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A multi-method evaluation of trait and state-sensitive impulsivity in relation to impulsiveness of suicide attempts and non-suicidal self-injury in an adolescent clinical sample

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ABSTRACT

Background: Understanding the heterogeneity of suicide attempts (SA), and non-suicidal self-injury (NSSI) – e.g., impulsiveness of these behaviors, as in the length of time between participants' thought of engaging in the relevant self-injurious behavior and acting on the thought – is an important step towards personalized intervention. Although impulsivity has been extensively studied in relation to SA and NSSI, much less work has evaluated impulsivity in relation to impulsiveness of these behaviors. This study assessed whether trait and state-sensitive impulsivity were associated with impulsiveness of SA and NSSI, respectively, in an adolescent inpatient sample.

Methods: Adolescents (N = 146) were recruited from a psychiatric inpatient facility. Multiple regression models examined whether trait impulsivity via self-report (i.e., lack of premeditation, lack of perseverance, sensation-seeking, and negative urgency) and state-sensitive impulsivity via the stop-signal task (SST) were associated with impulsiveness of SA and NSSI, respectively.

Results: Lack of premeditation was positively associated with impulsiveness of SA. Greater impulsivity, as reflected by worse impulse inhibition on the SST, was also positively related to impulsiveness of SA. Lack of premeditation and low sensation-seeking were associated with the impulsiveness of NSSI.

Conclusion: These findings suggest that aspects of trait and state-sensitive impulsivity are differentially associated with impulsiveness of SA and NSSI. Collectively, these findings support the view that despite phenotypic overlap between these forms of self-injurious behaviors, important distinctions exist in their underlying correlates. They also support impulsiveness of these behaviors as a meaningfully manifestation of their heterogeneity.

Introduction

Adolescent self-injurious behaviors (SIB) are highly prevalent in the U.S. [1]. SIB include suicide attempts (SAs) and non-suicidal self-injury (NSSI), both of which have increased over the past several decades. Indeed, rates of suicide increased 37% from 2000 and 2018 in the U.S. [2] and NSSI increased ~10% between 2011 and 2021 [3]. These concerning trends highlight the urgency and importance of improving our understanding of risk for these clinical outcomes.

Early research on SA and NSSI often combined these clinical phenomena [4], but they are increasingly recognized as distinct behaviors with overlapping, but also unique, etiologies and risk factors [5–7].

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Although there has been progress in differentiating *between* SA and NSSI, a lack of recognition remains of the distinctions *within* SA and NSSI, respectively. Indeed, it is common to treat SA and NSSI respectively, as uniform constructs, which neglects the nuance in how these behaviors may manifest [8–11]. That is, there may be significant heterogeneity within SA and NSSI, respectively, corresponding to variance in underlying risk profiles, that is missed in treating each as a homogenous outcome [8–11]. Accounting for different types of SA and NSSI and characterizing differences in correlates may enhance accuracy in the prediction and prevention of these behaviors.

One manner in which heterogeneity in SA and NSSI may manifest is in the *impulsiveness* of these clinical phenomena (i.e., the time between thinking of SA or NSSI and engaging in the behavior). This aspect of SA and NSSI heterogeneity is clinically meaningful insofar as more impulsive SA or NSSI means a shorter window of opportunity for intervention between thought and behavior. At the same time, prior work suggests less impulsive SAs tend to have more lethal intent and greater medical lethality [12]. Differences in impulsivity may reflect distinct underlying mechanisms, and uncovering these differences may be an informative step towards the development of personalized interventions.

Impulsivity may account for variance in impulsiveness of SA and NSSI and thereby potentially improve our ability to understand indicators of risk for subsequent SIB. Impulsivity is a broad construct, generally defined as the tendency to act quickly and/or with decreased forethought leading to risky decision-making [13]. Impulsivity is among the most widely studied variables in the suicide literature [14], and it figures prominently in several etiological models of suicide [14–16] and NSSI [17]. Further, the Centers for Disease Control and Prevention includes impulsivity as an intrapersonal risk factor for suicide [18], and several meta-analyses support the associations between impulsivity and these two behavioral outcomes [19–21].

There have been differing perspectives, however, regarding the relevance of impulsivity to self-injurious thoughts and behaviors, at least in the case of suicide, with some suggesting that it is only weakly or peripherally related to this clinical outcome [19], in part because some studies produced relatively modest effect sizes. There are several reasons, however, for qualifying this view. First, both SA and NSSI are multi-determined [4], meaning it is unlikely to be single variables driving these behaviors with large effects. Instead, the effect associated with any single variable is likely to be relatively small.

Second, developmental differences between adult and youth populations must be considered when examining the relation between impulsivity and SIB [22,23]. Adolescence is characterized by an increase in impulsivity relative to adulthood [24,25] *and* marks a dramatic increase in the onset of SIB [26]. Further, the relation between impulsivity and SIB, at least in the case of SA, is stronger in adolescents compared to adults [22,23]. The weaker association between impulsivity and SA in adults may partially explain diverging views on the relevance of this construct.

Third, impulsivity is a multi-faceted construct that has been operationalized and measured in numerous ways [21,27]. Self-report measures of impulsivity tend to capture more stable, trait characteristics of impulsivity [13,28,29], while task-based measures of impulsivity tend to capture more state-sensitive impulsivity [13,28,29]. Notably, prior research has found self-report and task-based measures of impulsivity to be only modestly correlated [28,30,31], highlighting the importance of collecting self-report *and* task-based measures of impulsivity to comprehensively assess the relation between impulsivity and SA and NSSI. It is possible that differences in perspectives on this role of impulsivity in SA and NSSI may in part be due to differences in what aspects of impulsivity is assessed.

Overall, self-report measures are more widely employed to measure impulsivity compared to task-based measures. One common self-report measure of trait impulsivity is the Urgency,[1] (lack of) Premeditation, (lack of) Perseverance, and Sensation-Seeking (UPPS) Impulsive Behavior Scale [32]. A meta-analysis of the UPPS and suicide-related outcomes found that negative urgency, lack of premeditation, and lack of perseverance had significant relations to SA, while sensation seeking had only a trivial relation with SA [33]. Another meta-analysis on the UPPS and NSSI found small to small-to-medium pooled effects for negative urgency, lack of premeditation, and lack of perseverance in relation to NSSI [20]. Again, sensation seeking yielded a comparably modest pooled effect size. While this evidence bolsters the argument that impulsivity is related to SIB, this research only reflects one measure of impulsivity and leaves unanswered the degree to which these findings generalize to impulsiveness of SA and NSSI.

As for task-based measures, one prominent aspect of impulsivity that has been commonly studied, particularly within the neurocognitive literature, is behavioral impulsivity, or impulse inhibition. Behavioral impulsivity represents a reduced ability to stop prepotent motor responses [34]. It is also unique in that it is one of the core aspects of executive control [35], with distinct underlying neural correlates (i.e., the ventrolateral prefrontal cortex, particularly the right inferior frontal gyrus) [36]. Additionally, behavioral impulsivity has been identified as a promising candidate for improving our understanding of risk for SIB, particularly SA [37]. Meta-analytic evidence has also found support for the associations between behavioral impulsivity, SA, and NSSI [21].

