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Predictive Validity of the Columbia-Suicide Severity Rating Scale for Short-Term Suicidal Behavior

A Danish Study of Adolescents at a High Risk of Suicide

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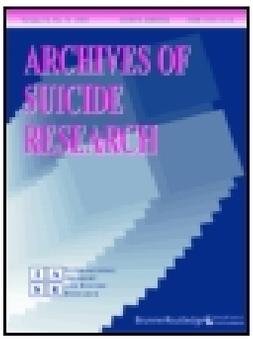

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Predictive Validity of the Columbia-Suicide Severity Rating Scale for Short-Term Suicidal Behavior: A Danish Study of Adolescents at a High Risk of Suicide

Paul Maurice Conway, Annette Erlangsen, Thomas William Teasdale, Ida Skytte Jakobsen, and Kim Juul Larsen

Using the Columbia-Suicide Severity Rating Scale (C-SSRS), we examined the predictive and incremental predictive validity of past-month suicidal behavior and ideation for short-term suicidal behavior among adolescents at high risk of suicide. The study was conducted in 2014 on a sample of 85 adolescents (90.6% females) who participated at follow-up (85.9%) out of the 99 (49.7%) baseline respondents. All adolescents were recruited from a specialized suicide-prevention clinic in Denmark. Through multivariate logistic regression analyses, we examined whether baseline suicidal behavior predicted subsequent suicidal behavior (actual attempts and suicidal behavior of any type, including preparatory acts, aborted, interrupted and actual attempts; mean follow-up of 80.8 days, SD = 52.4). Furthermore, we examined whether suicidal ideation severity and intensity incrementally predicted suicidal behavior at follow-up over and above suicidal behavior at baseline. Actual suicide attempts at baseline strongly predicted suicide attempts at follow-up. Baseline suicidal ideation severity and intensity did not significantly predict future actual attempts over and above baseline attempts. The suicidal ideation intensity items deterrents and duration were significant predictors of subsequent actual attempts after adjustment for baseline suicide attempts and suicidal behavior of any type, respectively. Suicidal ideation severity and intensity, and the intensity items frequency, duration and deterrents, all significantly predicted any type of suicidal behavior at follow-up, also after adjusting for baseline suicidal behavior. The present study points to an incremental predictive validity of the C-SSRS suicidal ideation scales for short-term suicidal behavior of any type among high-risk adolescents.

Keywords adolescents, C-SSRS, suicidal behavior, suicidal ideation intensity, suicidal ideation severity

INTRODUCTION

Globally, suicide is the second leading cause of death among people aged 15–29 years, accounting for 8.5% of all deaths in this age group (WHO, 2014). Carroll, Metcalfe, and Gunnell (2014) found that among people aged below 34 who presented to a health care service for suicide attempt, 1.1% (95% CI 0.7–1.5) died by suicide within a year, while 16.5% (95% CI 14.7–18.5) engaged in non-fatal repetition. In Denmark, the highest rates of suicide attempt are found among younger age groups in both genders. In particular, a growing trend of suicide attempt has been noted in young women (Christiansen, Larsen, Agerbo, Bilenberg, & Stenager, 2012; Morthorst, Søgaard, Nordentoft, & Erlangsen, 2016).

There is therefore a pressing need to develop effective prevention strategies against repeated suicide attempts and suicide in adolescents. In this regard, the availability of screening tools for suicide risk is crucial (Mundt et al., 2013; Wasserman et al., 2012). An increasingly used instrument is the Columbia-Suicide Severity Rating Scale (C-SSRS; Posner et al., 2011; Posner, Subramany, Amira, & Mann 2014; Wasserman et al., 2012). A distinct feature of the C-SSRS lies in the conceptual and operational distinction between suicidal behavior and ideation (Posner et al., 2011). A previous history of suicidal behavior is known to be one of the strongest predictors of future suicidal attempts and death by suicide (Bridge, Goldstein, & Brent, 2006; Brown, Beck, Steer, & Grisham, 2000; Posner et al., 2014; Tidemalm, Langstrom, Lichtenstein, & Runeson, 2008). However, existing studies also corroborate a significant role of suicidal ideation in the prediction of future suicidal behavior (e.g., Bebbington et al., 2010; Czyz & King, 2015; Gipson, Agarwala, Opperman, Horwitz, & King, 2014; Greist, Mundt, Gwaltney, Jefferson, & Posner, 2014; Horwitz, Czyz, & King, 2015; Huth-Bocks, Kerr, Ivey, Kramer, & King, 2007; King, Jiang, Czyz, & Kerr, 2014; Mundt et al., 2013; Posner et al., 2011). Importantly, recent evidence suggests that suicidal ideation incrementally predicts future suicide attempts over and above previous suicidal behavior (e.g., Gipson et al., 2014; Horwitz et al., 2015; Mundt et al., 2010).

A further distinction in the C-SSRS is that between severity and intensity of suicidal ideation. Recent studies have found that intensity of ideation is significantly associated with the risk of future suicidal attempts in adolescents (Gipson et al., 2014; Horwitz et al., 2015).

The C-SSRS seems therefore to be a promising tool for assessing the risk of suicidal behavior among adolescents. Nevertheless, being a relatively new instrument, it needs further scrutiny to confirm its utility in suicide risk identification.

