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Effect of Exposure to Suicidal Behavior on Suicide Attempt in a high-risk sample of Offspring of Depressed Parents

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Abstract

Objective—Exposure to suicidal behavior in peers and relatives is thought to increase risk for suicidal behavior in vulnerable individuals, possibly as a result of imitation or modeling. This study examines exposure to suicidal behavior and likelihood of suicide attempt in a high-risk cohort of offspring of a depressed parent.

Method—449 offspring of 255 probands with a mood disorder were enrolled in a family study. Probands and offspring were assessed for psychopathology and suicide attempt history, and offspring for suicide exposure. Generalized Estimating Equations (GEE) and Generalized Least Squares models were used to compare suicide attempt history in exposed and non-exposed offspring, and characteristics of exposure in exposed offspring suicide attempters and exposed non-attempters. GEE was used to compare exposure occurring before first attempt in attempter offspring and exposure occurring before the same age in matched non-attempter offspring.

Results—Offspring reporting exposure to suicidal behavior were four times more likely to report a lifetime suicide attempt compared with unexposed offspring, controlling for age. Suicide attempt status was not associated with age at first exposure, total number or degree (attempt or threat) of exposures, or relationship. Analysis of exposure occurring prior to age at first suicide attempt found no association between exposure and suicide attempt.

Conclusions—Offspring exposed to suicidal behavior are more likely to report a lifetime suicide attempt than non-exposed offspring. However when examining the temporal sequence of exposure and attempt the association is no longer significant, suggesting that imitation is not sufficient explanation.

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Keywords

Suicide; exposure; imitation; familial transmission

Introduction

In population based surveys, 7-27% of respondents report exposure to suicide and 17-59% to suicidal behavior in general in friends, acquaintances, or relatives [1-6]. This high level of exposure is of concern if exposure to suicidal behavior increases the risk for suicidal behavior in vulnerable individuals, particularly adolescents and young adults. Clustering of suicides in adolescents, where a greater than expected number of suicides is observed in spatio-temporal proximity, is considered to account for up to 5% of suicides in adolescents (see Insel and Gould 2008 for a review [7]). Also an increased incidence of suicidal behavior has been observed following the media reporting of suicides (reviewed in Pirkis 2001[8]). Finally, studies of the familial transmission of suicidal behavior indicate the involvement of other factors beyond transmission of a major psychiatric disorder, raising the possibility that exposure may play a role via imitation [9].

Studies of the relationship between suicide exposure and suicidal behavior have largely focused on adolescents and young adults in both community and clinical settings. Most[5,6,10-19], but not all [4,20], community or school based studies report associations between exposure to suicidal behavior and suicidal behavior in exposed individuals. Likewise in clinical and smaller scale cohort studies, both in adolescents and adults, some observe associations [21-24], while others do not [25-28]. While much of the published literature appears to support an exposure effect on suicidal behavior, questions remain concerning the mechanism of that putative effect. There is considerable variability across studies in terms of how exposure is operationalized and assessed, including types of suicidal behavior exposed to, intensity and frequency of exposure, and relationship of exposed to the individual engaging in suicidal behavior. Moreover, studies of suicide exposure differ considerably in the extent to which analyses control for common risk factors for suicidal behavior such as depression, life stress, and substance use. Some control for multiple related risk factors, and find a persistent association between suicide exposure and suicidal behavior [11,13,15,16,18], others report associations in univariate comparisons that become non-significant after adjusting for other risk factors [20,21], while yet others report associations but do not control for psychiatric symptoms or other risk factors [6,12,24,29].

The most commonly cited explanatory mechanism for an effect of suicide exposure on suicidal behavior is that of imitation or modeling, based on theories of ‘social learning’ (see De Leo 2008 [10]). A modeling or imitation model requires a clear temporal order where the exposure precedes the suicidal act in the exposed individual. However, the majority of studies of suicide exposure are cross-sectional and do not specify the temporal order between exposure events and suicidal behavior [6,10,11,13,16-19,22,24,25,29]. Others examine the occurrence of exposure and attempt in the 12 months prior to interview in order to establish a closer temporal proximity, however they do not examine the temporal order of exposures and suicidal acts within that 12 months, and/or do not assess attempts or exposures that may have occurred prior to that 12 months [4,5,12,14]. Prospective studies are better suited to examining sequence of exposure and suicidal behavior. Lewinsohn et al found that individuals who reported exposure at baseline were more likely to make a suicide attempt in follow-up, but did not describe if exposure had preceded past attempts or followed them and so temporal sequence of exposure and suicide attempt cannot be established. The only prospective study that clearly demarcated suicide attempts occurring following exposure found no effect of exposure to a friend's suicide on suicide attempt in the

following three years [26]. Thus, the majority of studies cannot determine if the associations observed between exposure and suicidal behavior reflect modeling or imitation behaviors.

