.
14. Bernstein DP, Fink L, Handelsman L, et al. Initial reliability and validity of a new retrospective measure of child abuse and neglect. *Am J Psychiatry*. 1994;151(8):1132–1136.
15. Brown GL, Goodwin FK, Ballenger JC, et al. Aggression in humans correlates with cerebrospinal fluid amine metabolites. *Psychiatry Res*. 1979;1(2):131–139.
16. Buss AH, Durkee A. An inventory for assessing different kinds of hostility. *J Consult Psychol*. 1957;21(4):343–349.
17. Foulds GA. *Personality and Personal Illness*. London, UK: Tavistock; 1965.
18. Fishbein DH, Lozovsky D, Jaffe JH. Impulsivity, aggression, and neuroendocrine responses to serotonergic stimulation in substance abusers. *Biol Psychiatry*. 1989;25(8):1049–1066.
19. Träskman L, Asberg M, Bertilsson L, et al. Monoamine metabolites in CSF and suicidal behavior. *Arch Gen Psychiatry*. 1981;38(6):631–636.
20. First MB, Spitzer RL, Gibbon M, et al. *Structured Clinical Interview for DSM-IV-TR Axis I Disorders, Research Version, Patient Edition (SCID-I/P)*. New York, NY: Biometrics Research, New York State Psychiatric Institute; November 2002
21. First MB, Spitzer RL, Gibbon M, et al. The Structured Clinical Interview for DSM-III-R Personality Disorders (SCID-II), part I: description. *J Pers Disord*. 1995;9:83–91.
22. Hanley JA, McNeil BJ. A method of comparing the areas under receiver operating characteristic curves derived from the same cases. *Radiology*. 1983;148(3):839–843.
23. Altman DG, Bland JM. Diagnostic tests, 1: sensitivity and specificity. *BMJ*. 1994;308(6943):1552.
24. Conner KR, Cox C, Duberstein PR, et al. Violence, alcohol, and completed suicide: a case-control study. *Am J Psychiatry*. 2001;158(10):1701–1705.
25. Sarchiapone M, Carli V, Cuomo C, et al. Childhood trauma and suicide attempts in patients with unipolar depression. *Depress Anxiety*. 2007;24(4):268–272.
26. Botsis AJ, Soldatos CR, Liossi A, et al. Suicide and violence risk, I: relationship to coping styles. *Acta Psychiatr Scand*. 1994;89(2):92–96.
27. McGirr A, Alda M, Séguin M, et al. Familial aggregation of suicide explained by cluster B traits: a three-group family study of suicide controlling for major depressive disorder. *Am J Psychiatry*. 2009;166(10):1124–1134.
28. Brodsky BS, Mann JJ, Stanley B, et al. Familial transmission of suicidal behavior: factors mediating the relationship between childhood abuse and offspring suicide attempts. *J Clin Psychiatry*. 2008;69(4):584–596.
29. Oquendo MA, Galfalvy H, Russo S, et al. Prospective study of clinical predictors of suicidal acts after a major depressive episode in patients with major depressive. *Am J Psychiatry*. 2004;161(8):1433–1441.
30. Placidi GP, Oquendo MA, Malone KM, et al. Aggressivity, suicide attempts, and depression: relationship to cerebrospinal fluid monoamine metabolite levels. *Biol Psychiatry*. 2001;50(10):783–791.
31. Mann JJ, Ellis SP, Waternaux CM, et al. Classification trees distinguish suicide attempters in major psychiatric disorders: a model of clinical decision making. *J Clin Psychiatry*. 2008;69(1):23–31.
32. Asberg M, Träskman L, Thorén P. 5-HIAA in the cerebrospinal fluid: a biochemical suicide predictor? *Arch Gen Psychiatry*. 1976;33(10):1193–1197.
33. Roy A. Self-rated childhood emotional neglect and CSF monoamine indices in abstinent cocaine-abusing adults: possible implications for suicidal behavior. *Psychiatry Res*. 2002;112(1):69–75.
34. Edwards VJ, Holden GW, Felitti VJ, et al. Relationship between multiple forms of childhood maltreatment and adult mental health in community respondents: results from the adverse childhood experiences study. *Am J Psychiatry*. 2003;160(8):1453–1460.
35. Dube SR, Anda RF, Felitti VJ, et al. Childhood abuse, household dysfunction, and the risk of attempted suicide throughout the life span: findings from the Adverse Childhood Experiences Study. *JAMA*. 2001;286(24):3089–3096.
36. Brezo J, Paris J, Vitaro F, et al. Predicting suicide attempts in young adults with histories of childhood abuse. *Br J Psychiatry*. 2008;193(2):134–139.
37. Widom CS, Czaja SJ, Dutton MA. Childhood victimization and lifetime revictimization. *Child Abuse Negl*. 2008;32(8):785–796.
38. Gladstone GL, Parker GB, Mitchell PB, et al. Implications of childhood trauma for depressed women: an analysis of pathways from childhood sexual abuse to deliberate self-harm and revictimization. *Am J Psychiatry*. 2004;161(8):1417–1425.
39. Jaffee SR, Caspi A, Moffitt TE, et al. Physical maltreatment victim to antisocial child: evidence of an environmentally mediated process. *J Abnorm Psychol*. 2004;113(1):44–55.
40. Krischer MK, Sevecke K. Early traumatization and psychopathy in female and male juvenile offenders. *Int J Law Psychiatry*. 2008;31(3):253–262.
41. Osvath P, Vörös V, Fekete S. Life events and psychopathology in a group of suicide attempters. *Psychopathology*. 2004;37(1):36–40.
42. Brodsky BS, Oquendo M, Ellis SP, et al. The relationship of childhood abuse to impulsivity and suicidal behavior in adults with major depression. *Am J Psychiatry*. 2001;158(11):1871–1877.
43. Sarchiapone M, Jaussent I, Roy A, et al. Childhood trauma as a correlative factor of suicidal behavior—via aggression traits: similar results in an Italian and in a French sample. *Eur Psychiatry*. 2009;24(1):57–62.
44. Sarchiapone M, Carli V, Cuomo C, et al. Association between childhood trauma and aggression in male prisoners. *Psychiatry Res*. 2009;165(1):187–192.
45. Krakowski M, Czobor P. Gender differences in violent behaviors: relationship to clinical symptoms and psychosocial factors. *Am J Psychiatry*. 2004;161(3):459–465.
46. Currier D, Mann MJ, Oquendo MA, et al. Sex differences in the familial transmission of mood disorders. *J Affect Disord*. 2006;95(1–3):51–60.
47. Prochazka H, Ågren H. Self-rated aggression and cerebral monoaminergic turnover: sex differences in patients with persistent depressive disorder. *Eur Arch Psychiatry Clin Neurosci*. 2003;253(4):185–192.
48. Elbogen EB, Johnson SC. The intricate link between violence and mental disorder: results from the National Epidemiologic Survey on Alcohol and Related Conditions. *Arch Gen Psychiatry*. 2009;66(2):152–161.

