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Research paper

Factor structure, reliability, and validity of the revised Suicide Crisis Inventory in major depression: A multicentric Indian study

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ABSTRACT

Background: The revised Suicide Crisis Inventory (SCI)-2 is a self-report measure to assess the suicide crisis syndrome (SCS). We aimed to assess the factor structure, reliability, and validity of SCI-2 among adults with major depression.

Methods: Using a cross-sectional design, between November 2021 and August 2022, the Hindi SCI-2, along with other self-report measures, was administered to Indian adult respondents clinically diagnosed with major depression across 24 centers in India. Confirmatory factor analysis was carried out to test the factor structure of SCI-2. Additionally, convergent, discriminant, and criterion validity were tested using bivariate or biserial correlations, as appropriate.

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Results: We obtained responses from 654 participants (Mean age = 36.9 ± 11.9 years, 50.2 % female). The SCI-2 fit both a one-factor (χ^2[1769] = 14,150.74, $p < .001$, CFI = 0.98, RMSEA = 0.10), and five-factor solution (χ^2[1759] = 13,130.83, $p < .001$,CFI = 0.98, RMSEA = 0.10) with the five-factor solution providing a significantly better fit. Internal consistencies of the SCI-2 total and subscale scores ranged from good to excellent. Most subscales significantly converged with each other and with other relevant measures although these associations were weak for thwarted belongingness and goal reengagement subscales. Small to moderate associations were noted in support of discriminant and criterion validity.
Limitations: We could not assess the predictive validity of SCI-2 for suicidal behaviors.
Conclusion: Consistent with prior data, the Hindi SCI-2 fit a five-factor solution and showed good psychometric properties. These findings support the use of SCI-2 to assess SCS among Indian adults with major depression.

1. Introduction

Suicide is a major global and public health issue accounting for >700,000 deaths worldwide in 2019 (World Health Organization, 2021). In India, the National Crime Records Bureau (NCRB) statistics have shown a steady increase in the annual suicide rate over the last five years from 9.9 per 100,000 in 2017 to 12.0 per 100,000 in 2021. Of particular concern was that the total number of suicide deaths in 2021 was 164,033; this figure represents a 7.1 % increase in suicides compared to 2020 (National Crime Records Bureau, 2021). Due to underreporting, it has been suggested that the actual suicide rate may be six to nine times higher (Vijayakumar, 2010). Data from the National Mental Health Survey showed that the ratio for suicide to attempted suicide in India is 1:15 while the ratio for suicide to suicidality is 1:200 (Amudhan et al., 2020). These figures clearly underscore the need for suicide prevention activities in the country, including early detection and management.

Current suicide risk assessment models suffer from two main drawbacks. First is their reliance on long-term risk factors, such as lifetime suicidal ideation (SI), past history of an attempt, or mental disorders (Nock et al., 2010; Vijayakumar and Rajkumar, 1999), to formulate and predict near-term risk of suicide, an approach for which there is little supporting evidence (Menon, 2013). Second, and perhaps more important, is their reliance on overtly expressed suicide ideation (SI). This is problematic because expressions of SI are often ephemeral, fluctuating, and unreliable (Kleiman et al., 2017). Tellingly, a retrospective chart review found that two-thirds of suicide decedents denied SI when last asked; half of them had died within two days of the assessment (Berman, 2018).

It is this gap in the risk assessment literature that the emerging construct of suicide crisis syndrome (SCS) seeks to fill by identifying individuals with increased near-term risk of suicide, irrespective of overtly expressed SI. The SCS represents an acute, pre-suicidal mental state characterized by affective and cognitive disturbances. The construct, originally proposed a decade ago (Yaseen et al., 2012), has undergone revisions to its formulation and currently comprises of the following five dimensions: entrapment, affective dysregulation, cognitive dyscontrol, feelings of hyperarousal, and social withdrawal (Schuck et al., 2019). Presently, the SCS is under evaluation for inclusion as a suicide-specific diagnosis in the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) (American Psychiatric Association, 2013).