If studies of task-based measures of impulsivity in relation to SA and NSSI are less common than studies employing self-report measures of impulsivity, even fewer studies have examined any form of impulsivity in relation to the *impulsiveness* of SA and NSSI, respectively. Some literature has found that impulsivity is positively related to impulsiveness of SA [38–40], although several studies have found null or opposing results [40–43]. Although the literature is quite modest, current evidence supports an association between executive control in general, and behavioral impulsivity specifically, in relation to impulsiveness of SA [12,21]. To our knowledge, only two studies [44,45] have investigated the relation between trait impulsivity and impulsiveness of NSSI. Interestingly, both found no relation between impulsivity, as measured with the UPPS, and impulsiveness of NSSI.

Several points should be considered when interpreting these findings. First, several studies used arbitrary cut-points for dichotomizing SA and NSSI, respectively, as impulsive versus non-impulsive. This presents a challenge for interpreting the literature insofar as it is possible that arbitrary cut-points risk being incorrect and therefore masking possible associations between impulsivity and SIB. This challenge is compounded by the lack of consensus in the literature in the choice of cut-point [12]. These study-level differences in how impulsiveness of SIB was operationalized may account for mixed findings. Second, prior research has not investigated the relation between impulsivity and impulsiveness of SA and NSSI, respectively, in adolescent populations. As previously noted, these relationships may be most relevant to adolescents for whom the relation between impulsivity and SA and NSSI has been found to be the strongest [22,23]. Therefore, caution should be taken in generalizing the aforementioned findings to this age group. Finally, both behavioral impulsivity and impulsiveness of NSSI have been historically understudied. There is only one study to our knowledge to test the role of behavioral impulsivity in relation to the impulsiveness of SA [40], but this study's wide age range (20–73 years old) may complicate the interpretation of the results. There is currently no research utilizing task-based measures of impulsivity in relation to NSSI, and as noted above, only two with trait impulsivity.

The current study sought to address these limitations by examining trait and state-sensitive behavioral impulsivity in relation to

[1] Here, urgency refers to negative urgency, or the tendency to act rashly in the presence of intense negative affect.

impulsiveness of SA and NSSI, respectively, in a clinical sample of adolescents, with impulsiveness of SIB analyzed dimensionally rather than dichotomously. The first aim was to examine trait impulsivity in relation to these outcomes. We hypothesized that greater negative urgency, lack of perseverance, and lack of premeditation would be associated with more impulsive SA and NSSI. The second aim of the study was to examine state-sensitive behavioral impulsivity, using a task-based measure, in relation to impulsiveness of SA and NSSI, respectively. We hypothesized that greater behavioral impulsivity would be associated with a more impulsive SA and NSSI, respectively.

Methods

Participants

Participants were drawn from a larger study of 180 adolescents between the ages of 12 and 17, recruited from a psychiatric inpatient facility in the northeastern United States. To be eligible, participants needed to be fluent in English and admitted to inpatient care within one month of consent. Participants who reported a lifetime history of SA or lifetime NSSI were included in the present study ($n = 146$). Exclusion criteria were: 1) an IQ below 80 (measured by the Wechsler Abbreviated Scale of Intelligence – II [46]; 2) acute psychosis or pervasive developmental disorder that would affect the validity of data; and 3) in the custody of child protective services.

Procedure

The Rhode Island Hospital institutional review board approved all study procedures. Legal guardians provided informed consent and adolescents provided assent. During inpatient hospitalization, participants completed semi-structured interviews assessing lifetime history of SA and NSSI, self-report measures of suicidal ideation (SI) and depressive symptoms, as well as self-report and behavioral measures of impulsivity.

Measures

Trait impulsivity

Trait impulsivity was measured using the UPPS [32]. The UPPS is a 45-item self-report questionnaire that measures four distinct facets of impulsivity: negative urgency (the tendency to act rashly in the context of intense negative affect and distress), lack of premeditation (tendency to act without deliberation), lack of perseverance (the inability to remain focused on a task and avoid boredom), and sensation-seeking (the tendency to seek out exciting and thrilling experiences). Items were scored on a 4-point Likert scale ranging from 1 (“*strongly agree*”) to 4 (“*strongly disagree*”). The scale was scored such that higher scores reflected greater impulsivity. The UPPS demonstrated moderate to strong internal consistency (negative urgency $\omega = .87$, lack of premeditation $\omega = .87$, lack of perseverance $\omega = .82$, and sensation-seeking $\omega = .87$).

State-sensitive impulsivity

The stop-signal task (SST) was used to measure state-sensitive behavioral impulsivity [47]. The SST measures an individual’s ability to inhibit pre-potent motor responses. It was administered via STOP-IT [48]. Participants were asked to respond to a target stimulus as quickly and accurately as possible by pressing a button (i.e., a specific button on the left side of the keyboard for a certain stimulus and a specific button on the right side of the keyboard for a certain other stimulus). They were also asked to inhibit their response when they heard an auditory stop signal. These stop signals occurred randomly on 25% of trials. The stop signal was presented after a variable stop signal delay (SSD). Thus, this task involves a competition between activating and inhibiting processes. The outcome variable is the stop signal reaction time (SSRT), with higher values reflecting greater impulsivity. The version of the task used in the current study dynamically adjusted to participant responding. That is, adopting what is termed the tracking procedure, difficulty increased after each successful stop-signal trial and decreased after each unsuccessful stop-signal trial. The advantage of the tracking procedure over the commonly used fixed-stop-signal delay procedure is that the former requires fewer stop-signal trials to yield reliable SSRT estimates and is thus recommended for experimental economy [49].

Suicide attempts and non-suicidal self-injury

Lifetime SA was assessed using the Columbia-Suicide Severity Rating Scale (C-SSRS) [50], a semi-structured interview. Lifetime NSSI was assessed using an adapted version of the Self-Injurious Thoughts and Behaviors Interview (SITBI) [51]. All interviewers received extensive training and supervision from the senior author in administering the interviews. More specifically, a rigorous protocol developed by the senior author was implemented, with an average training period of three to four months before interviewers conducted assessments independently. Each interview was reviewed by the senior author within a day of its administration and interviewers conferred with the senior author if coding questions arose. The C-SSRS has been found to have strong psychometric properties in youth samples [52]. The SITBI has also demonstrated good reliability and validity in adolescent samples [53]. In the current study, inter-rater reliability for a subsample ($n = 34$) of the larger study demonstrated excellent reliability for both lifetime suicide attempt history ($\kappa = .87$) and lifetime NSSI history ($\kappa = .94$).