Appendix 1 appears on page 1032.

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Appendix 1. The Karolinska Interpersonal Violence Scale[a]

**The steps of this scale are defined by short statements about violent behavior. On the basis of an interview with the subject, use the highest score where one or more of the statements apply.**

**A. Used violence.**

**As a child (6–14 years)**

0 No violence.
1 Occasional fights, but no cause for alarm among grown-ups in school or in the family.
2 Fighter. Been in fights a lot.
3 Often started fights. Hit a comrade who had been bullied. Continued hitting when the other had surrendered.
4 Initiated bullying. Often hit other children, with fist or object.
5 Caused serious physical injury. Violent toward adult(s). Violent behavior that led to intervention by social welfare authorities.

**As an adult (15 years or older)**

0 No violence.
1 Slapped or spanked children on occasion. Shoved or shook partner or another adult.
2 Occasionally smacked partner or child. Fought when drunk.
3 Assaulted partner drunk or sober. Repeated corporal punishment of child. Frequent fighting when drunk. Hit someone when sober.
4 Instance of violent sexual abuse. Repeated battering/physical abuse of child or partner. Assaulted/attacked other persons frequently, drunk or sober.
5 Killed or caused severe bodily harm. Repeated instances of violent sexual abuse. Convicted of crime of violence.

**B. Victim of violence.**

**Childhood (6–14 years)**

0 No violence.
1 Occasional slaps. Fights in school, of no great significance.
2 Bullied occasionally for short period(s). Occasionally exposed to corporal punishment.
3 Often bullied. Frequently exposed to corporal punishment. Beaten by drunken parent.
4 Bullied throughout childhood. Battered/beaten up by schoolmates. Regularly beaten by parent or another adult. Beaten with objects. Sexually abused.
5 Repeated exposure to violence at home or in school that resulted at least once in serious bodily harm. Repeated sexual abuse, or sexual abuse that resulted in bodily harm.

**Adulthood (15 years or older)**

0 No violence.
1 Threatened or subjected to a low level of violence on at least one occasion.
2 Beaten by partner on occasion. Victim of purse snatching. Threatened with object.
3 Threatened with a weapon. Robbed. Beaten by someone other than partner. Frequently beaten by partner.
4 Raped. Battered.
5 Repeatedly raped. Repeatedly battered. Severely battered, resulting in serious bodily harm.

[a] The Swedish version of the Karolinska Interpersonal Violence Scale (KIVS) was translated into English by an authorized bilingual translator; the English version of the KIVS was then back-translated into Swedish and the equivalence was checked by the original authors. Copies can be obtained from the author.