Predicting suicide attempts among adolescents

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This study set out to investigate the utility of 4 often referred to behavioural antecedents of suicide attempts – suicide ideation, plans, threats and deliberate self-harm – in the prediction of suicide attempts and the identification of suicide attempters and nonattempters among adolescents. A total of 156 male and 151 female students aged between 14 and 17 years (mean = 15.8) attending one randomly chosen metropolitan state high school completed a questionnaire concerning a number of aspects of suicidal behaviour. The findings indicated that suicide ideation, plans and threats, and deliberate self-harm are associated with suicide attempting and that a combination of suicide plans and deliberate self-harm present a particularly worrying mixture. Further, a composite index of suicidality was demonstrated to have some utility in the identification of suicide attempters and nonattempters. These findings add further weight of evidence to the suggestion that adolescents who enter the spectrum of suicide behaviours are at high risk of making a suicide attempt, although this requires further investigation in a prospective study.

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Suicidal behaviour in the adolescent population is a major public health concern. Despite the infrequency of completed suicide, a worldwide increase among young people aged 15 to 19 years has been observed over the last 30 years (1); and with an incidence of 16.4 suicide completions per 100,000 individuals, Australia has the highest suicide rate among young people aged 15 to 25 years in the world (2). Equally disturbing are the estimates of the ratio of suicide attempts to completions among adolescents, which range from 50:1 to 220:1 (3). Yet existing estimates of rates of suicidal behaviours are probably too conservative as they are often derived from special samples (for example, hospital admission data), and we now know that the majority of adolescents who attempt suicide do not present to the medical system (1, 4). Although it has been suggested (5) that such suicide attempts may lack clinical seriousness (defined in terms of whether illness or injury occurred as a result of the suicide attempt or whether medical intervention was required), all suicide attempts are very worrisome, not only because of the known dangers in not receiving medical attention following some methods of suicide attempt (for example, paracetamol overdoses), but also in view of the possibility that the effects of many suicide attempts are slept off (for example, drug overdoses), claims that the consequences of suicide attempts are already placing considerable burden

upon health services (6, 7) and because they reflect a considerable amount of desperation and psychological suffering (5). Further, school surveys of so-called normal adolescents suggest that 8–11% of high school students have made a suicide attempt (4, 8–9), suggesting a ratio of attempts to completions of between approximately 500:1 and 670:1 for Australian samples; suicide ideation is much more common (1, 4, 8, 10).

Given these statistics, it is not surprising that there has been considerable recent attention to discerning specific risk factors for suicide attempting among adolescents. A number of studies (3, 11–13) have been successful in identifying specific risk factors that offer statistically significant prediction of suicide attempting and utility in the identification (or discrimination) of adolescent suicide attempters. Although most such studies are limited by their cross-sectional research design, their findings are of great value because they identify variables worthy of further investigation into their utility in the prediction of future suicide attempts in prospective research. For once we are able to validate a group of variables that offer 95% sensitivity and specificity in the identification of individuals at risk of attempting suicide, we are then able to develop procedures for the early detection and prevention of adolescent suicidality. Further, given the reported similarity between risk factors for suicide attempting and completion

(12, 13), such early detection and subsequent intervention with those most at risk of attempting suicide may affect the current rates for completed suicide.

Mehr et al. (14) noted that, if the behavioural antecedents of attempted suicide can be isolated, then the strength and accuracy of clinical prediction can be increased and direction provided for intervention. Working from this perspective, we noted that some of the best behavioural predictors of suicide attempts reported in the literature include suicide ideation (12), deliberate self-harm (15) and previous suicide attempts (3). In view of this, and as part of a larger study of risk factors for adolescent suicidality, the hypothesis that the spectrum of suicide behaviours other than attempts and completion (i.e., suicide ideation, plans, threats and deliberate self-harm) would offer statistically significant prediction of attempting in a normal population of adolescents and classify attempters with accuracy greater than would be expected by chance was evaluated.

Material and methods

Subjects

The sample consisted of 156 male and 151 female students aged between 14 and 17 years (mean = 15.8) attending one randomly chosen metropolitan state high school. Located in the southern half of the state of South Australia (approximate population 1.5 million), the school serves a defined area population with predominantly middle-class residents. After permission was received from the school to conduct a study of issues concerning the psychological health and wellbeing of adolescents, all students enrolled in year 10 ($n = 169$, mean age = 15 years) and year 11 ($n = 138$, mean age = 16 years) who were present on the day of data collection, were willing to participate in the study and had parental assent to do so were recruited.

