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ADHD symptoms and suicide attempts in adults with mood disorders: An observational naturalistic study

Alberto Forte ^{a,b,*}, Salvatore Sarubbi ^c, Massimiliano Orri ^{d,e}, Denise Erbutto ^f, Maurizio Pompili ^f

^a Psychiatry Residency Training Program, Faculty of Medicine and Psychology, Sapienza University, Rome, Italy

^b Department of Psychiatry and Substance Abuse, ASL Roma 5, Rome, Italy

^c Department of Human Neurosciences, Sapienza University, Rome, Italy

^d McGill Group for Suicide Studies, Douglas Mental Health University Institute, Department of Psychiatry, McGill University, Montreal, Canada

^e Bordeaux Population Health Research Centre, Inserm U1219, Université de Bordeaux, Bordeaux, France

^f Department of Neurosciences, Mental Health and Sensory Organs, Suicide Prevention Center, Sant'Andrea Hospital, Sapienza University, Rome, Italy

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ABSTRACT

Background: Although several studies explored the association between ADHD and suicidality in the pediatric population, there is a lack of studies focusing on adults. It is particularly unclear whether comorbid mood disorders confer an increased risk of suicidal ideation and attempt among individuals with high ADHD symptoms. **Methods:** Participants were 111 inpatients admitted to the Department of Psychiatry of Sant'Andrea Hospital between July 2017 and July 2018. Data were collected using self-report questionnaires and semi-structured interviews. Lifetime and last-month suicidal ideation and attempts were rated with *The Columbia-Suicide Severity Rating Scale* (C-SSRS). Symptoms of ADHD were rated using *The Adult ADHD Self-Report Scale Version 1.1* (ASRS-V1.1).

Results: Of the 111 participants, 40.6% had a history of suicide attempts. No associations were found between ADHD symptoms and suicide attempt/ideation as well as mood disorder diagnosis and suicide attempt, while an association between mood disorder diagnosis and suicidal ideation was found. ADHD symptoms were significantly associated with suicide attempt (lifetime and in the last 3 months) only among participants with mood disorders (lifetime, OR 2.30; 95% CI: 0.97–3.64; 3-months OR 2.34; 95% CI: 0.19–4.49)

Limitations: Given the cross-sectional nature of the study, the directions of the associations described are uncertain. **Conclusions:** ADHD symptoms were significantly associated with lifetime and recent suicide attempts, only when a mood disorder diagnosis was comorbid. The co-occurrence of ADHD symptoms and a mood disorders diagnosis might confer a higher risk of suicide attempt among adults.

1. Introduction

A growing body of evidence suggests an association between ADHD and suicidality (Impey and Heun, 2012; James et al., 2004; Septier et al., 2019). Studies on clinical populations consistently found that attention-deficit/hyperactivity disorder among children is associated with a higher risk of suicidal behavior in adolescence (Balazs et al., 2014; Chronis-Tuscano et al., 2010; Hurtig et al., 2012; Ljung et al., 2014). This association was also found in longitudinal population-based studies (Forte et al., 2019; Galéra et al., 2008; Huang et al., 2018a; Sourander et al., 2009), suggesting that even subclinical traits of hyperactivity and inattention among children could be related to suicidal behavior among adolescents. A large longitudinal cohort study showed

that ADHD was an independent and direct risk factor for suicide attempts in adolescents and young adults and an even stronger risk factor for repeated suicide attempts (Huang et al., 2018b). Although many studies explored the association between ADHD and suicidality in the pediatric population, only a few focused on adult populations. This is important, as studies showed that ADHD persists into adulthood with a predominant neurodevelopmental nature of ADHD (Breda et al., 2021).

ADHD was three times more common in people with mood disorders than those without, suggesting a frequent co-occurrence of both conditions in adults (at least 17%) (Sandstrom et al., 2021). It was recently suggested that comorbid depression in adults presenting ADHD may be related to death due to unnatural causes, including suicide (Sun et al., 2019). A pilot study investigating the association between ADHD and

* Corresponding author.

E-mail address: alberto.forte@uniroma1.it (A. Forte).

