Eur Arch Psychiatry Clin Neurosci (2003) 253 : 197–202 DOI 10.1007/s00406-003-0425-6

ORIGINAL PAPER

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Dimensions of suicidal behavior according to patient reports

Received: 17 February 2003 / Accepted: 8 May 2003

Abstract Five factor analyses with limitations explored the Suicidal Intent Scale (SIS) subscales reflecting suicidal behavior dimensions. This larger sample study conducts an exploratory factor analysis of the SIS. Two large samples of suicide attempters (N = 435 and N = 252) from a general hospital were studied. The validity of SIS subscales obtained from the factor analysis was investigated by examining the association between the subscales and clinical variables. There were two factors: expected lethality and planning. In both samples, male gender and depression tended to be associated with higher scores in both subscales (small to medium effect sizes). Hospitalization was associated with higher scores in both SIS subscales (medium to large effects) suggesting that these subscales were reasonably good predictors of suicide attempt severity. Clinicians assessing patient reports to establish the severity of suicide attempts need to ask questions regarding both dimensions: expected lethality and planning.

Key words suicide · suicide attempts · factor analysis · scale · suicide intent scale

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Introduction

A suicide attempt is the most powerful predictor of eventual completed suicide (Harris et al., 1997). Suicide attempts by themselves cause significant morbidity and result in a major use of health resources. In the US, where the subject has been better studied, Crosby et al. (1999) surveyed more than 5,000 people and estimated that there are 700,000 suicide attempts each year with at least 301,000 receiving medical attention. Using the National Comorbidity Survey from 1990 to 1992, Kessler et al. (1999) estimated that 4.6 % of the US population acknowledged making a suicide attempt during their lifetime. In spite of these facts, suicide research has only recently started to receive attention (Jamison 1999; Mann et al. 1999; U. S. Public Health Service 2001).

Psychiatric scales are used to measure psychiatric symptoms in standardized ways. The scales are lists of symptoms (or items). In these scales, groups of symptoms tend to be correlated; each group of intercorrelated symptoms probably reflects underlying dimensions of behavior. The underlying dimensions of behavior in each scale can be explored with factor analysis. Dozens of papers use factor analysis to explore the factors or dimensions underlying depressive and/or schizophrenic symptoms. Factor analyses' utility is demonstrated by the fact that factor analytic studies showed that schizophrenic symptoms should not be classified as positive and negative; a third dimension, or disorganization factor, needs to be included (de Leon et al. 1992; Peralta et al. 1992).

Beck described the Suicidal Intent Scale (SIS) in 1974 (Beck et al. 1974). A computer assisted review of the literature revealed only five prior factor analyses (Table 1)

Table 1 Summary of prior published factor analyses of the Suicide Intent Scale

Author	Sample size	Description	Mean ± SD for total score	Number of factors	Factor Names
Beck et al. (1976)	188	Consecutive suicide attempts US university hospital	Not described	4[a]	Attitude toward attempt [10–14] Planning [5–7, 15] Precautions against intervention [1–3] Communication with others [4 and 8]
Wetzel (1977)	104	48 suicide attempts and 56 suicide threateners	Not described	4[b]	Serious intent [6.8, 9.12.13.15] Serious act [2.5, 9–14, alcohol] Precautions against interference [1–3] No notification [4]
Mieczkowski et al. (1993)	98	Consecutive depressive 2 US university hospitals Retrospective scores of SIS	16.4 ± 6.1[c] 16.0 ± 5.6[c]	2	Lethal intent [9–14] Planning [1–7, 15]
Kingsbury (1993)	50	Adolescents with overdose English hospital Age and method restrictions	10.4 ± 5.2[d]	4	Belief about intent [9–13] Preparation [5.6, 8.15] Prevention of discovery [1–3] Communication [4.7]
Spirito et al. (1996)	190	Adolescents Two US hospitals 134 general + 58 psychiatric Age restrictions Unknown representativity	9.3 ± 6.0	3	Expected outcome [9–14] Isolation behaviors [1–4] Planning activities [5.6, 15]

[a] Results may be contaminated by 3 additional items loaded on two other factors; [b] Results may be contaminated by one additional item: Alcohol; [c] Means from two different hospitals; [d] Some patients were seen in the hospital [mean = 10.7] and some were seen as outpatients [mean = 9.7]