Instruments

Suicidal behaviour was assessed using a self-report questionnaire developed by the present authors. Based on an assimilation of the literature, it asks respondents to indicate *yes* or *no* to specific questions about whether they have ever engaged in suicide ideation, plans, threats, deliberate self-harm and suicide attempts, to indicate how often they have engaged in these behaviours in the previous 6 months (from never to weekly) and to rate how likely they perceive themselves to be to engage in each behaviour in the near future. With the exception of suicide plans, each question specifically asks about the respondents' participation in acts with intent to deliberately hurt or kill themselves, as is recommended by other authors (5). The questionnaire also asks

Table 1. Suicide behavior questions

Variable	Question
Suicide ideation	Have you ever thought about killing yourself?
Suicide plans	Have you ever made specific plans to suicide without carrying them out?
Suicide threats	Have you ever made threats to others that you will kill yourself?
Deliberate self-harm	Have you ever deliberately tried to hurt yourself?
Suicide attempts	Have you ever tried to kill yourself?

subjects to rate the detail of suicide plans and the seriousness of suicide threats. Unpublished data on a small sample of female high school students ($n = 70$) indicate moderate to high test-retest reliability for each item (phi coefficients for nominal data ranging from 0.59 to 0.91; Pearson r for rating scales ranging from 0.58 to 0.89) over a 3-week interval spanning a suicide prevention programme. Further, the scale has face validity, and questions using a yes/no response to lifetime suicidal behaviour have been used extensively in the research literature. For the purposes of this study, only the five items asking for yes/no response to the spectrum of suicidal behaviours were used in data analysis, and they are presented in Table 1.*

Further, a range of demographic details were collected, including age, gender and year level. Questions about this information and the above-mentioned questionnaire were arranged in a single questionnaire booklet.

Procedure

After permission to conduct the study was obtained from the school principal, and prior to data collection, a letter was distributed to parents explaining the study and seeking for them to assent to their children entering the study. To assist parents in making this decision, copies of the questionnaire were made available for inspection at the school office, and parents received instructions about how to exclude their children from the study should this be their decision.

All students present on a day of data collection were given both written and verbal explanations of the study, and the questionnaires were distributed for completion during one normal class period. Subjects were assured of the confidentiality of their responses and asked not to write their names on any part of the booklet. Given the sensitive nature of some sections of the questionnaire, included on the inside cover of the booklet was an invitation to contact one of several community service organizations

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* The complete Revised Adolescent Suicide Questionnaire (ASQ-R) is available from us.

should they feel the need (for instance, if the questionnaire had caused some distress). The names and telephone numbers of these organizations were listed, and subjects were asked to tear off this page for their own reference. Subjects were asked to complete all questions as best they could and assured that there were no right or wrong answers. Upon completion of the questionnaire, subjects were thanked for their participation and placed their questionnaire into a sealed collection box to ensure the confidentiality of their responses.

Results

Forty-nine percent ($n = 150$) of the sample reported having thought about killing themselves; 14% ($n = 42$) reported having made specific plans to suicide without carrying them out; 13% ($n = 38$) reported having made suicide threats; 30% ($n = 91$) reported having deliberately tried to hurt themselves; and 9% reported having tried to kill themselves. Chi-square analysis indicated no statistically significant gender effects in the reported incidences of these suicidal behaviours, and a statistically significant year-level effect for suicide ideation only ($Y_{10} = 44\%$, $Y_{11} = 55\%$, $\chi^2 = 3.87$, $P < 0.05$).