The SCS is central to the narrative-crisis model (NCM) of suicide (Cohen et al., 2022), a multistage conceptual framework that seeks to conflate knowledge about evidence-based long and short-term suicide risk factors with theoretical models proposed to understand progression from trait vulnerabilities to suicidal behaviors (SB). This model proposes that individuals with trait vulnerabilities, when faced with stressful life events, develop maladaptive views about themselves and others, referred to as the 'suicidal narrative'. This is a predominantly cognitive state characterized by feelings of defeat, humiliation, clinging to unattainable goals, leading to hopeless perceptions of the future (Cohen et al., 2019). This phase predisposes the development of SCS, a more proximal, pre-suicidal phase, characterized by feelings of entrapment, significant emotional pain, inability to stop worrying, and isolation. Critically, the NCM, unlike other multistage models of suicide in literature (O'Connor and Kirtley, 2018; Van Orden et al., 2010), does not have SI as a milestone; this may offer the NCM a potential advantage over other models.

The revised Suicide Crisis Inventory (SCI-2) is a 61-item self-report measure developed to assess the latest SCS formulation. However, there is limited data on its factor structure, reliability, and validity, particularly in clinical populations. To our knowledge, only one prior study has examined the SCI-2 among a psychiatric sample; this was done on a diagnostically heterogeneous group of patients and showed a five-factor structure of the SCI-2 similar to findings from non-psychiatric samples (Bloch-Elkouby et al., 2021). Validation of the SCI-2 in specific diagnostic subgroups is an important preliminary step towards validation of the SCS construct and for examination of the clinical utility of SCI-2 in this group.

Therefore, we aimed to examine the factor structure, internal consistency, convergent, discriminant, and criterion validity of the revised SCI-2, among Indian adults diagnosed with major depression. Previous SCI-2 validation studies from India (Menon et al., 2022b), Korea (Park et al., 2023), Taiwan (Wu et al., 2022), and Russia (Chistopolskaya et al., 2022) in the general population have demonstrated that the SCI-2 fit both a one-factor and five-factor solution and showed good convergent, discriminant, and criterion validity, besides excellent internal consistency. An American validation study (Bloch-Elkouby et al., 2021), the only one to date on a psychiatric population, also showed similar findings. Based on these results, we primarily hypothesized that the SCI-2 would fit both a one-factor and five-factor structure of the revised SCS formulation. We additionally hypothesized that the SCI-2 total and subscale scores would show good internal consistency, convergent, discriminant, and criterion validity.

2. Methods

2.1. Setting and design

This was a cross-sectional study carried out between November 2021 and August 2022 in outpatient and inpatient psychiatry departments of 24 tertiary care hospitals in India. The participating centers included central government funded institutions (n = 11), state government funded institutions (n = 6), private medical schools (n = 5) as well as non-teaching hospitals (n = 2), spread across the country. These centers were selected purposively based on three criteria: staff credentials such as experience in clinical research, recruitment capabilities including availability of resources, and past performance in similar multicentric efforts with similar enrollment timelines (Grover et al., 2021). In addition, we made efforts to select sites fulfilling these criteria from all five zones of the country. The study was not preregistered and was carried out under the aegis of the Research and Education Foundation subcommittee of the Indian Psychiatric Society.

2.2. Participants

Study participants were adults, aged between 18 and 65 years, diagnosed with major depressive disorder (MDD; single/recurrent episode) as per the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) (American Psychiatric Association, 2013). A control group comprising of age and gender-matched apparently healthy individuals were also recruited from non-biologically related individuals accompanying patients to the outpatient department or attending to them in the wards. We excluded patients with documented intellectual disability, psychotic symptoms at intake, and those medically unstable for interviewing. Study participants were selected using purposive, non-random sampling. The present analysis was part of a larger study that aimed to assess the presence and correlates of SCS in major depression. In this paper, we report the internal structure, reliability, and validity indices of the SCI-2 among Indian adults with major depression.

2.3. Assessments

Every study participant was assessed on the following measures:

Suicide Crisis Inventory (*SCI*)*-2* (Bloch-Elkouby et al., 2021): This is the revised self-report version of the original 49-item SCI (Galynker et al., 2017). The SCI-2 is a 61-item version with five sub-scales: entrapment (10 items; e.g., "Did you feel that there was no way out?"), affective disturbance (18 items; e.g., "Did you have a sense of inner pain that was too much to bear?"), loss of cognitive control (15 items; e.g., "Did you feel that ideas kept turning over and over in your mind and they wouldn't go away?"), hyperarousal (13 items; e.g., "Did you feel you were constantly watching for signs of trouble?"), and social withdrawal (5 items; e.g., "Did you interact less with people who care about you?") (Suppl file 1). Individual items are rated by respondents on a 5-point scale ranging from 0 ("not at all") to 4 ("extremely") based on how they "were feeling over the last several days" when they "were feeling their worst." The five sub-scales have demonstrated good to excellent internal consistency in an Indian sample (Menon et al., 2022b); the Cronbach's alpha ranged from 0.87 for loss of cognitive control to 0.96 for entrapment. We used the total and subscale scores of the SCI-2 to test its internal consistency and convergent/discriminant/criterion validity.