(Beck et al. 1976; Wetzel 1977; Kingsbury 1993; Mieczkowski et al. 1993; Spirito et al. 1996). Unfortunately, factor analyses using the SIS have not been conducted as frequently as those using scales measuring depressive or schizophrenic symptoms. Factor analysis techniques are limited in that they need large samples. The final version of the SIS included 15 items, each scored 0 to 2. Some other items were not included in the total score. Some of these additional items contaminated the two oldest factor analysis studies (Beck et al. 1976; Wetzel 1977). For a scale with 15 items, a sample size of at least 150 patients (10 patients per item) is usually considered necessary to obtain stable factors that may reflect the dimensions underlying the scale (Child 1990). Only two of the five studies had these large sample sizes (Table 1) (Beck et al. 1976; Spirito et al. 1996). Moreover, only the original Beck's study (Beck et al. 1976) included a representative sample of all kinds of suicide attempts. Unfortunately, the Beck's factor analysis included some items not included in the final version of the scale (Beck et al. 1976). Mieczkowski et al. (1993) described the only study not limited to adolescents and not contaminated by other items. They proposed two factors (or dimensions) that were called expectation of lethality (items 9 to 14) and planification (items 1 to 7 and 15) (Table 1). Unfortunately, they used retrospective SIS scores.

The purpose of this study was to perform an exploratory factor analysis of the SIS using two large samples of suicide attempters from a general hospital. The validity of the subscales obtained from the factor analysis was investigated by examining the association between the subscales and clinical variables. Internal consistency of the SIS and its subscales was also studied.

Methods

This Spanish general hospital has a catchment area of 500,000 people and provides free medical coverage. As recommended by the US National Institute of Mental Health, a suicide attempt was defined as a self-destructive behavior with the intention of ending one's life, independent of the resulting damage (O'Carroll et al. 1996). Based on our consecutive recruitment of patients in the last two years (Baca-Garcia et al. 2002), we estimated that approximately 300 different patients are seen at the hospital every year after a suicide attempt, and in approximately 84 % of the cases, patients consent to take part in our studies. The non-consenting individuals did not appear to be different from consenting individuals in demographic variables (e. g. the percentages of females among the two groups of attempters were respectively 58 % vs. 66 %, p = 0.34; and the percentages of attempters with age lower than 35 years were respectively 45 % vs. 51 %, p = 0.54). After taking repeated suicide attempts in the same year into account, we estimated that 252 different suicide attempters consented per year. Taking into account the repeated attempters in three years, we estimated that approximately 618 different suicide attempters would consent in three years.

The first sample, collected at the hospital between 1996 and 1998, included 435 patients who made a total of 478 suicide attempts (Table 2). This sample was described in a previous paper (Baca-Garcia et al. 2001). For the current study, only the first recorded suicide attempt from patients with more than one attempt was used, so only 435 SIS questionnaires were analyzed (Table 2). The sample with 435 different attempters included approximately two-thirds (70 %) of the 618 suicide attempters from three years in different consenting individuals. This first study was conducted without external funding. Therefore, no research psychiatrist was available for on-call patient recruitment on some days. There was no intended pattern in this underrecruitment. However, based on our latter experience with consecutive sampling, we calculated that approximately one third of the attempts were not included in the 1996–1998 recruitment. During

Table 2 Description of samples

Variable	First sample [N = 435]		Second sample [N = 254]	
	N	%	N	%
Gender				
Male	160	37	87	34
Female	275	63	167	66
Most frequent DSM-IV axis I diagnoses[1]				
Depression	171	39	161	63
Substance use disorder	110	25	62	24
Psychosis	37	9	15	6
No major axis I diagnosis	56	13	29	11
Suicide method				
Poisoning	352	81	200	79
Cutting self	54	12	21	8
Other	29	7	33	13
Psychiatric history				
Prior psychiatric treatment	254	60	138	54
Prior psychiatric admission	114	26	93	36
Suicide history				
Suicide attempts during lifetime	226	52	131	52
Suicide attempts during last year	120	28	79	31

[1] The first sample included only the main or first clinical diagnosis. Therefore, each patient has only one diagnosis. The table does not include 14 % of other diagnoses that were infrequent. The second sample includes research diagnoses; therefore, each patient may have more than one diagnosis and percentages add to more than 100 %

these three years, the underrecruitment appeared to be more severe in the most difficult patients to recruit, particularly those needing medical attention first. Therefore, the patients with the most severe attempts and the highest SIS scores appeared to be underrepresented in this first sample. The 1999 external funding allowed us to provide consecutive recruitment and focused more resources on systematically recruiting the most difficult cases.