In this study of high-risk offspring of a depressed parent, we hypothesize that individuals exposed to suicidal behavior will have a greater likelihood for a lifetime suicide attempt than those not exposed to suicidal behavior. We then examine more closely the characteristics of exposure – relationship, frequency, intensity, - and the temporal order of exposures and suicidal behaviors to discern a potential causal pathway indicative of imitation or modeling. Finally, as this sample is drawn from a high-risk family study, we examine the role of exposure as a contributory factor to the familial transmission of suicidal behavior.

Method

Sample

The sample consisted of 449 offspring, over the age of 10 years, of 255 probands with a history of a depressive episode recruited into a prospective family study at two university hospital sites from inpatient units, outpatient departments, referring psychiatrists, and through advertisements. Probands were excluded if they had schizophrenia, schizoaffective disorder, or mental retardation. Offspring were excluded if they had a diagnosis of mental retardation. Written informed consent for all probands and for offspring 18 years and older, and for offspring younger than 18 both offspring written assent and parent written consent was obtained as approved by the institutional review boards of the University of Pittsburgh, St Francis Medical Center, Pittsburgh, and the New York State Psychiatric Institute/ Columbia University Medical Center in New York City. Approximately 6% of offspring over the age of 10 declined to participate in the study, and we were unable to contact a further proportion not exceeding 20%.

Of the 449 offspring, 234 were male (52%) and 215 were female (48%); the average age was 19±8 years. 119 offspring had no siblings in the study and 330 had at one or more siblings in the study.161 (36%) of offspring had a lifetime history of mood disorder: major depression (21.6%), depression not otherwise specified (10.1%), dysthymic disorder (4.7%), or bipolar disorder (4.3%). Other Axis 1 disorders in offspring were: psychotic disorders (0.22%), substance use disorders (19%), and ADHD (14%). Of the 255 probands, 83% were mothers and 17% fathers. Mean age of probands was 45±10 years. All probands had a lifetime history of a mood disorder: 81% had major depressive disorder and 19% bipolar disorder. No proband had an offspring that completed suicide before the study began.

Assessment

Probands were assessed for current and lifetime Axis I diagnosis using the SCID-1[30]. Offspring over the age of 18 were assessed for Axis I diagnosis using the SCID-I and those between the ages of 10-17 using the K-SADS[31].

Suicide exposure was assessed via clinical interview designed for the study. For the purposes of the clinical interview, consistent with published definitions of suicidal behaviors [32] suicidal ideation was defined as ‘thinking about killing oneself/themselves, and suicide attempt as any self-injurious behavior with some stated or inferred intent to die. Offspring were asked if they had *ever* been exposed to suicidal behavior. If the answer was positive, then they were asked specifically whether the exposure was high- or low-degree, (exposure to a suicide attempt or completion (high), exposure to suicidal ideation or threat (low)). Exposures were also rated as first- or second-hand. A first-hand exposure being when an individual actually witnesses the suicide event, a second-hand exposure when the individual hears about it from the individual involved or a third party. The relationship between offspring and the individual whose suicidal behavior the offspring is exposed to was

recorded and categorized as first-degree family members (biological and non-biological), other relatives, friends, acquaintances, or other. Exposure to suicide in the media or public realm was not assessed.

Offspring and proband lifetime suicide history was obtained using the Columbia Suicide History Form[33]; this form captures specific details about each attempt, including dates. A form was completed separately for each proband and offspring.