Suicidal Narrative Inventory (*SNI*)*-38* (Chistopolskaya et al., 2020): This is a shortened, 38-item version of the original SNI developed by combining relevant items from a series of validated tools measuring various components of the suicidal narrative construct such as the Interpersonal Needs Questionnaire. The SNI-38 has 8 subscales: thwarted belongingness (5 items, e.g., "These days, other people care about me"), perceived burdensomeness (5 items, e.g., "These days, the people in my life would be happier without me"), fear of humiliation (5 items, e.g., "I fear being ridiculed"), defeat (5 items, e.g., "I feel down and out"), goal reengagement (5 items, e.g., "I seek other meaningful goals"), goal disengagement (3 items, e.g., "I can't let my goals go"), entrapment (5 items, e.g., "I feel powerless to change myself"), and perfectionism (5 items, e.g., "I strive to be as perfect as I can be"). The scale has previously been validated among Indian adults (Menon et al., 2022a). We used the total and subscale scores of the SNI-38 to check its convergent validity with the SCI-2.

Columbia Suicide Severity Rating Scale (*C-SSRS*) (Posner et al., 2011): This is a widely used, criterion standard scale for assessing the complete spectrum of SI and SB and gauging their severity over specified time periods of interest. The tool can differentiate suicidal behavior from non-suicidal self-injurious behaviors. In the present study, we used the C-SSRS as an interviewer-rated measure to assess the presence of lifetime and past-month SI and SA as well as to test the criterion validity with SCI-2.

Patient health Questionnaire (*PHQ*)*-9* (Kroenke et al., 2001): This is a 9-item self-report version of the PRIME-MD diagnostic instrument for common mental disorders. It is composed of 9 items corresponding to the 9 Diagnostic and Statistical Manual for Mental Disorders, fourth edition (DSM-IV) criteria for depression. Each of these are scored on a four-point scale ranging from 0 ("not at all") to 3 ("nearly every day"). Thus, the total scores may range from 0 to 27. It has been shown to be a valid and reliable measure of depression severity. We used the total score on the PHQ-9 to check the convergent validity with SCI-2.

Generalized Anxiety Disorder (*GAD*)*-7* (Spitzer et al., 2006): This is a 7-item self-report measure originally developed as a screening tool for generalized anxiety disorder in primary care settings. However, it is now increasingly used as a tool to measure anxiety in general. The seven items on the scale are drawn from the criteria for GAD in the DSM-IV. Response options for each item range from 0 ("not at all") to 3 ("nearly every day"). Thus, total scale scores may range from 0 to 21. We tested the convergent validity of SCI-2 scores against total GAD-7 scores.

Perceived Stress Scale (*PSS*)*-10* (Cohen et al., 1983):This is a widely used measure of self-reported stress and the extent to which one's daily life situations are perceived as stressful. The scale comprises of six negative items and four positive items. The total score is calculated by summing scores across all items, after reversing the scores on the positive items, with higher scores indicating higher perceived stress. We used the total PSS-10 scores, which range from 0 to 40, to check convergent validity with SCI-2.

Presumptive Stressful Life Events Scale (*PSLES*) (Singh et al., 1984): This 51-item measure has specially been developed and validated to assess discrete stressful life events in the Indian population. The PSLES measures stress in terms of discrete life events experienced whereas the PSS is a global measure of perceived stress. In the present analysis, we summed the total number of life events experienced by an individual in the last one year and used it as a continuous measure to check convergent validity with the SCI-2.

Connor-Davidson Resilience Scale (*CD-RISC*)*-10* (Connor and Davidson, 2003): In this 10-item scale, each item is rated on a five-point Likert scale ranging from 0 ("not true at all") to 4 ('true nearly all the time"). As such, the total scores may range from 0 to 40 with higher scores indicative of greater psychological resilience, a protective factor against suicide. The tool has sound psychometric properties with good internal consistency. We used the total scores on the CD-RISC to check discriminant validity with SCI-2.