A series of chi-square analyses portrayed a statistically significant association between suicide attempts and suicide ideation ($\chi^2 = 26.16$, df = 1, $P < 0.0001$), suicide plans ($\chi^2 = 67.38$, df = 1, $P < 0.0001$), suicide threats ($\chi^2 = 21.50$, df = 1, $P < 0.0001$) and deliberate self-harm ($\chi^2 = 53.51$, df = 1, $P < 0.0001$). A stepwise multiple logistic regression analysis with forwards (likelihood ratio criterion) entry of predictor variables then demonstrated that suicide plans and deliberate self-harm offer statistically significant prediction of suicide attempts ($\chi^2 = 73.03$, df = 2, $P < 0.001$); with deliberate self-harm adding statistically significant unique prediction of suicide attempts to the variable entered into the regression equation first – suicide plans ($\chi^2 = 27.72$, df = 1, $P < 0.001$). In Table 2 it can be seen from the estimated odds ratios that each predictor has a strong effect, and from the regression equation it was found that the predicted prob-

ability of having made a suicide attempt given suicide plans and deliberate self-harm is greater than chance ($P_{(A/P.DSH)} = 0.55$). Moreover, these two variables identified suicide attempters and non-attempters with 68% sensitivity and 95% specificity.

In addition, chi-square analyses portrayed a statistically significant association between suicide plans and suicide ideation ($\chi^2 = 42.11$, df = 1, $P < 0.0001$) and suicide threats ($\chi^2 = 33.60$, df = 1, $P < 0.0001$), and between deliberate self-harm and suicide ideation ($\chi^2 = 62.48$, df = 1, $P < 0.0001$) and suicide threats ($\chi^2 = 27.61$, df = 1, $P < 0.0001$). Moreover, Cronbach's alpha, a test of internal consistency in responding, provided further evidence of the clustering of the 5 behaviours assessed in this study (standardized-item alpha = 0.74).

In other work by the present authors (15), a composite suicidality index representing both extent of suicidal behaviour engaged in, and the severity of these behaviours, has been derived from yes/no responses to questions asking the subject if they have ever engaged in suicide ideation, plans, threats, deliberate self-harm or suicide attempts. Rather than simply summing in a linear fashion the number of yes responses to these questions (giving rise to a composite score of the number of different suicide behaviours engaged in only, with range 0 to 5), this method attempted to also take into account the increasing severity of the behaviours, from suicide ideation, to plans and threats, to deliberate self-harm and suicide attempts, by assigning a value of zero to all *no* responses, and a value of 1 for *yes* responses to suicide ideation, 2 to suicide plans, 3 to suicide threats, 4 to deliberate self-harm, and 5 to *yes* responses to suicide attempts. This computational method produced a composite index of suicidality with a possible range of scores of 0 to 15, for which increasing scores indicated the extent of suicidal behaviours engaged in and the severity of these behaviours. In the context of the present study, it was thought to be of interest to evaluate the performance of a reduced composite index of the same form, with suicide attempts removed (giving a composite index with a possible range of 0 to 10) in predicting suicide attempters and discriminating them from nonattempters.

A logistic regression analysis demonstrated that this composite suicidality index is a statistically significant predictor of suicide attempts ($\chi^2 = 63.57$, df = 1, $P < 0.001$); although the effect is fairly weak given the odds ratio ($1.47 \leq 1.75 \leq 2.09$, 95% confidence interval). Further, with a sensitivity of 40% and a specificity of 98% in the identification of suicide attempters and nonattempters, it performs better than chance but not with sufficient sensitivity to be of any value on its own. Nevertheless, given that the logistic regression analysis appeared to be maximiz-

Table 2. Selected stepwise logistic regression output

Predictor variable	Coefficient (β)	WALD	Partial correlation (R)	Odds ratio	95% confidence interval
Deliberate self-harm	3.64	12.08***	0.24	38.21	4.86–55.59
Suicide plans	2.22	17.99***	0.31	9.19	3.32–25.51
Constant	−5.64	30.57***			

*** $P < 0.001$

ing specificity at the expense of sensitivity (in view of the much larger proportion of non-attempters in the sample), it was decided to conduct a series of chi-square analyses using different cut-off scores in the reduced suicidality index to evaluate their relative performance in identifying suicide attempters and nonattempters. As a result of these analyses, it was found that a cut-off of 5 identified suicide attempters and nonattempters with 96% sensitivity and 79% specificity. Although the specificity is somewhat low for this cut-off, a score of 5 or more indicates that the false positives reported having engaged in at least 2 of the 4 behaviours contributing to the index, conceivably identifying them as worthy of clinical attention anyway and most probably at risk of a future suicide attempt. Moreover, in terms of relative ratios, individuals with a score of 5 or more on the composite index were 64 times more likely to have made a suicide attempt than individuals who scored less than 5.

