

An Outcome Evaluation of the Sources of Strength Suicide Prevention Program Delivered by Adolescent Peer Leaders in High Schools

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Suicide accounts for more deaths among 10- to 24-year-olds in the United States than do all natural causes combined.¹⁻³ Each year, 5% to 8% of adolescents attempt suicide, and up to one third of these attempts result in an injury requiring medical intervention.¹⁻³ To address this public health problem, school-based suicide prevention programs have proliferated as a cost-effective and convenient way to reach adolescents; however, few have been rigorously evaluated, and only a narrow range of approaches has been used along the continuum of public health interventions.¹

Currently, school-based suicide prevention programs focus primarily on reducing individual-level risk factors by increasing identification and referral for treatment of students at high risk for suicide.⁴ The 3 major strategies involve (1) direct screening of school populations for mood, substance abuse, or suicide problems⁵⁻⁸; (2) training school staff as gatekeepers to increase the identification and referral of suicidal students⁹⁻¹¹; and (3) hybrid programs combining educational curricula with screening to increase students' self-referral.¹²⁻¹⁴ Nearly three quarters of students referred through screening will utilize at least some treatment with intensive case management; however, minimal evaluation has been reported to determine whether referrals to usual services reduce suicide risk.¹⁵ Staff gatekeeper training increases knowledge and attitudes,^{11,16-18} but a recently completed randomized trial showed no overall increases from gatekeeper training in staff-student communication about suicide.¹¹ The Signs of Suicide program, which combined an educational curriculum with a self-screening component, decreased high school students' short-term rates of self-reported suicide attempts but did not increase use of services, suggesting that some mechanism other than treatment of mental health problems decreased suicidal behaviors.^{12,13}

Objectives. We examined the effectiveness of the Sources of Strength suicide prevention program in enhancing protective factors among peer leaders trained to conduct schoolwide messaging and among the full population of high school students.

Methods. Eighteen high schools—6 metropolitan and 12 rural—were randomly assigned to immediate intervention or the wait-list control. Surveys were administered at baseline and 4 months after program implementation to 453 peer leaders in all schools and to 2675 students selected as representative of the 12 rural schools.

Results. Training improved the peer leaders' adaptive norms regarding suicide, their connectedness to adults, and their school engagement, with the largest gains for those entering with the least adaptive norms. Trained peer leaders in larger schools were 4 times as likely as were untrained peer leaders to refer a suicidal friend to an adult. Among students, the intervention increased perceptions of adult support for suicidal youths and the acceptability of seeking help. Perception of adult support increased most in students with a history of suicidal ideation.

Conclusions. Sources of Strength is the first suicide prevention program involving peer leaders to enhance protective factors associated with reducing suicide at the school population level. (*Am J Public Health.* 2010;100:1653-1661. doi:10.2105/AJPH.2009.190025)

Another limitation of programs relying on referrals to address the needs of suicidal adolescents is that the programs may not suit many communities' resources. In many rural and underserved communities, where suicide rates among youths are 2 to 10 times above the national average,^{19,20} there is scarcity of, and low accessibility to, mental health services.²¹

Modifying socioecological factors at the population level is an alternative suicide prevention strategy that has not been systematically tested. Pertaining to the relationship systems in which adolescents interact,^{22,23} factors that protect high school students from suicide risk include the quality and density of relationship ties as well as the norms that are propagated within those systems.²⁴⁻²⁸ The rationale for this intervention approach comes from well-established associations between suicidal behavior and adolescents' social ties and

norms. Specifically, suicidal adolescents have fewer positive connections to adults^{25,27} and peers^{24,26,28} and lower expectations of peer support for seeking help from adults.¹¹ Social connectedness, which encompasses social integration and support,²⁹ may reduce suicide risk through several protective mechanisms, including enhanced psychological well-being,³⁰ increased monitoring of behavior by others,²⁴ and exposure to normative social influences that encourage adaptive coping strategies.²⁹ Suicidal adolescents also have more ties to other suicidal youths, and adolescents who have a friend attempt suicide are 2 to 3 times as likely as are other adolescents to make an attempt themselves.^{24,31} Peer suicidal behavior may promote a perceived norm that suicide is a common-place response to distress, and adolescents are more susceptible to suicide imitation than are other age groups.³² Suicide