The SCI-2 and SNI were translated into six local languages to enhance diversity in responses: Hindi, Tamil, Marathi, Malayalam, Bengali, and Odiya. These were the official languages in the states where participating centers were located. For other scales, the translations were either already available or procured from copyright holders. For all translations, we followed the procedure recommended by the World Health Organization (2016). This involved forward translation to target language, scrutiny by an expert panel to check for semantic and conceptual equivalence, back translation to source language by an independent bilingual person, examination of the source and target versions for equivalence, and, finally, pre-testing in 5–10 participants to identify unacceptable words or expressions. For those unfamiliar with the local language, we used the English version of questionnaires.

2.4. Statistical analysis

For this paper, we analyzed only the Hindi language dataset, the largest among all. Descriptive statistics such as mean (M) with standard deviation (SD) or frequency (N) with % were used to depict participant characteristics. Confirmatory factor analyses (CFAs) were employed to test the proposed one-factor (unidimensional) and five-factor (multidimensional) structures of the SCI-2 in this sample. Specifically, in the one-factor model, all items were set to load onto a single factor, whereas in the five-factor model, items were set to load on their respective subscale factors: entrapment, affective disturbance, loss of cognitive control, hyperarousal, and social withdrawal. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy (Kaiser and Rice, 1974) and Bartlett's (1951) test of sphericity were both utilized to establish the

appropriateness of these data for factor analysis.

Because items were ordinal (i.e., rated on a 5-point Likert scale), diagonally weighted least squares (WLS) estimation was used. Model fit was evaluated using the chi-square statistic (χ^2, with non-significant indicative of good fit), comparative fit index (CFI $\geq$ 0.95), Tucker-Lewis index (TLI $\geq$ 0.95), root mean squared error of approximation (RMSEA $\leq$ 0.08), and standardized root mean residual (SRMR $\leq$ 0.06), as recommended by established guidelines (Hu and Bentler, 1999; Vandenberg and Lance, 2000). Comparison of the one-factor and five-factor models was computed using the chi-square difference test.

Convergent, discriminant, and criterion validity with other constructs were assessed through bivariate or biserial correlations between the SCI-2 total/subscale scores and all other measures. There was no missing data on any item. All analyses were conducted in R using the *lavaan* (Rosseel, 2012), *semTools* (Jorgensen et al., 2021), and *psych* (Revelle, 2015) packages.

2.5. Ethical aspects

The study protocol was approved by the respective institutional ethics committees of the lead site as well as all participating sites. For accessing relevant study data and materials, please contact the corresponding author. Written informed consent was obtained from every study participant.

3. Results

3.1. Participant characteristics

The full sample comprised 1184 patients diagnosed with MDD. The language-wise breakup of respondents was Hindi (n = 654, 55.3 %), Tamil (n = 140, 11.8 %), Marathi (n = 135, 11.4 %), Malayalam (n = 94, 7.9 %), Bengali (n = 58, 4.9 %), English (n = 56, 4.7 %), and Odiya (n = 47, 4.0 %). In the analysis for this paper, we included only the 654 Hindi-speaking patients, with 328 (50.2 %) women and 326 (49.8 %) men. Ages ranged from 18 to 65 years (M = 36.9, SD = 11.9). Participants self-identified as predominantly married (n = 445; 68.0 %) and living in a nuclear family (n = 417; 63.8 %), approximately half lived in an urban locale (n = 298; 45.6 %) and were unemployed (n = 304; 46.5 %), and the sample had an average of 11.39 years (*SD* = 4.92, range 0 to 26 years) of education. Total duration of illness ranged from 0 to 456 months (*M* = 36.70, *SD* = 52.72), and total duration of treatment ranged from 0 to 360 months (*M* = 16.50, *SD* = 37.37). The vast majority of participants were engaged in outpatient treatment (n = 604; 92.4 %), whereas 50 (7.6 %) were in inpatient treatment at the time of data collection. A fifth of the sample had a history of inpatient treatment for major depressive episodes (n = 130; 20.0 %). Approximately a fifth (n = 121; 18.5 %) had comorbid medical illnesses, and approximately a seventh (n = 87; 13.3 %) had comorbid psychiatric illnesses. With regard to SA histories, 96 (14.7 %) participants reported a lifetime attempt, and 61 (9.3 %) participants reported a past-month attempt. Detailed sociodemographic and clinical characteristics are presented in Table 1.