Impulsiveness of suicide attempts and impulsiveness of non-suicidal self-injury

If a participant reported at least one SA, they were asked an item adapted from the SITBI on impulsiveness of their most recent SA (“*How long did you think about making the most recent suicide attempt before you did it?*”). Similarly, an item adapted from the SITBI on impulsiveness of the most recent instance of NSSI was administered if participants reported at least one NSSI (“*How long did you think of purposely hurting yourself without trying to die before actually doing it?*”). Response options consisted of: 0 s, 1–60 s, 2–15 min, 16–60 min, less than a day, 1–2 days, more than two days. Impulsiveness of SA and impulsiveness of NSSI were treated as continuous variables (0−6). Responses were reverse coded such that higher scores reflected greater impulsiveness of SA and NSSI.

Suicidal ideation

The Suicidal Ideation Questionnaire – Jr (SIQ-Jr.) [54] is a 15-item self-report measure used to assess past-month SI severity. To avoid confounding lifetime SI with past-month SI, two response options were combined (i.e., answer choices *“I had this thought before but not in the past month”* and *“I never had this thought”* were combined to reflect non-endorsement of the relevant item in the past month). Items were therefore scored on a 6-item Likert scale (0 = *“not in the past month”* to 5 = “*Almost every day*”), with higher summed scores indicating more severe SI. The measure demonstrated strong internal consistency ($\omega = .95$).

Depressive symptoms

Current depressive symptoms were assessed using the Children’s Depression Inventory 2 (CDI 2) [55], a 28-item self-report measure, in which participants were presented with three statements per item that represent varying levels of symptom severity. Participants were asked to select the statement that best describes themselves. The SI item (item 8) was excluded to avoid confounding with the SI measure (i.e., SIQ-Jr). Higher values indicated greater depressive symptom severity. The measure demonstrated strong internal consistency ($\omega = .92$).

Analytic plan

First, descriptive analyses were conducted characterizing the sample and study variables. To assess trait and state-sensitive impulsivity, respectively, in relation to impulsiveness of SA, a pair of ordinal regression analyses were conducted with impulsiveness of SA as the criterion variable, trait and state-sensitive impulsivity variables, respectively, as the predictors, and age, sex, depressive symptoms, and suicidal ideation as the covariates. To assess associations for trait and state-sensitive impulsivity, respectively, with impulsiveness of NSSI, these analyses were repeated with the latter variable serving as the criterion variable.

Results

Sample demographic and clinical characteristics are summarized in Table 1. On average, the sample was 14.89 years old ($SD = 1.35$), with 17.81% identifying as Hispanic and 82.87% were female. The sample was predominantly White (81.51%), followed by multiracial (8.22%), Black (7.53%), and Asian (2.74%). Out of the full sample (N = 146), a total of 105 participants endorsed a lifetime history of SA, and 124 participants endorsed a lifetime history of NSSI. The mean impulsiveness of SA was 3.33 ($SD = 1.98$), indicating that, on average, adolescents reported thinking about making a suicide attempt for 16–60 min before their most recent attempt (see Fig. 1). The mean impulsiveness of NSSI was 3.90 ($SD = 1.66$), indicating that, on average, participants who engaged in NSSI thought about it on average for 2–15 min before their most recent instance of NSSI (see Fig. 2).

Bivariate correlations for participants with histories of SA and NSSI, respectively, are presented in Table 2. Impulsiveness of SA was positively correlated with SSRT ($r = .21$, $p = .04$) and lack of premeditation ($r = .23$, $p = .02$) and negatively correlated with SI ($r = -.26$, $p < .01$). Impulsiveness of NSSI was also negatively correlated with SI ($r = -.18$, $p = .04$). Among adolescents who had engaged in both SA and NSSI (n = 83), impulsiveness of these two behaviors were positively correlated ($r = .41$, $p < .001$).

Associations with impulsiveness of SA

In a multivariate regression model examining whether facets of trait impulsivity were associated with impulsiveness of SA (Table 3), the overall model was significant, $\chi^2(8) = 16.85$, $p = .03$. Lack of premeditation was positively associated with impulsiveness of SA (B=1.03, SE=.37, $p < 0.01$), meaning that among participants who had attempted suicide, lack of premeditation was associated with more impulsive SA. None of the other UPPS subscales (negative urgency, lack of perseverance, sensation-seeking) were associated with impulsiveness of SA (all $ps > .05$).

In a multivariate regression model examining whether SSRT (an index of state-sensitive impulsivity) was associated with impulsiveness of SA (Table 3), the overall model was significant, $\chi^2(5) = 12.75$, $p = .03$. Greater SSRT was associated with greater impulsiveness of SA (B=.01, SE <.01, $p = .03$), meaning that among participants who had attempted suicide, those with lower impulsive control were more likely to have their most recent SA be more impulsive.

Associations with impulsiveness of NSSI

In a multivariate regression model examining whether facets of trait impulsivity were associated with impulsiveness of NSSI (Table 4), the overall model was not significant, $\chi^2(8) = 12.18$, $p = .14$. Lack of premeditation was positively associated with impulsiveness of NSSI (B=.72, SE=.35, $p = .04$), meaning that among participants who had engaged in NSSI, lack of premeditation was associated with more impulsive NSSI. Sensation-seeking was negatively associated with impulsiveness of NSSI (B=-.58, SE=.26, p=.03), meaning that among participants who had engaged in NSSI, sensation-seeking was associated with less impulsive NSSI. Negative urgency and lack of perseverance were not significantly associated with impulsiveness of NSSI (all $ps > .05$).

In a multivariate regression model examining whether SSRT was associated with impulsiveness of NSSI (Table 4), the overall model was not significant, $\chi^2(5) = 6.31$, $p = .28$. SSRT was not significantly associated with impulsiveness of NSSI (B<.01, SE<.01, $p = .71$).

Discussion

In this study, we evaluated trait and state-sensitive impulsivity in relation to the impulsiveness of SA and NSSI, respectively. To our knowledge, this is the first multi-method (i.e., self-report and task-based measures of impulsivity) study examining these relations in youth. Overall, we found partial support for our hypotheses that impulsivity is associated with impulsiveness of SA and NSSI, respectively. Specifically, we found that behavioral impulsivity was significantly associated with impulsiveness of SA, but not impulsiveness of NSSI. In terms of trait impulsivity, lack of premeditation was associated with the impulsiveness of SA and NSSI, respectively. Contradictory to our hypothesis, sensation-seeking was also significantly associated with impulsiveness of NSSI.

In terms of state-sensitive impulsivity, these results are consistent with a meta-analysis that found an association between behavioral impulsivity and SA [21]. These results are also consistent with the only prior study on this topic which found a positive relation between behavioral impulsivity and impulsiveness of SA in a sample of adults experiencing alcohol dependence [40]. The current study therefore extends documentation of an association for behavioral impulsivity to impulsiveness of SA in a clinically acute sample of adolescents.