acceptance is linked to increased suicidal behavior and planning.^{33–35}

Sources of Strength³⁶ is built on a universal school-based suicide prevention approach designed to build socioecological protective influences across a full student population. Youth opinion leaders from diverse social cliques, including at-risk adolescents, are trained to change the norms and behaviors of their peers by conducting well-defined messaging activities with adult mentoring. The purpose is to modify the norms propagated through communication within peer groups to alter perceptions of what is typical behavior (i.e., descriptive norms) and of the social consequences for positive coping behaviors (i.e., injunctive norms).^{37,38} Peer leaders model and encourage friends to (1) name and engage “trusted adults” to increase youth–adult communication ties; (2) reinforce and create an expectancy that friends ask adults for help for suicidal friends, thereby reducing implicit suicide acceptability; and (3) identify and use interpersonal and formal coping resources. Changing these socioecological factors is designed to connect suicidal youths with capable adults and to reduce the likelihood that lower-risk youths will enter a trajectory that includes suicidal ideation or behavior. The use of peer leaders is well-suited to adolescence³² and is congruent with diffusion of innovations theory³⁹ and Valente’s⁴⁰ social network thresholds model, which point to the importance of one’s personal network in adopting new norms and behaviors.

In this article, we report results from a test of the short-term impact of Sources of Strength in 18 high schools that were recruited in 2 phases from 3 states.⁴¹ The first goal of this experiment was to measure the impact of the intervention on student peer leaders. Among peer leaders, Sources of Strength was expected to increase (1) positive norms pertaining to suicide, including the acceptability of obtaining adult help for suicidal friends despite their requests for secrecy (i.e., rejecting codes of silence) and using adaptive coping strategies to manage psychological risk factors; (2) social connectedness, including increasing the number of trusted adults at school and use of formal and informal coping resources (Sources of Strength); and (3) the frequency of engaging adults to help distressed or suicidal friends. In addition, by training diverse peer leaders within each school, Sources of Strength was expected to provide well-adapted

students with opportunities to influence at-risk students, thereby reducing possible iatrogenic effects that may occur by grouping at-risk adolescents.⁴² Accordingly, we also hypothesized that peer leaders who gained the most from the intervention would be those with the most maladaptive norms before training.

The second goal of this experiment was to ascertain the impact of the intervention on norms about suicide and social connectedness in the full student population, including suicidal youths. After 3 months of Sources of Strength messaging, students representative of their school’s population were expected to report (1) increased expectations that adults can help suicidal youths and increased acceptability of obtaining help for suicidal friends and (2) greater acceptability of help-seeking for personal distress and use of Sources of Strength resources for coping. Peer leader effects have been found to modify norms for publicly visible behaviors such as tobacco use,⁴³ but have not previously been demonstrated for norms about suicide.

METHODS

The 18 schools included in the intervention are summarized in Table 1. Random assignment occurred at the school level because Sources of Strength is intended to be a schoolwide intervention.³⁶ Six metropolitan schools in Cobb County, Georgia, participated in the first phase (2007–2008). Eight predominantly rural schools in New York and 4 in North Dakota participated in phase 2 (2008–2009). After blocking the schools by state and region and matching by size, 1 school from each pair was randomly assigned to begin training immediately and the other to a wait-list control group to begin training 5 months later. We have found the use of randomization to assign wait-list status to be acceptable to schools in lieu of a traditional control condition.^{11,19} The metropolitan schools were larger and had more African American and Hispanic students than did the rural schools. No school withdrew or altered its assigned status. The intervention impact was tested on peer leaders in all 18 schools and representative samples of students in the 12 schools in phase 2.

Before assignment to early or late training, each school used identical, standardized

procedures to recruit peer leaders. Nomination forms were distributed school-wide, and each staff member was asked to nominate up to 6 students whose “voices are heard” by other students. A team reviewed the nominations to select a diverse group representing as many student friendship groups as possible; additional nominations by students and administrators were obtained as needed. Each school in phase 1 recruited approximately 2% of all students. Each school in phase 2 recruited approximately 10% of all students to increase the number of peer leaders involved in the intervention messaging phase. Of the 720 students nominated (10 to 54 per school), 496 (68.9%) enrolled with parent permission and youth’s assent, and 453 completed 2 assessments: the first before any schools were randomly assigned to a condition (baseline) and the second 4 months later, after the early intervention schools had completed 3 months of messaging activities and before training had started in the wait-listed schools.

The characteristics of the peer leaders are summarized in Table 1. The intervention and control groups were equivalent in terms of gender and race/ethnicity; however, peer leaders in the intervention condition were, on average, 0.5 years younger (mean age=15.7 years, SD=1.17) than were the controls (mean age=16.1 years, SD=1.12; $t=3.46$; $P<.001$). To assess the impact of the intervention on the student population in this group-randomized trial,⁴⁴ anonymous surveys were administered at baseline and 4 months later to students in the 12 schools in phase 2. Surveys were administered to all students in the 6 smallest schools and to one half of all classrooms selected through stratified (by grade) random sampling in the larger schools. Peer leaders were excluded. The proportion of students completing baseline surveys was comparable in the intervention (84.9%) and the control (76%) schools. The surveyed students ($n=2675$) in the intervention and control schools were also equivalent in terms of gender, age, and race/ethnicity (Table 1). There was no significant difference in the proportion of students who completed the second survey for early (77%) and wait-listed schools (69%). Because the surveys were anonymous, the proportion of students completing both surveys could not be

