

Evaluation of Indicated Suicide Risk Prevention Approaches for Potential High School Dropouts

ABSTRACT

Objectives. This study evaluated the efficacy of 2 indicated preventive interventions, postintervention and at 9-month follow-up.

Methods. Drawn from a pool of potential high school dropouts, 460 youths were identified as being at risk for suicide and participated in 1 of 3 conditions randomly assigned by school: (1) Counselors CARE (C-CARE) (n=150), a brief one-to-one assessment and crisis intervention; (2) Coping and Support Training (CAST) (n=155), a small-group skills-building and social support intervention delivered with C-CARE; and (3) usual-care control (n=155). Survey instruments were administered pre-intervention, following C-CARE (4 weeks), following CAST (10 weeks), and at a 9-month follow-up.

Results. Growth curve analyses showed significant rates of decline in attitude toward suicide and suicidal ideation associated with the experimental interventions. C-CARE and CAST, compared with usual care, also were effective in reducing depression and hopelessness. Among females, reductions in anxiety and anger were greater in response to the experimental programs. CAST was most effective in enhancing and sustaining personal control and problem-solving coping for males and females.

Conclusions. School-based, indicated prevention approaches are feasible and effective for reducing suicidal behaviors and related emotional distress and for enhancing protective factors. (*Am J Public Health.* 2001;91:742–752)

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“The Surgeon General’s Call to Action to Prevent Suicide” (issued in 1999) affirms that suicide is a major public health problem.¹ Nationally, suicide deaths outnumber homicides.¹ Among youths, the problem is profound—suicide is a leading cause of death among youths aged 15 to 19 years.^{2–5} As evidenced in community samples, suicidal behaviors, including ideation and attempts, foreshadow suicide. The prevalence of suicidal ideation among youths ranges from 11% to 49%; the frequency of suicide attempts ranges from 3.6% to 9%.^{6–9} Suicide-related morbidity is marked among youths: for every known suicide attempt, an estimated 100 to 200 suicide attempts are made.² Despite alarming facts about youth suicidal behaviors, indicated prevention programs—programs that target and benefit individuals who have been identified as being at high risk—remain underdeveloped.

Potential high school dropouts represent an at-risk group in need of indicated suicide prevention services.¹⁰ Suicidal behaviors are linked to school performance factors: suicidal ideation is associated with weak academic orientation, attempts are related to deficits in school performance, and suicides often follow long absences from school.^{7,11–13} Compared with their peers, proportionately more of these vulnerable youths are at risk for suicide^{13,14} and manifest co-occurring risk factors, including depression and drug involvement, that intensify their suicide risk.^{13,15,16}

In response to the problem, schools nationwide have begun to adopt universal school-based suicide prevention programs. Needed, however, are indicated programs designed to prevent escalating suicide risk among youths at high risk for suicidal behaviors.^{1,14,17–19} Although school-based implementation is logical, indicated school-based suicide prevention programs are rarely instituted¹⁴; those used are often not well designed²⁰ or scientifically evaluated.²¹ Thus, the public health challenge is multifaceted: (1) develop methods to identify youths at risk for school failure or dropout and

for suicidal behaviors; (2) design theory-based, empirically supported prevention services; and (3) test the efficacy of interventions for reducing suicide risk behaviors and related risk factors and for enhancing protective factors.

The current study addressed this challenge, evaluating the longer-term efficacy of 2 promising programs for reducing suicide potential among youths at risk for high school dropout. These programs derived from prior research in which a brief assessment and intervention protocol was found to be as effective as a semester-long, daily prevention class in reducing suicide potential.²² The class, however, was more effective for increasing sense of personal control, an important protective factor.¹⁴ Refined from these studies were 2 indicated preventive interventions: (1) Counselors CARE (C-CARE),^{14,19} a comprehensive assessment of risk and protective factors,²³ followed by a brief intervention designed to enhance a youth’s personal resources and social network connections with parents and school personnel; and (2) Coping and Support Training (CAST) (L. L. Eggert, PhD, RN, FAAN, L. J. Nicholas, MEd, unpublished manual, January 1996), a 12-session peer-group, life-skills training program added to the C-CARE assessment and crisis intervention. The CAST intervention was modeled as a briefer version of the daily Reconnecting Youth²² high school class. Preliminary studies¹⁹ indicated that, compared with usual care, the combined C-CARE/CAST approach led to increased personal control, problem-solving coping, and perceived

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family support. Both C-CARE alone and C-CARE/CAST led to decreased depression; all 3 interventions contributed to decreased suicide risk behaviors.

Other than these prevention approaches^{22,23} (also L. L. Eggert, PhD, RN, FAAN, L. J. Nicholas, MEd, unpublished manual, January 1996), few standardized indicated suicide prevention programs exist that have been tested in randomized prevention trials targeting high school students.^{14,19} The only other systematic prevention studies targeting suicidal behaviors have been with college students with chronic suicidal ideation.²⁴ Reported treatment studies focus on adults with repeated suicide attempts,^{25,26} borderline personality disorder,^{27,28} or both, and occasionally on youths hospitalized for suicide attempts.²⁹⁻³¹

Most interventions, whether brief or intensive, tend to be associated with positive psychosocial outcomes, such as decreased depression,^{14,19,25,30,31} hopelessness,^{24,25} anxiety,¹⁹ and anger^{19,28} and increased problem-solving skills.^{14,24,25,28} Short-term follow-up studies have shown reductions in suicide risk behaviors for most youths.^{14,19} Generally, usual care is as effective as the experimental approaches in decreasing suicide intent²⁵ or attempts^{14,26} or suicide incidence.^{32,33} Generalizing from these studies to nonclinical youth populations is questionable, however, and argues for testing of indicated prevention programs.

Longer-term follow-up studies with young adults found that differences between intervention and control groups on suicide attempts tend to decrease over time.³²⁻³⁴ Programs that enhance problem-solving skills, compared with those without this focus, are more likely to produce significant reductions in suicide risk behaviors and increases in protective factors.^{14,27,28,32,34,35} These findings generally are consonant with those from our earlier studies and with expectations that a skills-building intervention—emphasizing the development of coping and help-seeking skills—would heighten problem-solving coping skills, personal control, and family support.^{14,19,36}

The purpose of this investigation was to evaluate the extended efficacy and differences in effects between the sexes of 2 suicide risk prevention protocols: C-CARE and CAST. We hypothesized that these interventions would (1) reduce suicide risk behaviors and the related risk factors of depression, hopelessness, anxiety, and anger; (2) promote personal control and problem-solving coping skills; and (3) enhance social resources, particularly family support. These effects were expected immediately postintervention and at 9-month follow-up. From our previous research,^{14,19} we hypothesized that the 2 prevention protocols, compared with usual care, would decrease suicide risk and that CAST, in particular, would eff-

fect changes in skills-associated outcomes, including enhanced personal control, problem-solving coping, and family support. Because sex is known to be associated with levels of suicide risk behaviors¹³ (also E. A. Thompson, PhD, RN, J. J. Mazza, PhD, J. R. Herting, PhD, L. L. Eggert, PhD, RN, FAAN, unpublished data, 1999) and some intervention outcomes,^{14,37} sex-associated intervention outcomes also were explored.