In terms of trait impulsivity as measured with the UPPS, the specificity regarding lack of premeditation is somewhat inconsistent with a prior meta-analysis examining the relation between the UPPS and suicidal thoughts and behaviors, which found an association between all subscales of the UPPS and this outcome [33]. As for interpreting current findings in the context of the decidedly inconsistent literature relating trait impulsivity and impulsiveness of SA [38–43], as noted above,

Table 1
Sample demographics and clinical characteristics.

	Full sample (n = 146)		History of non-suicidal self-injury (n = 124)		History of suicide attempt (n = 105)	
	% (n)	M (SD)	% (n)	M (SD)	% (n)	M (SD)
Age		14.88 (1.33)		14.84 (1.35)		14.91 (1.39)
Sex (female)	82.87 (121)		85.48 (106)		85.71 (90)	
Race						
White	81.51 (119)		82.26 (102)		79.05 (83)	
Black	7.53 (11)		7.26 (9)		10.47 (11)	
Asian	2.74 (4)		2.42 (3)		2.86 (3)	
Multiracial	8.22 (12)		8.06 (10)		7.62 (8)	
Ethnicity						
Hispanic	17.81 (26)		18.0 (23)		21.90 (23)	
Clinical Characteristics						
Depressive Symptoms		22.98 (10.33)		24.16 (10.21)		23.50 (10.27)
Suicidal Ideation		36.76 (20.08)		38.59 (20.07)		38.35 (20.48)

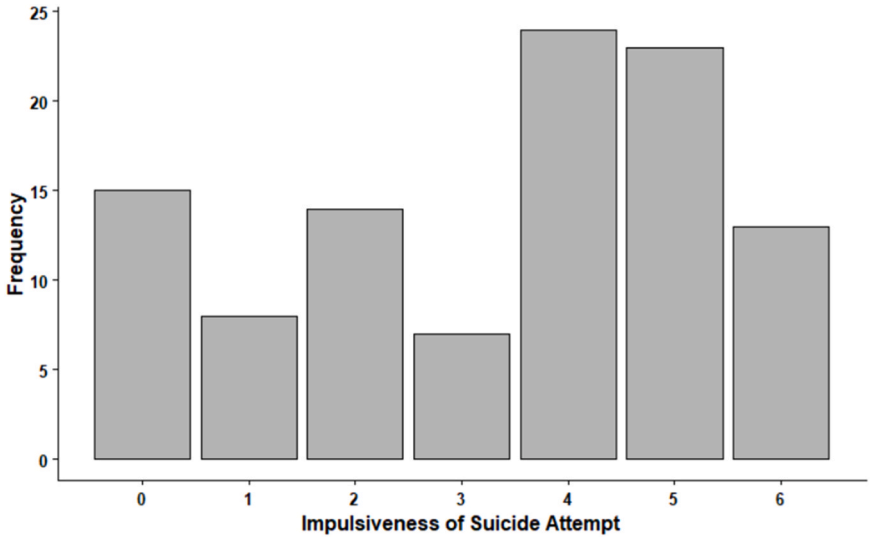

Fig. 1. Distribution table of the impulsiveness of the most recent suicide attempt. *Note.* 0 = more than two days; 1 = 1–2 days; 2 = less than a day; 3 = 16–60 min; 4 = 2–15 min; 5 = 1–60 s; 6 = 0 s.

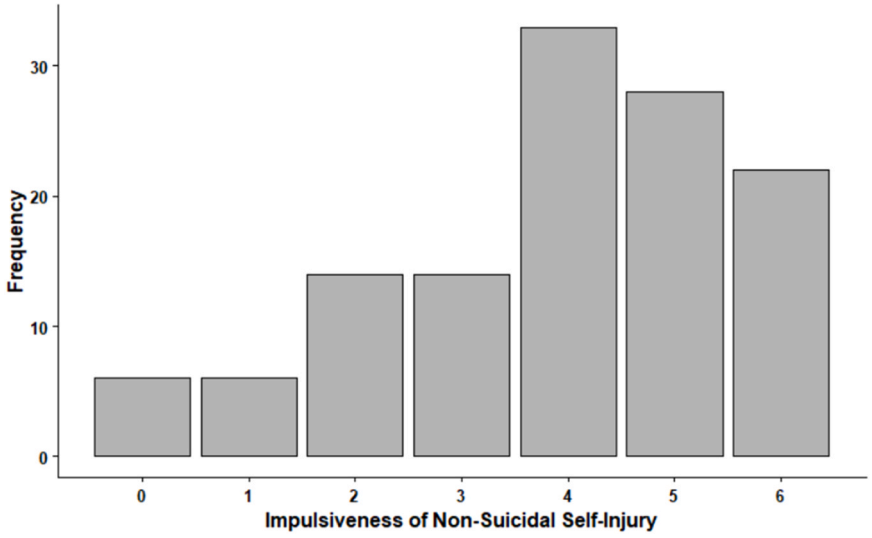

Fig. 2. Distribution table of the impulsiveness of the most recent non-suicidal self-injury. *Note.* 0 = more than two days; 1 = 1–2 days; 2 = less than a day; 3 = 16–60 min; 4 = 2–15 min; 5 = 1–60 s; 6 = 0 s.

Table 2
Bivariate correlations between study variables.

Variables	1	2	3	4	5	6	7	8	9	10	11
1 Stop-Signal Reaction Time	-	.05	.18	.03	.12	-.08	-.25*	.02	-.01	.21*	.07
2 Negative Urgency	.06	-	.29**	.37**	.07	.19	-.07	.35**	.20*	-.08	< .01
3 Lack of Premeditation	.14	.21*	-	.48**	.22*	-.07	-.07	.10	.01	.23*	.09
4 Lack of Perseverance	-.03	.15	.49**	-	-.15	.04	.03	.42**	.20*	.08	.07
5 Sensation-Seeking	.14	.14	.22*	-.10	-	-.04	.01	-.18	-.05	-.13	-.21
6 Sex (female)	-.10	.02	-.04	.02	-.05	-	.07	.28**	.17	-.13	-.01
7 Age	-.25**	.02	-.09	.05	.01	.19*	-	.80	-.06	.03	.15
8 Depressive Symptoms	-.04	.27**	.11	.32**	-.12	.15	.16	-	.65**	-.15	-.12
9 Suicidal Ideation	-.04	.13	-.02	.10	-.07	.01	-.11	.53**	-	-.26**	-.23*
10 Impulsiveness of Suicide Attempt	.24*	-.01	.25*	.04	-.17	-.07	.06	-.12	-.25*	-	.41**
11 Impulsiveness of Non-Suicidal Self-Injury	.03	.03	.13	.02	-.09	-.04	.11	-.06	-.18*	.41**	-

Note. Correlation coefficients above the diagonal are for participants with suicide attempts (n = 105); correlation coefficients below the diagonal are for participants with non-suicidal self-injury (n = 124). Participants with a history of both suicide attempts and non-suicidal self-injury are represented on both sides of the diagonal. *$p < 0.05$; **$p < 0.01$.

almost all prior studies used arbitrary and inconsistent dichotomizations of impulsiveness of SA, which poses challenges for interpreting their

Table 3
Associations between trait and state-sensitive impulsivity and impulsiveness of the most recent suicide attempt.