The present study may provide at least three novel contributions to the validation of the C-SSRS. First, this is the first published study testing the predictive validity of the C-SSRS for suicidal behavior among Danish adolescents, while the existing research using the C-SSRS has hitherto involved samples from the U.S. and has been conducted by the same research groups (e.g., Gipson et al., 2014; Horwitz et al., 2015; Kerr, Gibson, Leve, & DeGarmo, 2014; Posner et al., 2011). Second, unlike previous studies using the C-SSRS, we tested the predictive validity of this instrument in a sample of adolescents at high risk of suicide (see Posner et al., 2011 for an exception). The prediction of the suicidal behavior is crucial in adolescents with previous suicidal behavior and/or ideation, given the particularly high risk of engaging in fatal or non-fatal repetition observed in this group (Czyz & King, 2015; Huth-Bocks et al., 2007). Third, we investigated the predictive validity of both recent suicidal behavior and ideation

in relation to short-term suicidal behavior, which has important implications for clinical management (Glenn & Nock, 2014). Although a significant association between different dimensions of suicidality and short-term suicidal behavior (3–6 months) was reported previously (Bridge et al., 2006; Goldston et al., 1999; Huth-Bocks et al., 2007; Lewinsohn, Rohde, & Seeley, 1996), previous studies applying the C-SSRS in adolescent samples either adopted longer follow-up periods (i.e., between 12 and 18 months after baseline; Gipson et al., 2014; Horwitz et al., 2015) or did not perform a complete examination of the predictive validity of suicidal behavior and ideation (Posner et al., 2011).

The present study therefore aimed to examine the predictive validity of the C-SSRS instrument in relation to short-term suicidal behavior in a sample of adolescents at high risk of suicide. We will examine in particular whether recent (past-month) suicidal ideation severity and intensity, and distinct qualities thereof (frequency, duration, controllability, presence of deterrents and reasons for ideation), show incremental predictive validity in relation to suicidal behavior over and above the role played by recent suicidal behavior assessed at baseline.

METHOD

Participants and Procedure

We conducted a questionnaire-based follow-up study on a sample of adolescents accessing the Clinic for Suicide Prevention for Children and Youth in Odense, Denmark. The Clinic specializes in psychosocial therapeutic support to at-risk children and adolescents (up to the age of 17). The support is provided in an outpatient setting for the catchment area of the island of Funen (466,000 inhabitants), with a yearly patient volume of about 150 children and adolescents. Referral is primarily made through the regional psychiatric consultation, but also from somatic emergency departments, general wards, and general practitioners.

Eligible for inclusion in the study were adolescents accessing the clinic after suicidal behavior or severe suicide thoughts that were ascertained via a psycho-social assessment at the index visit. Participants who agreed to take part in the study were requested to sign an informed consent form and later received an on-line questionnaire via a link provided by email. The baseline questionnaires were sent between February 21, 2014 and April 16, 2014. In total, 199 adolescents ($n = 167$ females, 83.9%; $n = 32$ males, 16.1%) were invited and 99 (49.7%) responded at baseline. Of those invited, more females ($n = 88$, 52.7%) than males ($n = 11$, 34.4%) consented to participate, although the difference only approached significance ($\chi^2 = 3.61$, $df = 1$, $p = 0.06$). There were no significant differences ($t = 1.16$ $df = 197$, $p = 0.25$) in relation to age between baseline participants (mean age = 16.2, $SD = 1.45$) and non-participants (mean age = 16.5, $SD = 1.66$). The invitation for the follow-up interview was sent between April 26, 2014 and November 9, 2014. Out of the 99 baseline participants, 85 (85.9%; 77 females and 8 males) also responded at follow-up. Despite the small number of males, we decided to keep them in the study sample to avoid losing statistical power. The follow-up period ranged from 32 to 258 days (mean = 80.8, $SD = 52.4$). There were no statistically significant differences between those who participated at follow-up and those who dropped-out in relation to gender, age, psychological distress (assessed through the K10+ scale, see below), suicidal behavior, and suicidal ideation severity and intensity at baseline (results available from the authors). Between baseline and follow-up, participants received psychosocial therapeutic sessions with a special focus

on suicide prevention, either in the form of psychological consultations or dialectic behavior therapy.

The study has been approved by the Danish Data Protection Agency.

Measures

A self-reported version of the C-SSRS (Posner et al., 2011) was used to measure suicidal behaviour and suicidal ideation severity and intensity. Convergent validity with clinical-based C-SSRS has previously been demonstrated for an electronic self-reported version of the C-SSRS (eC-SSRS; Mundt et al., 2010) administered through interactive voice response (IVR) technology. Prior to study conduction, permission was obtained from the instrument developers to use the official Danish translation of the C-SSRS (http://www.cssrs.columbia.edu/translations_cssrs.html). The English version of the C-SSRS is available at: http://www.cssrs.columbia.edu/documents/C-SSRS1-14-09-Screening.pdf. Note that at both baseline and follow-up participants were asked to answer all questions with reference to the previous 30 days.

Outcome: Suicidal Behavior. Suicidal behavior was treated both as an outcome (follow-up measurement) and as a predictor (baseline measurement). The scale comprised four items assessing suicidal behaviors of increasing severity, i.e., preparatory acts, aborted attempts, interrupted attempts, and actual attempts. Participants were asked to report (using a yes/no format) whether they had engaged in one or more suicidal behaviors during the past 30 days. In the present study, those participants reporting more the one suicidal behavior were coded with the most severe behavior.