TABLE 1—Characteristics of Schools, Peer Leaders Trained, and Students, by Study Group and Site: Sources of Strength Suicide Prevention Program, Georgia, New York, and North Dakota, 2007-2008

	Georgia		New York		North Dakota	
	Intervention	Control	Intervention	Control	Intervention	Control
Schools						
No. of schools	3	3	4	4	2	2
No. of students, mean (range)	2306 (1847-2643)	1889 (1594-2208)	621 (308-1007)	261 (97-387)	134 (67-201)	97 (71-122)
Total no. of students	6888	6059	2485	1043	293	193
Race/ethnicity, % (range)						
Black	35.0 (7-70)	33.3 (6-46)	2.8 (0.3-9.0)	7.7 (0-30)	0.2 (0-0.4)	0.5 (0-1)
Hispanic	8.0 (2-14)	18.3 (3-32)	0.8 (0-2)	2.0 (0.5-5.2)	0.4 (0-0.7)	1.0 (0-2)
White	52.0 (12-89)	41.7 (14-27)	95.4 (89-98)	98.7 (65.0-99.2)	98.5 (98.5)	94.5 (89-100)
Peer leaders						
Sex, no. (%)						
Female	61 (70.9)	69 (75.8)	83 (60.1)	44 (55.0)	29 (76.3)	10 (50.0)
Male	31 (29.1)	16 (24.2)	55 (39.9)	36 (45.0)	9 (23.7)	10 (50.0)
Race/ethnicity, no. (%)						
Black	32 (35.2)	31 (36.0)	5 (3.6)	3 (3.8)	1 (2.6)	0
Hispanic	13 (14.3)	13 (15.1)	4 (2.9)	1 (1.3)	0	1 (5.0)
White	38 (41.8)	37 (43.0)	119 (86.2)	71 (88.8)	37 (97.4)	19 (95.0)
Peer leaders/total students, % (range)	1.3 (0.8-2.0)	1.9 (1.7-2.3)	6.4 (4.0-9.0)	7.6 (4.6-9.2)	14.4 (14.0-15.0)	10.4 (9.8-11.0)
Students surveyed from school population						
Sex, no. (%)						
Female	NA	NA	832 (52.7)	390 (51.9)	86 (48.0)	84 (50.3)
Male	NA	NA	746 (47.3)	361 (48.1)	93 (52.0)	83 (49.7)
Race/ethnicity, no. (%)						
Black	NA	NA	78 (4.8)	15 (2.0)	2 (0.6)	0
Hispanic	NA	NA	220 (13.6)	77 (10.1)	7 (3.9)	14 (8.4)
White	NA	NA	1193 (73.6)	626 (81.9)	168 (92.8)	140 (83.3)

Note. NA = not applicable. Population-level surveys were not administered in Georgia schools. Race/ethnicity percentages do not equal 100% of samples because “other” race/ethnicity groups are not reported or because of missing data.

ascertained directly. An informational letter allowed parents to refuse their child’s participation; students provided their own assent, and participation was voluntary.

Study Intervention

Sources of Strength³⁶ was implemented using the 3 standard phases: (1) school and community preparation, (2) peer leader training, and (3) schoolwide messaging. The school and community preparation phase included training 2 to 3 staff members as adult advisors who would guide the peer leaders to conduct safe suicide prevention messaging (4 to 6 hours of training). A 1-hour orientation to the intervention was provided to school staff. Staff in Georgia schools had attended a 1-hour gatekeeper training within the previous 2 years.¹¹

Peer leader training consisted of 4 hours of interactive training for peer leaders and adult advisors led by certified trainers following 15 modules. One focus was on 8 protective “sources of strength” and skills for increasing those resources for themselves and other students. Another focus was on engaging “trusted adults” to help distressed and suicidal peers.

In the schoolwide messaging phase, peer leaders carried out specific messaging steps with adult advisor mentoring: they engaged trusted adults, encouraged friends to identify their trusted adults, and disseminated messages about Sources of Strength through presentations, public service announcements, and video or text messages on Internet social network sites. Peer leaders in each school completed at least 3 of the 4 messaging steps; participation in

messaging ranged from 59% to 100% across schools. To check fidelity, 36 staff members in 4 schools in phase 2 were interviewed after the messaging phase. A total of 97.2% had observed or received intervention-specific messages, and 88.9% of those named as trusted adults reported that they had been contacted by a peer leader as the intervention had intended.