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lifetime suicidality suggested that this association may be primarily due to comorbid mental health disorders (e.g., mood disorders, substance use disorder) (Taylor et al., 2014). Another study suggested an increased risk of self-harm in young women with a history of ADHD symptoms (Swanson et al., 2014). Despite the growing literature, there is a lack of studies focusing on co-occurring ADHD symptoms and mood disorders on suicidal behavior among adults. It is unclear whether comorbid mood disorders confer an increased risk of suicidal ideation and attempt among individuals with high ADHD symptoms. Given that the presence of mood disorders is a main risk factor for suicidal behavior in adulthood (Turecki et al., 2019), and the high frequency of co-occurrence of the two conditions (Sandstrom et al., 2021), clarifying the interplay between mood disorders and ADHD symptoms on suicide risk is important for personalized suicide prevention among adults suffering from ADHD.

The present study aimed to (1) investigate the association of ADHD symptoms and mood disorders with suicidal ideation and suicide attempt and (2) analyze mood disorders' moderating role in the association between ADHD and suicidal ideation and attempt using a clinical sample of adult outpatients from a large university hospital unit .

2. Methods

2.1. Participants

Participants were 111 inpatients consecutively admitted to the Department of Psychiatry and Suicide Prevention Center of Sant' Andrea Hospital between July 2017 and July 2018. Their participation in the study was conditional on signing a written informed consent, drafted according to the new European rules 679/2016 (GDPR).

Inclusion criteria were: meeting the DSM-5 criteria for any mental disorder, understanding the instructions and answer the questions, age of 18 or older, and signing the informed consent.

Exclusion criteria were: severe neuropsychiatric disorders (e.g., epilepsy, cognitive impairment, genetic syndromes) and the presence of cognitive deficits causing language problems.

All patients gave their informed consent. Data are part of a broader study on mental pain and suicide risk, approved by the local institutional review board.

2.2. Assessment

Data were collected using self-report questionnaires and semi-structured interviews.

Demographic and clinical information: (1) A Socio-Anamnestic form gathering information about socio-demographic variables (sex, age, ethnicity, educational level, occupation, etc.) (2) Clinical data, including diagnosis, assessed according to Diagnostic and Statistical Manual of Mental Disorders, fifth edition (DSM-5) criteria (American Psychiatric Association, 2013) and supported by the Mini International Neuropsychiatric Interview (MINI) (Sheehan et al., 1998). The MINI has good validity, with median kappa coefficients greater than 0.63 against other interviews and interrater reliability ranging from kappas of 0.79 to 1.00. The MINI has been updated for DSM-IV/MINI 6.0 (version10/10/10) and DSM-5/MINI 7.0.2 diagnostic criteria.

Suicidal ideation and attempt: Lifetime and last-month suicidal ideation, as well as lifetime and previous three months suicidal behaviors, were rated with *The Columbia-Suicide Severity Rating Scale (C-SSRS)*, a semi-structured interview assessing suicide severity risk (Posner et al., 2011). It examines two areas: lifetime and last month's suicidal ideation. The C-SSRS rates an individual's degree of suicidal ideation on a scale ranging from "wish to be dead" to "active suicidal ideation with a specific plan and intent." and lifetime and last 3 months suicidal behaviors (e.g., focusing on previous suicide attempts, lethality, potential physical damages, if the attempt was interrupted or failed).

ADHD symptoms: Symptoms of hyperactivity/inattention were rated using *The Adult ADHD Self-Report Scale short-form screener* (Kessler et al.,

2005; Somma et al., 2019), a screening scale for ADHD in adulthood. The ASRS screener comprises 6 items rated on a 5-point Likert scale (0 = never to 4 = very often) relative to the last six months. The short version was chosen given its excellent operating characteristics for screening purposes both in the general population and in a specialty treatment setting (Ustun et al., 2017). Questions investigate both attention and impulsivity/hyperactivity dimensions. Although the scale does not allow one to confirm a clinical diagnosis of ADHD, prior work indicates that, relative to the other items on the scale, the items on the ASRS-6 are most predictive of clinically relevant ADHD concerns (Kessler et al., 2005). Therefore, the 0–4 ASRS response scale was dichotomized, with "often" or "very often" considered above the clinical threshold to assess symptoms (coded 1, vs 0), and summed. Participants scoring above 3 were defined as having high ADHD symptoms (vs low ADHD symptoms) (Kessler et al., 2005).