Methods

Study Design and Sample

A 3-group, repeated measures, randomized prevention trial was used to evaluate program efficacy. The sample consisted of 460 high-risk youths from 7 high schools representing 2 Pacific Northwest urban school districts. One district's 4 high schools were included; 3 of the other district's schools were selected on the basis of their geographic and demographic representation of that district's 10 high schools. Sample selection criteria and recruitment procedures were standardized across all schools.

The 3 study conditions included

1. C-CARE (n=150), a one-to-one, 2-hour assessment interview, followed by an additional 1.5 to 2 hours that included a counseling session and social "connections" intervention with parents and school personnel.
2. CAST (n=155), a 12-session (12 hours) small-group skills-training program combined with the C-CARE individual approach.
3. Control (usual care; n=155), a brief (15–30 minutes) assessment interview and social "connections" intervention with parents and school personnel, simulating typical school protocols.

Measurement was performed at the following 4 times: T_1 , baseline/preintervention; T_2 , 4 weeks from baseline and after the initial C-CARE and usual-care control interviews; T_3 , 10 weeks from baseline, coinciding with CAST skills-training completion; and T_4 , 9 months after baseline.

Study Procedures

The design included random assignment by school to 1 of the 3 study conditions. Randomization of conditions by school avoided having experimental and control conditions in the same school simultaneously, minimizing the potential for contamination. Within schools, the 3 study conditions were rotated systematically such that each school received each condition: usual care/control, C-CARE, CAST, and finally a "pause" semester during which no

interventions were implemented. Schools began with different conditions, but across time, all study conditions were assigned to each school. Study conditions were neither repeated at a given site in successive school semesters nor nested within schools. The pause semester permitted dissipation of potential carry-over effects within schools over time.

Case identification and invitation. A 2-step process served to identify youths at risk for suicide. First, each school's database and referrals from school personnel were used to identify the total pool of potential high school dropouts in each of the 7 schools on the basis of criteria known to predict dropout, including academic performance, attendance, and prior dropout status.^{14,23}

Second, from this pool of potential dropouts, youths were randomly sampled by computer and then personally invited to participate by research staff. Institutional review board–approved informed consent was obtained from each youth and his or her parent(s) or legal guardian(s). Participants responded to the baseline questionnaire that contained the Suicide Risk Screen³⁸ used to identify youths at risk for suicide. Suicide risk was based on combinations of 7 elements, including suicidal behaviors (thoughts, thoughts due to drug involvement, direct and indirect threats, attempts, depression, and drug involvement). Tests of the Suicide Risk Screen case-finding model showed that it was reliable and had concurrent and predictive validity.^{23,36,38} Youths identified as not at risk for suicide exited from the study at this point. Following the baseline questionnaire, youths in the 2 experimental conditions received the C-CARE intervention. Four weeks later, the 6-week CAST program began for youths assigned to the CAST condition. Control subjects received the individualized usual-care protocol with timing of implementation paralleling that of C-CARE.

Recruitment and retention rates. Of the 1546 high-risk youths identified as potential dropouts and invited to participate in the study, 1217 (79%) agreed to take the baseline questionnaire, and 460 (38%) of these youths were identified as at risk for suicide and continued in the study. Retention at 9-month follow-up (T_4) was equivalent across conditions: 86% for C-CARE, 93% for CAST, and 90% for the control ($\chi^2_2=3.7, P=.15$).

Experimental Prevention Protocols

The content and modalities used in the C-CARE and CAST standardized intervention protocols were derived from clinical work and ethnographic studies^{22,39} and are congruent with motivational interviewing^{23,40} and short-term counseling^{41,42} models.

C-CARE. The C-CARE protocol is a standardized individual prevention approach¹⁴ de-

livered in 3.5 to 4 hours by trained research staff, typically advanced-practice nurses or social workers. The intervention consisted of (1) a 2-hour, one-to-one computer-assisted suicide assessment, called the Measure of Adolescent Potential for Suicide²³; (2) a brief motivational counseling session to enhance empathy and support, deliver personal information, reinforce positive coping skills and help-seeking behaviors, and increase access to help; and (3) a social network connections intervention to link each youth with the school-based case manager, a favorite teacher, or both, and to contact a parent or guardian of the youth's choice to enhance immediate support, access to help, and communication between the youth, school personnel, and parents.

CAST. CAST is a small-group skills-training and social support intervention. It entailed 12 one-hour sessions over 6 weeks with 6 to 7 students per group. The CAST program was based on a standardized protocol (L. L. Eggert, PhD, RN, FAAN, L. J. Nicholas, MEd, unpublished manual, January 1996) and was implemented by trained, experienced, master's-level high school teachers, counselors, or nurses. Each CAST session incorporated key concepts, objectives, skills, and a small-group implementation plan specifying the motivational preparation and coaching activities for the CAST leader. The content was adapted from Reconnecting Youth,²² targeting mood management (depression and anger management), school performance, and drug involvement. Each session included helping youths apply newly acquired skills and gain support from family and other trusted adults.

Usual-care control condition. The usual-care protocol simulated procedures typically used by school personnel in response to youths showing suicidal behavior. The assessment interview involved Beck's Scale for Suicidal Ideation⁴³ and Suicidal Intent Scale.⁴⁴ Independent interviewers conducted the standardized usual-care procedures; these interviewers were helping professionals (e.g., nurses, counselors, social workers) with at least a bachelor's degree. Following each assessment, the interviewer implemented school policies and used standardized social connections procedures, as in C-CARE, including notifying parents and designated school personnel. In all study conditions, immediate assistance was provided if the risk of suicide was imminent.

Fidelity of intervention implementation. First, CAST group leaders received training, and a school-based pilot test of the intervention was conducted. CAST groups were continually assessed for implementation fidelity.¹⁹ Process evaluation of CAST included videotaping all sessions to measure the exposure to program content, leaders' skills-training competencies, and skills acquired by the youths. To

tap these aspects, each group leader coded his or her videotape after each session with a standardized coding form. The principal investigator established interrater reliability by reviewing randomly selected videotapes. During CAST implementation, group leaders met weekly with the principal investigator, the CAST program coordinator, or both, for supervision, videotape reviews, and implementation fidelity assessments. Analyses of group leader and supervisor ratings indicated uniform implementation across leaders and cohorts.

