ORIGINAL ARTICLE

Proximal Psychiatric Risk Factors for Suicidality in Youth

The Great Smoky Mountains Study

Debra L. Foley, PhD; David B. Goldston, PhD; E. Jane Costello, PhD; Adrian Angold, MRCPsych

Context: Psychiatric disorder is a major risk factor for suicidality but has poor positive predictive value.

Objectives: To characterize proximal risks for suicidality associated with anxiety, depressive, disruptive behavior, and substance use disorders, and to test whether there are critical combinations of disorders that discriminate at-risk youth independent of severity of psychopathology.

Design: The Great Smoky Mountains Study, a representative sample of children and adolescents aged 9 to 16 years from the southeastern United States. Subjects and their parents were interviewed on multiple occasions from 1993 to 2000 about the subjects' recent psychiatric and suicidal history.

Setting: An epidemiological sample of youth.

Participants: The sample included 1420 individual subjects with 6676 records across 8 waves of data collection.

Main Outcome Measures: Wanting to die, suicidal ideation, suicide plans, or suicide attempt during the past 3 months.

Results: Eleven broad psychiatric profiles discriminated suicidal youth. Risk was greatest in association with current depression plus anxiety (specifically GAD [generalized anxiety disorder]) (odds ratio, 468.53) or depression plus a disruptive disorder (primarily ODD [oppositional-defiant disorder]) (odds ratio, 222.94). Unless comorbid, anxiety and substance use disorders were not proximally associated with suicidality. The severity of symptom-related impairment and, in some cases, total symptom load explained risk associated with all psychiatric profiles except depression plus anxiety, specifically GAD (adjusted odds ratio, 50.16). Severity of impairment and poverty defined by federal guidelines for families were both independent risk factors, irrespective of psychiatric profile. Suicidal youth without diagnosable disorders had subthreshold (mostly disruptive) disorders, disabling relationship difficulties, or psychiatric symptoms without associated impairment.

Conclusions: Severity of symptom-related impairment and total symptom load explained most of the risk for suicidality associated with current psychiatric disorders. Only depression plus GAD discriminated at-risk youth independent of severity of psychopathology.

Arch Gen Psychiatry. 2006;63:1017-1024

Author Affiliations: Department of Human Genetics, Virginia Institute for Psychiatric and Behavioral Genetics, Medical College of Virginia Commonwealth University, Richmond (Dr Foley); and Department of Psychiatry and Behavioral Sciences, Duke University Medical Center, Durham, NC (Drs Goldston, Costello, and Angold).

SUICIDAL BEHAVIOR IS A GREAT concern for clinicians who deal with mental health problems in youth.[1] From 70% to 91% of youth who attempt or think about suicide in community settings have a psychiatric disorder.[2,3] Mood, anxiety, disruptive, and substance use disorders (SUD) have all been identified as risk factors,[2-11] but the available studies have several methodological problems. First, with 1 exception,[3] suicide attempts have been surveyed retrospectively over the lifetime. Lifetime surveys underestimate true lifetime prevalence,[12] and reporting errors associated with more distal recall may bias estimated associations. Second, lifetime surveys combine psychiatric disorders that precede, co-occur with, and follow suicidal episodes, with the result that disorders with an onset after the suicidal episode will be identified as risk factors. Third, psychiatric comorbidity is more common in suicidal youth than pure (ie, single) disorders,[2] and lifetime comorbidity is associated with greater-than-expected risks in adolescents and young adults.[5,13] No epidemiological study has capitalized on these findings to examine risks associated with specific comorbid profiles in younger samples. If risks associated with comorbidity exceed those predicted from the combined effects of individual disorders (ie, if there are disorder-by-disorder interactions), then estimating the main effect of disorders[2] will

©2006 American Medical Association. All rights reserved.
Downloaded From: http://archpsyc.jamanetwork.com/ on 12/02/2015

not indicate which comorbid psychiatric profiles are most discriminating, or why. Comorbidity may index more severe psychopathology and a greater psychic burden[13] owing to higher total symptom levels or greater severity of symptom-related impairment. Alternatively, comorbidity may index a discriminating risk factor or pattern of risk factors. Fourth, risks associated with adjustment problems have been described,[3] but risks associated with subthreshold disorders have not.

The aim of this study was to characterize proximal psychiatric risk factors for wanting to die, suicidal ideation, suicide plans, or suicide attempts in a large epidemiological sample of youth aged 9 to 16 years from the southeastern United States. Psychiatric and suicidal histories were surveyed in reference to the same 3-month period to distinguish proximal diagnostic correlates from psychiatric outcomes and to permit identification of temporal comorbidity. Suicidal histories were surveyed in all subjects irrespective of psychiatric history to provide an unbiased estimate of risks associated with all disorders. To clarify which comorbidity profiles were associated with elevated risks, we report risks associated with the pattern of anxiety, depressive, disruptive, and substance use disorders that were actually observed in suicidal youth. Risks associated with discriminating psychiatric profiles were subsequently adjusted for level of depression symptoms, level of all other symptoms, and severity of all symptom-related impairment to evaluate whether there were still critical combinations of psychiatric disorders that discriminated at-risk youth independent of severity of psychopathology. Risks associated with subthreshold psychiatric disorders were characterized in suicidal youth who did not meet *DSM-IV* diagnostic thresholds.[14]

METHODS

The Great Smoky Mountains Study (GSMS) is a longitudinal study of the development of psychiatric disorder and the need for mental health services.[15-19] Three cohorts of children and adolescents aged 9, 11, and 13 years at intake were recruited from 11 counties in western North Carolina. A multistage sampling design was used with weighting that returned the weighted sample to its original size.[20] Potential participants were randomly selected from the population of some 20 000 children using a household equal-probability, accelerated household design.[21] Each cohort therefore reaches a given age in a different year, thus controlling for cohort effects.[22] The initial random sample of 4067 yielded 3896 screening questionnaires (95%) consisting mainly of the externalizing (behavioral) problems scale of the Child Behavior Checklist[23] completed by a parent (usually the mother), by telephone or in person. All children scoring above a predetermined cutoff (the top 25% of total scores), plus a 1-in-10 random sample of the rest, were recruited for detailed interviews.