Data Analysis

Demographic and clinical variables in exposed and unexposed offspring were compared with generalized least squares [34] using the compound symmetry correlation structure that assumed equal correlations between siblings. Given the presence of sibling groups of different sizes, subjects were grouped into family clusters and statistical analyses were adjusted for the correlation between data from siblings. Comparisons between exposed and non-exposed offspring for suicide attempt history and other categorical variables were conducted using the Generalized Estimating Equation approach[35] with the exchangeable correlation structure that models equal correlations among siblings in the same family, and generalized least squares with equal correlations among observations on siblings for continuous variables. All models were adjusted for participant age. To examine the question of temporality with regard to exposure and attempt, suicide exposure in attempter offspring that occurred before the first attempt (n=11) was compared to the exposure that occurred before the same age in matched non-attempter offspring (n=22). Offspring were matched in a 2:1 ratio (2 non-attempters to each attempter) based on age at study entry, sex and presence/absence of offspring MDD or Bipolar Disorder diagnosis, using the pair-wise matching algorithm in the library “optmatch” in the statistical software R [36]. The matching ratio was determined by the availability of control matches within 5 years of age for all attempter offspring. Non-matched non-attempters were excluded from this analysis. Association between attempter status and presence of exposures before the age of the first attempt in the paired attempter was analyzed using mixed effects logistic regression analysis with random effects due to common proband and common matched group, and association between number of exposures (in exposed offspring only) prior to attempt was analyzed using mixed effect Poisson regression. On average, offspring were 17.5±8 years at the time of exposure to parental suicide event.

Results

Suicide exposure

212 (47%) offspring were exposed to some form of suicidal behavior. Relationships were: exclusively parental suicidal behavior (33%; n=71), non-parental suicidal behavior only (friends, other relatives, or acquaintances; (51%; n =109), or both (14% n=29). Among exposed offspring, 78% had at least one high-degree exposure (attempt or completion), and 42% had first-hand exposure (witnessed the event). Exposed offspring were less likely to be male, and were older at time of assessment (Table 1). Proband diagnosis (MDD vs. BD) was not related to offspring exposure (OR=1.06, 95%CI: 0.6-1.8, p=.819) or offspring attempt (OR=0.64, 95%CI: 0.2-1.9, p=.410). Offspring of a suicide attempter proband had more than three times high odds of suicide exposure than offspring of a non-attempter proband (OR=3.7, 95% CI:1.6-8.9, p=.0023). As would be expected, offspring mood disorder was significantly related to offspring attempt (OR=13.4, 95% CI: 4.5-40, p<.001), and was also related to offspring exposure (OR=1.6, 95% CI: 1.1-2.5, p=.019).

Suicidal exposure and suicide attempt

Thirty (6.7%) offspring reported a lifetime suicide attempt, 23 (76.7%) of whom were exposed to suicidal behavior. Exposed offspring were 4 times more likely to report a lifetime suicide attempt compared with unexposed offspring (11% vs. 3%, respectively; OR=4.1, 95% CI:1.7-9.8, p=0.0017), controlling for age (Table 2). Among suicide attempters, 47.8% were exposed prior to their first suicide attempt (n=11) and 52.2% exposed after their first suicide attempt (n=12). Controlling for the timing of exposure relative to suicide attempt, offspring exposed prior to their first suicide attempt were not at higher risk for suicidal behavior compared with unexposed offspring of the same age, gender and diagnosis (OR=1.76, 95% CI: 0.6-5.1, p=0.3020)(Table 3).

Degree, proximity, relationship,, and frequency of exposure and suicide attempt

Table 4 details suicide exposure characteristics in offspring. Degree of exposure to suicidal behavior was not associated significantly with lifetime history of suicide attempt in offspring (OR=3.1, 95% CI: 0.7-14.6, p=0.14), nor was first- or second-hand exposure (OR=1.3, 95% CI: 0.5 – 3.1, p=0.63). There was no significant difference in suicide attempt risk related to whether offspring were first exposed before or after the age of 18 (data not shown). Number of exposures prior to first attempt in attempters was not different to number of exposures before the same age in matched exposed non-attempters (average 1.0±1.7- in attempters vs. 0.5±0.6 in non-attempters mixed effects Poisson regression b=0.67, z=1.8, p=. 0696), indicating no significant threshold effect of exposures or dose-response.

The odds of suicide attempt did not differ between offspring exposed exclusively to parental suicidal behavior, those exposed to only non-parental suicidal behavior, and those exposed to both (p=0.75). There was also no difference in the odds of a suicide attempt between offspring with exclusively parental exposure and those with exclusively non-parental exposure (OR=0.64, 95%CI=0.23-1.83, p-value=0.40), or between offspring exposed to suicidal behavior in biological relatives and those exposed only to suicidal behavior in non-biological relative (OR=1.24, 95%CI=0.46-3.32, p-value=0.664). All results remained consistent when conducted using only the oldest sibling from each family to rule out any sampling bias due to including multiple offspring from the same family.