Measures

Peer leaders completed questionnaires covering 3 constructs: (1) suicide perceptions and norms, (2) social connectedness, and (3) peer leader behaviors. Several scales were created to assess constructs for which measures did not previously exist. An expert panel reviewed items for content validity.

Help for Suicidal Peers assessed perceptions that adults help suicidal students in their school ($\alpha=0.75$; 4 items). Reject Codes of Silence assessed overcoming secrecy barriers to engage adults for suicidal peers ($\alpha=0.68$; 6 items, e.g., “I would tell an adult about a suicidal friend, even if that friend asked me to keep it secret”). Maladaptive Coping assessed perceptions including suicide acceptability ($\alpha=0.60$; 4 items, e.g., “Suicide is a possible solution to problems”).⁴⁵

Help Seeking From Adults at School assessed expectations and perceived peer norms about seeking help ($\alpha=0.78$; 4 items, e.g., “If I was really upset and needed help my friends would want me to talk to an adult at school”).¹¹ On Sources of Strength Coping, students rated their status on 8 resources spanning family, friends, adult mentors, and services ($\alpha=0.81$; 9 items). School Engagement assessed attitudes and participation ($\alpha=0.63$; 4 items). On Trusted Adults, students listed the names of adults whom they would ask for help for a suicidal friend (only completed in phase 2 schools).

Two questions assessed the frequency of behaviors in the past 3 months corresponding to the intervention’s objective of increasing peer leaders’ partnering with adults to help peers (Referred Distressed Peers to Adults; $\alpha=0.76$; 2 items): “I told a friend who was considering suicide to get help from an adult” answered on a 5-point frequency scale (never, 1–2, 3–5, 6 or more times); “I told a friend to get help because of emotional or behavior problems” answered on the same 5-point scale. Support to Peers assessed the frequency of supportive behaviors ($\alpha=0.78$; 2 items). With the exception of the Maladaptive Coping questionnaire, higher scores indicated adaptive perceptions and behaviors.

Students in the school population completed 4 scales measuring constructs targeted by peer leaders’ messaging: Help for Suicidal Peers, Reject Codes of Silence, Help-Seeking From Adults, and Sources of Strength Coping. Suicidal ideation in the past year and past 3 months was assessed by 2 questions. The first question was, “During the last 3 months have you seriously thought about killing yourself?” The second question was, “During the past year have you seriously thought about killing yourself?” Past-year suicidal

ideation was assessed to determine whether exposure to Sources of Strength increased suicidal ideation reporting and to explore differential intervention impact on students with and without a history of suicidal ideation. Suicidal ideation in the prior 3 months was used to assess changes during the intervention period and to monitor the safety of the trial. Student suicide deaths were also collected for safety monitoring. One student died by suicide shortly after that school received peer leader training (year and state not disclosed for confidentiality purposes). Our data safety and monitoring committee found no indication that this death was related to the intervention. Surveys listed mental health support contact information for students with concerns about suicidal behavior for themselves or others.

Data Analyses

To test for intervention effects on peer leaders, we used a 2-level linear mixed-effects model (LMM) in which level 1 included individual covariates (gender, grade, age, race/ethnicity, and baseline scores) and level 2 included fixed factors of intervention condition and state. Schools were included in each model as random factors because randomization occurred at that level. All analyses used an intent-to-treat approach by including all enrolled peer leaders regardless of their level of participation.⁴⁶ We reported intervention changes from baseline by using Cohen *d* effect sizes (ESs),⁴⁷ which were adjusted for all level 1 covariates. We also tested whether baseline factors moderated the intervention by including baseline-by-condition interactions. To compare intervention effects in the 2 phases, we included a year-by-condition interaction. To evaluate the impact of Sources of Strength on the 2 peer leader self-reports of referral behaviors, we conducted generalized mixed models in SAS version 9.1 (SAS Institute Inc, Cary, NC) by using GLIMMIX, in which we treated the outcome as dichotomous and school as a random factor. In conducting tests of the intervention effects on these 2 variables, we took a more conservative approach of replacing GLIMMIX’s degrees of freedom for the F-test, which is dependent on the overall number of peer leaders, with the number of schools. This small sample correction to testing in

a group-based trial with a dichotomous outcome closely matches the test in a similar design with a normally distributed outcome.

To ascertain the intervention effects on the student populations in the 12 rural schools in which the data were longitudinal but unlinked, we tested for changes in survey responses by school over time and by condition by examining aggregate scores within schools by gender and grade at baseline and follow-up. We then used univariate analysis of covariance models to control for baseline school aggregate scores on each scale, plus condition (tested with 9 denominator degrees of freedom), state, gender, age, and school (treated as a random effect). Race/ethnicity was not included because of low frequencies for some categories. Next, student surveys were categorized by suicidal ideation in the past year (yes or no), and models were run that included a main effect term for suicidal ideation and a suicidal ideation-by-condition interaction term. We also tested for interactions of condition by grade and gender.