2.3. Statistical analyzes

All analyzes were performed with the statistical package for social sciences (IBM SPSS Statistics for Windows. Version 25.0. Armonk. NY) and PROCESS macro (Hayes, 2017). Descriptive statistics are presented as percentages, means, and standard deviations. Independent sample t-tests and chi-square tests were used to test differences in the measured variables between participants without a history of a suicide attempt. We investigated the association between high ADHD symptoms and suicide-related outcomes using binary logistic regression, adjusted for age and sex. Finally, we conducted moderation analyzes by introducing an interaction term (high ADHD symptoms by mood disorders diagnosis) to test the potential moderating role of mood disorder diagnosis in the association between high ADHD symptoms and suicide-related outcomes. Analyzes were performed using suicide ideation and suicide attempt as outcomes, considering lifetime and last 3 months ideation/attempt.

Table 1
Descriptive statistics.

Variables	History of lifetime SA (N = 45)	Never SA (N = 66)	Whole sample (=111)	P
Sex				
Male	23 (61.0)	36 (57.7)	59 (54.8)	$\chi^2 = 0.127$
Female	22 (39.0)	30 (42.3)	52 (45.2)	
Age (M±SD)	40.35 ± 13.7	44.18 ± 14.9	41.90 ± 14.3	$t = -1.388$
Diagnosis				$\chi^2 = 4.191$
Major Depressive Disorder	10 (23.3)	12 (18.5)	22 (19.8)	
Bipolar Disorder	15 (34.9)	16 (24.6)	31 (27.9)	
Schizophrenia	7 (16.3)	18 (27.7)	25 (22.6)	
Personality Disorder	4 (9.3)	5 (7.7)	9 (8.1)	
Substance abuse	5 (11.6)	7 (10.8)	12 (10.8)	
Other	2 (4.7)	7 (10.8)	9 (8.1)	
ADHD screening				$\chi^2 = 1.849$
At risk	28 (42.4)	25 (55.6)	53 (48.7)	
Not at risk	38 (57.6)	20 (44.4)	58 (51.3)	
CSSRS-S				
<i>Suicide attempt in the last 3 months</i>				
Yes	21 (46.7)	0 (0.0)	21 (18.9)	$\chi^2 = 37.98^{***}$
No	24 (53.3)	66 (100.0)	90 (81.1)	
<i>Lifetime suicidal ideation severity</i>	4.36 ± 1.1	1.55 ± 1.9	2.68 ± 2.1	$t = -9.723^{***}$
<i>Last month suicidal ideation severity</i>	3.16 ± 1.9	1.15 ± 1.7	1.96 ± 2.0	$t = -5.465^{***}$

*** = $p < 0.001$.

3. Results

Descriptive statistics are shown in Table 1. Participants were 45.2% females; the mean age was 41.9 years (SD = 14.3). Concerning mental disorders, 27.9% of participants were diagnosed with Bipolar Disorder (24 Type I, 7 Type II) and 19.8% with Major Depressive Disorder. Of the 111 participants, 45 (40.6%) had a history of suicide attempts, while 66 (59.4%) have never attempted suicide. Those with a history of suicide attempt were more likely than those without to present with higher severity of lifetime suicidal ideation ($M = 4.36 \pm 1.1$ vs $M = 1.55 \pm 1.9$; $p < 0.001$), higher severity of suicidal ideation in the last month ($M = 3.16 \pm 1.9$ vs $M = 1.15 \pm 1.7$; $p < 0.001$), and to be more likely to report a suicide attempt in the previous three months ($\chi^2 = 37.98$; $p < 0.001$). The two groups did not differ on the ASRSs score.

3.1. Association of high ADHD symptoms and mood disorders with suicide attempt

Using logistic regression adjusted for age and sex, no associations were found between high ADHD symptoms and suicide attempt (lifetime, OR 1.83, CI 0.834–4.01; past 3 months, OR 0.974, CI 0.374–2.56). Similarly, no associations were found between mood disorder diagnosis and suicide attempt (lifetime, OR 1.86; 95% CI: 0.803–4.32; past 3 months, OR 1.45, 95% CI: 0.52–4.10). For suicidal ideation, an association was found between mood disorder diagnosis and lifetime suicidal ideation but not for past month suicidal ideation (lifetime, $B = 1.12$; 95% CI 0.259–1.97; past month $B = 0.809$; 95% CI –0.037–1.65). No associations were found between high ADHD symptoms and suicidal ideation (lifetime, $B = 0.530$; 95% CI –0.287–1.35; past month, $B = 0.029$; 95% CI –0.766 –0.824).