We dichotomized suicidal behavior in two alternative ways. First, we created a dichotomous variable contrasting actual suicide attempts with a combined category that included the other types of suicidal behavior (i.e., preparatory acts, aborted attempts and interrupted attempts) as well as no suicidal behavior. This was done since actual attempt is among the strongest antecedents of subsequent attempts and death by suicide (Posner et al., 2014). The second dichotomization was previously employed by Posner et al. (2011) and Gipson et al. (2014), and contrasted "any type of suicidal behavior" (i.e., preparatory acts, aborted attempts, interrupted attempts and actual attempts) with no suicidal behavior. This was done since engaging in different suicidal acts is prevalent among high-risk individuals and is associated with an increased risk of subsequent suicide attempts and other forms of suicidal behavior (Greist et al., 2014; Mundt et al., 2013; Posner et al., 2014). The scale also includes an item measuring non-suicidal self-injurious behavior (NSSI).

Predictors: Suicidal Ideation Severity and Intensity. The suicidal ideation severity scale contains five questions (to be answered using a yes/no format) indicating suicidal thoughts of increased severity: wish to be dead (1); non-specific active suicidal thoughts (2); active suicidal ideation with method, without plan and intent to act (3); active suicidal ideation with some intent to act, without specific plan (4); active suicidal ideation with specific plan and intent to act (5). An item example is: "Have you actually had any thoughts of killing yourself?" In line with previous studies (e.g., Gipson et al., 2014; Posner et al., 2011), ideation severity was included both as continuous predictor (scores ranging from 0 to 5; for each participant, the most severe ideation endorsed was considered) and in a dichotomous format as ideation *with* (0–3) vs. ideation *without* intent to act (4–5). This dichotomization was adopted previously (e.g., Gipson et al., 2014) and is based on previous indications that intent

to act ("the extent to which one is ready to act on thoughts of killing oneself"; Posner et al., 2014; page 68) may constitute a clinically meaningful threshold for future suicidal behavior (Posner et al., 2011).

The five items of the suicidal ideation intensity scale (frequency, duration, controllability, deterrents, reasons for ideation) were answered only by those endorsing suicidal ideation on the severity scale. Respondents were asked to rate the intensity of the most severe thought reported in the scale measuring ideation severity. An item example is: "How many times have you had these thoughts?" Each item of the intensity scale was scored from 1 to 5, with higher scores indicating higher intensity of ideation. A suicidal ideation intensity composite score (Cronbach's alpha 0.70) was calculated by averaging the answers given to all the five intensity items, with scores thus ranging from 5 (minimum overall intensity) to 25 (maximum overall intensity).

For sample descriptive purposes only, we also used the Kessler scale (K10+; Kessler et al., 2002) for measuring non-specific psychological distress.

Statistical Analysis

We calculated percentage distributions, means, and standard deviations (depending on measure properties) of the baseline sample characteristics. We conducted a series of Fisher's exact tests (for the categorical variables) and t-tests (for the continuous variables) to examine the bivariate associations of gender, age, suicidal behavior and ideation, and NSSI at baseline with the two types of suicidal behavior outcome at follow-up.

To test (incremental) predictive validity, we conducted a series of bivariate and multivariate logistic regression analyses estimating odds ratios (OR) and their 95% confidence intervals for suicidal ideation severity at baseline as a predictor of the two suicidal behavior outcomes separately. Among the subsample of participants reporting suicidal ideation at baseline ($n = 56$), we performed a further set of bivariate and multivariate logistic regression analyses testing suicidal ideation intensity (either composite score or single items separately) as a predictor of the two suicidal behavior outcomes. In the multivariate analyses, we were unable to control for gender since no cases of suicidal behavior were detected among the eight male participants in the sample. We also conducted analyses adjusting for NSSI, based on evidence suggesting a significant association between NSSI and future suicide attempts (e.g., Asarnow et al., 2011; Nock, Joiner, Gordon, Lloydrichardson, & Prinstein, 2006; Zlotnick, Donaldson, Spirito, & Pearlstein, 1997). However, we did not include NSSI in the final analyses as this factor did not show any significant impact on the ORs for the associations between suicidal ideation and future suicidal behavior. For the same reason, we did not include age as potential confounder.

RESULTS

Sample Characteristics

Characteristics of the sample are shown in Table 1. At baseline, 18 participants (21.2%) reported they had engaged, in the previous month, in at least one of the four types of suicidal behavior covered in the C-SSRS; 12 participants (14.1%) reported an actual attempt. At follow-up, suicidal behavior was reported by 16 participants (18.8%), all female. Half of these ($n = 8$, 9.4%) reported an actual attempt.

At baseline, about two thirds of the sample ($n = 56$, 65.9%) reported suicidal ideation of some kind. In all, 33 participants (38.8%) reported suicidal ideation with at least some intent to act (i.e., a score ≥ 4

TABLE 1. **Baseline Sample Characteristics, Overall and by Suicidal Behavior at Follow-Up (Actual Attempts and Any Type of Suicidal Behavior)**