C-CARE interventions were pilot tested. Throughout delivery of this protocol, assessment interviews were videotaped and reviewed weekly for implementation fidelity. To prevent interviewer "drift" from protocol, interviewers and the C-CARE program coordinator independently rated randomly selected videotapes, focusing on selected components of the assessment; interrater reliability was maintained at 90% agreement.

The control assessments also were initially pilot tested; training was provided, and the usual-care assessments were routinely videotaped. Once competency was established, the program coordinator reviewed randomly selected videotaped sessions to monitor and evaluate implementation fidelity. To assess the validity and reliability of youth assessments across interviewers, risk behaviors were independently rated by a psychologist. Agreement ratings were 85% or better.

Measurement

The High School Questionnaire: A Profile of Experiences⁴⁵ was used to measure suicide risk behaviors and related risk and protective factors. All measures were derived from standard measures or constructed specifically for the Reconnecting Youth Prevention Research Program. Scales were based on 7-point, Likert-type response options ranging from 0 to 6. Higher values indicated higher levels of the measured construct. Over the past 15 years, traditional psychometric analyses and confirmatory factor analyses have established good reliability and construct and predictive validity of all measures with multiple independent samples.^{13,14,18,23,36,38} Reliability coefficients for the current sample are reported below with description of the measures.

Suicide risk behaviors. The 4 single-item indicators of suicide risk behaviors were (1) favorable attitude toward suicide, (2) frequency of suicidal ideation, (3) frequency of direct suicide threats, and (4) number of suicide attempts within the past month. Construct validity, established previously with confirmatory factor analysis, reported factor loadings ranging from 0.69 to 0.92 for these indicators on a latent suicide risk behavior dimension³⁶ (also E. A. Thompson, PhD, RN, J. J. Mazza, PhD, J. R. Herting, PhD, L. L. Eggert, PhD, RN, FAAN,

unpublished data, 1999; E. A. Thompson, PhD, RN, C. D. Connelly, PhD, RN, L. L. Eggert, PhD, RN, FAAN, unpublished data, June 2000).

Related risk factors. The 4 measures of emotional distress were depression, hopelessness, anxiety, and anger. The depression scale measured depressed affect with 6 items adapted from the Center for Epidemiologic Studies Depression Scale⁴⁶ for use with adolescents ($\alpha = .76$), including items such as "I feel depressed," "I can't shake off feeling 'down' or blue," and "I feel sad." In earlier studies,^{14,18} the validity of student self-reports based on this scale was corroborated by teacher ratings on depression ($r = 0.74$). Hopelessness (3 items; $\alpha = .63$) measured feelings of hopelessness about life vs satisfaction with life. Anxiety (4 items; $\alpha = .70$) measured physical, emotional, and cognitive signs of anxiety. Anger control problems (4 items; $\alpha = .69$) were measured by indicators such as "irritability or getting easily angered," "feeling out of control when angry," and "hitting something or someone when angry." Construct validity and acceptable reliability coefficients for each of these dimensions were shown in earlier studies^{14,23,36} (also E. A. Thompson, PhD, RN, J. J. Mazza, PhD, J. R. Herting, PhD, L. L. Eggert, PhD, RN, FAAN, unpublished data, 1999; E. A. Thompson, PhD, RN, C. D. Connelly, PhD, RN, L. L. Eggert, PhD, RN, FAAN, unpublished data, June 2000).

Protective factors. The 3 protective factors measured were sense of personal control, problem-solving coping, and family support. Personal control (5 items; $\alpha = .76$), defined as perceived self-efficacy in coping with problems and influencing positive outcomes, was measured by indicators of "confidence in handling problems," "ability to make good things happen for self," "ability to learn to adjust/cope with problems," "confident about feeling better eventually," and "feeling capable and in control." Problem-solving coping (3 items; $\alpha = .74$) measured the degree of active problem-solving coping approaches used. Items included "face problems head on until settled," "imagine myself solving the problem, then handling it for real," and "think about options, choose the best, and take action." Family support⁴⁷ (5 items; $\alpha = .85$), a measure of support satisfaction, reflected the degree of satisfaction with close, comfortable family ties; open communication and sharing of problems; time spent together; acceptance and support from family; and being able to turn to family members for help. Acceptable reliability coefficients and construct validity have been established for each of these dimensions with confirmatory factor analyses.^{36,48}

Analysis

One-way analysis of variance and χ^2 tests were used to assess baseline equivalency

among groups. Multilevel models with students nested within schools were estimated for interval-level outcome and demographic variables; models with Bernoulli distributions were used to examine equivalency of dichotomous demographic variables.^{49,50}

Differences in change among the 3 study groups were assessed with individual growth curve models^{50,51} that were estimated by hierarchical linear modeling.⁴⁹ The multilevel growth models posited (1) a general equation in which individual patterns of change or growth are a function of time (level 1: repeated measures or within individuals); (2) variation in the growth parameters as a function of individual differences (level 2: between individuals); and (3) variation in these individual differences caused by the cluster sampling by schools or school differences (level 3: between schools). From related studies and empiric assessment of the current data, we observed that the rate of change or growth was not constant but increased or decreased across time. Thus, we fitted a quadratic growth model with *time* and *time*² terms in the equation. The general form of the level 1 model (repeated measures or within individuals) was

$$(1) \quad Y_{ij} = \beta_{0j} + \beta_{1j}(\text{time}) + \beta_{2j}(\text{time}^2) + r_{ij},$$

where Y_{ij} represents the status of the outcome variable for individual j at time i , β_{0j} refers to the intercept or baseline value the individual j , β_{1j} and β_{2j} represent the nonlinear rate of change in the outcome variable across time, and r_{ij} represents the residual variance.

Level 2 equations describe variation in the level 1 intercept and slope parameters as predicted by variables such as age, sex, intervention group (CAST vs C-CARE), and the interaction of intervention group and sex. Equations describing the level 2 models were as follows:

$$(2a) \quad \beta_{0j} = \gamma_{00} + \gamma_{01}(\text{Age}) + \gamma_{02}(\text{Sex}) \\ + \gamma_{03}(\text{CAST}) + \gamma_{04}(\text{C-CARE}) \\ + \gamma_{05}(\text{CAST} \times \text{Sex}) \\ + \gamma_{06}(\text{C-CARE} \times \text{Sex}) + u_{0j}$$

$$(2b) \quad \beta_{1j} = \gamma_{10} + \gamma_{11}(\text{Age}) + \gamma_{12}(\text{Sex}) \\ + \gamma_{13}(\text{CAST}) + \gamma_{14}(\text{C-CARE}) \\ + \gamma_{15}(\text{CAST} \times \text{Sex}) \\ + \gamma_{16}(\text{C-CARE} \times \text{Sex}) + u_{1j}$$

$$(2c) \quad \beta_{2j} = \gamma_{20} + \gamma_{21}(\text{Age}) + \gamma_{22}(\text{Sex}) \\ + \gamma_{23}(\text{CAST}) + \gamma_{24}(\text{C-CARE}) \\ + \gamma_{25}(\text{CAST} \times \text{Sex}) \\ + \gamma_{26}(\text{C-CARE} \times \text{Sex}) + u_{2j}$$

The coefficients β_{0j} , β_{1j} , and β_{2j} are defined for equation 1, above; the coefficient γ represents the effect of level 2 predictors on time coefficients (i.e., β_{0j} , β_{1j} , β_{2j}); and the coefficient u represents residual variance for level 2 equations. The equations are described further under Results.