3.2. The moderating role of mood disorders in the association between high ADHD symptoms and suicide attempt

We examined the role of mood disorder diagnosis as a moderator of the relation between the ADHD risk and suicidal behavior (lifetime suicide attempt and suicide attempt in the last 3 months). We found a significant interaction between ADHD symptoms and mood disorders. As shown in Table 2, ADHD symptoms were significantly associated with lifetime and last 3 months suicide attempt only among participants diagnosed with mood disorders (lifetime, OR 2.30; 95% CI: 0.97–3.64; 3-months OR 2.34; 95% CI: 0.19–4.49). The interactions are illustrated in Fig. 1.

Table 2
Regression analyzes for suicide attempt.

Variable	OR [95% CI.]	<i>p</i>
Outcome: History of suicide attempt		
Age	1.02 [.993–1.05]	.153
Sex	1.12 [.508–2.48]	.774
ADHD Risk	1.83 [.834–4.01]	.132
Mood Disorder Diagnosis	1.86 [.803–4.32]	.147
Conditional effect of ADHD risk		
ADHD Risk = 1	2.30 [.967–3.64]	<0.001
ADHD Risk = 0	–0.673 [–1.79–0.499]	.24
Outcome: Suicide attempt in the last 3 months		
Age	1.01 [.975–1.04]	.621
Sex	.780 [.291–2.08]	.621
ADHD Risk	.974 [.374–2.56]	.979
Mood Disorder Diagnosis	1.45 [.515–4.10]	.480
Conditional effect of ADHD risk		
ADHD Risk = 1	2.34 [.188–4.49]	.03
ADHD Risk = 0	–0.984 [–2.43–0.472]	.18

3.3. The moderating role of mood disorders in the association between high ADHD symptoms and suicidal ideation

We examined the role of a mood disorder diagnosis as a moderator of the relation between the ADHD symptoms and lifetime/last month suicidal ideation. We found no significant interaction between mood disorder diagnosis and ADHD symptoms on both lifetime ($B = 0.805$, SE = 0.813, $p = 0.325$) and last month suicidal ideation ($B = 1.02$, SE = 0.802, $p = 0.206$; Table 3).

4. Discussion

This observational study aimed to investigate the association between ADHD symptoms and suicidal ideation and attempt among a clinical sample of adult inpatients with and without a diagnosis of mood disorders. We found that high ADHD symptoms were significantly associated with increased risk of suicide attempts, both lifetime and in the last three months, but only among those with a mood disorder diagnosis.

In line with previous findings, our study suggests that ADHD among adults with mood disorders might have a role in increasing the risk of suicide attempt only when the two conditions are comorbid (Yoshimasu et al., 2019). Our findings also expand the results from previous studies, suggesting a specific interaction between ADHD symptoms and the presence of a mood disorder diagnosis (Babinski et al., 2020). Our findings are in line with previous studies suggesting that subjects with a comorbid mood disorder and ADHD symptoms might have an increased likelihood of attempted suicide compared with those affected by a mood disorder only (Lan et al., 2015; Pinna et al., 2019). Similarly, our findings are in line with prior studies on the interplay between ADHD and mood disorders in adults (Babinski et al., 2020; Lan et al., 2015), supporting the evidence that among a clinical sample of adults with ADHD, the co-occurrence of a mood disorder is related to unfavorable outcomes (Pinna et al., 2019), and confirming previous reports that already suggested a higher risk of suicide attempt in clinical population with comorbid ADHD and mood disorders symptoms (Babinski et al., 2020).