Power was calculated⁴⁸ by assuming an intraclass correlation of 0.05 and by using reciprocal averages for sample size (average $n=20$ for peer leaders and $n=200$ for school population). There was 80% power to detect an effect size of 0.44 for peer leader measures in all 18 schools and an effect size of 0.42 for student population in the 12 schools. All analyses were conducted by using SAS.

RESULTS

One difference was found between peer leaders who were retained versus those who dropped out over the 4-month intervention period. Peer leaders who were retained in schools in both randomized conditions had marginally higher baseline scores on School Engagement ($F_{1, 13.41}=4.44$; $P=.054$). However, attrition of peer leaders was not related to school randomization condition, which indicated that our subsequent analyses and interpretations about the impact of the intervention were not vulnerable to this potential threat to validity. There were no significant differences by condition in any baseline behavioral measure for peer leaders or other students. Past-year suicidal ideation rates in the population at baseline were

14.8% for the intervention schools and 12.8% for the control schools (not significantly different). Students with suicidal ideation had more maladaptive suicide perceptions and lower social connectedness than did students without suicidal ideation ($P < .001$). Intervention exposure did not increase past-year suicidal ideation reported through anonymous surveys. At the second survey, 11.6% in the intervention schools and 12.2% in the control schools reported suicidal ideation, but these decreased rates did not vary significantly by randomized condition. Attenuation of suicidal ideation has also been found in other longitudinal studies with linked data⁵; slightly lower participation at the second survey or time of year may also have contributed to decreased rates of suicidal ideation.

Impact of Sources of Strength on Student Peer Leaders

We found consistent evidence of a positive intervention impact on peer leaders after 4 months. Means (corrected for baseline) and standard deviations at follow-up are shown in Table 2. Average standardized training ESs, 95% confidence intervals (CIs), and significance levels based on 16 denominator degrees of freedom are also shown. The values for relative change in the table

compare how training affected peer leaders differentially on the basis of their baseline response. This relative change score was negative if training had a larger effect on peer leaders with low compared with high baseline scores.

All outcomes for peer leaders were in the expected direction, and most were highly significant. Trained peer leaders reported much more positive expectations that adults at school help suicidal students ($ES = 0.75$; $P < .001$), more rejection of codes of silence ($ES = 0.34$; $P < .002$), and decreased maladaptive coping attitudes ($ES = 0.26$; $P < .01$). Training also substantially increased norms for help-seeking from adults at school ($ES = 0.62$; $P < .001$), use of the Sources of Strength coping resources ($ES = 0.44$; $P < .002$), and the number of identified trusted adults ($ES = 0.49$; $P < .001$). School engagement also was increased in trained peer leaders ($ES = 0.22$; $P < .043$). Concerning peer leaders' behaviors, training increased support to peers ($ES = 0.34$; $P < .015$), and the intervention impact was directionally positive on connecting distressed peers to adults ($ES = 0.21$; $P = .08$).

The intervention affected peer leaders more strongly if they had low baseline norms or connectedness than if they had high baseline scores, as shown by the significant negative values for relative change in Table 2.

The most significant interactions of training with baseline scores were for school engagement (relative change = $-.26$) and trusted adults (relative change = $-.28$). By contrast, training increased peer leaders' referrals of distressed peers to adults most strongly for those with higher baseline scores (relative change = $.20$).

The only significant difference in the impact of the intervention on peer leaders by study phase was for referred distressed peers, as shown by a significant intervention condition-by-phase interaction ($F_{1, 7.36} = 6.80$; $P = .034$). Training increased peer leader referrals in the large metropolitan schools in phase 1 ($ES = 0.43$; 95% CI = 0.10, 0.77) but not in the smaller phase 2 schools ($ES = 0.03$; 95% CI = -0.25 , 0.30). To further specify the intervention impact on referrals in the 6 large schools, we extended our analysis by using logistic regression to examine separately the 2 types of referrals. Both variables were dichotomized (1 or more referrals versus none), and follow-up referrals were regressed on baseline scores with gender, age, and race/ethnicity as covariates. For referral of a peer because of concerns about suicide, the odds ratio for making a referral in the intervention condition was 4.12 times as great as in the untrained schools (95% CI = 1.91, 8.91; $F_{1,4} = 10.42$; $P = .03$). There was no

TABLE 2—Effects of the Sources of Strength Suicide Prevention Program on Peer Leaders' Suicide Perceptions, Social Connectedness, and Behaviors with Peers, Georgia, New York, North Dakota, 2007-2008