	Trait Impulsivity (n = 102)			State-sensitive Impulsivity (n = 102)		
Variable	B	SE	*p*	B	SE	*p*
Negative Urgency	-.34	.37	.36	-	-	-
Lack of Premeditation	1.03	.37	.01	-	-	-
Lack of Perseverance	-.09	.43	.83	-	-	-
Sensation-Seeking	-.46	.28	.10	-	-	-
Stop-Signal Reaction Time	-	-	-	.01	< .01	.03
Age	.03	.13	.84	.08	.13	.53
Sex (female)	-.43	.55	.44	-.49	.52	.35
Depressive Symptoms	< .01	.03	.90	.01	.02	.62
Suicidal Ideation	-.02	.01	.10	-.02	.01	.04

Table 4
Associations between trait and state-sensitive impulsivity and impulsiveness of the most recent non-suicidal self-injury.

	Trait Impulsivity (n = 119)			State-sensitive Impulsivity (n = 120)		
Variable	B	SE	*p*	B	SE	*p*
Negative Urgency	.23	.33	.49	-	-	-
Lack of Premeditation	.72	.35	.04	-	-	-
Lack of Perseverance	-.40	.40	.32	-	-	-
Sensation-Seeking	-.58	.26	.03	-	-	-
Stop-Signal Reaction Time	-	-	-	< .01	< .01	.71
Age	.16	.13	.20	.14	.13	.28
Sex (female)	-.30	.49	.54	-.27	.48	.57
Depressive Symptoms	-.01	.02	.78	.01	.02	.62
Suicidal Ideation	-.01	.01	.16	-.02	.01	.06

findings collectively. In contrast, the current study treated this outcome as a continuous variable. Furthermore, it is notable that, to our knowledge, the current study is the first to assess the UPPS in relation to the impulsiveness of SIB with youth. Thus, caution should be taken comparing the current findings with the aforementioned adult studies. While this study provided the first evidence that aspects of trait impulsivity, namely lack of premeditation, may be uniquely related to impulsiveness of SA in adolescents, further research should be conducted to determine the robustness of this finding.

We did not find support for a relationship between a neurocognitive index of behavioral impulsivity and impulsiveness of NSSI. This contrasts with a meta-analysis that found evidence of a positive association between this type of impulsivity and NSSI generally [21]. As for trait impulsivity, our findings are somewhat consistent with those of a prior meta-analysis, in which trait impulsivity, measured via the UPPS, was related to NSSI [20]. Specifically, Hamza and colleagues found significant positive relations between all four subscales of the UPPS and NSSI, but with the smallest effect (i.e., trivial-to-small) for sensation-seeking. The current study only found significant relations between lack of premeditation and sensation-seeking in relation to impulsiveness of NSSI. Interestingly, sensation-seeking was negatively related to impulsiveness of NSSI such that less sensation-seeking was associated with greater impulsiveness of NSSI. Caution should be taken in interpreting our findings on trait impulsivity, particularly in the case of sensation-seeking, given the lack of overall significance for the relevant regression model, along with the fact that it ran counter to our hypothesis. Additionally, our current findings do not align with two prior studies with adult samples investigating the relation between this form of impulsivity, measured via the UPPS, and impulsiveness of NSSI [44,45], with both reporting no significant associations. Our results tentatively suggest that these findings may not be generalizable to adolescents.

It is important to highlight the contrast that emerged between a) the unique positive association for state-sensitive impulsivity (i.e., behavioral impulsivity) and impulsiveness of SA, and b) the shared positive association for trait impulsivity (i.e., lack of premeditation) and impulsiveness of SA and NSSI. This constellation of findings lends weight to the view that SA and NSSI are distinct clinical phenomena, despite phenotypic similarities and some overlapping correlates [5–7,56]. Moreover, the current findings are interestingly consistent with prior meta-analytic findings that behavioral impulsivity may be more strongly associated with the presence of SA than NSSI [21] and suggest that this pattern may hold too for impulsiveness of these behaviors. It is therefore possible that some features of impulsivity may be more etiologically relevant to SA than NSSI (and vice versa), although additional longitudinal work is necessary to explore this possibility.

That our findings for impulsiveness of SA and NSSI, respectively, only partially aligned with results from prior research on impulsivity in relation to SA [21,33] and particularly NSSI [20,21] warrants further discussion. Within this context, our findings highlight the importance of investigating features of SA and NSSI, and moving beyond viewing SA and NSSI, respectively, as unitary constructs. The impulsiveness of these behaviors appears to be a meaningfully distinct aspect of these outcomes. That is, these divergent results provide evidence that correlates of SA and NSSI, respectively, are not necessarily the same as correlates of specific features of these SIB.

Variability within SA and NSSI, respectively, is important to investigate to improve precision in our characterization of risk for these clinical outcomes. This knowledge may enable clinicians to advance personalized treatment and prevention efforts [8–10,57,58] within a precision medicine framework [57,58]. The current study suggests, for example, that dimensions of impulsivity may not be a key treatment target in all at-risk youth. For example, even though impulsivity is associated with SA more generally, our findings suggest that targeting impulsivity in adolescents at risk for this outcome may yield mixed benefits, and instead targeting those high on impulsivity may yield the most benefit. Additionally, it may be helpful for clinicians to know that these individuals may be more likely to engage in impulsive SAs and NSSI, especially insofar as this means the window for clinical intervention may be briefer. For example, knowing a patient's tendency to impulsively or non-impulsively engage in SIB may be a vital aspect of safety planning for some high-risk adolescents. Less impulsive adolescents may benefit more from safety planning due to an increased latency period between thoughts and behaviors. More impulsive teens may benefit from a more unique, exhaustive safety plan that indicates outside intervention sooner. Related to this point, although means restriction is important for all at-risk individuals [59], this may be particularly so for youth who are at risk for impulsive SIB insofar as the urge to engage in self-harm in shorter lived in these cases. In terms of treatment implications for these individuals, if behavioral impulsivity underlies impulsive SA, the right inferior frontal cortex has been identified as a neural substrate of behavioral impulsivity, and thus may be a promising target for neuromodulation [60–63].

Despite this potential for informing personalized risk profiles and treatment, past studies have predominantly treated SA and NSSI, respectively, as unitary constructs, rather than attempt to account for heterogeneity in their manifestation. This is partially because SA and NSSI are, at the population level, low base-rate phenomena. Therefore, having enough cases of either outcome to study factors underlying their heterogeneity is particularly challenging. Thus, a notable strength of this study is its sample size. By recruiting participants from a psychiatric inpatient unit to capture a large population of youth with SA or NSSI, the current study was able to overcome this common barrier to research investigating specific features of SIB in a clinically acute patient sample.