A second sample, collected between February 1999 and January 2000, included all consenting and consecutive 254 patients, totaling 278 suicide attempts (Baca-Garcia et al. 2002). As in the first sample, only the first recorded suicide attempt from relapsed patients was considered, so only 254 SIS questionnaires were analyzed (Table 2).

Diagnostic procedures were different for the two samples. For the second sample, the Mini International Neuropsychiatric Interview (MINI) was used to establish Axis I DSM-IV diagnoses (Sheehan et al. 1998). For the first sample, only clinical diagnoses from clinicians were available. Therefore, when diagnoses are used to validate SIS subscales, only broad comparisons of syndromic diagnoses between the two samples are possible. The main obvious difference is that clinicians focused on only one main diagnosis while the MINI records all possible diagnoses.

Statistics

An exploratory factor analysis of the first 15 items of the SIS was performed using SPSS (SPSS Inc., 1999). A principal component analysis with oblique rotation was used to extract and rotate the factors (Dziuban and Shirkey 1974; Zwick and Velicer 1986). For each of the factors obtained, a factor subscale was computed by summing the score of all items with factor loadings of 0.4 or greater on the factor. The internal consistency of the total SIS and its factor subscales was investigated by computing Cronbach's alpha (α) (Cronbach 1951), which is a measure of scale reliability.

First, a factor analysis was conducted in each sample. When comparing results from the two factor analyses, similar factor loadings were observed in both samples. This suggested similar factor structures for the samples. Moreover, after combining the samples, the factors appeared more robust in that the rotation yielded a clearer separation of the factors than suggested by the two separate factor analyses. Therefore, only a factor analysis of the combined sample is reported (Table 3). As described before, the first sample had an underrepresentation of the most severe cases, associated with lower scores in the subscales (and in the total SIS). In summary, the severity of the attempt does not appear to influence the structure of the factors, although it influences the subscale scores. This suggests that the SIS is particularly robust from the psychometric point of view. The difference in severity between our first and second samples was small compared with the variation in the mean total scores obtained in previous studies. The mean total scores for the first and second samples were respectively 10.3 and 13.5 (Table 4). By contrast, two samples of retrospectively assessed depressive attempters had quite higher mean scores (16.4 and 16.0; Mieczkowski et al. 1993), whereas one sample of adolescent attempters had a mean score of 9.3 (Spirito et al. 1996) (Table 1).

To assess the validity of a factor subscale, the subscale scores for patients discharged from the emergency room were compared with the scores for hospitalized patients (Table 4). Since suicide attempts were presumably more severe in hospitalized patients, hospitalized attempters were expected to have higher scores. Similarly, depressive attempters were compared with non-depressive attempters, expecting higher scores for the depressive attempters. Since, on average, males made more severe attempts than females, the above comparisons were performed separately in males and females (Table 4).

Standardized effect sizes were computed to measure the magnitude of the association between the hospitalization variable and subscale scores (Table 5). A standardized effect size was defined as the mean score for hospitalized patients minus the mean score for discharged patients divided by the standard deviation (Cohen 1992). These computations were performed separately in males and females. Analogous computations were performed for the depression dichotomy (Table 5). Standardized effect sizes allow the assessment of the clinical importance of a significant difference between means; the larger the effect size, the greater the importance. In the behavioral sciences, by convention, effect sizes of 0.2 are considered small, effect sizes of 0.5 are considered medium and effect sizes of 0.80 are considered large (Cohen 1992). In general, two effect sizes computed from two samples of different size are comparable. As our first sample is larger than the second, it will be easier to find significant differences in the first than in the second sample.

Table 3 Factor loadings for the two-factor solution of the SIS scale in the combined sample [N = 689]

Item description [item number]	Factor loading	
	Expected lethality factor*	Planning factor*
Isolation [1]	0.10	<u>0.46</u>
Timing [2]	0.19	<u>0.57</u>
Precautions [3]	0.21	<u>0.52</u>
Act to get help [4]	<u>0.46</u>	0.07
Final acts [5]	–0.10	<u>0.52</u>
Active preparation [6]	0.04	<u>0.72</u>
Note [7]	–0.04	<u>0.58</u>
Communication [8]	–0.09	<u>0.44</u>
Purpose of attempt [9]	<u>0.71</u>	–0.03
Expectations of fatality [10]	<u>0.84</u>	–0.04
Concept of lethality [11]	<u>0.79</u>	–0.03
Seriousness [12]	<u>0.82</u>	0.05
Ambivalence to living [13]	<u>0.71</u>	0.04
Concept of rescuability [14]	<u>0.65</u>	–0.01
Degree of premeditation [15]	0.24	<u>0.50</u>

* Loadings greater than 0.4 are underlined.
Factor loadings were obtained from the pattern matrix. An item with a factor loading of 0.4 or greater was considered as belonging to that factor. Cattell's scree test was used to determine the number of components to retain (Zwick and Velicer 1986). Kaiser-Meyer-Olkin [KMO] measure of sampling adequacy and Barttle's test of sphericity were computed to examine the appropriateness of the correlation matrix (Dziuban and Shirkey 1974). The correlation matrix was found to be appropriate [KMO = 0.87, Barttle $\chi^2 = 3059.6$, df = 105, $p < 0.001$].