Discussion

These findings support the experimental hypothesis and the notion that adolescents who try to kill themselves also engage in a range of other suicide-related behaviours. Although the temporal relationship between these behaviours and suicide attempts cannot be inferred for this sample, the findings do suggest that adolescents who report any or a combination of suicide ideation, plans and threats and deliberate self-harm, particularly suicide plans and deliberate self-harm, substantially overlap the population of suicide attempters. This seems to be an important finding that supports and extends the associated finding in the literature that suicide ideators and attempters are overlapping populations (17, 18).

As to why only suicide plans and deliberate self-harm enter the regression equation, it is conceivable that they represent behaviours that place the suicidal individual at increased risk of actually carrying through with a suicide attempt. For the making of plans to kill oneself, however diffuse, may remove a potential hurdle to acting upon suicidal wishes. For example, a cognitive set in which the available options for dealing with a crisis are seen to be limited may allow for the swift adoption of the ready-made plan should suicidal wishes become extremely strong. Further, the act of deliberate self-harm, while probably representing a continuum of behaviours from the less serious acts associated with teenage thrill-seeking to the more serious deliberately self-damaging acts such as self-mutilation, may be seen to indicate a willingness to do actual harm to oneself. When they coexist, the plan and the willingness to do harm to oneself appear to constitute a very serious and dangerous recipe for suicide attempting.

On the other hand, it appears that suicidal ideation is too common a behaviour in this sample to compete with suicide plans and deliberate self-harm in the prediction of suicide attempts, having a fairly obvious lack of specificity. This is not to say that suicide ideation is of no use in the identification of at-risk individuals, as it is strongly associated with both suicide plans and deliberate self-harm. Rather, there is a degree of covariation between these behaviours, and suicide plans and deliberate self-harm merely account for greater proportions of the variance in suicide attempting. As to why suicide threats fail to offer statistically significant unique prediction of suicide attempts, the picture is less clear. Although psychological autopsies of suicide victims have found that they have often informed another person of their intention to commit suicide before the attempt (19), an often held lay belief is that suicide threateners will not attempt suicide as they are probably simply crying for help and have chosen to do this in an alternative, safer fashion. This view seems to conceptualize suicide threats as similar to low-intent parasuicide attempts and may offer some clue as to the failure of suicide threats to enter the regression equation in this study. Nevertheless, the chi-square analyses demonstrate an association between suicide threats and attempts, which probably indicates that a proportion of threateners intend to make a suicide attempt and another group choose threats as an alternative to a suicide attempt to communicate their strife and need for help. Further, suicide threats are also strongly associated with both suicide plans and deliberate self-harm, suggesting a pathway from ideation and threats to suicide plans and deliberate self-harm, and in turn from plans and deliberate self-harm to suicide attempts.

With regard to the composite index of suicidality, it seems that regardless of possible criticisms of its lack of empirical evaluation, it does prove to be useful in identifying suicide attempters. For when taking a cut-off of 5, 96% of attempters (sensitivity) and 79% of nonattempters (specificity) were correctly identified. And while the specificity is modest, the 21% who constitute the pool of false-positives reported having engaged in at least 2 of the 4 suicidal behaviours contributing to the index; conceivably making them a worrisome group in their own right who are deserving of clinical attention. More importantly though, it is quite possible that they are at increased risk of making a future suicide attempt, as those who score 5 or more on the composite suicidality index have 64 times the relative risk of making a suicide attempt as those who score less than 5.

Perhaps the main limitations of this study are its restricted sample (one randomly chosen high school with predominantly white, middle-class students) and the cross-sectional research design. This design

does not allow for inferences to be made about the temporal relationship between such behaviours as suicide plans and deliberate self-harm and attempting suicide; and hence, their predictive validity over time. Further, it possibly inflates the false-positive rate, as there may be some individuals who score 5 or more on the composite suicidality index, or who are currently thinking about/planning a suicide attempt, who will make such an attempt at some stage in the future. Hence, while it may never be possible to avoid this kind of inflation of the false-positive rate, it is necessary to re-examine these findings in a prospective study.