Baseline factors	All		Actual attempts at follow-up					Any type of suicidal behavior at follow-up				
			Cases ($n = 8$, 9.4%)		Non-cases ($n = 77$, 90.6%)			Cases ($n = 16$, 18.8%)		Non-cases ($n = 69$, 81.2%)		
	N (col%)	Mean *(SD)*	*N* (row%)	Mean *(SD)*	*N* (row%)	Mean *(SD)*	*P*[b]	*N* (row%)	Mean *(SD)*	*N* (row%)	Mean *(SD)*	*p*[b]
Gender												
Female	77 (90.6)		8 (10.4)		69 (89.6)		1.00	16 (20.8)		61 (79.2)		0.34
Male	8 (9.4)		0 (0.0)		8 (100.0)			0 (0.0)		8 (100.0)		
Age	85 (100.0)	16.3 (1.6)		16.25 (1.49)		16.23 (1.32)	0.97		16.1 (1.24)		16.3 (1.35)	0.57
Actual attempts												
No	73 (85.9)		3 (4.1)		70 (95.9)		0.001	11 (15.1)		62 (84.9)		0.04
Yes	12 (14.1)		5 (41.7)		7 (58.3)			5 (41.7)		7 (58.3)		
Any type of suicidal behavior[c]												
No	67 (78.8)		3 (4.5)		64 (95.5)		0.01	8 (11.9)		59 (88.1)		0.004
Yes	18 (21.2)		5 (27.8)		13 (72.2)			8 (44.4)		10 (55.6)		
Suicidal ideation - severity scale												
Continuous score (0–5)				3.88 (2.10)		2.13 (2.10)	0.03		4.13 (1.74)		1.87 (2.02)	<0.001

By intent									
Without intent (score: 0–3)	52 (61.2)		2 (3.8)	50 (96.2)	0.05	3 (5.8)	49 (94.2)		<0.001
With intent (score: 4–5)	33 (38.8)		6 (18.2)	27 (81.8)		13 (39.4)	20 (60.6)		
Suicidal ideation - intensity scale[c]									
Composite continuous score (5–25)	56 (100.0)	13.57 (3.89)		17.14 (4.85)	13.06 (3.51)	0.008	16.20 (4.26)	12.61 (3.31)	0.002
Intensity items (all cont., 1–5)									
Frequency	56 (100.0)	2.48 (1.31)		3.43 (1.13)	2.35 (1.28)	0.04	3.47 (1.30)	2.12 (1.12)	<0.001
Duration	56 (100.0)	2.21 (1.04)		3.29 (1.50)	2.06 (0.88)	0.003	2.87 (1.25)	1.98 (0.85)	0.004
Controllability	56 (100.0)	3.00 (1.35)		3.29 (1.60)	2.92 (1.32)	0.51	3.13 (1.30)	2.90 (1.38)	0.58
Reasons for ideation	56 (100.0)	4.20 (0.97)		4.43 (0.79)	4.14 (1.00)	0.47	4.33 (0.72)	4.12 (1.05)	0.48
Deterrents	56 (100.0)	1.73 (1.09)		2.71 (1.11)	1.59 (1.02)	0.009	2.40 (1.24)	1.49 (0.93)	0.004
Non-suicidal Self-injury (NSSI)									
No	49 (57.6)		4 (8.2)	45 (91.8)	0.72	6 (12.2)	43 (87.8)		0.09
Yes	36 (42.4)		4 (11.1)	32 (88.9)		10 (27.8)	26 (72.2)		

Note. [a]Includes preparatory acts, aborted, interrupted and actual attempts.
[b]Based on Fisher's exact test and t-test for categorical and continuous variables, respectively.
[c]Intensity scores (composite and single items) are calculated only among participants ($n = 56$) endorsing suicidal ideation at baseline (scores 1–5 on the suicidal ideation severity scale).

on the severity scale). Among those reporting suicidal ideation at baseline ($n = 56$), the mean score of the intensity scale was 13.57 ($SD = 3.89$); the highest and lowest mean scores were observed for the items reasons for ideation (mean = 4.20; $SD = 0.97$) and deterrents (mean = 1.73; $SD = 1.09$), respectively.

Nearly half of the sample ($n = 40$, 47.1%) had a score between 30 and 50 on the K10+ scale, indicating the presence of "likely severe psychological disorder" (result not shown in Table 1).

Predictive Validity of Suicidal Behavior and Ideation for Short-Term Suicidal Behavior

Suicidal Behavior. Table 1 shows the bivariate associations between actual attempts and any type of suicidal behavior at baseline and the same variables at follow-up. Actual attempts at baseline were positively associated with both attempts ($p = 0.001$) and any type of suicidal behavior ($p = 0.04$) at follow-up. Similarly, any type of suicidal behavior at baseline was significantly associated with both actual attempts ($p = 0.01$) and any type of suicidal behavior ($p = 0.004$) at follow-up. Baseline NSSI was not significantly related to subsequent suicidal behavior.

As shown in Table 2, actual attempts at baseline remained a strong predictor of future attempts also after adjusting for suicidal ideation severity at baseline.

Suicidal Ideation Severity. Table 2 shows that, after adjusting for baseline suicidal behavior, ideation severity remained significantly associated only with any type of suicidal behavior at follow-up. More specifically, a one-unit increase in the suicidal ideation continuous score was related to an increase by 66% in the subsequent risk of any type of suicidal behavior. Ideation with intent to act, as compared with ideation without intent, was associated with approximately an eight-fold increase in the risk of any type of suicidal behavior at follow-up. The statistical significance of the ORs associated with suicidal ideation severity did not change when we adjusted for any type of suicidal behavior and actual attempts at baseline, in the models predicting attempts and any type of suicidal behavior at follow-up, respectively.

Suicidal Ideation Intensity (Composite Score). As shown in Table 3, when adjusting for baseline attempts the association between ideation intensity and subsequent attempts became non-significant. However, the association between ideation intensity and any type of suicidal behavior at follow-up remained significant also in the adjusted model. Each one-unit increase in the ideation intensity score was linked to an increase of 27% in the risk of any type of suicidal behavior at follow-up. Again, similar ORs were obtained when adjusting for any type of suicidal behavior and actual attempts at baseline, in the models predicting attempts and any type of suicidal behavior at follow-up, respectively.