Results

Factor analysis of the SIS

The factor analysis yielded a two-factor solution (Table 3). The first factor, expected lethality, was essentially loaded by items 4, 9, 10, 11, 12, 13 and 14. The second factor, planning, was loaded by items 1, 2, 3, 5, 6, 7, 8 and 15.

SIS subscales

The internal consistency of the total SIS was $\alpha = 0.86$ for the first sample and $\alpha = 0.78$ for the second sample ($\alpha = 0.84$ for the combined sample). The internal consistency of the expected lethality subscale was excellent, $\alpha = 0.85$ for the first sample and $\alpha = 0.76$ for the second sample ($\alpha = 0.84$ for the combined sample). The internal consistency of the planning subscale was somewhat lower, $\alpha = 0.71$ for the first sample and $\alpha = 0.69$ for the second sample ($\alpha = 0.70$ for the combined sample).

Table 4 shows that the scores of the total SIS and expected lethality subscale were significantly higher in the

Table 4 Mean values for total SIS and factor subscales

	Expected lethality subscale Mean [CI]	Planning subscale Mean [CI]	Total SIS Mean [CI]
First sample			
Total sample [N = 435]	7.0 [6.6–7.4]	3.3 [3.1–3.6]	10.3 [9.7–10.9]
Females (N = 275)	6.6 [6.1–7.1]	3.0 [2.7–3.3]	9.6 [8.8–10.3]
Males (N = 160)	7.7 [7.1–8.3]	3.9 [3.4–4.4]	11.6 [10.7–12.6]
Depressive patients (N = 171)	7.6 [7.0–8.2]	3.6 [3.2–4.1]	11.3 [10.3–12.3]
Non-depressive patients (N = 264)	6.6 [6.1–7.0]	3.1 [2.8–3.5]	9.7 [9.0–10.4]
Second sample			
Total sample [N = 254]	9.5 [9.1–9.9]	3.9 [3.6–4.3]	13.5 [12.8–14.1]
Females [N = 87]	9.3 [8.8–9.8]	3.6 [3.2–4.1]	12.9 [12.2–13.7]
Males [N = 167]	10.0 [9.3–10.6]	4.5 [3.9–5.1]	14.5 [13.4–15.5]
Depressive patients [N = 161]	10.0 [9.6–10.5]	4.5 [4.0–4.9]	14.5 [13.7–15.3]
Non-depressive patients [N = 84]	8.6 [7.8–9.2]	3.0 [2.4–3.6]	11.6 [10.5–12.6]

CI 95 % confidence interval. Table 5 provides information on p values for significant differences. As described in the method section, the first sample underrepresented the most severe cases; therefore, the total SIS and factor subscales had lower mean scores in the first sample

Table 5 Standardized effect sizes of clinical variables on mean differences for SIS subscales

	First sample		Second sample	
	Expected lethality	Planning	Expected lethality	Planning
Male gender	+0.29*	+0.30*	+0.21	+0.29*
Depression among females	+0.33*	+0.16	+0.41*	+0.43*
Depression among males	+0.27	+0.28	+0.61*	+0.60*
Hospitalization among females	+1.1*	+0.79*	+0.20	+0.56*
Hospitalization among males	+0.96*	+0.59*	+0.56*	+0.52*

* Each effect size compares two means. Asterisks (*) mark significant differences between the means at the 0.05 level in independent samples t tests. For instance, among females, the effect size of depression on expected lethality was +0.33. The asterisk on this effect size means that there was a significant difference in the mean score of this subscale between depressive and non-depressive females. The plus sign (+) means that the mean for depressive females was larger than that for non-depressive females

second sample. This higher severity is observed even after controlling for gender and depressive diagnosis.