Approximately 8% of area residents and the sample are African American, and fewer than 1% are Hispanic. American Indians make up only 3% of the population of the study area, which is overwhelmingly white, but were oversampled from school records to constitute 25% of the study sample. We used the same screening procedure but recruited all American Indian children irrespective of screen score. Of the 456 American Indian children identified, screening questionnaires were obtained from 96%, and 81% (n=350) participated in the study. Although race was included in all analyses, no conclusions are drawn in this report about racial or ethnic similarities or differences in psychiatric status, which are reported elsewhere.[24-26]

The present report analyses the first 8 waves of GSMS data for subjects aged 9 to 16 years. Participants were interviewed as close as possible to their birthday. The sample consisted of 1420 individual subjects (49% female) and 6670 records for these subjects across all 8 waves. Broken down by age, 514 records were for subjects aged 9 years; 502, 10 years; 996, 11 years; 753, 12 years; 942, 13 years; 882, 14 years; 1227, 15 years; and 854, 16 years. Date of interview by cohort and response rate at each wave (range, 75.0%-94%) are detailed elsewhere.[27]

MEASURES

The Child and Adolescent Psychiatric Assessment (CAPA) is an interviewer-based interview.[17,28] The goal of interviews using this format, such as the adult Present State Examination[29] or Schedules for Clinical Assessment in Neuropsychiatry,[30] is to combine the advantages of clinical interviews with those of highly structured epidemiological interview methods. A detailed glossary provides the operational rules for identifying clinically significant symptoms. With the CAPA, the parent and child are interviewed separately by different interviewers. In this report, with the exception of attention-deficit/hyperactivity disorder symptoms, about which only the parent was interviewed, a symptom was counted as present if it was reported by the parent, the child, or both.[31] The time frame of the CAPA for determining the presence of most psychiatric symptoms is the past 3 months. In the case of a few rare and severe acts, such as fire setting or assault, a lifetime frame of reference is used, as required by the *DSM-IV*. Two-week test-retest reliability of CAPA–Child version diagnoses in children and adolescents aged 10 through 18 years is similar to that of other highly structured child psychiatric interviews.[19,28]

Operational definitions for surveying suicidal histories incorporated relatively high thresholds in an effort to distinguish fleeting thoughts or behaviors from persistent, clinically significant thoughts or behaviors. Wanting to die was defined by recurrent thoughts about death that included a wish to die. The thoughts needed to be intrusive into at least 2 activities and at least sometimes uncontrollable. Suicidal ideation was defined by thoughts about suicide that were at least sometimes uncontrollable and recurring in at least 2 activities. Suicidal plans were defined by a specific plan, considered on more than 1 occasion, with or without preparatory action (eg, storing up pills). A suicide attempt was defined as deliberately self-harmful behavior that involved some intention to die at the time of its occurrence. Self-harmful behaviors associated with mixed motives or ambivalence were still coded as a suicide attempt if the act was associated at least in part with a wish to die.

Symptom-related impairment was rated in all youth with psychiatric symptoms, including those who did not meet formal criteria for psychiatric disorder. Impairment associated with each symptom area was rated in reference to the following functional domains: parent relationships, sibling relationships, self-care, homework and chores, leaving the house, school performance, school suspension, teacher relationships, school peer relationships, spare time activities, nonschool adult relationships, nonschool peer relationships, employment, treatment, and placement.[32] Impairment was rated for each functional domain when it was attributable to the presence of symptoms and was manifested as a change in the child's functioning. Ratings were made on a 3-point scale for no, partial, or severe impairment.

©2006 American Medical Association. All rights reserved.
Downloaded From: http://archpsyc.jamanetwork.com/ on 12/02/2015

PROCEDURE

Interviewers were residents of the study area and had at least a bachelor's-level degree. They received 1 month of training and constant monitoring for quality control. Interviews usually took place at home. The parent signed a consent form, the child signed an assent form, and each was paid $10. The project was approved by the Duke University (Durham, NC) institutional review board.

DATA MANAGEMENT AND ANALYSIS

Scoring programs for the CAPA, written in SAS statistical software,[33] combined information about the date of onset, duration, and intensity of each symptom to create diagnoses according to the *DSM-IV*.[14] Specific diagnoses were collapsed into superordinate diagnostic categories to maximize statistical power. Any anxiety disorder included generalized anxiety disorder (GAD), panic attacks (given the rarity of panic disorder), posttraumatic stress, separation anxiety disorder, specific phobia, and social phobia. Any depressive disorder included major depression, depression not otherwise specified, and dysthymia. Any disruptive disorder included attention-deficit/hyperactivity disorder, conduct disorder, and oppositional-defiant disorder (ODD). Substance use disorder included alcohol and/or other illicit drug use disorders.

Subjects with subthreshold psychiatric symptoms plus symptom-related impairment but who did not meet full *DSM-IV* criteria for diagnosis were assigned a diagnosis of subthreshold disorder. Among youth with subthreshold diagnoses, impairment due to relationship difficulties was distinguished from impairment related to subthreshold psychiatric symptoms.

Severity of psychopathology was estimated by the number of depression symptoms, number of all other symptoms, and level of all symptom-related impairment across all functional domains. Symptoms that were criteria for more than 1 disorder (eg, difficulty sleeping) were counted only once. Suicidality was not included in the depression symptom count.

Suicidality was defined as the presence of suicidal ideation, with or without a plan, or a suicide attempt. Ideation was defined as thoughts or wishes to be dead or to kill oneself.[34]

DATA ANALYSIS

Parent-child agreement was estimated using the κ statistic. The relationships among suicidal behaviors were quantified using the Cronbach coefficient α. Evidence for a dose-response relationship in reference to severity of suicidality was assessed in relation to demographic characteristics and proximal clinical correlates using a 2-tailed χ^2 test. Data for this analysis only were coded to reflect the highest level of suicidality recorded in the previous 3 months, ie, wanting to die but no suicidal ideation, plan, or attempt; suicidal ideation but no plan or attempt; and so on.