	Trained (n=268), Mean (SD)	Untrained (n=185), Mean (SD)	Effect Size (95% CI)	P	Relative Change (95% CI)	P	ICC School
Suicide perceptions and norms							
Help for suicidal peers	3.53 (0.45)	3.23 (0.47)	0.75 (0.53, 0.97)	<.001	-0.16 (-0.31, -0.001)	0.049	0.022
Reject codes of silence	3.59 (0.45)	3.47 (0.48)	0.34 (0.13, 0.54)	.002	-0.05 (-0.18, 0.08)	0.44	0.012
Maladaptive coping	1.26 (0.35)	1.35 (0.36)	0.26 (0.05, 0.46)	.013	-0.19 (-0.36, -0.02)	0.034	<0.001
Social connectedness							
Help-seeking from adults	3.25 (0.54)	2.94 (0.60)	0.62 (0.41, 0.84)	<.001	-0.10 (-0.27, 0.07)	0.254	0.006
Sources of Strength coping	3.52 (0.41)	3.38 (0.42)	0.44 (0.19, 0.69)	.002	-0.004 (-0.17, 0.16)	0.961	0.042
School engagement	3.27 (0.47)	3.20 (0.48)	0.22 (0.04, 0.48)	.043	-0.26 (-0.41, -0.11)	0.001	<0.001
Trusted adults ^a	3.43 (1.66)	2.72 (1.69)	0.49 (0.20, 0.77)	<.001	-0.28 (-0.50, -0.07)	0.009	0.016
Peer leader behaviors							
Referred distressed peers	0.49 (0.62)	0.38 (0.49)	0.21 (-0.01, 0.41)	.08	0.20 (0.03, 0.37)	0.025	0.012
Support to peers	6.20 (1.31)	5.88 (1.39)	0.34 (0.08, 0.61)	.015	-0.12 (-0.25, 0.02)	0.086	0.036

Note. CI = confidence interval; ICC = intraclass correlation. Effect size is the difference in means for trained and untrained groups after adjustment for a linear effect of baseline, divided by the total standard deviation. Relative change is the ratio of slopes (time 2 scores regressed on baseline scores) for the trained versus untrained groups. A negative ratio indicates a greater gain from training for participants with low baseline scores.

^aTrusted adults were assessed only in phase 2 schools (New York and North Dakota).

intervention effect on referring friends to adults because of other emotional or behavior problems.

Impact of Sources of Strength on the Student Population

As seen in Table 3, there were positive and significant population-level intervention effects on perceptions of adult help for suicidal peers (ES=0.63; 95% CI=0.29, 0.97) and on norms for help-seeking from adults (ES=0.58; 95% CI=0.24, 0.91). The intervention effect on rejecting codes of silence was directionally positive but non-significant (ES=0.41; 95% CI=-0.08, 0.74; *P*=.17). There was no significant change in the Sources of Strength coping measure.

Intervention effects on perceptions of adult help for suicidal peers varied by history of suicidal ideation, as revealed by a condition-by-suicidal ideation interaction (*P*=.037). To elucidate, we predicted time 2 perceptions separately for surveys aggregated at both time points by the presence or absence of past-year suicidal ideation, gender, and grade. The intervention significantly increased perceptions of adult help for students with suicidal ideations ($F_{1, 5.78} = 8.35$; *P*=.029) and was positive but nonsignificant for students without suicidal ideations ($F_{1, 8.62} = 3.59$; *P*=.092). The means and CIs for perceptions at time 2 (corrected for baseline) by suicidal ideation and condition are displayed in Figure 1. The intervention impact was larger for the proportion of the school population with a history of suicidal ideation; however, the proportion of students reporting suicidal ideations at both surveys could not be ascertained directly by these unlinked data. No other interactions were significant.

At baseline, rates of suicidal ideation in the past 3 months were 8.8% in the intervention schools (female adolescents, 10.3%; male adolescents, 6.9%) and 8.4% in the control schools (female adolescents, 10.6%; male adolescents, 5.7%); no differences by condition were found. There was substantial variation in these baseline rates across schools (range=0.5%–23.4%), and baseline suicidal ideation rates were significantly lower in schools in North Dakota than in New York. Three-month suicidal

TABLE 3—Effects of the Sources of Strength Suicide Prevention Program on Suicide Perceptions and Social Connectedness at the School Population Level, New York and North Dakota, 2007-2008