Table 1
Sociodemographic and clinical characteristics of participants.

	N	Valid %
Gender		
Male	326	49.8
Female	328	50.2
Age (*M* = 36.89, *SD* = 11.86, Range = 18–65)		
Marital status		
Single	198	30.3
Married	445	68.0
Separated	11	1.7
Years of education (*M* = 11.39, *SD* = 4.92, Range = 0–26)		
Employment status		
Unemployed	304	46.5
Unskilled worker	47	7.2
Semi-skilled worker	59	9.0
Skilled worker	35	5.4
Clerical/shop-owner/farmer	94	14.4
Semi-professional	49	7.5
Professional	66	10.1
Family type		
Nuclear	417	63.8
Joint	151	23.1
Extended	80	12.2
Living Alone	6	0.9
Locality		
Urban	298	45.6
Semi-urban	127	19.4
Rural	229	35.0
Total duration of illness (*M* = 36.70, *SD* = 52.72, Range = 0–456)		
Duration of treatment (*M* = 16.50, *SD* = 37.37, Range = 0–360)		
Number of episodes needing inpatient treatment		
0	508	77.7
1	103	15.7
2+	27	4.3
Missing	*15*	*2.3*
Current treatment setting		
Outpatient	604	92.4
Inpatient	50	7.6
Recurrent depressive disorder		
Yes	261	40.1
No	390	59.9
Comorbid medical illness		
Yes	121	18.5
No	533	81.5
Comorbid psychiatric illness		
Yes	87	13.3
No	567	86.7
Lifetime suicide attempt		
Yes	96	14.7
No	558	85.3
Past-month suicide attempt		
Yes	61	9.3
No	593	90.7

3.2. Confirmatory factor analyses

The KMO coefficient (0.98) and Bartlett's test of sphericity (χ^2 [1830] = 46,197.89, $p < .001$) showed that there were sufficient significant correlations in the data for factor analysis. The initial one-factor model of the SCI-2 exhibited adequate-to-poor model fit (χ^2[1769] = 14,150.74, $p < .001$, CFI = 0.98, TLI = 0.98, RMSEA = 0.10, SRMR = 0.08), as did the initial five-factor model of the SCI-2 (χ^2[1759] = 13,130.83, $p < .001$, CFI = 0.98, TLI = 0.98, RMSEA = 0.10, SRMR = 0.08). However, in both models, all reverse-scored items (i.e., items 3 and 28, reflecting anhedonia, and items 24, 34, and 37, reflecting cognitive rigidity) did not appropriately load onto the theorized factors (i.e., the anhedonia items did not significantly load onto their factors, whereas the cognitive rigidity items *negatively* loaded onto their factors). Because these items have consistently exhibited poor loadings on other factor analyses of the SCI-2 cross-nationally (Chistopolskaya et al., 2022; Wu et al., 2022), including the first examination of the SCI-2 in an Indian population (Menon et al., 2022b) and the original formation of the SCI-2 in the United States (Bloch-Elkouby et al., 2021), these five items were removed from subsequent analysis.

Accordingly, the revised models resulted in comparable model fit for both the one-factor (χ^2[1484] = 11,668.13, $p < .001$, CFI = 0.98, TLI = 0.98, RMSEA = 0.10, SRMR = 0.08) and five-factor (χ^2[1474] = 10,495.05, $p < .001$, CFI = 0.98, TLI = 0.98, RMSEA = 0.10, SRMR = 0.07) models. Standardized factor loadings are presented in Table 2, and standardized covariances among latent factors are presented in Table 3. Comparison of the two models indicated that the five-factor model demonstrated superior model fit to the one-factor model ($\Delta\chi^2$[10] = 1173.08, $p < .001$). All latent factors in the five-factor model were significantly and strongly correlated with each other (*ps* < 0.001).

Table 2
Standardized factor loadings of all items.