Parent attempt and participant attempt

Suicide attempt history in offspring and parents was positively associated: 9.3% of offspring with attempter parents made an attempt compared to 3.8% of offspring with non-attempter parents (OR=2.7, 95% CI: p=.02). Among participant attempters of attempter parents (n=22), the first parental suicide attempt predated the first offspring suicide attempt 73% of the time and by an average of 13 years.

Discussion

Exposure and risk for suicide attempt

We found that exposure to suicidal behavior was associated with a four-fold increase in the likelihood that an exposed individual would report a lifetime suicide attempt compared with non-exposed individuals. However, when we examined only exposure antecedent to suicide attempt (approximately half of all exposures) that association was not significant. The risk of suicide attempts in exposed offspring was also not related to age at first exposure (older or younger than 18 years), degree of exposure (attempt or completion versus ideation or threat), whether the exposure was first-hand or second-hand, relationship (parent, non-parent, or both), or to the number of exposures.

Our findings are consistent with studies observing an association between exposure status and increased likelihood of suicidal behavior [6,10-19,21-24], but do not support a casual pathway for exposure via imitation where the exposure must necessarily precede the imitative attempt. Despite finding that any lifetime exposure increased the likelihood of being a suicide attempter, when we examined only exposures that occurred before the age of first suicide attempt in attempters and before the same age in matched controls we found that exposure was not associated suicide attempter status. We identified two studies that adequately assessed the effect of an exposure on subsequent suicide attempt. One followed 132 adolescents for three years following the suicide of a member of their social circle and found no increase in suicidal behavior compared to unexposed matched controls, but more new onset of psychopathology including depression and PTSD [26]. The second study of hospitalized suicide attempters and medical controls collected exposure data for first-time attempters as well as repeat attempters and thus could account for temporal sequence[28]. However, suicide attempters did not have more exposure than controls, arguing against a modeling effect. We found no other studies that adequately addressed the temporal sequence of exposure and suicidal behavior in the exposed. Most did not describe temporal sequence at all [6,10,11,13,16-19,22,24,25,29], or only that there were limited exposures and/or attempts within 12 months prior to assessment, excluding possible earlier exposures and attempts [4,5,12,14]. In a prospective study, Lewinsohn et al assessed baseline exposure and suicidal behavior at a subsequent timepoint, but did not address the relationship of baseline exposure to prior suicide attempt, thus preventing any clear establishment of temporality necessary to infer causality[23].

While we find no evidence of a direct causal pathway between exposure and suicide attempt that would support an imitation or modeling explanation, the strong association of lifetime exposure and suicide attempter status does suggest that individuals at higher risk for suicidal behavior may tend to congregate. The notion of assortive friendships or relationships, whereby individuals who share behavioral risk factors selectively associate, has been proposed as an alternative explanation for the association of exposure and suicidal behavior (see Joiner 2003 [37]). Given that individuals exposed to suicidal behavior have higher levels of other psychological disturbances, such as Major Depression or PTSD [26], and risk behaviors such as smoking, substance use and physical fighting [12] assessing risk behaviors and psychopathology in an individual's social network may be a more useful indicator of future suicidal behavior risk than suicide exposure alone. Assortive friendships may partly explain the consistent finding in studies that examined the relationship between exposed individuals and those engaging in suicidal behavior, namely, that adolescent exposure to a suicidal act of a friend or peer is more strongly associated with the individual's suicidal behavior, than exposure to a suicidal act in a family member [10,11,13,14,23,29]. Of course, risk behaviors may be shared among family members as well, raising a question as to why risk for suicidal behavior appears to be more pronounced among adolescents exposed to peer suicidal behavior compared to adolescents exposed to familial suicidal behavior.

Exposure and familial transmission of suicidal behavior

The familial risk for suicidal behavior is well documented (see Brent and Mann [9]). This sample is drawn from a larger family study which observed an increase risk for suicide attempt in offspring of attempter parents compared to offspring of non-attempter parents[38], and consequently finds the same associations. However, that increase in risk of suicide attempt in offspring of an attempter parent does not appear to be related to exposure to suicidal behavior within families. Offspring of attempter parents were more likely to have been exposed, though not necessarily to the parental attempt as not all offspring were aware of parental attempts, and in some cases parental attempt preceded offspring birth. However, analyses of the effect of relationship on risk for suicide attempt did not find greater risk for

exposure to parental than non-parental suicidal behavior. Moreover, 27% of offspring attempts occurred before the parental attempt. This suggests that imitation is unlikely to be sufficient explanation for the familial transmission of suicidal behavior, and that other pathways such as genetic transmission, shared environment, and other heritable factors such as psychiatric disorders are important contributors[9].