Central to this investigation was the test of the experimental intervention effects revealed by modeling rate of change (measured by the

slope parameters for time in the level 1 equation) as related to membership in an intervention group (CAST or C-CARE at level 2). In the analyses, CAST and C-CARE were entered as dummy variables, with usual care serving as the reference group. We expected the interventions to be related to steeper declines in negative outcomes (or, conversely, steeper increases in positive outcomes). For example, intervention effects reflecting the rate of decline in suicidal ideation would be indicated by a negative β_{1j} in the level 1 equation above. When predicting β_{1j} in level 2, the growth coefficients for CAST (γ_{13}) and C-CARE (γ_{14}) would be significant and negative, representing steeper rates of decline compared with usual-care controls.

All growth parameter equations included controls for age and sex. Preliminary models included a dichotomous racial/ethnic minority status variable (1=racial/ethnic minority, 0=White), which did not influence the growth model parameter estimates and was thus removed from the equation. In the hierarchical linear modeling analyses, P values were not corrected for multiple testing because the study examined new indicated suicide prevention approaches; thus, observing even very small effects may be important. Graphic displays and one-way analysis of variance with post hoc tests supplemented these analyses for descriptive purposes. Statistically conservative Bonferroni corrections for multiple comparisons were used to examine mean differences post-CAST intervention (T_3) and at follow-up (T_4).

Intent-to-treat analyses. Analyses of all study participants assigned to the 3 study conditions were conducted, regardless of whether they had complete data. These more conservative intent-to-treat results were compared with those from analyses of study completers only. Study completers were defined as participants with no interruption in data across the 4 data collection periods. To account for missing data among study participants in the intent-to-treat analyses, we used multiple imputation procedures^{52,53} with the NORM program.⁵³ When expectation maximization techniques were used to determine maximum likelihood parameter estimates, the procedure converged in 84 iterations; following standard recommendations, 840 data augmentation cycles were conducted, producing 10 imputed data sets used in all hierarchical linear modeling analyses.

The growth curve models estimated in hierarchical linear modeling⁴⁹ yielded essentially the same conclusions as did traditional repeated-measures trend analyses that used multivariate analysis of variance.^{54,55} This was true in both the intent-to-treat sample and the study completers sample. The growth curve results (with intent-to-treat sample) are reported here, because this method has distinct ad-

vantages over the more traditional analytic methods. For example, the growth models take into consideration unequal time intervals between data collection points and test simultaneously for multilevel effects and the cross-level interaction effects. In addition, hierarchical linear modeling allows use of the multiple imputation data sets necessary for the intent-to-treat analysis and produces reliable parameter estimates.⁵⁰

Estimated variance components. Initially, 3-level, fully unconditional (intercepts only) models were tested. These produced estimates of variance components across all 3 levels (within individuals, between individuals, between schools).⁵⁰ For the suicide risk indicators, the results indicated that 65% to 75% of the variance was associated with the within-individuals level, whereas 24% to 35% of the variance was associated with the between-individuals level. Only 0% to 0.1% of the variance was associated with the between-schools level. For related risk and protective factors, 38% (for family support) to 54% (for depression) of the variance was associated with the within-individuals level, and 46% to 62% was associated with the between-individuals level. In contrast, 0% to 1.9% (for problem-solving coping) of the variance was associated with the between-schools level. Thus, with the exception of problem-solving coping, no significant random variation was due to school or school district, and all intraclass correlations were at or near 0. These results indicated independence of observations within vs between schools and mitigated the need to include a school or school district level in the multi-level analyses.⁵⁰

Because all study conditions were rotated within each school, study participants were not nested in schools or classrooms. Individuals, not preconstituted groups, were the sampling unit. Any effects of belonging to a common group, however, were most likely to arise in the small-group CAST intervention; C-CARE and control study conditions involved one-to-one interventions. Multilevel statistical models that included clustering of CAST participants into groups (vs models in which group status was ignored) also were tested. With low variance, the normality assumption underlying the z test may be violated; thus, a multiparameter, likelihood-ratio, χ^2 -based test is recommended.⁵⁰ Evidence from both the estimated variance components and the likelihood-ratio χ^2 tests showed no significant group variation across study outcomes. Intraclass correlations were extremely small (generally <.0001). Thus, this analysis indicated that study results would not be influenced by the putative CAST group or cluster effects.

Based on the above analyses, final-stage growth curve analyses, with one exception, used 2-level models. Level 1 examined change *within* individuals across time (repeated measures), and level 2 tested for effects related to individual differences. For all outcomes, we included both *time* and *time*² terms in the equations and tested whether the baseline level (β_0), and change across time (β_1, β_2) were functions of the intervention groups net of effects associated with sex and age.⁵⁰ Tests for problem-solving coping used a 3-level model incorporating school to account for small but significant school effects.

Results

Sample Characteristics

Of the 460 youths aged 14 to 19 years who were judged through screening to be at risk for suicide, 412 (89.6%), 25 (5.4%), 14 (3.0%), and 9 (2.0%) completed data collection 4 times, 3 times, twice, and only once, respectively. Of these youths, 150 were in C-CARE, 155 were in CAST, and 155 were in the usual-care control group. The sample was 52% female and was ethnically diverse, with 49% Euro-American youths and a minority representation of approximately 51%: Native American (4%), Asian American/Pacific Islander (18%), African American (19%), and Latino or Hispanic (10%). This distribution reflected ran-

dom sampling of potential high school dropouts from participating schools with minority representations ranging from 34% to 60%.

Baseline Equivalency

One-way analysis of variance in the intent-to-treat sample (n=460) showed no significant differences among groups for the background variables of sex, race/ethnicity, and percentage living with both biological parents. CAST youths, however, tended to be slightly older ($F_{2,457}=3.19, P=.04$), but by no more than 5 months on average. Study groups also were equivalent on all outcome variables except for problem-solving coping ($F_{2,457}=4.30, P=.01$); CAST and usual-care youths had similar baseline scores, although scores from both groups were significantly higher than C-CARE scores. Multilevel models estimating only mean levels for outcome and demographic variables were compared with models including terms for intervention groups. Chi-square tests of differences in deviance statistics for these nested models were all nonsignificant, indicating baseline equivalence among groups.⁵⁰ Consistent with these findings were the hierarchical linear modeling parameter tests of the intercepts, controlling for age, sex, and sex-by-group interactions (Table 1). These tests indicated no baseline differences for most of the variables, except for a few C-CARE group differences in depression, hopelessness, and problem-solving coping. These differences are

considered in the description of the growth curve analyses results that follow.