Suicidal Ideation Intensity (Single Items). Table 3 shows that, in the model adjusted for baseline actual attempts, only deterrents remained significantly related to future attempts. Duration remained a significant predictor of attempts at follow-up after adjustment for any type of suicidal behavior at baseline. Frequency, duration and deterrents at baseline remained all significant predictors of any type of suicidal behavior at follow-up also when adjusting for suicidal behavior at baseline. In the adjusted models, the increase in the risk of any type of suicidal behavior at follow-up was similar in size (ranging from a 1.92-fold to a 2.73-fold increase) across intensity items and the two suicidal behavior outcomes.

TABLE 2. **Results of Logistic Regression Analyses Testing the Associations of Baseline Suicidal Behavior and Suicidal Ideation Severity with Suicidal Behavior at Follow-Up (Actual Attempts and Any Type of Suicidal Behavior), Unadjusted and Adjusted for Baseline Suicidal Behavior, n = 85**

	Actual attempts at follow-up			Any type of suicidal behavior[a] at follow-up		
Baseline factors	**Unadjusted OR (95% CI)**	**Suicidal ideation severity and actual attempts at baseline mutually adjusted OR (95% CI)**	**Suicidal ideation severity and any type of suicidal behavior at baseline mutually adjusted OR (95% CI)**	**Unadjusted OR (95% CI)**	**Suicidal ideation severity and any type of suicidal behavior at baseline mutually adjusted OR (95% CI)**	**Suicidal ideation severity and actual attempts at baseline mutually adjusted OR (95% CI)**
Suicidal ideation severity (continuous score, 0–5)	1.52 (1.01–2.30)**	1.17 (0.71–1.94)	1.22 (0.72–2.05)	1.79 (1.27–2.53)*	1.66 (1.13–2.44)*	1.75 (1.22–2.51)**
Actual attempts (ref.: No)	16.67 (3.27–84.95)**	11.50 (1.66–79.65)*		4.03 (1.08–14.99)*		1.85 (0.47–7.30)
Any type of suicidal behavior a (ref.: No)	8.21 (1.74–38.68)**		4.84 (0.67–34.78)	5.90 (1.80–19.34)**	1.39 (0.33–5.83)	
Suicidal ideation with intent (score: 4–5) (ref.: Suicidal ideation without intent, score: 0–3)	5.56 (1.05–29.43)*	1.80 (0.23–14.36)	2.09 (0.23–18.71)	10.62 (2.73–41.32)**	7.76 (1.66–36.23)**	9.55 (2.27–40.18)**
Actual attempts (ref.: No)	16.67 (3.27–84–95)**	11.97 (1.72–83.21)*		4.03 (1.08–14.99)*		1.40 (0.33–5.91)
Any type of suicidal behavior a (ref.: No)	8.21 (1.74–38.68)**		5.09 (0.68–38.20)	5.90 (1.80–19.34) **	1.86 (0.46–7.43)	

Note. $^{**}p < 0.01$; $^{*}p < 0.05$.
[a]Includes preparatory acts, aborted, interrupted and actual attempts.

TABLE 3. **Results of Logistic Regression Analyses Testing the Associations of Baseline Suicidal Ideation Intensity with Suicidal Behavior at Follow-Up (Actual Attempts and Any Type of Suicidal Behavior), Unadjusted and Adjusted for Baseline Suicidal Behavior, $n = 56$**

	Actual attempts at follow-up			Any type of suicidal behavior[a] at follow-up		
Baseline factors	**Unadjusted OR (95% CI)**	**Adjusted for actual attempts at baseline OR (95% CI)**	**Adjusted for any type of suicidal behavior at baseline OR (95% CI)**	**Unadjusted OR (95% CI)**	**Adjusted for any type of suicidal behavior at baseline OR (95% CI)**	**Adjusted for actual attempts at baseline OR (95% CI)**
Suicidal ideation intensity (composite score, cont., 5–25)	1.32 (1.05–1.66)*	1.24 (0.96–1.61)	1.23 (0.97–1.16)	1.30 (1.08–1.57)**	1.27 (1.04–1.54)*	1.29 (1.07–1.56)**
Intensity items (cont.,1–5)						
Frequency	1.90 (1.00–3.62)*	1.73 (0.81–3.68)	1.57 (0.79–3.16)	2.43 (1.38–4.26)**	2.24 (1.25–4.02)**	2.36 (1.34–4.17)**
Duration	3.12 (1.30–7.53)*	2.24 (0.87–5.77)	2.60 (1.02–6.62)*	2.43 (1.25–4.76)**	2.18 (1.08–4.38)*	2.37 (1.16–4.82)*
Controllability	1.23 (0.67–2.25)	0.93 (0.44–1.95)	0.85 (0.54–2.13)	1.14 (0.73–1.78)	1.03 (0.64–1.68)	1.07 (0.67–1.70)
Reasons for ideation	1.44 (0.54–3.84)	1.26 (0.38–4.15)	1.42 (0.49–4.12)	1.28 (0.66–2.49)	1.25 (0.62–2.54)	1.23 (0.62–2.43)
Deterrents	2.12 (1.12–4.02)*	2.73 (1.13–6.58)*	1.89 (0.96–3.75)	2.10 (1.18–3.72)**	1.92 (1.07–3.45)*	2.12 (1.18–3.82)*

Note. $^{**}p < 0.01$; $^{*}p < 0.05$.