Interestingly, we found that a mood disorder diagnosis in adults with high ADHD symptoms does not influence the risk of suicidal ideation, as no significant interactions between a mood disorder diagnosis and ADHD symptoms on suicidal ideation (lifetime and past month) was found. On the contrary, other studies in clinical populations found that having high ADHD symptoms were associated with an increased risk for suicidal behavior in adult psychiatric outpatients, even after controlling for pre-existing psychiatric conditions (Stickley et al., 2018, 2016). One possible explanation might be that we only included inpatient, and thus more severe psychiatric conditions compared to previous studies (Stickley et al., 2018). Of note, in our sample, 48% of the subjects presented high ADHD symptoms, which is a higher rate than those reported in previous studies (Corbisiero et al., 2017), and higher than the prevalence of ADHD diagnosis. This may be related to the inclusion of inpatients with complex and severe psychopathology, but might also confirm that the presence of high ADHD symptoms among patients affected by mood disorders is underestimated (Ginsberg et al., 2014). However, our results align with the finding that later-onset psychiatric comorbidity in patients diagnosed with ADHD (such as major mood disorders) mainly influenced death due to suicide and unintentional injury (Sun et al., 2019). Thus, the present findings confirmed the previous literature suggesting that psychiatric comorbidity, particularly major affective disorders, confers a higher risk of suicide in patients with high ADHD symptoms.

Our findings expand the association between impulsivity-related traits and suicidal behavior in mood disorders (Swann et al., 2005). Indeed, according to previous studies, the co-occurrence of a mood disorder diagnosis and high ADHD symptoms might suggest the presence of higher impulsivity traits (Swann et al., 2005). Thus it might help to identify subjects at higher risk of suicide attempts. Also,

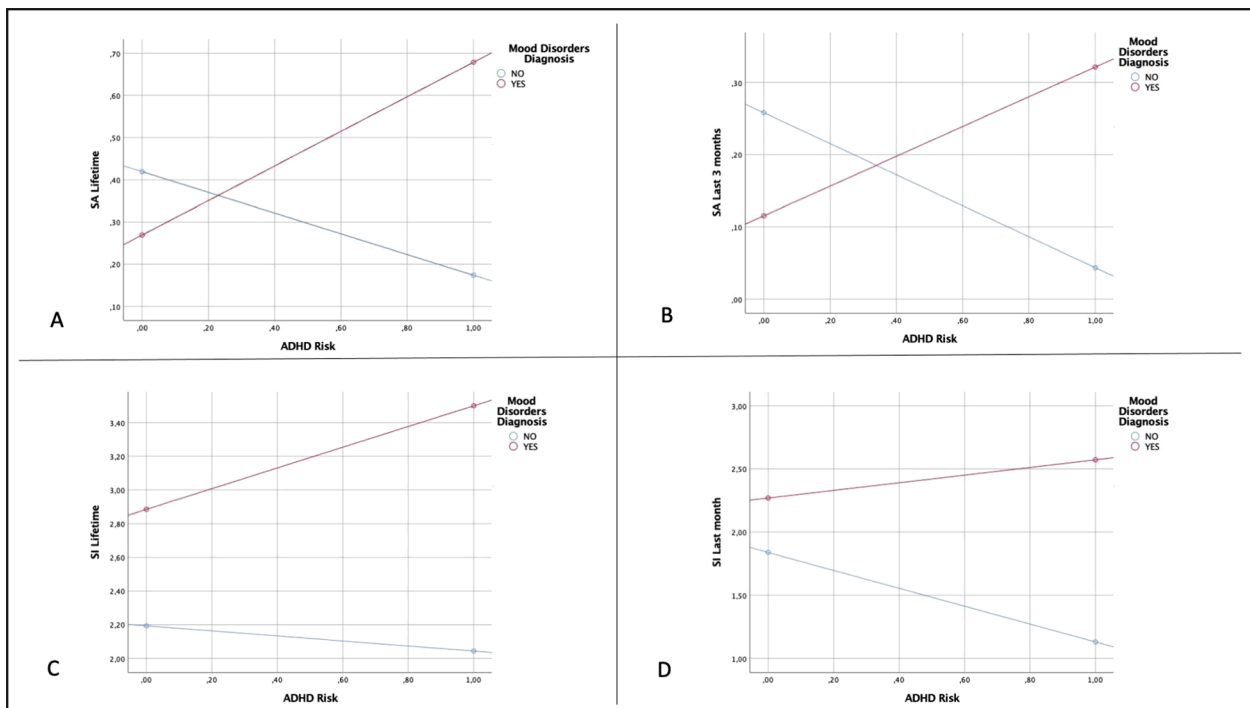


Fig. 1. A. Interaction between mood disorders diagnosis and ADHD risk on suicide attempt lifetime (X = ADHD risk, Y = SA lifetime) B. Interaction between mood disorders diagnosis and ADHD risk on Suicide Attempt in the last 3 months (X = ADHD risk, Y = SA last 3 months) C. Interaction between mood disorders diagnosis and ADHD risk on Suicidal Ideation Lifetime (X = ADHD risk, Y = SI lifetime) D. Interaction between mood disorders diagnosis and ADHD risk on Suicidal Ideation in the last month (X = ADHD risk, Y = SI lifetime).