Logistic regression was used to estimate cross-sectional (proximal) associations between psychiatric disorders and suicidality. Each wave of data for each subject was treated as a separate record, with appropriate correction made for within-individual correlations across measurement occasions. Univariate regression estimated associations with each individual psychiatric disorder. Multiple regression estimated the main effect of each disorder after controlling for all other disorders, but without adjustment for nonadditive effects. Preliminary examination of the actual pattern of observed disorders showed that several comorbid profiles had much higher than expected risks compared with pure profiles, which implied interactions between disorders. To explicate these risks, logistic regression was also used to model the association between suicidality and each observed psychiatric profile. For 5 diagnostic classes, there are 5 factorial (n=120) possible profiles, including no disorder, but only a subset of profiles were actually observed. Broad profiles with a prevalence greater than 10% in suicidal youth were subtyped to identify the most common types associated with suicidality. Multiple regression was used to test whether severity of psychopathology accounted for risks associated with psychiatric profiles. The reference group in each profile analysis was youth without psychiatric disorders. The statistical significance of the differential risk associated with comorbid vs pure profiles was tested for common comorbidity profiles.

Weighted analyses were conducted using the SAS procedure GENMOD with robust (sandwich-type) variance estimates to obtain unbiased community estimates and their standard errors, taking into account the screened stratification of the sample and the effects of repeated measurements for each subject.[35,36] This means that the results from this study can be generalized to the population from which the sample was drawn.

All partial odds ratios (ORs) were adjusted for the possible confounding effects of age in years, being 13 years or older (ie, 13-16 vs 9-12 years), female sex, the interaction between being 13 years or older and female sex, race, and poverty. The interaction between age and sex was included because the risk for attempted suicide in girls began to increase at 13 years of age[37] and because sex differences for depression emerge in association with hormonal changes at around the same time.[38] Poverty was included because 20% of subjects from the GSMS were living in poverty according to federal guidelines for families.

Table 1. Three-Month Overlap Among Wanting to Die, Suicidal Ideation, Suicide Plans, and Suicide Attempt*

	Phi Coefficient (%)			
Records	Wants to Die (n = 83)	Suicidal Ideation (n = 51)	Suicide Plans (n = 19)	Suicide Attempt (n = 24)
Wants to die	. . . (100)	0.56 (67)	0.32 (57)	0.42 (83)
Suicidal ideation	0.56 (47)	. . . (100)	0.67 (99)	0.51 (85)
Suicide plans	0.32 (18)	0.67 (45)	. . . (100)	0.54 (61)
Suicide attempt	0.42 (21)	0.51 (31)	0.54 (49)	. . . (100)

*$P<.001$ for all phi coefficients. Ellipses indicate that an association was not estimated.

RESULTS

INFORMANT AGREEMENT

Parent-child agreement did not exceed chance levels for wanting to die ($\kappa=0.05$; 95% confidence interval [CI], –0.02 to 0.13), suicidal ideation ($\kappa=0.06$; 95% CI, –0.03 to 0.15), and suicidal plans ($\kappa=-0.0005$; 95% CI, –0.0012 to 0.0001). Agreement exceeded chance levels for suicide attempts ($\kappa=0.41$; 95% CI, 0.15 to 0.67) and any suicidality ($\kappa=0.14$; 95% CI, 0.04 to 0.24). Sixty-two percent of ratings of any suicidality indexed a positive child rating and a negative parental rating. In other words, parents were typically unaware of their child's suicidality.

ITEM RELATIONSHIPS

The overlap among suicidal behaviors during the previous 3 months was substantial (**Table 1**). The coeffi-

©2006 American Medical Association. All rights reserved.
Downloaded From: http://archpsyc.jamanetwork.com/ on 12/02/2015

Table 2. Correlates of Highest Level of Current Suicidality and Any Suicidality

	% of Records							
	Correlates of Highest Level of Current Suicidality					Correlates of Any Current Suicidality		
Characteristics	Wants to Die (n = 43)	Suicidal Ideation (n = 23)	Suicide Plans (n = 11)	Suicide Attempt (n = 24)	*P* Value*	Any Suicidality (n = 101)	No Suicidality (n = 6571)	*P* Value*
Age ≥13 y	70.7	74.0	91.6	83.3	.47	76.8	57.8	<.001
Female sex	35.0	66.1	84.7	72.0	.006	57.0	50.9	.14
African American	2.6	4.1	0.0	7.8	.72	3.7	6.5	.30
American Indian	4.4	2.7	5.6	1.7	.94	3.6	3.7	.94
Poverty according to federal guidelines	57.7	52.8	49.2	8.3	.24	48.9	18.6	<.001
Any depressive disorder	51.6	47.6	51.8	32.6	.61	46.7	1.6	<.001
Any anxiety disorder	19.5	41.5	50.4	15.3	.07	28.3	1.9	<.001
Any disruptive disorder	39.4	18.5	10.9	58.9	.02	34.3	4.9	<.001
Alcohol abuse/dependence	0.0	0.7	2.8	5.2	.53	1.6	1.2	.73
Illicit drug abuse/dependence	0.0	2.7	1.4	2.7	.81	1.4	1.8	.79
Any disorder	58.1	57.9	57.5	71.4	.79	60.7	9.0	<.001
Any comorbidity	48.2	45.6	51.8	30.0	.57	44.3	1.6	<.001
Any symptom-related impairment	79.4	78.2	95.9	94.6	.29	84.3	27.0	<.001

*The *P* value was estimated for a χ^2 test with 3 *df*.

Table 3. Repetition of Suicidal Behaviors Across Multiple Measurement Occasions

	Wants to Die (n = 72)	Suicidal Ideation (n = 42)	Suicide Plans (n = 17)	Suicide Attempt (n = 21)	Any Suicidality (n = 85)
Frequency, No. (%) of subjects*					
1	64 (78)	35 (57)	15 (58)	18 (88)	72 (70)
2	5 (16)	5 (37)	2 (42)	3 (12)	10 (25)
3	3 (6)	2 (6)	0	0	3 (5)
No. (%) of records	83 (100)	51 (100)	19 (100)	24 (100)	101 (100)

*Percentage is weighted by probability of ascertainment to return unbiased prevalence estimates.

cient α was 0.80 for a scale defined by the intercorrelation among wanting to die, suicidal ideation, suicide plans, and suicide attempts. The individual item correlation with the scale (and the change in α if the item was removed) was $r=0.51$ (change in α, 0.801) for wanting to die, $r=0.74$ (change in α, 0.691) for suicidal ideation, $r=0.63$ (change in α, 0.747) for suicide plans, and $r=0.60$ (change in α, 0.761) for a suicide attempt. All 4 suicidality items were therefore strongly related. We did not create a quantitative index of risk reflecting apparent level of severity of suicidality because there was no evidence of a dose-response relationship across wanting to die, suicidal ideation/plan, and suicide attempt in relation to demographic or clinical characteristics (**Table 2**). Only the prevalence of alcohol abuse increased in association with increasingly severe suicidal behavior, but this effect was nonsignificant. In subsequent data analyses, we have therefore modeled risks associated with the presence of any level of suicidality. It was noteworthy, however, that the typical positive female-male ratio for suicidality was reversed (0.35) for wanting to die in the absence of suicidal ideation/plans or attempts.