[a]Includes preparatory acts, aborted, interrupted and actual attempts.

DISCUSSION

The present study examined the (incremental) predictive validity of the C-SSRS scales for short-term suicidal behavior among adolescents at high risk of suicide.

Actual suicide attempts were a potent predictor of reattempts in the short-term, confirming previous evidence that pointed to a high short-term risk of repetition (i.e., 3–6 months) among adolescents engaging in suicide attempts (Bridge et al., 2006). However, we did not find support for incremental predictive validity (over and above previous suicidal behavior) of recent suicidal ideation severity in relation to future suicide attempts. This contrasts with previous studies adopting the C-SSRS (Gipson et al., 2014; Horwitz et al., 2015). A possible explanation is that in our study no variance in short-term suicide attempts was left to be explained after taking into account the powerful role of previous suicide attempts. The longer follow-up periods used in the studies by Gipson et al. (2014) and Horwitz et al. (2015) might explain the less strong association observed by these authors between baseline and future attempts. Further research conducted on larger sample sizes with short follow-up periods is thus needed to shed more light onto whether recent suicidal ideation severity provides incremental predictive validity in relation to short-term suicide attempts.

We found substantial support for an incremental predictive validity of suicidal ideation severity in relation to future suicidal behavior of any type (i.e., including preparatory acts, aborted, interrupted and actual attempts). Improving prediction of the full range of suicidal behaviors has high clinical importance since engaging in different types of suicidal act is prevalent among high-risk individuals and is a salient antecedent of suicide attempts (Posner et al., 2014).

We found incremental predictive validity of suicidal ideation severity for suicidal behavior of any type also when ideation was dichotomized by intent to act. This result concurs with that of Posner et al. (2011), who observed a significant effect of lifetime ideation with intent to act on short-term suicidal behavior of any type. As emphasized by Posner et al. (2014), distinguishing by intent to act is clinically useful as intention to act reflects a person's belief that he/she could act on thoughts of killing him/herself.

Contrary to Horwitz et al. (2015), we did not find a significant effect of ideation intensity on short-term suicide attempts after adjustment for baseline attempts. In our study only the intensity items deterrents (after adjusting for baseline suicide attempts) and duration (after adjusting for any type of suicidal behavior at baseline) remained significantly associated with future suicide attempts. Incremental predictive validity was, however, supported for the C-SSRS intensity scale and the intensity items frequency, duration, and deterrents in relation to subsequent suicidal behavior of any type. These results corroborate the previously observed significant role of duration (Gipson et al., 2014; Horwitz et al. (2015)) and, to a minor extent, frequency (Horwitz et al., 2015), in the prediction of future suicidal behavior. As argued by Horwitz et al. (2015), the duration item of the C-SSRS scale may reflect a ruminative process whereby persons pay selective attention to suicide-related clues such as suicide as a potential solution to own problems. Duration, thus, merits a more detailed clinical examination in the assessment of suicide risk.

The significant association we found between deterrents and short-term risk of suicidal behavior was not observed in earlier studies using the C-SSRS (Gipson et al., 2014; Horwitz et al., 2015). Our finding suggests that among high-risk adolescents the absence of external and/or internal factors inhibiting suicidal thoughts may act as a critical risk factor for short-term

suicidal behavior. The presence of fewer deterrents among suicide attempters was also observed previously (e.g., Mann, Waternaux, Haas, & Malone, 1999). Further research is thus needed to clarify the role of deterrents in the prediction of future suicidal behavior.

Strengths and Limitations

A major strength of this study is that it examined the (incremental) predictive validity of the C-SSRS scales for short-term suicidal behavior in an adolescent high-risk sample. Furthermore, we tested the performance of the C-SSRS in a country outside the United States, wherein the scale was developed and the vast majority of the validation studies conducted.

However, this study also presents some limitations. First, results are applicable to adolescents characterised by a very high risk of suicide. Furthermore, given the vast majority of female participants, the results are mainly generalizable to female adolescents.

A second limitation is linked to the low participation rate at baseline (49.7%) and the further loss of participants at follow-up (85.9% responded out of the baseline sample). The resulting reduced sample ($n = 85$), combined with the few suicide attempts observed at follow-up ($n = 8$), has affected the statistical power of our study. Indeed, suicidal ideation intensity, duration, and deterrents showed a trend ($p < 0.10$) in predicting actual attempts after adjusting for actual attempts or any type of suicidal behavior at baseline. Low power may also explain the wide 95% CIs we obtained for some of the ORs in this study. We must note, however, that the reduced size of our sample was inevitable due to the highly selected nature of the sample examined. Moreover, adolescents participating in this study received psychosocial therapy intervention focused on suicide prevention (Erlangsen et al., 2015), which might have been beneficial for reducing the risk of subsequent suicidal behavior.

Third, we were unable to examine potential moderation effects of gender and age, despite their possible role (Horwitz et al., 2015) in the association between suicidal ideation and suicidal behavior, owing to insufficient sample size and the few male participants included in the follow-up sample.

Fourth, we asked for reporting suicidal behavior with reference to the past month. Therefore, some suicidal acts occurring before that time-period might have been missed. Furthermore, it was not possible to obtain information about potential completed suicide occurring during follow-up.