Factor/item	One-factor model	Five-factor model
Entrapment		
Item 2	0.72	0.74
Item 4	0.70	0.72
Item 15	0.78	0.80
Item 19	0.77	0.79
Item 25	0.71	0.74
Item 27	0.81	0.84
Item 35	0.71	0.74
Item 39	0.85	0.88
Item 56	0.85	0.87
Item 58	0.82	0.85
Affective disturbances		
Item 1	0.68	0.64
Item 6	0.56	0.56
Item 8	0.69	0.70
Item 10	0.63	0.64
Item 12	0.66	0.67
Item 13	0.57	0.58
Item 18	0.62	0.63
Item 22	0.69	0.69
Item 30	0.60	0.61
Item 38	0.70	0.71
Item 43	0.84	0.85
Item 44	0.85	0.86
Item 45	0.85	0.86
Item 46	0.85	0.85
Item 50	0.72	0.73
Item 54	0.85	0.85
Loss of cognitive control		
Item 5	0.62	0.65
Item 9	0.62	0.65
Item 11	0.72	0.76
Item 14	0.66	0.70
Item 17	0.74	0.77
Item 26	0.72	0.76
Item 33	0.69	0.72
Item 48	0.79	0.83
Item 51	0.72	0.75
Item 57	0.69	0.72
Item 59	0.80	0.84
Item 61	0.77	0.81
Hyperarousal		
Item 7	0.66	0.68
Item 16	0.73	0.76
Item 20	0.51	0.54
Item 21	0.62	0.65
Item 29	0.68	0.71
Item 32	0.57	0.60
Item 36	0.79	0.82
Item 41	0.65	0.68
Item 42	0.66	0.68
Item 47	0.71	0.74
Item 49	0.74	0.77
Item 53	0.68	0.71
Item 60	0.71	0.73
Social withdrawal		
Item 23	0.77	0.87
Item 31	0.54	0.61
Item 40	0.66	0.74
Item 52	0.57	0.64
Item 55	0.70	0.79

Table 3
Standardized covariances between all latent factors.

Variable	2	3	4	5
1. Entrapment	0.97***	0.89***	0.87***	0.86***
2. Affective disturbances	–	0.93***	0.96***	0.85***
3. Loss of cognitive control		–	0.89***	0.78***
4. Hyperarousal			–	0.89***
5. Social withdrawal				–

*** $p < .001$.

3.3. Reliability, convergent, discriminant, and criterion validity

Good to excellent internal consistency was noted for the SCI-2 total ($\alpha = 0.98$) as well as the five subscales (α ranging from 0.81 for the social withdrawal subscale to 0.93 for the entrapment subscale). Descriptive statistics of the SCI-2 and bivariate correlations between the SCI-2 total score, subscale scores, and all other measures are included in Table 4. All scales of the SCI-2 were normally distributed. There were moderate positive associations between total and subscale SCI-2 scores and all subscale scores of the SNI except thwarted belongingness and goal reengagement; contrary to expectations, these two scales exhibited small negative correlations with all SCI-2 scales. Similarly, there were moderate positive correlations between all SCI-2 scales and symptoms of depression, anxiety, and perceived stress, as well as small-to-moderate associations between the SCI-2 and both lifetime and past-month SI, and small associations between the SCI-2 and both lifetime and past-month SA. In support of discriminant validity, there were small negative relations between the SCI-2 and resilience; however, there were also small negative associations between the SCI-2 and number of life events experienced. Finally, we conducted independent samples *t*-tests to examine whether there were differences in SCI-2 scores among (1) lifetime attempters and non-attempters and (2) past-month attempters and non-past-month attempters. Results indicated that lifetime attempters ($t[138.22] = -6.15$, $p < .001$, $M = 71.2$, $SD = 20.8$) and past-month attempters ($t[75.34] = -4.70$, $p < .001$, $M = 71.2$, $SD = 21.3$) had significantly higher SCI-2 total scores than non-attempters ($M = 56.8$, $SD = 23.1$) and non-past-month attempters ($M = 57.6$, $SD = 23.1$), respectively.

4. Discussion

4.1. Main findings

Consistent with our main hypothesis, in our sample, we found that the Hindi SCI-2 adequately fit both a one-factor and five-factor model. Importantly, when the two models were compared, the fit in the five-factor model was significantly better than the fit in the one-factor model. We also found good to excellent internal consistency for the SCI-2 total and the five subscales. Good convergent validity, adequate criterion validity, and weak discriminant validity were noted. Overall, these findings align with results from an exploratory factor analysis of the SCI-2 in an American psychiatric population (Bloch-Elkouby et al., 2021); to our knowledge, this is the only other analysis of the psychometric properties of the SCI-2 in a clinical sample. It also aligns with findings from examination of the SCI-2 in non-clinical samples, both from India (Menon et al., 2022b) and elsewhere (Chistopolskaya et al., 2022; Park et al., 2023; Wu et al., 2022).