PREVALENCE

The 3-month prevalence of wanting to die was 0.99%; suicidal ideation, 0.69%; suicide plans, 0.31%; suicide attempts, 0.25%; and any suicidality, 1.24%. Methods of attempted suicide were drug overdose in 60%, stabbing/cutting in 20%, hanging in 5%, shooting in 3%, running into traffic in 3%, and other methods in 14%. Multiple methods were used by 5% of attempters. Most individuals reported suicidality on only a single occasion (**Table 3**).

The prevalence of wanting to die (whether or not suicidal ideation/plans or attempts were also present) was similar in girls and boys (1.01% vs 0.96%; $\chi^2=0.04$; $P=.83$), but girls had a significantly higher prevalence of suicidal ideation (1.04% vs 0.36%; $\chi^2=11.44$; $P<.001$), plans (0.54% vs 0.09%; $\chi^2=11.04$; $P<.001$), and attempts (0.37% vs 0.14%; $\chi^2=3.59$; $P=.06$) than did boys. The prevalence of any suicidality was nonsignificantly higher in girls than in boys (1.44% vs 1.04%; $\chi^2=2.12$; $P=.14$).

There was no significant linear effect of age on wanting to die (OR, 1.14; $P=.15$); suicidal ideation (OR, 1.05; $P=.47$), plans (OR, 1.05; $P=.22$), or attempts (OR, 0.99;

©2006 American Medical Association. All rights reserved.
Downloaded From: http://archpsyc.jamanetwork.com/ on 12/02/2015

P=.80); or any suicidality (OR, 1.10; P=.21). The highest 3-month prevalence of each aspect of suicidality was at 13 years of age. There was a significant main effect of being 13 years or older on wanting to die (OR, 3.00; P=.02); suicidal ideation (OR, 3.00; P=.03), plans (OR, 10.00; P=.001), and attempts (OR, 3.00; P=.02); and any suicidality (OR, 3.00; P=.03). The main effect of sex was nonsignificant. The interaction between female sex and being 13 years or older was strongly associated with a suicide attempt (OR, 23.00; P=.006). In analyses conducted separately by sex, there was a sharply increased risk for attempted suicide after 12 years of age in girls (OR, 19.00; P=.006), but not boys (OR, 0.70; P=.50). The interaction between sex and being 13 years or older was not significantly associated with wanting to die (OR, 3.00; P=.18), suicidal ideation (OR, 3.00; P=.26), or any suicidality (OR, 2.00; P=.34). All girls with suicidal plans were 13 years or older. Racial differences were nonsignificant.

Lifetime history of suicide attempts was surveyed at each wave, and the cumulative prevalence by 16 years of age was 3.90% (4.55% for girls vs 3.28% for boys; χ^2=1.52; P=.22).

PROXIMAL PSYCHIATRIC DISORDERS

All suicidal youth had some degree of psychiatric or relationship problems: 60.7% met full *DSM-IV* criteria for 1 or more psychiatric disorders, an additional 31.3% had a subthreshold psychiatric disorder, 4.1% had psychiatric symptoms without apparent impairment, and 3.8% had impairing relationship difficulties without psychiatric symptoms. Suicidal youth were 6 times more likely to have a psychiatric disorder and 22 times more likely to have multiple psychiatric disorders than were nonsuicidal youth (Table 2).

Anxiety, depressive, and disruptive behavior disorders were all associated with a significantly increased risk of suicidality (**Table 4**). Risk was greatest in association with depression. Drug abuse was not associated with suicidality. After controlling for all other disorders, anxiety, depression, and disruptive behavior disorders were all still independently associated with suicidality. Illicit drug abuse was associated with a significantly decreased risk for suicidality. Associations were only slightly attenuated after additionally controlling for age, sex, race, and poverty, but the association with anxiety disorders was technically nonsignificant (P=.07). The negative association with illicit drug abuse was unaltered.

Eleven broad psychiatric profiles discriminated suicidal youth (**Table 5**). Two comorbid profiles accounted for most of the risk: depression plus anxiety and depression plus disruptive disorder. Unless comorbid, anxiety and SUD were not associated with suicidality. No suicidal youth had pure SUD (Table 5), which explained the negative independent effect of SUD on risk for suicidality (Table 4).

Three broad profiles had a prevalence greater than 10% in suicidal youth (Table 5), which allowed us to explore risks associated with different subtypes of (1) depression plus anxiety, (2) depression plus disruptive behavior disorder, and (3) pure disruptive behavior disorder. Suicidal youth with depression plus anxiety had a significantly higher prevalence of GAD (89.99% vs 26.13%; χ^2=17.91; P<.001), obsessive-compulsive disorder (21.10% vs 0%; χ^2=5.99; P=.01), and multiple anxiety disorders (28.05% vs 5.59%; χ^2=4.35; P=.04), specifically GAD plus obsessive-compulsive disorder (21.10% vs 0%; χ^2=5.99; P=.01), than nonsuicidal youth with depression plus anxiety. No other subtype of the most common profiles was significantly more prevalent in suicidal than in nonsuicidal youth. The most common subtype of depression plus disruptive disorder in suicidal youth was depression plus ODD (73.09% vs 42.07%; χ^2=2.34; P=.12). The most common subtype of pure disruptive disorder in suicidal youth was pure ODD (46.71% vs 35.79%; χ^2=0.51; P=.47).

There was a statistically significant interaction between depression and GAD and between depression and ODD (Table 5), indicating that both comorbidity profiles conferred a greater than expected risk for suicidality.