Prevention Effects

Suicide risk behaviors. Table 1 summarizes the parameter estimates from the quadratic growth curve models focusing on the cross-level interaction between individual-level temporal factors (*time, time*²) based on repeated measures and intervention group. Baseline coefficients (under β_0) represent T_1 intercept differences between CAST and C-CARE in contrast to usual care. The absence of significant intercept coefficients for suicide risk behaviors (Table 1) indicates no baseline differences for CAST or C-CARE relative to usual care.

In these multilevel analyses, the individual growth curve (level 1) is represented by a pair of slope coefficients (β_1, β_2) which are necessary to fit the quadratic model. The β_1 coefficient reflects the rate of change across time; the β_2 coefficient represents increases or decreases in the rate of change. Gamma (γ) coefficients reflect the effects of level 2 predictors on level 1 rates of change. In Table 1, γ coefficients represent the influence of the 2 intervention groups, CAST and C-CARE, compared with usual care.

Compared with usual care, both CAST ($\gamma_{13}=-.292, P<.05; \gamma_{23}=.030, P<.05$) and C-CARE ($\gamma_{14}=-.223, P<.10; \gamma_{24}=.020, P<.10$) influenced the rate of change (β_1) associated

TABLE 1—Growth Curve Parameter Estimates for Suicide Risk, Related Risk, and Protective Factors Reflecting Cross-Level Interaction Effects for Time, by Intervention Group (N=460)

	Baseline Coefficients		Rate of Change Coefficients			
	β_0 (intercept)		β_1 (time)		β_2 (time ²)	
	CAST γ_{03}	C-CARE γ_{04}	CAST γ_{13}	C-CARE γ_{14}	CAST γ_{23}	C-CARE γ_{24}
Suicide risk behaviors						
Attitude toward suicide	.078	.074	-.292**	-.223*	.030**	.020*
Suicidal ideation ^a	.127	.132	-.341**	-.329**	.032**	.028**
Direct suicide threats	.036	-.134	-.120	-.001	.012	.000
Attempts last month	.020	-.080	-.045	-.007	.003	.000
Related risk factors						
Depression ^a	.002	.451**	-.231**	-.389 [†]	.021**	.035 [†]
Hopelessness	-.008	.435**	-.285***	-.306***	.024**	.024**
Anxiety ^a	-.252	.076	-.381 [†]	-.431 [†]	.037 [†]	.043 [†]
Anger ^a	-.086	.238	-.250***	-.253***	.025***	.024***
Protective factors						
Personal control	.202	-.090	.242**	-.011	-.021**	.004
Problem-solving coping ^b	-.202	-.703***	.349***	.033	-.030**	-.000
Family support	-.107	-.280	.044	.015	.000	.003

Note. CAST=Coping and Support Training; C-CARE=Counselors CARE. Coefficients represent growth curve parameter estimates for cross-level interactions between time (repeated measures) and intervention groups. Study groups entered as dummy variables with usual care (n=155) serving as the reference group for CAST (n=155) and C-CARE (n=150). All estimates controlled for age, sex (0=female, 1=male), and sex-by-intervention group effects. Time intervals parameterized at 0, 1, 2.5, and 9 months reflecting time intervals of data collection periods.

^aEffects qualified by group-by-time-by-sex interaction effect discussed in text.

^bResults based on 3-level model, with school entered at third level because problem-solving coping had small (1.9%) but significant percentage of variance with school level.

* $P<.10$; ** $P<.05$; *** $P<.01$; [†] $P<.001$.

with favorable attitude toward suicide and suicidal ideation. Both interventions were associated with faster rates of decline compared with usual care, with comparable rates of decline for CAST and C-CARE. For both CAST and C-CARE compared with the control group, the coefficients for $time^2$ (β_2) were significant or nearly significant, suggesting that for CAST and C-CARE, the rate of decline tapered slightly faster. This small tapering effect, however, did not substantially alter the overall rate of decline for CAST and C-CARE. There were no intervention-specific outcomes for suicide threats or attempts within the last month; however, both are low-base-rate variables and thus limited as outcome measures for prevention research.

Changes in mean levels of suicide risk behaviors by study group are illustrated in Figure 1 (a–d). All 3 groups showed declines in suicide risk behaviors between T_1 and T_4 . Consistent with the growth curve analyses, intervention group differences relative to usual care were evident for attitude toward suicide and suicidal ideation. Importantly, reductions in these direct suicide risk behaviors were sustained at the 9-month follow-up.

Related risk factors. The γ coefficients in Table 1 indicate that CAST and C-CARE, compared with usual care, were associated with significantly different rates of decline in depression, hopelessness, anxiety, and anger. These rates tapered off across the 9-month period. Some intervention effects were moderated by sex, requiring further explication below.

Both CAST and C-CARE had significant effects on the rates of decline in depression (Figure 1e). A single sex interaction effect was associated with C-CARE but not CAST, indicating that sex moderated the influence of C-CARE on depression. At baseline, females in the C-CARE group reported significantly higher levels of depression than did males, creating differentials in the rates of change. The overall pattern of change for males and females in C-CARE, however, was fully consistent with the pattern observed in Figure 1e.

Post hoc comparisons of mean levels of depression, controlled for baseline depression, indicated significant differences among the group means at T_3 and T_4 ($F_{2,456}=5.41, P<.005$; $F_{2,456}=6.83, P<.001$, respectively). Comparisons between the intervention groups, CAST and C-CARE, and usual care showed significantly lower levels of depression at T_3 ($P<.008$ and $P<.03$, respectively) and T_4 ($P<.002$ and $P<.01$, respectively).

Compared with usual care, the growth curve analyses (Table 1) also showed significantly different rates of decline in hopelessness for both CAST ($\gamma_{13}=-.285, P<.01$; $\gamma_{23}=.024, P<.05$) and C-CARE ($\gamma_{14}=-.306, P<.01$; $\gamma_{24}=-$

.024, $P<.05$). Figure 1f illustrates that among CAST and C-CARE participants, declines in hopelessness were sustained across all time points, whereas following T_2 , the usual-care effects rebounded and then declined. No significant sex interaction effects were found for hopelessness.

With respect to mean levels of hopelessness, controlling for baseline levels, follow-up tests found significant differences among group means at T_3 and T_4 ($F_{2,456}=7.62, P<.001$; $F_{2,456}=2.96, P<.05$, respectively). For CAST vs usual care, hopelessness was significantly lower at T_3 ($P<.002$) but not at T_4 . For C-CARE vs usual care, hopelessness was significantly lower at T_3 ($P<.004$) and T_4 ($P<.05$). In brief, both the growth curve analyses and the post hoc tests indicated that the experimental interventions, compared with usual care, produced significantly greater rates of decline and, importantly, sustained reductions in mean levels of depression and hopelessness at follow-up.