4.2. Comparison with extant literature

The SCS represents an acute presuicidal mental state characterized by affective and cognitive disturbances. Prior prospective analyses have shown its predictive validity for imminent suicide thoughts and behaviors in high-risk clinical samples (Bloch-Elkouby et al., 2021; Rogers et al., 2022). We observed moderate positive correlations between the SCI-2 total scores and lifetime and past month suicide ideation and attempt. Pertinently, the SCI-2 scores distinguished lifetime and past-month attempters from non-attempters, respectively. These findings add support to the convergent validity of SCI-2. Further, the entrapment subscale showed the strongest correlation with recent and lifetime suicidal thoughts and behaviors, supporting its centrality in the SCS construct, as posited earlier (Li et al., 2018).

Some other findings merit discussion. Interestingly, we noted that five items, mainly pertaining to anhedonia and cognitive rigidity, did not load onto their theorized factors in both the one-factor and five-factor models. Since these observations are consistent with those from

Table 4
Correlations between SCI-2 Total and subscale scores and other relevant constructs.

	SCI-2 total	SCI-2 entrapment	SCI-2 affective disturbance	SCI-2 loss of cognitive control	SCI-2 hyperarousal	SCI-2 Social withdrawal
SNI-PB	.64***	.57***	.58***	.48***	.61***	.57***
SNI-TB	−.24***	−.18***	−.25***	−.24***	−.27***	−.20***
SNI-Humiliation	.64***	.54***	.61***	.50***	.66***	.53***
SNI-Defeat	.64***	.70***	.62***	.64***	.54***	.52***
SNI-GR	−39***	−.24***	−.38***	−.25***	−.45***	−.39***
SNI-GD	.48***	.36***	.45***	.38***	.51***	.43***
SNI-Entrapment	.76***	.80***	.73***	.70***	.66***	.63***
SNI-Perfectionism	.21***	.10**	.22***	.23***	.28***	.20***
Depression	.60***	.59***	.60***	.54***	.54***	.51***
Anxiety	.62***	.58***	.64***	.62***	.61***	.50***
Perceived stress	.30***	.39***	.30***	.37***	.21***	.24***
Life events	−.19***	−.16***	−.18***	−.19***	−.19***	−.17***
Resilience	−.03	−.08*	−.03	−.12**	−.01	−.02
Lifetime SI	.22***	.27***	.20***	.18***	.16***	.16***
Past-month SI	.33***	.39***	.33***	.30***	.26***	.23***
Lifetime SA	.22***	.24***	.20***	.17***	.18***	.15***
Past-month SA	.17***	.21***	.16***	.13***	.13***	.11**
Mean	58.91	22.33	33.71	28.26	25.26	9.91
SD	23.30	9.42	13.41	10.01	10.94	4.57
Range	2–114	0–40	1–64	1–48	0–52	0–20
Skewness	−.04	−.18	−.09	−.22	.17	.08
Kurtosis	−.42	−.69	−.44	−.42	−.38	−.40

Note: SD = standard deviation; SNI = suicide narrative inventory; TB = thwarted belongingness; PB = perceived burdensomeness; GD = goal disengagement; GR = goal reengagement; PSS = perceived stress scale; SI = suicidal ideation; SA = suicide attempt; SCI-2 = Suicide Crisis Inventory—2.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

prior Indian (Menon et al., 2022b) and cross-national investigations (Chistopolskaya et al., 2022; Wu et al., 2022), they argue for possible removal of these items from subsequent iterations of the SCI-2.

We noted weak negative correlations between SCI-2 and number of life events experienced. Two explanations can be offered for this unexpected finding. First, the PSLES includes both positive and negative life events. Prior studies have shown that there is an asymmetric memory recall for positive and negative life events with a bias towards positive events (Walker et al., 2003); this may have influenced the findings. Second, this finding may also indicate built up resiliency over time following the accumulation of life events. The latter possibility can be examined through a repeated measures design.