A fifth and final limitation may be that we adopted a self-reported way of administering the C-SSRS, which is otherwise commonly employed as a semi-structured, rater-based interview instrument. As mentioned earlier, the self-reported eC-SSRS using IVR technology demonstrated convergent validity with the interview-based C-SSRS (Mundt et al., 2010). However, since we did not adopt IVR, the validity of the self-reported version of the C-SSRS used in the present study still needs to be established. Although self-reporting might affect precision in the measurement of suicidal behavior and ideation, it may on the other hand increase self-disclosure as compared to face-to-face interviews (Hesdorffer et al., 2013; Mundt et al., 2010; Posner et al., 2014) and may even outperform other methods in detecting adolescents at a high risk of suicide (e.g., Huth-Bocks et al., 2007).

CONCLUSION

In this study we provided additional evidence regarding the (incremental) predictive validity of the C-SSRS scales for future suicidal behavior among high-risk adolescents.

In particular, we observed incremental predictive validity (over and above previous suicidal behavior) of recent suicidal ideation severity and intensity, as well as of the intensity items duration, frequency and deterrents, in relation to the short-term risk of suicidal behavior of any type. Deterrents and duration were also significantly associated with future attempts, over and above the role played by baseline attempts and suicidal behavior of any type, respectively.

Future research, conducted on larger samples, is however needed to ascertain how the C-SSRS scales perform in the prediction of short-term suicidal behavior among high-risk adolescents. This will contribute to determining useful clinical thresholds for risk identification among adolescents at a high risk of suicide.

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REFERENCES

Asarnow, J. R., Porta, G., Spirito, A., Emslie, G., Clarke, G., Wagner, K. D., . . . Brent, D. A. (2011). Suicide attempts and non-suicidal self-injury in the treatment of resistant depression in adolescents: Findings from the TORDIA study. *Journal of the American Academy of Child and Adolescent Psychiatry*, *50*, 772–781. doi: 10.1016/j.jaac.2011.04.003

Bebbington, P. E., Minot, S., Cooper, C., Dennis, M., Meltzer, H., Jenkins, R., & Brugha, T. (2010). Suicidal ideation, self-harm and attempted suicide: Results from the British psychiatric morbidity survey 2000. *European Psychiatry*, *25*, 427–431. doi: 10.1016/j.eurpsy.2009.12.004

Bridge, J. A., Goldestein, T. R., & Brent, D. A. (2006). Adolescent suicide and suicide behavior. *Journal of Child Psychology and Psychiatry*, *46*, 372–394. doi: 10.1111/j.1469-7610.2006.01615.x

Brown, G. K., Beck, A. T., Steer, R. A., & Grisham, J. R. (2000). Risk factors for suicide in psychiatric outpatients: A 20-year prospective study. *Journal of Consulting and Clinical Psychology*, *68*, 371–377. doi: 10.1037/0022-006x.68.3.371

Carroll, R., Metcalfe, C., & Gunnell, D. (2014). Hospital management of self-harm patients and risk of repetition: Systematic review and meta-analysis. *Journal of Affective Disorders*, *168*, 476–483. doi: 10.1016/j.jad.2014.06.027

Christiansen, E., Larsen, K. J., Agerbo, E., Bilenberg, N., & Stenager, E. (2012). Incidence and risk factors for suicide attempts in a general population of young people: A Danish register-based study. *Australian & New Zealand Journal of Psychiatry*, *47*, 259–270. doi: 10.1177/0004867412463737

Czyz, E. K., & King, C. A. (2015). Longitudinal trajectories of suicidal ideation and subsequent suicide attempts among adolescent inpatients.

Journal of Clinical Child & Adolescent Psychology, *44*, 181–193. doi: 10.1080/15374416.2013.836454

Erlangsen, A., Lind, B. D., Stuart, E. A., Qin, P., Stenager, E., Larsen, K. J., . . . Charlotte, M. (2015). Short and long term effects of psychosocial therapy provided to persons after deliberate self-harm: A register-based, nationwide multicenter study using propensity score matching. *The Lancet Psychiatry*, *2*, 49–58. doi: 10.1016/s2215-0366(14)00083-2

Gipson, P. Y., Agarwala, P., Opperman, K. J., Horwitz, A., & King, C. A. (2014). Columbia-suicide severity rating scale (C-SSRS): Predictive validity with adolescent psychiatric emergency patients. *Pediatric Emergency Care*, *31*, 88–94. doi: 10.1097/PEC.0000000000000225

Glenn, C. R., & Nock, M. K. (2014). Improving the short-term prediction of suicidal behavior. *American Journal of Preventive Medicine*, *47*, S176–S180. doi: 10.1016/j.amepre.2014.06.004

Goldston, D. B., Daniel, S. S., Reboussin, D. M., Reboussin, B. A., Frazier, P. H., & Kelley, A. E. (1999). Suicide attempts among formerly hospitalized adolescents: A prospective naturalistic study of risk during the first 5 years after discharge. *Journal of the American Academy of Child and Adolescent Psychiatry*, *38*, 660–671. doi: 10.1097/00004583-199906000-00012

Greist, J. H., Mundt, J. C., Gwaltney, C. J., Jefferson, J. W., & Posner, K. (2014). Predictive value of baseline electronic columbia-suicide severity rating scale (eCSSRS) assessments for identifying risk of prospective reports of suicidal behavior during research participation. *Innovations in Clinical Neuroscience*, *11*, 23–31.