Validity of the subscales

In both samples, males had significantly higher mean scores in the planning subscale than females (Table 5). Depressive females had significantly higher mean scores than non-depressive females, particularly in the expected lethality subscale. Differences between depressive and non-depressive males were significant only in the second sample. Hospitalized females had consistently significantly higher mean scores in the planning subscale than discharged females. Hospitalized males had significantly higher mean scores in both factor subscales than discharged males (Table 5). Most effect sizes were small or medium. Hospitalization reached large effects, though only in the first sample (Table 5).

Discussion

Comparison with prior studies

Our study has some obvious limitations (see section on limitations), particularly in the first sample. However, there is no doubt that our study has clear advantages when compared with prior studies (Table 1). These include a large sample size, the use of two samples to replicate results, and the inclusion of all types of suicide attempts without restrictions in diagnoses or age. When compared with Mieczkowski et al.'s (1993) study, our study scored the SIS immediately after the patient had made the attempt instead of using a retrospective SIS score.

The two factors yielded by our factor analysis were similar to those of Mieczkowski et al. in depressive patients. However, these authors found that item 4 loaded stronger on their planning factor and that item 8 loaded poorly on their two factors. Dissimilarities among reported factor analyses of the SIS, and the finding of more than two factors by other researchers, may be due to the use of different factorization techniques, target populations, sampling procedures, sample sizes, and over-factorization.

The mean total SIS scores allow for broad interstudy comparisons. Unfortunately, Beck's study did not describe mean total SIS scores (Beck et al. 1976). The mean total SIS scores in the two prior adolescent studies were 9.3 (Spirito et al. 1996) and 10.4 (Kingsbury 1993) while the higher mean scores from Mieczkowski et al.'s (1993) samples were around 16 (Table 1). The Mieczkowski et al.'s study was restricted to depressive patients and computed SIS scores in a retrospective way. Our second and most representative sample had an intermediate mean total SIS score of 13.5 with depressive patients having a higher mean score, 14.5. Our first sample had lower mean scores but depressive patients also had a relatively higher mean score (Table 4).

Validity of the SIS subscales

As expected from the literature, males had higher mean total SIS scores (Table 4). They also had higher mean scores in both the expected lethality and planning subscales. The effect sizes for male gender were in the small range, 0.2–0.3 (Table 5).

As expected from the literature (including Mieczkowski et al.'s study) depressive patients had higher mean total SIS scores (Table 4). Moreover, male and female depressive patients tended to have higher scores in both expected lethality and planning subscales, but the differences were not always significant (Table 5). When the MINI was used to diagnose depression in the second sample, the effect sizes were in the medium range (0.4 for females and 0.6 for males).

Hospitalization had medium to large effect sizes when controlling for gender, suggesting that the SIS subscales were reasonably good predictors of suicide attempt severity according to the decisions of treating physicians.

Limitations

The current need to obtain a written consent even for non-invasive naturalistic clinical studies limits the rep-

resentativity of this and other studies. Refusing subjects were excluded. Our samples appear to represent suicide attempts very well due to the lack of other hospitals in the catchment area providing emergency services, the large sample size and the lack of demographic differences between included patients and non-consenting individuals. The second sample is very representative due to the inclusion of all consecutive consenting subjects. The first sample is more limited since not all subjects were asked to participate in the study. However, the lower severity of the first sample did not affect the pattern of SIS responses, since the factor analysis and the associations of clinical variables with subscales were very similar in both samples. One must remember that most prior SIS studies included smaller samples and were not done in settings with such thorough knowledge of suicide attempt patterns over so many years. Without the second consecutive sample, it would have been impossible to detect that the first study's recruitment was possibly biased. In summary, the differences between the first and second samples will not affect validation since validation was done independently in each sample and the subscales appeared to be very robust in the factor analysis. Moreover, the two SIS subscales were very similar in both samples, and remarkably similar to the results from the depressive sample of Mieczkowski et al. (1993).

Clinical implications

In summary, clinicians assessing patient reports to establish the severity of suicide attempts in the emergency room need to focus on two dimensions, expected lethality and planning. They need to ask patients questions regarding both dimensions. Certainly, new factor analytical studies of the SIS in large representative samples are needed to better study suicide behaviors using patients' self-report.

Acknowledgements The sample was recruited at the Hospital Ramon y Cajal, Madrid, Spain. The study was supported by 1999 and 2001 National Alliance for Research on Schizophrenia and Depression (NARSAD) Young Investigator Awards and a grant from the Spanish Government (Fondo de Investigacion Sanitaria, FIS 01/0077–01). The authors thank Margaret T. Susce, R. N., M. L. T. for editorial assistance.

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