In addition to this strength, there are a few notable limitations to the current study. First, this study was cross-sectional and thus could not assess impulsivity as a prospective predictor of the impulsiveness of SIB. Future studies should expand upon this work and investigate the longitudinal nature of these relations to provide temporal clarity. Second, this study examined one of many potential constructs related to impulsiveness of SIB. A past meta-analysis has linked aggression and

other aspects of executive functioning with impulsiveness of SA [12], suggesting the importance of exploring other potential predictors of impulsiveness of SIB in future research. Third, given the sex distribution within our sample (82.87% female), we could not examine sex differences in the relations between impulsivity and impulsiveness of SIB. This is notable, given that prior literature has found, beginning in adolescence, females at are a higher risk of SA compared to males [64,65], and similarly, a meta-analysis investigating global NSSI frequency reported that NSSI is twice as prevalent in female adolescents compared to male adolescents [66]. Future studies should consider evaluations of sex differences in how impulsivity may relate impulsiveness of SA and NSSI, respectively. Finally, how internally consistent adolescents are in the impulsiveness of their SIB is unclear. The current study assessed the most recent SA and NSSI for practical reasons – recall is likely to be most accurate for the impulsiveness of the most recent SIB – and so it was not possible to evaluate how much the impulsiveness of these behaviors correlated within individuals, an important consideration for future research.

In summary, this is the first study to test the relation between a task-based measure of impulsivity and the impulsiveness of SA in youth, as well as the first to test a task-based measure of impulsivity in relation to impulsiveness of NSSI in any age group. We found a significant relation between behavioral impulsivity and lack of premeditation in relation to impulsiveness of SA. We found significant relations for lack of premeditation and low sensation-seeking in relation to impulsiveness of NSSI. These findings highlight the importance of studying specific features of SIB to gain a more nuanced perspective on the heterogeneity of these behaviors. Future research employing longitudinal designs is needed to expand upon the current findings. Despite the considerable research that remains before clinicians can develop personalized risk assessments and interventions, the current study marks an important step towards this goal.

Ethical statement

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008.

Declaration of Competing Interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Dr. Richard Liu reports financial support was provided by National Institute of Mental Health. Dr. Rachel Walsh reports financial support was provided by National Institute of Mental Health. Dr. Ana Sheehan reports financial support was provided by National Institute of Mental Health. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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References

[1] Villodas ML. Suicidality and non-suicidal self-injury: a narrative review of measurement, risk, and disparities among minoritized and system-involved youth in the USA. Children 2024;11(4):466. https://doi.org/10.3390/children11040466.
[2] CDC. (2025, March 26). *Suicide Data and Statistics*. Suicide Prevention. ⟨https://www.cdc.gov/suicide/facts/data.html⟩.
[3] Zetterqvist M, Jonsson L, Landberg Å, Svedin C. A potential increase in adolescent nonsuicidal self-injury during covid-19:a comparison of data from three different time points during 2011 – 2021. Psychiatry Res 2021;305:114208. https://doi.org/10.1016/j.psychres.2021.114208.
[4] Prinstein MJ. Introduction to the special section on suicide and nonsuicidal self-injury: a review of unique challenges and important directions for self-injury science. J Consult Clin Psychol 2008;76(1):1–8. https://doi.org/10.1037/0022-006X.76.1.1.
[5] Maciejewski DF, Creemers HE, Lynskey MT, Madden PAF, Heath AC, Statham DJ, Martin NG, Verweij KJH. Overlapping genetic and environmental influences on nonsuicidal self-injury and suicidal ideation: different outcomes, same etiology? JAMA Psychiatry 2014;71(6):699–705. https://doi.org/10.1001/jamapsychiatry.2014.89.
[6] Mars B, Heron J, Crane C, Hawton K, Kidger J, Lewis G, Macleod J, Tilling K, Gunnell D. Differences in risk factors for self-harm with and without suicidal intent: Findings from the ALSPAC cohort. J Affect Disord 2014;168:407–14. https://doi.org/10.1016/j.jad.2014.07.009.
[7] Wichstrøm L. Predictors of non-suicidal self-injury versus attempted suicide: Similar or different? Arch Suicide Res J Int Acad Suicide Res 2009;13(2):105–22. https://doi.org/10.1080/13811110902834992.
[8] Heesen K, Mérelle S, Brand I, van den Bergen D, van Baden D, Slotema K, Gilissen R, Veen S, van. The forever decision: a qualitative study among survivors of a suicide attempt. eClinicalMedicine 2024;69. https://doi.org/10.1016/j.eclinm.2024.102449.
[9] Millner AJ, Lee MD, Nock MK. Describing and measuring the pathway to suicide attempts: a preliminary study. Suicide Life-Threat Behav 2017;47(3):353–69. https://doi.org/10.1111/sltb.12284.
[10] Singhal N, Bhola P, Reddi VSK, Bhaskarapillai B, Joseph S. Non-suicidal self-injury (NSSI) among emerging adults: sub-group profiles and their clinical relevance. Psychiatry Res 2021;300:113877. https://doi.org/10.1016/j.psychres.2021.113877.
[11] Turner BJ, Austin SB, Chapman AL. Treating nonsuicidal self-injury: a systematic review of psychological and pharmacological interventions. Can J Psychiatry Rev Can De Psychiatr 2014;59(11):576–85. https://doi.org/10.1177/070674371405901103.
[12] Rimkeviciene J, O'Gorman J, De Leo D. Impulsive suicide attempts: a systematic literature review of definitions, characteristics and risk factors. J Affect Disord 2015;171:93–104. https://doi.org/10.1016/j.jad.2014.08.044.
[13] Moeller FG, Barratt ES, Dougherty DM, Schmitz JM, Swann AC. Psychiatric aspects of impulsivity. Am J Psychiatry 2001;158:1783–93. https://doi.org/10.1176/appi.ajp.158.11.1783.
[14] Wenzel A, Beck AT. A cognitive model of suicidal behavior: theory and treatment. Appl Prev Psychol Self-Harming Behav Spec Ser Non-Suicidal Self-Inj Suicide 2008;12(4):189–201. https://doi.org/10.1016/j.appsy.2008.05.001.
[15] Mann JJ, Apter A, Bertolote J, Beautrais A, Currier D, Haas A, Hegerl U, Lonnqvist J, Malone K, Marusic A, Mehlum L, Patton G, Phillips M, Rutz W, Rihmer Z, Schmidtke A, Shaffer D, Silverman M, Takahashi Y, Hendin H. Suicide prevention strategies: a systematic review. JAMA 2005;294(16):2064–74. https://doi.org/10.1001/jama.294.16.2064.
[16] O'Connor RC, Kirtley OJ. The integrated motivational–volitional model of suicidal behaviour. Philos Trans R Soc B Biol Sci 2018;373(1754):20170268. https://doi.org/10.1098/rstb.2017.0268.
[17] Claes, L., & Muehlenkamp, J. (2020, October 10). Non-Suicidal Self-Injury in Eating Disorders: Advancements in Etiology and Treatment. https://doi.org/10.1007/s11920-020-01191-y.
[18] CDC. (2024, May 20). *Risk and Protective Factors for Suicide*. Suicide Prevention. ⟨https://www.cdc.gov/suicide/risk-factors/index.html⟩.
[19] Anestis MD, Soberay KA, Gutierrez PM, Hernández TD, Joiner TE. Reconsidering the link between impulsivity and suicidal behavior. Personal Social Psychol Rev 2014;18(4):366–86. https://doi.org/10.1177/1088868314535988.
[20] Hamza CA, Willoughby T, Heffer T. Impulsivity and nonsuicidal self-injury: a review and meta-analysis. Clin Psychol Rev 2015;38:13–24. https://doi.org/10.1016/j.cpr.2015.02.010.
[21] Liu RT, Trout ZM, Hernandez EM, Cheek SM, Gerlus N. A behavioral and cognitive neuroscience perspective on impulsivity, suicide, and non-suicidal self-injury: Meta-analysis and recommendations for future research. Neurosci & Biobehav Rev 2017;83:440–50. https://doi.org/10.1016/j.neubiorev.2017.09.019.
[22] Kasen S, Cohen P, Chen H. Developmental course of impulsivity and capability from age 10 to age 25 as related to trajectory of suicide attempt in a community cohort. Suicide Life-Threat Behav 2011;41(2):180–92. https://doi.org/10.1111/j.1943-278X.2011.00017.x.
[23] McGirr A, Renaud J, Bureau A, Seguin M, Lesage A, Turecki G. Impulsive-aggressive behaviours and completed suicide across the life cycle: a predisposition for younger age of suicide. Psychol Med 2008;38(3):407–17. https://doi.org/10.1017/S0033291707001419.
[24] Rosenbaum GM, Hartley CA. Developmental perspectives on risky and impulsive choice. Philos Trans R Soc B Biol Sci 2019;374(1766):20180133. https://doi.org/10.1098/rstb.2018.0133.