Intervention effects on rates of decline in anxiety for CAST ($\gamma_{13}=-.381, P<.001$; $\gamma_{23}=.037, P<.001$) and C-CARE ($\gamma_{14}=-.431, P<.001$; $\gamma_{24}=.043, P<.001$) and in anger for CAST ($\gamma_{13}=-.250, P<.01$; $\gamma_{23}=.025, P<.01$) and C-CARE ($\gamma_{14}=-.253, P<.01$; $\gamma_{24}=.024, P<.01$) were significant. These effects were qualified, however, by statistically significant sex interaction effects, depicted in Figure 2 (a–d).

For females, both CAST and C-CARE significantly influenced the rate of decline in anxiety ($P<.001$) and anger ($P<.001$). Follow-up tests, controlling for baseline levels of anxiety and anger, found significant differences in group means at T_3 and T_4 for anxiety ($F_{2,236}=14.10, P<.001$; $F_{2,236}=5.90, P<.003$, respectively) and at T_3 for anger ($F_{2,236}=5.35, P<.005$). Group comparisons, using Bonferroni corrections, showed significant effects for CAST compared with usual care in (1) reducing anxiety at T_3 ($P<.001$) and at T_4 follow-up ($P<.003$) and (2) reducing anger at T_3 ($P<.006$) but not at T_4 . A similar, although not as strong, pattern of effects was observed for C-CARE compared with usual care in (1) reducing anxiety at T_3 ($P<.001$) and at T_4 follow-up ($P<.09$) and (2) reducing anger at T_3 ($P<.07$) but not at T_4 .

For males, CAST and C-CARE did not influence the rate of change in either anxiety or anger. Trend analyses showed significant linear declines in anxiety ($F_{1,217}=39.41, P<.001$) and anger ($F_{1,217}=50.26, P<.001$), but the pattern of decline was similar across all groups. In contrast to the findings for females, no significant group differences were seen for males among the 3 study groups for mean levels of anxiety or anger at T_3 or T_4 .

In summary, males tended to show improvements regardless of the intervention mode, with mean levels of anxiety and anger

decreasing by at least 20%; females, in contrast, were differentially responsive to the experimental interventions, especially CAST.

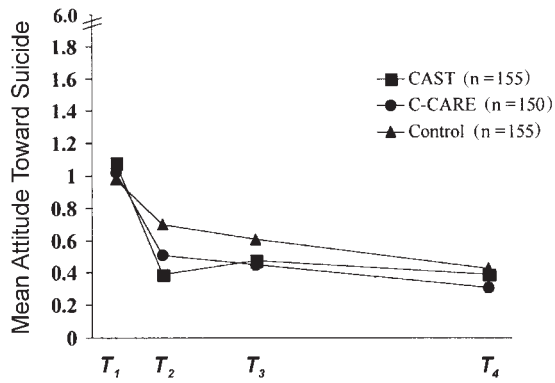
Protective factors. Consistent with the study hypotheses, the multilevel growth curve analyses showed that CAST, but not C-CARE, had significant influences on the rate of change in personal control ($\gamma_{13}=.242, P<.05$; $\gamma_{23}=-.021, P<.05$) and problem-solving coping ($\gamma_{13}=.349, P<.01$; $\gamma_{23}=-.030, P<.05$). Figure 3 (a and b) illustrates these findings, with the effects of CAST being most remarkable.

Follow-up tests, controlling for baseline levels, detected significant differences in group means at T_3 and T_4 for problem-solving coping ($F_{2,456}=11.53, P<.001$; $F_{2,456}=6.56, P<.002$, respectively) and personal control ($F_{2,456}=5.62, P<.004$; $F_{2,456}=4.94, P<.008$, respectively). Youths participating in CAST, compared with those in C-CARE and usual care, showed significantly greater problem-solving coping immediately after the CAST intervention (T_3) and at follow-up (T_4) (both $P<.001$). CAST also was associated with significantly greater increases in personal control, relative to usual-care participants, at T_3 ($P<.003$) and at T_4 ($P<.006$). Mean level differences between C-CARE and usual care were not statistically significant. For family support, linear trends were significant for all groups ($F_{1,454}=54.38, P<.001$), indicating gains, but no differentials in rates of change or increases in mean levels were associated with the experimental interventions. Generally, increases in protective factors were observed, with the strongest and most consistent effects occurring for youths in the CAST skills-building intervention.

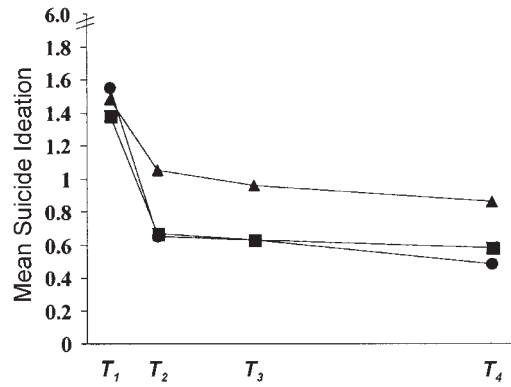
Sensitivity tests. Traditional trend analyses also were conducted, yielding results fully consistent with the growth curve analyses reported earlier in this article. A series of sensitivity tests was also conducted to determine the degree to which regression to the mean may have influenced the outcomes based on changes in means across time. Estimates of 10%, 20%, and 30% regression to the mean were used, values of baseline measures were reduced, and traditional trend analyses were redone. The results did not differ substantially from the results of analyses conducted without the regression-to-the-mean adjustments. Taken together, results from the growth curve modeling, post hoc descriptive analyses, and trend analyses provide strong and consistent evidence for the efficacy of the experimental interventions.