Hesdorffer, D. C., French, J. A., Posner, K., DiVentura, B., Pollard, J. R., Sperling, M. R., . . . Kanner, A. M. (2013). Suicidal ideation and behavior screening in intractable focal epilepsy eligible for drug trials. *Epilepsia*, *54*, 879–887. doi: 10.1111/epi.12128

Horwitz, A. G., Czyz, E. K., & King, C. A. (2015). Predicting future suicide attempts among adolescent and emerging adult psychiatric emergency patients. *Journal of Clinical Child & Adolescent Psychology*, *44*, 751–761. doi: 10.1080/15374416.2014.910789

Huth-Bocks, A. C., Kerr, D. C. R., Ivey, A. Z., Kramer, A. C., & King, C. A. (2007). Assessment of psychiatrically hospitalized suicidal adolescents: Self-report instruments as predictors of suicidal thoughts and behavior. *Journal of the American Academy of Child & Adolescent Psychiatry*, *46*, 387–395. doi: 10.1097/chi.0b013e31802b9535

Kerr, D. C. R., Gibson, B., Leve, L. D., & DeGarmo, D. S. (2014). Young adult follow-up of adolescent girls in juvenile justice using the Columbia suicide severity rating scale. *Suicide and Life Threatening Behavior*, *44*, 113–129. doi: 10.1111/sltb.12072

Kessler, R. C., Andrews, G., Colpe, L. J., Hiripi, E., Mroczek, D. K., Normand, S. L. T., . . . Zaslavsky, A. M. (2002). Short screening scales to monitor population prevalences and trends in non-specific psychological distress. *Psychological Medicine*, *32*, 959–976. doi: 10.1017/s0033291702006074

King, C. A., Jiang, Q., Czyz, E. K., & Kerr, D. C. R. (2014). Suicidal ideation of psychiatrically hospitalized adolescents has one-year predictive validity for suicide attempts in girls only. *Journal of Abnormal Child Psychology*, *42*, 467–477. doi: 10.1007/s10802-013-9794-0

Lewinsohn, P. M., Rohde, P., & Seeley, J. R. (1996). Adolescent suicidal ideation and attempts: Prevalence, risk factors, and clinical implications. *Clinical Psychology Science and Practice*, *3*, 25–46. doi: 10.1111/j.1468-2850.1996.tb00056.x

Mann, J. J., Waternaux, C., Haas, G. L., & Malone, K. M. (1999). Toward a clinical model of suicidal behavior in psychiatric patients. *American Journal of Psychiatry*, *156*, 181.

Morthorst, B. R., Søgaard, B., Nordentoft, M., & Erlangsen, A. (2016). Incidence rates of deliberate self-harm in Denmark during 1994–2011: A nationwide register study. *Crisis*. Advance online publication. doi:10.1027/0227-5910/a000391

Mundt, J. C., Greist, J. H., Gelenberg, A. J., Katzelnick, D. J., Jefferson, J. W., & Modell, J. G. (2010). Feasibility and validation of a computer-automated Columbia–suicide severity rating scale using interactive voice response technology. *Journal of Psychiatric Research*, *44*, 1224–1228. doi: 10.1016/j.jpsychires.2010.04.025

Mundt, J. C., Greist, J. H., Jefferson, J. W., Federico, M., Mann, J. J., & Posner, K. (2013). Prediction of suicidal behavior in clinical research by lifetime suicidal ideation and behavior ascertained by the electronic Columbia-suicide severity rating scale. *The Journal of Clinical Psychiatry*, *74*, 887–893. doi: 10.4088/jcp.13m08398

Nock, M., Joiner, Jr., T., Gordon, K., Lloydrichardson, E., & Prinstein, M. (2006). Non-suicidal self-injury among adolescents: Diagnostic correlates and relation to suicide attempts.

Psychiatry Research, *144*, 65–72. doi: 10.1016/j.psychres.2006.05.010

Posner, K., Brown, G. K., Stanley, B., Brent, D. A., Yershova, K. V., Oquendo, M. A., . . . Mann, J. J. (2011). The Columbia–suicide severity rating scale: Initial validity and internal consistency findings from three multisite studies with adolescents and adults. *American Journal of Psychiatry*, *168*, 1266–1277. doi: 10.1176/appi.ajp.2011.10111704

Posner, K., Subramany, R., Amira, L., & Mann, J. J. (2014). From uniform definitions to prediction of risk: The Columbia suicide severity rating scale approach to suicide risk assessment. In K. E. Cannon & T. J. Hudzik (Eds.), *Suicide: Phenomenology and Neurobiology* (pp. 59–84). Switzerland: Springer International Publishing.

Tidemalm, D., Langstrom, N., Lichtenstein, P., & Runeson, B. (2008). Risk of suicide after suicide attempt according to coexisting psychiatric disorder: Swedish cohort study with long-term follow-up. *British Medical Journal*, *337*, a2205. doi: 10.1136/bmj.a2205

Wasserman, D., Rihmer, Z., Rujescu, D., Sarchiapone, M., Sokolowski, M., Titelman, D., . . . Carli, V. (2012). The European psychiatric association (EPA) guidance on suicide treatment and prevention. *European Psychiatry*, *27*, 129–141. doi: 10.1016/j.eurpsy.2011.06.003

World Health Organization. (2014). *Preventing suicide: A global imperative*. Geneva, Switzerland: World Health Organization.

Zlotnick, C., Donaldson, D., Spirito, A., & Pearlstein, T. (1997). Affect regulation and suicide attempts in adolescent inpatients. *Journal of the American Academy of Child and Adolescent Psychiatry*, *36*, 793–798. doi: 10.1097/00004583-199706000-00016