[25] Steinberg L, Albert D, Cauffman E, Banich M, Graham S, Woolard J. Age differences in sensation seeking and impulsivity as indexed by behavior and self-report: evidence for a dual systems model. Dev Psychol 2008;44(6):1764–78. https://doi.org/10.1037/a0012955.
[26] Wiggin D, Ní Dhálaigh D, McMahon E, McNicholas F, Griffin E. Age of onset of self-harm in children and adolescents: A scoping review. Child Adolesc Psychiatry Ment Health 2025;19(1):128. https://doi.org/10.1186/s13034-025-00982-6.
[27] MacKillop J, Weafer J, Gray J, Oshri A, Palmer A, de Wit H. The latent structure of impulsivity: impulsive choice, impulsive action, and impulsive personality traits. Psychopharmacology 2016;233(18):3361–70. https://doi.org/10.1007/s00213-016-4372-0.
[28] Cyders MA, Coskunpinar A. Measurement of constructs using self-report and behavioral lab tasks: Is there overlap in nomothetic span and construct representation for impulsivity? Clin Psychol Rev 2011. https://doi.org/10.1016/j.cpr.2011.06.001.
[29] Dougherty DM, Mathias CW, Marsh DM, Moeller FG, Swann AC. Suicidal behaviors and drug abuse: impulsivity and its assessment (Suppl) Drug Alcohol Depend 2004;76:S93–105. https://doi.org/10.1016/j.drugalcdep.2004.08.010.
[30] Huang Y, Luan S, Wu B, Li Y, Wu J, Chen W, Hertwig R. Impulsivity is a stable, measurable, and predictive psychological trait. Proc Natl Acad Sci USA 2024;121(24):e2321758121. https://doi.org/10.1073/pnas.2321758121.
[31] Reynolds B, Ortengren A, Richards JB, de Wit H. Dimensions of impulsive behavior: Personality and behavioral measures. Personal Individ Differ 2006. https://doi.org/10.1016/j.paid.2005.03.024.
[32] Whiteside SP, Lynam DR. The Five Factor Model and impulsivity: Using a structural model of personality to understand impulsivity. Personal Individ Differ 2001. https://doi.org/10.1016/S0191-8869(00)00064-7.
[33] Bruno S, Anconetani G, Rogier G, Del Casale A, Pompili M, Velotti P. Impulsivity traits and suicide related outcomes: A systematic review and meta-analysis using the UPPS model. J Affect Disord 2023;339:571–83. https://doi.org/10.1016/j.jad.2023.07.086.
[34] Logan GD, Schachar RJ, Tannock R. Impulsivity and inhibitory control. Psychol Sci 1997. https://doi.org/10.1111/j.1467-9280.1997.tb00545.x.
[35] Miyake A, Friedman NP, Emerson MJ, Witzki AH, Howerter A, Wager TD. The unity and diversity of executive functions and their contributions to complex "Frontal Lobe" tasks: a latent variable analysis. Cogn Psychol 2000;41(1):49–100. https://doi.org/10.1006/cogp.1999.0734.
[36] Winstanley CA, Eagle DM, Robbins TW. Behavioral models of impulsivity in relation to ADHD: Translation between clinical and preclinical studies. Clin Psychol Rev 2006;26(4):379–95. https://doi.org/10.1016/j.cpr.2006.01.001.
[37] National Action Alliance for Suicide Prevention. (2014). *A Prioritized Research Agenda for Suicide Prevention: An Action Plan to Save Lives.*
[38] Baca-Garcia E, Diaz-Sastre C, García Resa E, Blasco H, Braquehais Conesa D, Oquendo MA, Saiz-Ruiz J, de Leon J. Suicide attempts and impulsivity. Eur Arch Psychiatry Clin Neurosci 2005;255(2):152–6. https://doi.org/10.1007/s00406-004-0549-3.
[39] Borges G, Nock MK, Haro Abad JM, Hwang I, Sampson NA, Alonso J, Andrade LH, Angermeyer MC, Beautrais A, Bromet E, Bruffaerts R, de Girolamo G, Florescu S, Gureje O, Hu C, Karam EG, Kovess-Masfety V, Lee S, Levinson D, Kessler RC. Twelve-month prevalence of and risk factors for suicide attempts in the World Health Organization World Mental Health Surveys. J Clin Psychiatry 2010;71(12):1617–28. https://doi.org/10.4088/JCP.08m04967blu.
[40] Wojnar M, Ilgen MA, Czyz E, Strobbe S, Klimkiewicz A, Jakubczyk A, Glass J, Brower KJ. Impulsive and non-impulsive suicide attempts in patients treated for alcohol dependence. J Affect Disord 2009;115(1–2):131–9. https://doi.org/10.1016/j.jad.2008.09.001.
[41] Giegling I, Olgiati P, Hartmann AM, Calati R, Möller H-J, Rujescu D, Serretti A. Personality and attempted suicide. Analysis of anger, aggression and impulsivity. J Psychiatr Res 2009;43(16):1262–71. https://doi.org/10.1016/j.jpsychires.2009.04.013.
[42] Wyder M, De Leo D. Behind impulsive suicide attempts: indications from a community study. J Affect Disord 2007. https://doi.org/10.1016/j.jad.2007.02.015.
[43] Chaudhury SR, Singh T, Burke A, Stanley B, Mann JJ, Grunebaum M, Sublette ME, Oquendo MA. Clinical correlates of planned and unplanned suicide attempts. J Nerv Ment Dis 2016;204(11):806–11. https://doi.org/10.1097/NMD.0000000000000502.
[44] Maxfield BL, Pepper CM. Impulsivity and response latency in non-suicidal self-injury: the role of negative urgency in emotion regulation (29018995) Psychiatr Q 2018;89(2):417–26. https://doi.org/10.1007/s11126-017-9544-5.