Discussion

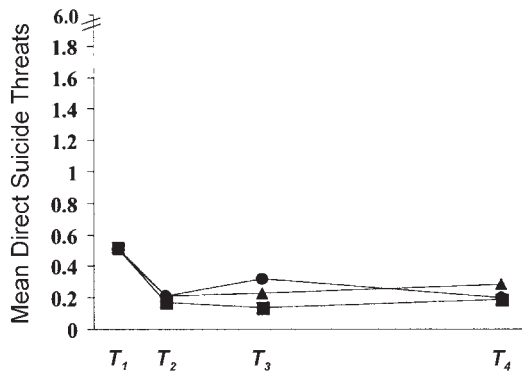
This study evaluated the efficacy of 2 brief school-based suicide risk preventive interventions—CAST, a small-group skills-



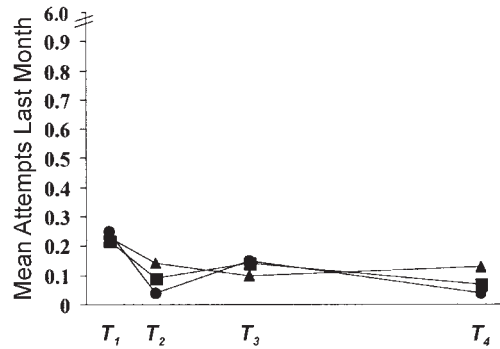
(a) Attitude toward suicide



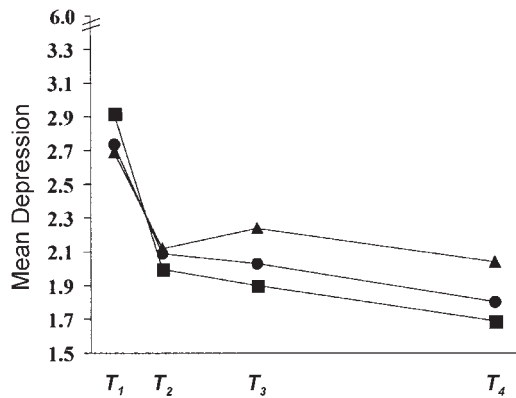
(b) Suicidal ideation



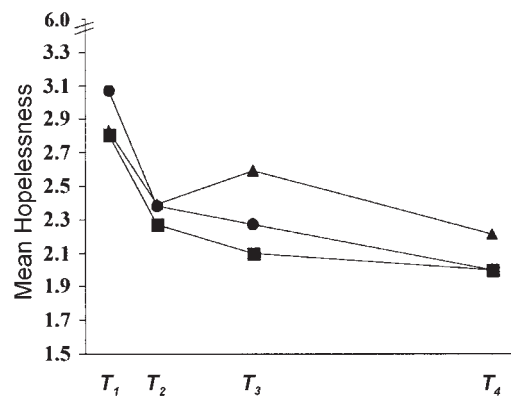
(c) Direct suicide threats



(d) Attempts last month



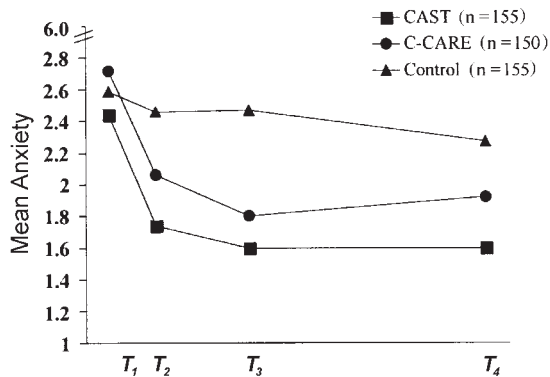
(e) Depression



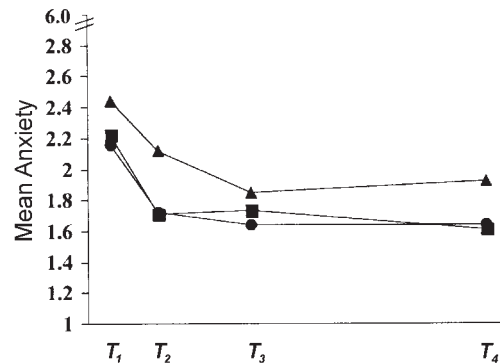
(f) Hopelessness

Note. CAST=Coping And Support Training; C-CARE=Counselors Care; T₁=baseline/preintervention; T₂=4 weeks after C-CARE and usual-care control interviews; T₃=10 weeks after CAST intervention; T₄=9 months after baseline. The control condition was for usual care.

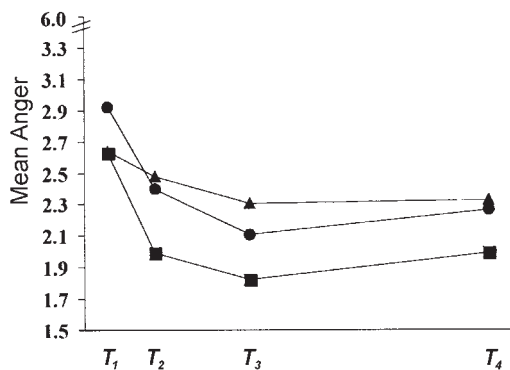
FIGURE 1—Changes in mean levels of suicide risk behaviors, depression, and hopelessness across measurement intervals, by condition.



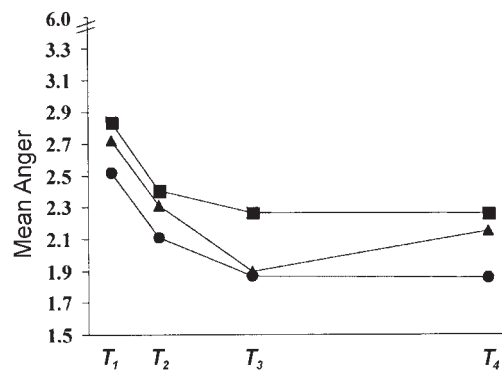
(a) Anxiety for females



(b) Anxiety for males



(c) Anger for females



(d) Anger for males

Note. See note for Figure 1.

FIGURE 2—Changes in mean levels of anxiety and anger across measurement intervals, by condition, showing sex interaction effects.

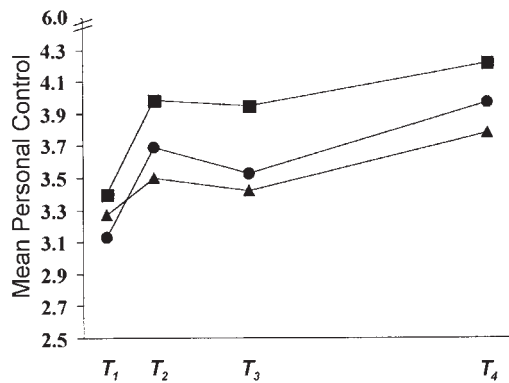
building and social support intervention, and C-CARE, a brief one-to-one assessment and crisis intervention—compared with a simulated school-based, usual-care control group. The overall hypothesis was that CAST would be most effective in reducing suicide risk behaviors and related risk behaviors and enhancing protective factors among youths at combined risk for school dropout and suicidal behaviors.

All study groups showed some reductions in suicide risk behaviors and emotional distress immediately following the intervention and at the 9-month follow-up. Significant differences in rates of change were observed

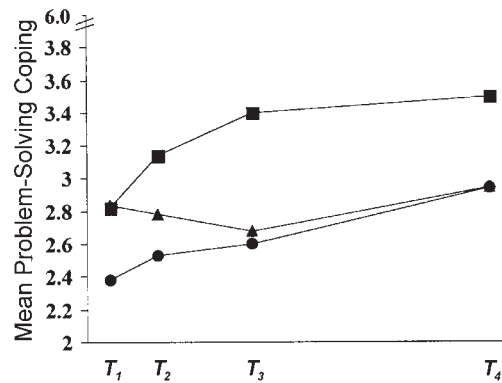
for attitude toward suicide, suicidal ideation, depression, hopelessness, anxiety, and anger, indicating intervention-specific effects. The CAST and C-CARE interventions were more effective than usual care in sustaining reductions in suicidal ideation, depression, and hopelessness across time. In contrast to other studies,^{32–34} these are promising results, because they suggest that the 2 prevention approaches may provide longer-term prevention effects.