Table 4. Bivariate and Multivariate Odds of Suicidality Associated With Psychiatric Disorders

	Raw OR	OR Adjusted for Other Disorders	OR Adjusted for Other Disorders and Covariates
Anxiety disorder	13.68*	2.70*	2.53
Depressive disorder	50.82*	24.52*	21.66*
Disruptive disorder	9.20*	4.02*	3.82*
Alcohol abuse	0.92	0.35	0.36
Illicit drug abuse	0.26	0.12*	0.13*
Male sex			1.00
Age ≥13 y			2.69
Age ≥13 y and male sex			0.66
American Indian			0.67
African American			0.53
Poverty			3.44*

Abbreviation: OR, odds ratio.
*P<.05.

SEVERITY OF PSYCHOPATHOLOGY

Controlling for severity of psychopathology explained most of the risk associated with pure and comorbid psychiatric profiles (Table 5). Severity of impairment was an independent risk factor for suicidality, irrespective of psychiatric profile. Level of depression symptoms was not an independent risk factor once diagnostic status had been controlled for. Total level of other symptoms additionally predicted risk for suicidality in youth with pure disruptive disorders and depression comorbid with anxiety (GAD). Poverty defined by federal guidelines for families was an independent risk factor after controlling for all psychiatric profiles except depression plus ODD, where the trend was positive but nonsignificant (P=.13). Poverty did not, however, mediate associations with psychiatric disorders (Table 4).

Youth with depression plus GAD still had a greatly elevated risk for suicidality (OR, 50.16; P=.005) after adjustment for severity of impairment and symptom load. The interaction between depression and GAD remained significant after adjustment for impairment and total symptom load (Table 5). Severity of psychopathology therefore

©2006 American Medical Association. All rights reserved.
Downloaded From: http://archpsyc.jamanetwork.com/ on 12/02/2015

Table 5. Observed Psychiatric Profiles in Suicidal Youth

	Records, %		Psychiatric Profile, Raw OR	Adjusted OR*				
	Nonsuicidal (n = 6570)	Suicidal (n = 101)		Psychiatric Profile	Poverty	Impairment	No. of Depressive Symptoms	No. of Other Symptoms
Pure depression	0.59	3.01	11.61†	1.93	3.29†	1.25†	1.48	1.09
Pure anxiety disorder	1.85	0.50	0.58	0.09	3.47†	1.25†	1.55	1.11
Pure disruptive behavior disorder	3.66	12.36	7.36†	1.53	3.86†	1.15†	1.46	1.09†
Pure ODD	1.31	5.77	8.27†	1.63	4.30†	1.17†	1.47	1.10
Pure CD	1.36	3.90	6.63†	1.46	3.15†	1.25†	1.49	1.11†
Depression + anxiety disorder	0.39	22.71	134.56†	10.29	3.94†	1.16†	1.41	1.13†
Depression + GAD	0.10	20.43	468.53†‡	50.16†‡	4.32†	1.22†	1.36	1.11*
Depression + disruptive behavior disorder	0.25	15.04	129.60†	5.83	3.10†	1.18†	1.43	1.05
Depression + ODD	0.11	10.61	222.94†‡	9.09	2.46	1.26†	1.42	1.11
Anxiety + disruptive behavior	0.25	1.13	9.50†	0.12	3.88†	1.24†	1.52	1.09
Depression + anxiety + disruptive behavior	0.15	3.84	52.68†	0.29	3.64†	1.19†	1.52	1.07
Depression + disruptive behavior + alcohol abuse	0.07	0.52	16.45†	0.14	3.81†	1.24†	1.59	1.09
Depression + anxiety + disruptive behavior + alcohol abuse	0.00	0.18†	. . .	. . .	. . .	. . .	. . .	. . .
Depression + anxiety + disruptive behavior + illicit drug abuse	0.00	0.53†	. . .	. . .	. . .	. . .	. . .	. . .
Depression + anxiety + alcohol abuse + illicit drug abuse	0.00	0.18†	. . .	. . .	. . .	. . .	. . .	. . .
Depression + disruptive behavior + alcohol abuse + illicit drug abuse	0.01	0.57†	. . .	. . .	. . .	. . .	. . .	. . .
Depression + anxiety + disruptive behavior + alcohol abuse + illicit drug abuse	0.05	0.18	. . .	. . .	. . .	. . .	. . .	. . .
Pure alcohol abuse	0.50	0.00	. . .	. . .	. . .	. . .	. . .	. . .
Pure illicit drug abuse	0.92	0.00	. . .	. . .	. . .	. . .	. . .	. . .

Abbreviations: CD, conduct disorder; GAD, generalized anxiety disorder; ODD, oppositional-defiant disorder; OR, odds ratio; ellipses, ORs were not estimated for very low prevalence profiles.

*Adjusted for age, sex, the interaction between being 13 years or older and sex, race, poverty, number of depression symptoms (excluding suicidality), number of other symptoms, and level of all symptom-related impairment. Reference group is children and adolescents with no psychiatric disorder. All ORs are corrected for within-individual correlations across waves.

†$P \leq .05$.

‡Comorbidity was associated with a significantly greater risk than pure disorders. In a model containing depression, ODD, and the interaction between depression and ODD, the interaction was OR = 49.2 ($P < .001$). In a model containing depression, GAD, and the interaction between depression and GAD, the interaction was OR = 27.9 ($P < .001$). In a model containing depression, GAD, the interaction between depression and GAD, and all other covariates, the interaction was OR = 15.8 ($P = .05$).

did not fully explain why youth with depression plus GAD were at increased risk. Severity of impairment and total symptom load did explain why youth with depression plus ODD were at such increased risk.

SUBTHRESHOLD DISORDERS

Suicidal youth without full *DSM-IV* psychiatric disorders had a significantly higher prevalence of 6 (mutually exclusive) subthreshold profiles than nonsuicidal youth without psychiatric disorders. Suicidal youth were more likely to have pure subthreshold disruptive disorders (27.95% vs 5.88%; $\chi^2 = 28.1$; $P < .001$), subthreshold disruptive disorders plus impairing relationship difficulties (15.24% vs 3.79%; $\chi^2 = 11.5$; $P < .001$), subthreshold disruptive disorders plus impairing relationship difficulties plus alcohol use (24.22% vs 0.22%; $\chi^2 = 538.6$; $P < .001$), and subthreshold disruptive disorders plus illicit drug use (12.11% vs 0.07%; $\chi^2 = 360.9$; $P < .001$) than nonsuicidal youth. Risk associated with subthreshold profiles were not adjusted for other covariates because there were not enough suicidal youth without subthreshold psychiatric problems to define a reference group.