	Trained Population (n=6), Mean (SD)	Untrained Population (n=6), Mean (SD)	Effect Size (95% CI)	<i>P</i>
Suicide perceptions and norms				
Help for suicidal peers	2.99 (0.43)	2.73 (0.40)	0.63 (0.29, 0.97)	.034
Reject codes of silence	3.15 (0.42)	2.98 (0.38)	0.41 (-0.08, 0.74)	.174
Social connectedness				
Help-seeking from adults	2.73 (0.45)	2.48 (0.40)	0.58 (0.24, 0.91)	.04
Sources of Strength coping	2.91 (0.46)	2.86 (0.41)	0.11 (-0.21, 0.43)	.966

Note. CI=confidence interval. Effect size is the difference in means for trained and untrained groups after adjustment for a linear effect of baseline, divided by the total standard deviation.

ideation decreased overall at the second survey, but the decrease was not significantly different by condition. The prevalence of 3-month suicidal ideation at time 2, controlling for baseline, was 4.38% (95% CI=2.14, 6.62) for the intervention schools and 5.16% (95% CI=3.31, 7.00) for the control schools.

DISCUSSION

Training of peer leaders with the Sources of Strength curriculum led to changes in norms across the full population of high school students after 3 months of school-wide messaging. The norms most strongly enhanced through the intervention were students' perceptions that adults in their school can provide help to suicidal students and the acceptability of seeking help from adults. These changes were congruent with the proximate goals of Sources of Strength to enhance norms pertaining to suicide, knowledge of capable adults, and the perceived acceptability of engaging adults for help within student peer groups. We also found that the largest, most positive increases in perceptions of adult help for suicidal youth occurred among students with a history of suicidal ideation. These findings show that an intervention delivered by adolescent peer leaders can modify a set of norms across the full school population that are conceptually and empirically linked to reduced suicidal behavior.^{11,25,27}

The use of peer leaders has become a state-of-the-art approach in substance abuse prevention,⁴⁹ HIV prevention,⁵⁰ and in other health

promotion interventions,⁵¹ but not yet in suicide prevention.⁵² This study showed that Sources of Strength training was highly effective in increasing diverse peer leaders' adaptive norms about suicide as well as positive coping, connectedness to adults, and supportive behaviors with their friends. Peer leaders with the least adaptive norms, lowest school engagement, and fewest connections to adults benefited the most. By training diverse adolescents together and providing ongoing adult mentoring, the Sources of Strength approach appears to minimize potential iatrogenic effects of grouping at-risk adolescents.⁴² Overall, these findings suggest that the Sources of Strength training had a beneficial effect for peer leaders on 2 intervention targets. First, the training prepared diverse students to become effective agents of change in their schools by implementing systematic messaging activities, including peer-to-adult and peer-to-peer contacts, classroom presentations, and public service announcements. Interviews with staff in a subset of schools, which were designed to check the fidelity of the messaging steps, indicated that the messages pertaining to Sources of Strength had reached nearly all adults. Moreover, peer leaders, as intended, personally engaged those adults that they identified as their trusted adults.

Second, Sources of Strength enhanced in the group of peer leaders a set of protective factors including their norms pertaining to help-seeking, connectedness with adults, and school engagement. The preceding protective factors, in addition to being associated with lower risk for suicidal behavior,^{11,25,27} are also associated