Based on our findings, we propose some directions for further strengthening the assessment and clinical utility of the SCS. To enhance the uptake and utility of the tool for busy clinical and emergency settings, a brief, validated, screening version of the tool may be useful. Further, given that diagnostic criteria have been proposed for the SCS and given that the SCS has many dimensions, it may be meaningful to compare the predictive validity for suicide-related outcomes among those with SCS symptoms, which can be established using a brief screening tool, versus the full SCS syndrome in high-risk patient subgroups. In this context, readers may note that the positive predictive value (PPV) of SCI-2 for prediction of near-term attempts was modest (Rogers et al., 2022; Yaseen et al., 2019; Ying et al., 2020), as is true for other suicide prediction tools (Kessler et al., 2020). A related, overlapping pre-suicidal construct is the acute suicidal affective disturbance, characterized by rapid onset suicide intent. Investigators have found that ASAD retrospectively predicted suicide risk by differentiating multiple attempters, single attempters, and non-attempters (Rogers et al., 2017; Stanley et al., 2016; Tucker et al., 2016). However, prospective assessments of the PPV of ASAD are lacking. How to combine knowledge of traditional risk factors such as suicidal ideation and constructs such as the SCS and ASAD to augment suicide prediction needs further study.

4.3. Implications of study findings

Our findings have theoretical implications. As explained earlier, in the narrative-crisis model of suicide (Cohen et al., 2022), the suicidal narrative, a predominantly negative cognitive state, precedes the emergence of the SCS, a state of acute affective and cognitive dysregulation that indicates increased near-term risk of suicide (Bloch-Elkouby et al., 2020; Cohen et al., 2019; Galynker et al., 2017). Our findings, from a clinical sample, lend support for the construct validity of the SCS in a sample of clinically depressed individuals and provide a basis for examination of this novel stepwise progression from chronic to acute suicide risk in this group.

Our findings also have two important clinical implications. The SCS, assessed by the SCI-2, may be a valid construct in MDD to explain the progression of SB and hence, may augment conventional suicide risk assessment models. The main advantage of the SCS is that it does not rely on overtly expressed SI yet overlaps with other warning signs of suicide (Schuck et al., 2019). Next, because the one-factor model of SCI-2 demonstrated adequate model fit, it supports the use of the SCI-2 total score as a continuous measure in emergency settings for triaging and identifying those individuals with MDD who may need more intensive interventions. This assumption needs to be empirically tested and verified.

4.4. Limitations and strengths

Our study findings must be interpreted carefully considering its limitations. Being a cross-sectional study, we cannot comment on the predictive validity of the SCI-2 for future SI and behaviors; this will have to be studied prospectively. Some of the associations we noted, particularly the negative association with resilience, were weak and the statistical significance can be ascribed to the large sample size. Future examinations of the SCI-2 need to check its discriminant and criterion validity using more robust designs, such as repeated measures, and an expanded array of outcome measures. Our findings must be extrapolated with due caution given the purposive, non-random sampling employed. Finally, our results represent the first investigation of the SCI-2 in a clinical sample from an Asian setting. Though the dimensions of SCS are well-defined, their expression may be culture sensitive. Hence, there is a need to confirm our findings across cultures and settings. Strengths of the study include the large sample drawn from diverse regions of the

country. Sample demographics suggested demographic diversity of respondents in terms of their domicile (rural/urban) and employment status. Apart from factor structure and internal consistency, we also tested the convergent, discriminant, and criterion validity of SCI-2 against validated measures.

5. Conclusion

Among Indian adults with MDD, the SCI-2 fit both a one-factor and five-factor solution with the five-factor model proving a superior fit. Other psychometric properties of the tool such as internal consistency, convergent, discriminant, and criterion validity were adequate. As such, these findings support the use of SCI-2 to assess SCS in MDD in our setting. Although our results merit further confirmation, they have the potential to augment existing suicide risk assessment approaches because the SCS does not rely on overtly expressed SI to identify individuals with imminent risk of suicide. At the very least, they help delineate potential symptom dimensions that must be flagged when assessing suicide risk among Indian adults who are clinically depressed.

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CRediT authorship contribution statement

VM, IB, MLR, and SKP designed the study. VM, IB, SG, BL, RR, SS, NN, RAK, VR, KKM, JA, NA, RD, LKS, ADS, AN, DS, DM, SKK, VD, PNSK, SSB, RR, VR, conducted the study and led data collection in respective centers. VM and MLR were responsible for data analysis. VM and MLR wrote the first draft of the manuscript. All authors approved the final version of the manuscript.

Declaration of competing interest

None. The authors have no conflicts to declare with regard to the contents of this manuscript.

Data availability

Relevant study data will be shared upon reasonable request. Please contact the corresponding author.

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