Table 3
Regression analyzes for suicidal ideation.

	B [95% CL.]	p
Outcome: Lifetime suicidal ideation		
Age	.001 [−0.028–0.030]	.949
Sex	.407 [−0.419–1.23]	.331
ADHD Risk	.530 [−0.287–1.35]	.201
Mood Disorder Diagnosis	1.12 [.259–1.97]	.011
ADHD Risk x Mood Disorder Diagnosis	.805 [−0.808–2.42]	.325
Outcome: Suicidal ideation in the last month		
Age	−0.003 [−0.031–0.025]	.813
Sex	.810 [.011–1.61]	.047
ADHD Risk	.029 [−0.005–1.62]	.943
Mood Disorder Diagnosis	.809 [−0.037–1.65]	.061
ADHD Risk x Mood Disorder Diagnosis	1.02 [−0.570–2.61]	.206

population-based studies found that children with impulsive-disruptive traits and ADHD symptoms are more likely than their peers to attempt suicide by early adulthood (McGirr and Turecki, 2007), regardless of psychopathological comorbidities (Brezo et al., 2008; Forte et al., 2019). Our study expands the literature on the association between impulsive-disruptive and suicidal behavior in adulthood (Swann et al., 2020; Baca-Garcia et al., 2005; Gvion and Apter, 2011), suggesting that mood disorders might moderate this association in adults.

Our findings have important implications for the clinical management of suicide risk. They confirm the importance of evaluating comorbid mood disorders in patients with ADHD symptoms and carefully assess the risk of suicide attempts in the presence of such comorbidity (Asherson et al., 2014). Our study also suggests the need to further investigate the links between ADHD symptoms, mood disorders, and suicidal behavior; especially, further studies are needed to clarify the neurobiological and environmental mechanisms underlying these interactions and how to treat and prevent suicidality among patients affected by comorbid mood disorders and high ADHD symptoms.

5. Limitations

The present findings need to be considered in light of several limitations. First, given the cross-sectional nature of our design caution should be used in interpreting our findings. Second, all variables were measured at the same assessment, thus the directions of the associations described are uncertain. However, associations were consistent with suicidal outcomes measured using lifetime and past 3-month assessments, suggesting that our association describes general mechanisms. Another limitation is that subjects with bipolar disorders were in different affective states (manic, depressed, mixed, or euthymic), and this cannot be controlled in our analyzes due to the absence of this variable. A further limitation is that the group presenting high ADHD symptoms, might be characterized by an over-representation of patients affected by bipolar disorder, who are themselves characterized by a greater suicide risk. Also, in this study we found that 48.7% of the included participants had high ADHD symptoms; as some previous studies reported lower rates, it is possible that the prevalence of high ADHD symptoms our sample was over-estimated and this might limit the generalizability of our findings. However, it is important to note that our measure of ADHD symptoms is not a diagnostic measure, therefore can capture high but subsyndromal symptoms. Finally, our sample size was relatively small, which influenced the power of our statistical tests.

6. Conclusion

Among a clinical sample of adults, we found that having high ADHD symptoms were significantly associated with lifetime suicide attempts and suicide attempts in the last 3 months only when a mood disorder diagnosis was comorbid. The present study suggests that the co-occurrence of high ADHD symptoms and a mood disorders diagnosis might confer a higher risk of suicide attempt, but does not influence the risk of suicidal ideation. The present findings stress the importance of evaluating the co-occurrence of ADHD symptoms and mood disorders among adults, and also carefully assess the risk of suicide in the presence

of such comorbidity. Further research on the mechanisms underlying the moderating role of mood disorders in the association between ADHD symptoms and suicide attempts may lead to an improved suicide prevention strategies for this at-risk group.

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