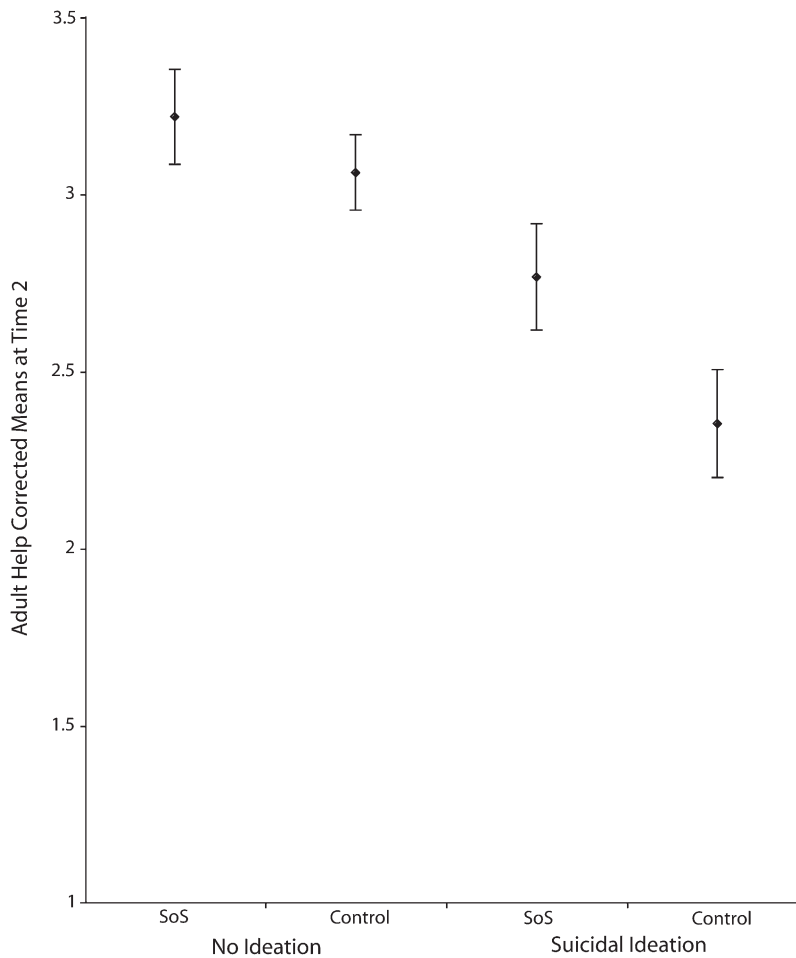


FIGURE 1—Perceptions of adult help for suicidal youths at time 2 by condition and suicidal ideation status in the school population: Sources of Strength (SoS) suicide prevention program, New York and North Dakota, 2007 and 2008.

with reduced risk for school dropout,^{53,54} depression, and substance use problems,^{55–57} thereby indicating that Sources of Strength may have broad, positive benefits for high school students. The overlap of suicide prevention objectives with other educational and health promotion goals that are priorities for schools and communities, such as keeping students enrolled in school and increased achievement, can increase the feasibility of disseminating this peer leader intervention. Also facilitating the evaluation of this intervention in schools was our use of a wait-listed design, because schools are generally not comfortable with being placed in a control condition for such a serious outcome as suicide.

In larger high schools, Sources of Strength training also increased peer leaders' referrals

of friends to adults because of concerns about suicide. Adolescents are far more likely than are adults to be aware of suicidal behavior in their friends⁵²; increasing students' partnering with adults to help suicidal peers may be a key process for reducing adolescent suicidal behavior. By contrast, a recent study of gatekeeper training for adult staff in secondary schools found minimal change in adult-student communication about suicide.¹¹ The reasons for a nonsignificant intervention impact on peer leader referrals in smaller, rural schools were not addressed in this study. Determining whether the ratio of peer leaders to other students or other differences in smaller schools, such as social norms that dissuade disclosure of suicidal behavior, accounted for this differential response

should be addressed in future studies of this intervention. In addition to school size, the increase in referrals also occurred primarily among peer leaders already making referrals before training. This is quite similar to recent evidence that gatekeeper training enhances school staff members' ability to talk to students about suicide only for adults already addressing issues of suicide with students.¹¹ Whether implementation of Sources of Strength over time increases referrals of suicidal friends among peer leaders without a history of engaging adults for help also remains to be determined in longer-term studies of this intervention. In addition, approximately 25% of peer leaders did not remain consistently engaged in the Sources of Strength program, and those students reported overall lower school engagement at entry. Identifying strategies for retaining peer leaders, particularly those from high-risk peer groups that are more likely to contain suicidal students, is another future challenge for this and other peer leader interventions.

The results from this study support hypothesized changes from the Sources of Strength intervention in socioecological norms and behaviors for peer leaders and for the full student population. However, these findings were limited by our reliance on self-report measures. In addition, this short-term study did not assess whether changes in students' perceived norms about suicide and help-seeking translate into more adaptive coping behaviors, which the Sources of Strength intervention model posits will contribute to reductions in maladaptive trajectories involving students' suicidal ideation and behavior. It remains for future studies to test whether positive intervention effects on school-wide norms from Sources of Strength translate over a longer time period into positive behavior changes and reduced suicidal behavior.⁴¹ Also unanswered by this study is the optimal proportion of students in a school to train as peer leaders and whether the current method for selecting peer leaders can be improved by social network methods.⁴³ ■

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Contributors

P. A. Wyman originated the study and supervised all aspects of its implementation and led the writing of the article. C. H. Brown contributed to the study design and supervised the data analyses and contributed to writing of the article. M. LoMurray originated the intervention and led the implementation of the intervention. K. Schmeelk-Cone, Q. Yu, X. Tu, and W. Wang contributed to data analyses and contributed to writing of the article. M. Petrova and E. Walsh assisted with the data collection and analyses.

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Note. Mark LoMurray is president and owner of Sources of Strength, Inc, which distributes the Sources of Strength intervention. P. A. Wyman had full access to the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Human Participant Protection

The University of Rochester institutional review board approved the study protocol. Letters were sent home to parents of students invited to be trained as peer leaders, and parents provided signed permission; students provided signed assent. Students provided assent for completing anonymous surveys (under a waiver of parent permission); parents were sent a letter notifying them of the study and instructions on how to decline their child's participation.

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