Nevertheless, as mentioned previously, cross-sectional studies like the present one are important pre-requisites to a prospective study, as they identify the variables whose predictive validity is worth investigating in the more costly and time-consuming exercise of a longitudinal study.

In conclusion, then, as part of a growing interest in early detection of adolescent suicide attempters, this study was conceived to investigate the predictive utility of some noted behavioural antecedents of attempted suicide (3, 12, 15). Consistent with the recommendation in the literature (5) that specific questioning is needed to get accurate data on clinically significant suicide attempts, the questionnaire assessed acts intended to kill oneself (hence, psychologically and/or medically significant). The findings suggest that a propensity to make suicide plans and engage in acts of deliberate self-harm are very important indicators of suicide attempting in a normal population of adolescents; and that a composite index of suicidality that incorporates the extent and severity of suicidal behaviours engaged in can be very useful in the identification of suicide attempters in a normal population of adolescents and, possibly, individuals at risk of a future suicide attempt. These appear to be very significant findings worthy of further investigation and validation in a prospective study.

Acknowledgements

References

1. SMITH K, CRAWFORD S. Suicidal behaviours among "normal" high school students. Suicide Life Threat Behav 1986: 16: 313–325.
2. UNICEF report. The progress of nations, 1993.
3. SLAP GB, VORTERS DF, CHAUDHURI S, CENTOR RM. Risk factors for attempted suicide during adolescence. Pediatrics 1989: 84: 762–772.
4. PEARCE CM, MARTIN G. Locus of control as an indicator of risk for suicidal behaviour among adolescents. Acta Psychiatr Scand 1993: 88: 409–414.
5. MEEHAN PJ, LAMB JA, SALTZMAN LE, O'CARROLL PW. Attempted suicide among young adults: progress towards a meaningful estimate of prevalence. Am J Psychiatry 1992: 149: 41–44.
6. GOLDNEY RD. Suicide in young persons. Med J Aust 1987: 147: 161–162.
7. KOSKY R. Is suicidal behaviour increasing among Australian youth. Med J Aust 1987: 147: 164–169.
8. MARTIN G, CLARKE M, PEARCE CM. Adolescent suicide: music preference as an indicator of vulnerability. J Am Acad Child Adolesc Psychiatry 1993: 32: 530–535.
9. GARRISON CZ. The study of suicidal behaviour in schools. Suicide Life threat Behav 1989: 19: 120–120.
10. DAVIS JM. Suicidal crises in schools. School Psychol Rev 1985: 14: 313–324.
11. SWEDO SE, RETTEW DC, KUPPENHEIMER M, LUM D, DOLAN S, GOLDBERGER E. Can adolescent suicide attempters be distinguished from at-risk adolescents? Pediatrics 1991: 88: 620–629.
12. KIENHORST CWM, DE WILDE EJ, VAN DEN BOUT J, DIEKSTRA RFW, WOLTERS WHG. Characteristics of suicide attempters in a population-based sample of Dutch adolescents. Br J Psychiatry 1990: 156: 243–248.
13. BRENT D, PERPER JA, GOLDSTEIN CE et al. Risk factors for adolescent suicide: a comparison of adolescent suicide victims with suicidal inpatients. Arch Gen Psychiatry 1988: 45: 581–589.
14. MEHR M, ZELTZER LK, ROBINSON RR. Continued self-destructive behaviours in adolescent suicide attempters. II. A pilot study. J Adolesc Health Care 1982: 2: 183–187.
15. HENDERSON S. Evaluating suicide risk. Patient Management 1978: 39–42.
16. ALLISON S, PEARCE CM, MARTIN G. Expressed emotion and hopelessness: a path to adolescent suicide? Unpublished.
17. KOSKY R, SILBURN S, ZUBRICK SR. Are children and adolescent who have suicidal thoughts different from those who attempt suicide? J Nerv Ment Dis 1990: 178: 38–43.
18. FRIEDMAN JM, ASNIS GM, BOECK M, DiFIORE J. Prevalence of specific suicidal behaviours in a high school sample. Am J Psychiatry 1987: 144: 1203–1206.
19. SHAFII M, CARRIGAN S, WHITTINGHILL JR, DERRICK A. Psychological autopsy of completed suicide in children and adolescents. Am J Psychiatry 1985: 142: 1061–1064.