[45] Peckham AD, Jordan H, Silverman A, Steele SJ, Björgvinsson T, Beard C. From urges to action: negative urgency and nonsuicidal self-injury in an acute transdiagnostic sample. Arch Suicide Res J Int Acad Suicide Res 2020;24(3):367–83. https://doi.org/10.1080/13811118.2019.1625831.
[46] Wechsler, D. (2011). Wechsler Abbreviated Scale of Intelligence–Second Edition (WASI-II) [Database record]. APA PsycTests. https://doi.org/10.1037/t15171-000.
[47] Verbruggen F, Logan GD. Automatic and controlled response inhibition: Associative learning in the go/no-go and stop-signal paradigms. J Exp Psychol General 2008;137(4):649–72. https://doi.org/10.1037/a0013170.
[48] Verbruggen F, Logan GD, Stevens MA. STOP-IT: windows executable software for the stop-signal paradigm. Behav Res Methods 2008;40(2):479–83. https://doi.org/10.3758/brm.40.2.479.
[49] Verbruggen F, Logan GD. Models of response inhibition in the stop-signal and stop-change paradigms. Neurosci Biobehav Rev 2009;33(5):647–61. https://doi.org/10.1016/j.neubiorev.2008.08.014.
[50] Posner K. Columbia-suicide. Sev Rating Scale [Dataset] 2016. https://doi.org/10.1037/t52667-000.
[51] Nock MK, Holmberg EB, Photos VI, Michel BD. Self-Inj Thoughts Behav Interview [Dataset] 2011. https://doi.org/10.1037/t03674-000.
[52] Liu RT, Bettis AH, Lawrence HR, Walsh RFL, Sheehan AE, Pollak OH, Stephenson AR, Kautz MM, Marlowe RM. Measures of suicidal thoughts and behaviors in children and adolescents: a systematic review and recommendations for use in clinical and research settings. Assessment 2025;32(3):303–20. https://doi.org/10.1177/10731911241249438.
[53] Nock MK, Holmberg EB, Photos VI, Michel BD. Self-injurious thoughts and behaviors interview: development, reliability, and validity in an adolescent sample. Psychol Assess 2007;19(3):309–17. https://doi.org/10.1037/1040-3590.19.3.309.
[54] Reynolds WM. Suicidal Ideation Questionnaire. Psychol Assess Resour 1987.
[55] Kovacs M. Children's Depression Inventory (CDI2): Technical Manual. Multi-Health Systems, Incorporated; 2011.
[56] Grandclerc S, De Labrouhe D, Spodenkiewicz M, Lachal J, Moro M-R. Relations between nonsuicidal self-injury and suicidal behavior in adolescence: a systematic review. PLoS ONE 2016;11(4):e0153760. https://doi.org/10.1371/journal.pone.0153760.
[57] Comai S, Manchia M, Bosia M, Miola A, Poletti S, Benedetti F, Nasini S, Ferri R, Rujescu D, Leboyer M, Licinio J, Baune BT, Serretti A. Moving toward precision and personalized treatment strategies in psychiatry. pyaf025 Int J Neuropsychopharmacol 2025;28(5). https://doi.org/10.1093/ijnp/pyaf025.
[58] Kas MJH, Penninx BWJH, Knudsen GM, Cuthbert B, Falkai P, Sachs GS, Ressler KJ, Bałkowiec-Iskra E, Butlen-Ducuing F, Leboyer M, Marston H, Luthman J, Mantua V. Precision psychiatry roadmap: towards a biology-informed framework for mental disorders. Mol Psychiatry 2025;30(8):3846–55. https://doi.org/10.1038/s41380-025-03070-5.
[59] Yip PS, Caine E, Yousuf S, Chang S-S, Wu KC-C, Chen Y-Y. Means restriction for suicide prevention. Lancet 2012;379(9834):2393–9. https://doi.org/10.1016/S0140-6736(12)60521-2.
[60] Cunillera T, Fuentemilla L, Brignani D, Cucurell D, Miniussi C. A simultaneous modulation of reactive and proactive inhibition processes by anodal tDCS on the right inferior frontal cortex. PLOS ONE 2014;9(11):e113537. https://doi.org/10.1371/journal.pone.0113537.
[61] Ditye T, Jacobson L, Walsh V, Lavidor M. Modulating behavioral inhibition by tDCS combined with cognitive training. Exp Brain Res 2012;219(3):363–8. https://doi.org/10.1007/s00221-012-3098-4.
[62] Cai Y, Li S, Liu J, Li D, Et A. The Role of the Frontal and Parietal Cortex in Proactive and Reactive Inhibitory Control: A Transcranial Direct Current Stimulation Study. J Cogn Neurosci 2016. https://doi.org/10.1162/jocn_a_00888.
[63] Stramaccia DF, Penolazzi B, Sartori G, Braga M, Mondini S, Galfano G. Assessing the effects of tDCS over a delayed response inhibition task by targeting the right inferior frontal gyrus and right dorsolateral prefrontal cortex. Exp Brain Res 2015;233(8):2283–90. https://doi.org/10.1007/s00221-015-4297-6.
[64] Nock MK, Borges G, Bromet EJ, Cha CB, Kessler RC, Lee S. Suicide and suicidal behavior. Epidemiol Rev 2008;30(1):133–54. https://doi.org/10.1093/epirev/mxn002.
[65] Nock MK, Green JG, Hwang I, McLaughlin KA, Sampson NA, Zaslavsky AM, Kessler RC. Prevalence, correlates, and treatment of lifetime suicidal behavior among adolescents: Results from the National Comorbidity Survey Replication Adolescent Supplement. JAMA Psychiatry 2013;70(3):300–10. https://doi.org/10.1001/2013.jamapsychiatry.55.
[66] Moloney F, Amini J, Sinyor M, Schaffer A, Lanctôt KL, Mitchell RHB. Sex Differences in the Global Prevalence of Nonsuicidal Self-Injury in Adolescents: A Meta-Analysis. JAMA Netw Open 2024;7(6):e2415436. https://doi.org/10.1001/jamanetworkopen.2024.15436.