This study has several limitations. The subjects were high-risk offspring of clinically referred depressed parents, and it is possible that our results reflect a ceiling effect, in which the genetic or behavioral risk factors mask the effects of exposure. In a cohort with fewer comorbid risk factors and less predisposition to suicidal behavior, non-parental or non-familial exposure may have a greater relative impact and measurably increase the likelihood of suicidal behavior. In addition, the exposure form used in clinical interviews only assesses the impact of exposure to the suicidal behavior of family, friends, and acquaintances. The measure does not include questions about exposure to suicide in the media, such as in newspapers, on television, or in the movies. Media exposure is quite prevalent and may increase risk for suicidal behavior [8]. Furthermore, since exposure is assessed by subject self-report, we cannot rule out recall bias. Recall bias may especially affect offspring with multiple episodes of exposure: a major event, such as a parental attempt, may result in a tendency to under-report less salient exposures, such as threats from friends or acquaintances. In fact, of all offspring who report high degree exposure (attempt or suicide death), 80% do not report any low degree exposure (ideation or threat), 17% report one low degree exposure, and 3% report three or four low degree exposures. This study was not designed to specifically test the role of imitation or modeling, and this analysis only examined exposure prior to a first attempt and so does not rule out a role for imitation or modeling effects with respect to subsequent attempts. A longitudinal study collecting fine-grained data on dates of exposure and attempt could better address this issue. Moreover, the examination of temporal sequence of exposure and first suicide attempt, was done by retrospective self-report, and future studies using prospective data collection would reduce possible recall bias and provide better information on the concurrent presence of other risk factors such as depression and substance use.

Conclusion

Exposure to suicidal behavior was associated with increased odds of suicide attempt, however we found no evidence of an imitation effect of suicide exposure on suicide attempt. The higher level of exposure in suicide attempters is compatible with an assortive relating paradigm and further studies should investigate whether association with peers who have elevated risk for suicidal behavior increases risk for suicide attempt, especially among adolescents.

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TABLE 1
Comparison of offspring with and without a history of exposure to suicidal behavior

	Exposed (N=212) Mean±SD or Number(Percent)	Unexposed (N=237) Mean±SD or Number(Percent)	t/Wald chi-square*	p-value
Age (years)	21.1±8.5	17.2±7.8	3.5	**0.0005**
Male	93/212 (44%)	141/237 (59%)	10.02	**0.0015**
Caucasian	153/202 (76%)	147/221 (67%)	0.53	0.4660
Suicide Attempt (Yes)	23/212 (11%)	7/237 (3%)	10.23	**0.0014**
Parent Attempt (Yes)	124/212 (58%)	112/237 (47%)	5.89	**0.0152**

* Wald chi-square statistic is reported for binary variables, t statistics for quantitative variables

** P-values are asymptotic and sample size is small

Table 2

Lifetime history of suicide attempt dependent variable, exposure to suicidal act before age of first attempt and age at first attempt as independent variables in a matched sub-sample with 30 attempters and 60 non-attempters

	B	Odds Ratio	Z	p-value
Exposure to suicide (before age of 1st attempt)	0.27	1.31	0.49	.6190
Age at first attempt	-0.003	.068	-0.04	.9620

Table 3

Age matched offspring suicide attempters and non-attempters with Lifetime history of suicide attempt dependent variable, exposure to suicidal act before age of first attempt and age as independent variables

	B	Odds Ratio	Z	p-value
Exposure to suicide (before age of 1st attempt)	0.56	1.76	1.03	.3020
Age	-0.02	.983	-0.24	.8070

TABLE 4

Exposure characteristics and offspring lifetime suicide attempt*

Exposed Offspring	Parental or Non-Parental Relationship			Relation to exposure source			Degree of exposure		Number of exposures	
	Parental Only#	Non-parent only	Both	Biol. relative only	Others only	Both	Low	High	1	>1
Attempters	6 (27%)	13 (59%)	3 (14%)	10 (46%)	8 (36%)	4 (18%)	2 (9%)	21 (91%)	11 (48%)	12 (52%)
Non-Attempters	65 (35%)	96 (51%)	26 (14%)	78 (42%)	80 (43%)	28 (15%)	44 (23%)	145 (77%)	124 (66%)	65 (34%)

*Three exposed offspring are missing data on relationship, degree and number of exposures.

#Includes biological and non-biological parent

No comparison significantly different (data not shown).