COMMENT

To our knowledge, there are no directly comparable 3-month prevalence data in the epidemiological literature with which to compare our findings. Cumulative lifetime prevalence estimates for suicide attempts from studies that variably covered ages ranging from 9 to 19 years and used interviewer-based assessments range from 3% to 7%.[2-4,8,10,39] Excluding studies that did not explicitly assess intent[4,8] the estimated lifetime prevalence of youth suicide attempts is very consistent (3%-4%) across studies, including the GSMS. Current and lifetime prevalence estimates for other suicidal behaviors are, in contrast, highly variable.[2-4,7-11,34,40,41] The low prevalence estimates for other suicidal behaviors in the GSMS likely

©2006 American Medical Association. All rights reserved.
Downloaded From: http://archpsyc.jamanetwork.com/ on 12/02/2015

reflect the diversity of interstudy definitions.[42] The CAPA uses explicit operational definitions and relatively high thresholds in an effort to capture clinically significant thoughts and behaviors. The very strong proximal associations between psychiatric disorders and suicidality in the GSMS support the clinical significance of these definitions, but a lower or graded threshold may have identified more at-risk youth.

The sharply increased prevalence of suicide attempts in girls at 13 years of age replicates reports of a rapidly increasing risk in girls at this age.[37] The excess female-male ratio for suicide attempts was also consistent with previous reports[3,8] but, as expected, in contrast to the 0.38 female-male ratio of suicides in children and adolescents aged 9 to 16 years from North Carolina.[43] Of note, the female-male ratio for wanting to die in the absence of more overtly suicidal thoughts or acts was almost identical to the statewide ratio for suicide. A persistent wish to be dead in the absence of other suicidal indicators may identify more at-risk boys in the community than narrower definitions of suicidality.

Depression is a major risk factor for suicidality,[34] and it was the diagnosis associated with the greatest proximal risk in the GSMS through 16 years of age. We also found that the pattern of associated disorders was more informative than any single diagnosis. Risk associated with certain comorbid depression profiles was far greater than the combined risk for each constituent disorder in its pure form, replicating findings for older adolescents.[5,13] The diversity of psychiatric profiles observed in suicidal youth and the prominence of comorbid depression also masked a common source of explanatory risk. The severity of symptom-related impairment and, for 2 profiles, total symptom load was more informative than diagnosis per se. This does not, however, imply that diagnosis is unimportant. Depression is the focus of many research programs around the world because it causes more disability than any other disorder,[44] but our results indicate that assessing severity of impairment will help to identify depressed youth who are most at risk.

Substance use disorder increased risk for suicidality only in the presence of multiple psychiatric disorders. The latter always included depression. Depression may lead to SUD, or depression may be a complication of severe SUD. Anxiety disorders (specifically GAD) also increased risk only when comorbid,[2-4,7] again mostly in association with depression, replicating findings for older youth.[5,13] Although we typically expect to see an impact of comorbidity against a background of significant main effects for individual disorders, surveys of older youth have shown this is not always the case.[5,13] Comorbid SUD and comorbid GAD may index a different pattern of risk factors than pure SUD and pure GAD. Features of SUD or GAD may interact with features of associated comorbid profiles to substantially increase risk. For example, GAD-related irritability or SUD-related recklessness plus hopelessness may jointly increase risk much more than either individual feature does without the other. Comorbid SUD and comorbid GAD may also index a different prevalence or pattern of nonclinical risk factors compared with youth with pure profiles. These may include factors associated with increased psychic pain, such as social disengagement or loneliness,[45] or contextual factors, such as negative life events or family dysfunction. Substance use disorder may also be a complication of the primary psychiatric risk factors in suicidal youth and may thereby serve to index distress associated with severity of associated psychopathology.

Our findings for SUD currently apply only to adolescents through 16 years of age. Replication in older youth in whom comorbid drug abuse is more common[5,13] will determine the relevance of our findings for different age cohorts and will permit a more detailed exploration of the possible mechanisms via which SUD increases risk. The prominence of depression plus GAD was consistent with reports from clinical and selected samples[46,47] where the importance of comorbid depression has been emphasized.[5,48,49] Depression plus GAD must index a highly discriminating pattern of symptoms or other risk factors because this was the only profile that predicted suicidality independent of severity of impairment and total symptom load.

Youth suicide in the absence of psychiatric disorder is associated with prior suicidal behavior, legal/disciplinary problems, and familial psychiatric disorder, suggesting a propensity to significant but undetected psychiatric difficulties.[50,51] Our findings are consistent with that premise and highlight the importance of subthreshold disruptive disorders, especially in association with substance use.

The robust association between poverty and suicidality after controlling for psychiatric profile and severity of psychopathology accords with geographic variation in the incidence of deliberate self-harm and suicide that is associated with area-based measures of socioeconomic deprivation.[52] Socioeconomic deprivation is also associated with individual variation in risk in clinical settings, and with suicide in males.[52] Risk associated with poverty in adults is partly explained by social fragmentation.[52] In at-risk youth, poverty may index a vast list of potential risk factors, including abuse, trauma, social isolation or diminution of social support due to parental unemployment or illness, frequent residential moves, or the operation of other factors, that disturb familial or youth support structures.

The following limitations and caveats should be noted when interpreting the findings presented herein. First, the sample was derived from a relatively small geographic area in the southeastern United States and may not be representative of other areas. Second, there was no medical verification of reported suicide attempts. Third, the relatively high thresholds used to identify suicidality in the GSMS may attenuate associations with (impulsive) disruptive behavior disorders, which may be associated with more fleeting thoughts of suicide.

Several conclusions can be drawn regarding short-term risks for suicidality in children and adolescents through 16 years of age. Depression is a major proximal risk factor, especially in association with anxiety (specifically GAD) or disruptive disorders (primarily ODD). Anxiety or SUD alone do not increase risk. Subthreshold (disruptive) disorder is as potent a risk factor as many diagnosable psychiatric disorders. Severity of symptom-related impairment will help identify which youth with psychiatric disorders are most at risk. Youth living in poverty defined by federal guidelines for families are also at increased risk, irrespective of psychiatric profile or severity of psychopathology.