Interestingly, females participating in CAST and C-CARE showed the steepest rates of decline in anxiety and anger-control problems, compared with those receiving usual

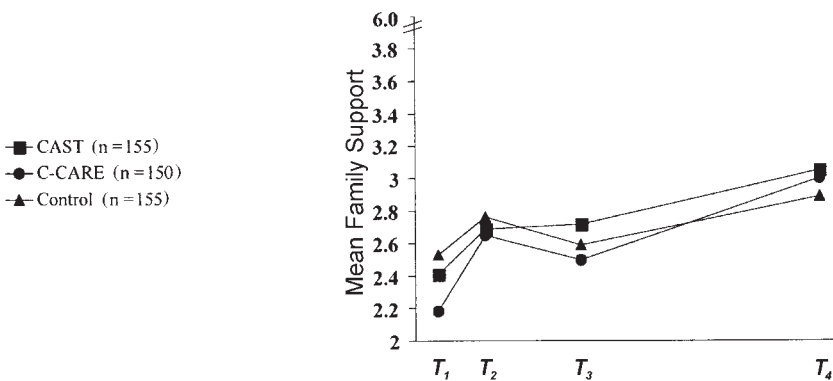
care. In contrast, CAST and C-CARE vs usual care were not differentially effective for males. These findings suggest that small-group and more intense interventions may be most effective in reducing anxiety and anger in females at risk for suicide. For males, the public nature of the group-based anger-management intervention may contribute to reactive responses, particularly for changing male stereotypic behavior (assertiveness, aggression), thereby dampening the effectiveness of the approach. Alternatively, the individual approach, for males in particular, may facilitate development of trust and initially reduce feelings of vulnerability, opening re-



(a) Personal control



(b) Problem-solving coping



(c) Family support

Note. See note for Figure 2.

FIGURE 3—Changes in mean levels of protective factors across measurement intervals, by condition.

ceptiveness to alternative means of coping and seeking support from the counselor, parents, and school personnel.⁴²

These findings related to anxiety and anger are congruent with a stress-coping-social support model, suggesting that support resources from a trusted adult can serve to redefine stress demands and reinforce more adaptive coping (e.g., seeking support), both of which serve to reduce stress-associated emotions.^{24,42} Additional research is needed to determine whether group or individual intervention approaches to anger management contribute to differential program effectiveness in this area. Although the question “For whom does which program work?” is important, a key observation was that both

males and females had reductions in anger and anxiety.

The efficacy of CAST and C-CARE also was examined relative to gains in protective factors—that is, personal control, problem-solving coping, and family support. Notably, youths participating in the small-group skills-building CAST program, compared with those in usual care, showed significantly greater rates of change in problem-solving coping and personal control at program exit, with continued gains at follow-up. In contrast, C-CARE youths, compared with usual-care control subjects, did not show these gains in protective factors.

The results suggest that indicated prevention approaches show promise for reducing sui-

cide risk among potential high school dropouts, a particularly high-risk group.^{13,14} The findings are consonant with prior research that tested the social support/skills-training theoretic model²² for reducing co-occurring problem behaviors, including suicide risk behaviors, and depression among vulnerable youths.^{14,36} The results also parallel findings from treatment studies in which young adults^{24,33,56} and adolescents²⁹ had significant reductions in suicidal behaviors, and adolescents showed significant reductions in depression.⁵⁷ Together, these studies indicate that young people benefit from even brief suicide risk assessments and crisis interventions. This study reinforces the need for public health prevention through school-based screening and indicated intervention programs.

Study Limitations

For both ethical and legal reasons, studies of youth suicide risk behaviors must incorporate usual-care comparison groups. Consequently, the effects of a no-intervention control group cannot be evaluated. The fact that all groups showed significant decreases in suicide risk behaviors may have been the result of regression to the mean. However, 3 facts argue against this as an encompassing explanation. First, the criteria for screening youths were broad based; there was considerable variation across individuals and groups. For example, some youths reported multiple suicide attempts, and others reported none; some reported high levels of suicidal ideation but no depression, whereas others had elevated depression but no suicidal ideation. Second, different intervention approaches resulted in different patterns of outcomes among the study variables. For example, in contrast to usual care, C-CARE and CAST contributed to long-term decreases in depression and hopelessness, major predictors of suicidal behaviors. Additionally, CAST, the skills-building program, contributed specifically to sustained increases in personal control and problem-solving coping, consistent with earlier studies^{14,36} that used a longer, more intensive prevention approach²² from which CAST was developed. Third, sensitivity tests conducted to account for potential regression effects found that the hypothesized effects remained statistically significant and the interpretation of results was substantially unchanged. In summary, although regression to the mean may contribute to the results, intervention effects were evident.

Although longer-term outcomes were examined, the follow-up interval was relatively brief (9 months). A review of behavioral treatments of suicidal behaviors among clinical populations suggests that outcomes among experimental and control groups may dissipate across time.³³ Thus, the stability of important improvements, such as enhanced personal control and problem-solving coping, in this prevention trial with a nonclinical population cannot be adequately evaluated without longer-term follow-up.

Future Research

Crucial research questions remain. For example, what individual and intervention factors contribute most to improvement? What factors promote the differential responsiveness of females to the small-group skills-training intervention for reductions in anxiety and anger? Do personal and social resources serve as mediators, thereby indirectly influencing reductions in suicide risk and emotional distress? Do the gains made by youths in the 2 brief interven-

tions hold across longer periods and into young adulthood when the risk for suicide escalates?

This study addressed the critical process of defining, implementing, and evaluating effective public health prevention approaches for reducing suicide risk among adolescents as called for by the surgeon general.¹ Despite limitations and the need for more research, the study showed the feasibility and efficacy of suicide risk screening and brief indicated suicide prevention programs designed for vulnerable high school youths. Reducing emotional distress and enhancing personal competencies and social resources during adolescence provide high-risk youths with skills and social support resources for counteracting complex and stressful life events that often lead to depression and suicide risk. □

Contributors

E. A. Thompson, L. L. Eggert, and B. P. Randell collaborated in the development and implementation of study measures and research protocols and developed the C-CARE intervention. L. L. Eggert developed the CAST intervention. E. A. Thompson, L. L. Eggert, and K. C. Pike designed, conducted, and interpreted the data analyses. All authors contributed to the writing of the paper.

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