©2006 American Medical Association. All rights reserved.
Downloaded From: http://archpsyc.jamanetwork.com/ on 12/02/2015

Submitted for Publication: September 14, 2004; final revision received January 31, 2006; accepted February 3, 2006.
Correspondence: Debra L. Foley, PhD, Department of Human Genetics, Virginia Institute for Psychiatric and Behavioral Genetics, Medical College of Virginia Commonwealth University, PO Box 980003, Richmond, VA 23298-0003 (foley.debra@gmail.com).
Funding/Support: This study was supported by grants DA11301, MH57761, MH66252, MH48762, MH60324, and MH57761 and Independent Scientist Award MH01167 from the US National Institutes of Health; Faculty Scholar awards from the William T. Grant Foundation (Drs Costello and Angold); and a Young Investigator Award from The American Foundation for Suicide Prevention (Dr Foley).

REFERENCES

1. American Academy of Child and Adolescent Psychiatry. Summary of the practice parameters for the assessment and treatment of children and adolescents with suicidal behavior. *J Am Acad Child Adolesc Psychiatry*. 2001;40:495-499.
2. Gould MS, King R, Greenwald S, Fisher P, Schwab-Stone M, Kramer R, Flisher AJ, Goodman S, Canino G, Shaffer D. Psychopathology associated with suicidal ideation and attempts among children and adolescents. *J Am Acad Child Adolesc Psychiatry*. 1998;37:915-923.
3. Fergusson DM, Lynskey MT. Suicide attempts and suicidal ideation in a birth cohort of 16-year-old New Zealanders. *J Am Acad Child Adolesc Psychiatry*. 1995; 34:1308-1317.
4. Pilowsky DJ, Wu LT, Anthony JC. Panic attacks and suicide attempts in mid-adolescence. *Am J Psychiatry*. 1999;156:1545-1549.
5. Lewinsohn PM, Rohde P, Seeley JR. Adolescent psychopathology, III: the clinical consequences of comorbidity. *J Am Acad Child Adolesc Psychiatry*. 1995; 34:510-519.
6. Lewinsohn PM, Rohde P, Seeley JR. Psychosocial risk factors for future adolescent suicide attempts. *J Consult Clin Psychol*. 1994;62:297-305.
7. Reinherz HZ, Giaconia RM, Silverman AB, Friedman A, Pakiz B, Frost AK, Cohen E. Early psychosocial risks for adolescent suicidal ideation and attempts. *J Am Acad Child Adolesc Psychiatry*. 1995;34:599-611.
8. Andrews JA, Lewinsohn PM. Suicidal attempts among older adolescents: prevalence and co-occurrence with psychiatric disorders. *J Am Acad Child Adolesc Psychiatry*. 1992;31:655-662.
9. Kashani JH, Goddard P, Reid JC. Correlates of suicidal ideation in a community sample of children and adolescents [published correction appears in *J Am Acad Child Adolesc Psychiatry*. 1990;29:314]. *J Am Acad Child Adolesc Psychiatry*. 1989;28:912-917.
10. Levy JC, Deykin EY. Suicidality, depression, and substance abuse in adolescence. *Am J Psychiatry*. 1989;146:1462-1467.
11. Velez CN, Cohen P. Suicidal behavior and ideation in a community sample of children: maternal and youth reports. *J Am Acad Child Adolesc Psychiatry*. 1988; 27:349-356.
12. Angold A, Erkanli A, Costello EJ, Rutter M. Precision, reliability and accuracy in the dating of symptom onsets in child and adolescent psychopathology. *J Child Psychol Psychiatry*. 1996;37:657-664.
13. Wunderlich U, Bronisch T, Wittchen HU. Comorbidity patterns in adolescents and young adults with suicide attempts. *Eur Arch Psychiatry Clin Neurosci*. 1998; 248:87-95.
14. American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* . Washington, DC: American Psychiatric Association; 1994.
15. Costello EJ, Angold A, Burns BJ, Stangl DK, Tweed DL, Erkanli A, Worthman CM. The Great Smoky Mountains Study of Youth: goals, design, methods, and the prevalence of *DSM-III-R* disorders. *Arch Gen Psychiatry*. 1996;53:1129-1136.
16. Burns BJ, Costello EJ, Angold A, Tweed D, Stangl D, Farmer EMZ, Erkanli A. Children's mental health service use across service sectors. *Health Aff (Millwood)*. 1995;14:147-159.
17. Angold A, Prendergast M, Cox A, Harrington R, Simonoff E, Rutter M. The Child and Adolescent Psychiatric Assessment (CAPA). *Psychol Med*. 1995; 25:739-753.
18. Costello EJ, Angold A, March J, Fairbank J. Life events and post-traumatic stress: the development of a new measure for children and adolescents. *Psychol Med*. 1998;28:1275-1288.
19. Angold A, Costello EJ. A test-retest reliability study of child-reported psychiatric symptoms and diagnoses using the Child and Adolescent Psychiatric Assessment (CAPA-C). *Psychol Med*. 1995;25:755-762.
20. Shrout PE, Newman SC. Design of two phase prevalence surveys of rare disorders. *Biometrics*. 1989;45:549-555.
21. Schaie KW. A general model for the study of developmental problems. *Psychol Bull*. 1965;64:92-107.
22. Kleinbaum DG, Kupper LL, Morgenstern H. *Epidemiologic Research: Principles and Quantitative Methods*. New York, NY: Van Nostrand Reinhold; 1982.
23. Achenbach TM, Edelbrock CS. Behavioral problems and competencies reported by parents of normal and disturbed children aged four through sixteen. *Monogr Soc Res Child Dev*. 1981;46:1-82.
24. Costello EJ, Farmer Eangold A, Burns B, Erkanli A. Psychiatric disorders among American Indian and white youth in Appalachia: the Great Smoky Mountains Study. *Am J Public Health*. 1997;87:827-832.
25. Federman EB, Costello EJ, Angold A, Farmer EMZ, Erkanli A. Development of substance use and psychiatric comorbidity in an epidemiologic study of white and American Indian young adolescents: the Great Smoky Mountains Study. *Drug Alcohol Depend*. 1997;44:69-78.
26. Costello EJ, Farmer EMZ, Angold A. Same place, different children: white and American Indian children in the Appalachian Mountains. In: Cohen P, Robins L, Slomkowski C, eds. *Where and When: Historical and Geographical Aspects of Psychopathology*. Mahwah, NJ: Lawrence Erlbaum Associates; 1999:279-298.
27. Costello EJ, Mustillo S, Erkanli A, Keeler G, Angold A. Prevalence and development of psychiatric disorders in children and adoelscence. *Arch Gen Psychiatry*. 2003;60:837-844.
28. Angold A, Fisher PW. Interviewer-based interviews. In: Shaffer D, Lucas C, Richters J, eds. *Diagnostic Assessment in Child and Adolescent Psychopathology*. New York, NY: Guilford Press; 1999:34-64.
29. Wing JK, Cooper JE, Sartorius N. Present State Examination (PSE). In: Wing JK, Cooper JE, Sartorious N, eds. *The Measurement and Classification of Psychiatric Symptoms*. New York, NY: Cambridge University Press; 1974:1-9.
30. Wing JK, Barbor T, Brugha T, Burke J, Cooper JE, Giel R, Jablenski A, Regier D, Sartorius N. SCAN: Schedules for Clinical Assessment in Neuropsychiatry. *Arch Gen Psychiatry*. 1990;47:589-593.
31. Bird HR, Gould MS, Staghezza B. Aggregating data from multiple informants in child psychiatry epidemiological research. *J Am Acad Child Adolesc Psychiatry*. 1992;31:78-85.
32. Ezpeleta L, Keeler G, Erkanli A, Costello EJ, Angold A. Epidemiology of psychiatric disability in childhood and adolescence. *J Child Psychol Psychiatry*. 2001; 42:901-914.
33. Littell RC, Milliken GA, Stroup WW, Wolfinger RD. *SAS System for Mixed Models*. Cary, NC: SAS Institute Inc; 1996.
34. Lewinsohn PM, Rohde P, Seeley JR. Adolescent suicidal ideation and attempts: prevalence, risk factors, and clinical implications. *Clin Psychol Sci Pract*. 1996; 3:25-46.
35. Diggle PJ, Liang KY, Zeger SL. *Analysis of Longitudinal Data*. Oxford, England: Clarendon Press; 1994.
36. Pickles A, Dunn G, Vazquez-Barquero JL. Screening for stratification in two-phase ("two-stage") epidemiological surveys. *Stat Methods Med Res*. 1995; 4:73-89.
37. Lewinsohn PM, Rohde P, Seeley JR, Baldwin CL. Gender differences in suicide attempts from adolescence to young adulthood. *J Am Acad Child Adolesc Psychiatry*. 2001;40:427-434.
38. Angold A, Costello EJ, Erkanli A, Worthman CM. Pubertal changes in hormone levels and depression in girls. *Psychol Med*. 1999;29:1043-1053.
39. Glowinski AL, Bucholz KK, Nelson EC, Fu Q, Madden PA, Reich W, Heath AC. Suicide attempts in an adolescent female twin sample. *J Am Acad Child Adolesc Psychiatry*. 2001;40:1300-1307.
40. Grunbaum JA, Kann L, Kinchen S, Ross J, Hawkins J, Lowry R, Harris WA, McManus T, Chyen D, Collins J. Youth risk behavior surveillance: United States, 2003. *MMWR Surveill Summ*. 2004;53:1-96.
41. Borowsky IW, Ireland M, Resnick MD. Adolescent suicide attempts: risks and protectors. *Pediatrics*. 2001;107:485-493.
42. O'Carroll PW, Berman AL, Maris RW, Moscicki EK, Tanney BL, Silverman MM. Beyond the Tower of Babel: a nomenclature for suicidology. *Suicide Life Threat Behav*. 1996;26:237-252.
43. National Center for Injury Prevention and Control. Suicide deaths and rates per 100,000. National Center for Injury Prevention and Control, Centers for Disease Control and Prevention. 2001. http://www.cdc.gov/ncipc/. Accessed May 25, 2004.
44. World Health Organization. *The World Health Report 2001—Mental Health: New Understanding, New Hope*. Geneva, Switzerland: World Health Organization; 2001.
45. Conner KR, Duberstein PR, Conwell Y, Seidlitz L, Caine ED. Psychological vulnerability to completed suicide: a review of empirical studies. *Suicide Life Threat Behav*. 2001;31:367-385.
46. Esposito CL, Clum GA. Psychiatric symptoms and their relationship to suicidal ideation in a high-risk adolescent community sample. *J Am Acad Child Adolesc Psychiatry*. 2002;41:44-51.
47. Strauss J, Birmaher B, Bridge J, Axelson D, Chiappetta L, Brent D, Ryan N. Anxiety disorders in suicidal youth. *Can J Psychiatry*. 2000;45:739-745.
48. Pawlak C, Pascual-Sanchez T, Rae P, Fischer W, Ladame F. Anxiety disorders, comorbidity, and suicide attempts in adolescence: a preliminary investigation. *Eur Psychiatry*. 1999;14:132-136.
49. Masi G, Mucci M, Favilla L, Millepiedi S. Anxiety comorbidity in referred children and adolescents with dysthymic disorder. *Psychopathology*. 2001;34:253-258.
50. Brent DA, Perper JA, Moritz G, Allman C, Friend A, Roth C, Schweers J, Balach L, Baugher M. Psychiatric risk factors for adolescent suicide: a case-control study. *J Am Acad Child Adolesc Psychiatry*. 1993;32:521-529.
51. Marttunen MJ, Aro HM, Henriksson MM, Lonnqvist JK. Mental disorders in adolescent suicide: *DSM-III-R* axes I and II diagnoses in suicides among 13- to 19-year-olds in Finland. *Arch Gen Psychiatry*. 1991;48:834-839.
52. Hawton K, Harriss L, Hodder K, Simkin S, Gunnell D. The influence of the economic and social environment on deliberate self-harm and suicide: an ecological and person-based study. *Psychol Med*. 2001;31:827-836.

©2006 American Medical Association. All rights reserved.
Downloaded From: http://archpsyc.jamanetwork.com/ on 12/02/2015