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Research paper

Risk factors of suicide re-attempt: A two-year prospective study

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ABSTRACT

Background: History of suicide attempt (SA) is the strongest predictor of a new SA and suicide. It is primordial to identify additional risk factors of suicide re-attempt. The aim of this study was to identify risk factors of suicide re-attempt in patients with recent SA followed for 2 years.

Methods: In this multicentric cohort of adult inpatients, the median of the index SA before inclusion was 10 days. Clinicians assessed a large panel of psychological dimensions using validated tools. Occurrence of a new SA or death by suicide during the follow-up was recorded. A cluster analysis was used to identify the dimensions that best characterized the population and a variable “number of personality traits” was created that included the three most representative traits: anxiety, anger, and anxious lability. Risk factors of re-attempt were assessed with adjusted Cox regression models.

Results: Among the 379 patients included, 100 (26.4 %) re-attempted suicide and 6 (1.6 %) died by suicide. The two major risk factors of suicide re-attempt were no history of violent SA and presenting two or three personality traits among trait anxiety, anger and anxious lability.

Limitations: It was impossible to know if treatment change during follow-up occur before or after the re-attempt.

Discussion: One of the most important predictors of re-attempt in suicide attempters with mood disorders, was the presence of three personality traits (anger, anxiety, and anxious lability). Clinicians should provide close monitoring to patients presenting these traits and proposed treatments specifically targeting these dimensions, especially anxiety.

1. Introduction

Suicidal behavior (i.e. suicide attempt (SA) and suicide) is a major public health concern. Each year, ~700,000 people die by suicide worldwide and SA are 20 to 30 time more frequent (OMS | [Données et Statistiques Sur Le Suicide](#), n.d.). Importantly, suicide rate has not decreased significantly in the last 50 years (Grendas et al., 2019), mainly because until recently, suicidal behaviors were seen as consequences or symptoms of a comorbid psychiatric pathology, mainly depression (Courtet et al., 2020). Yet, most of the currently available pharmacological treatments (e.g. antidepressants) are not sufficient to prevent

suicidal behaviors (Nobile et al., 2020, 2021). Moreover, risk factors of suicidal behaviors need to be better identified, especially in patients with a previous SA.

Currently, history of lifetime SA is one of the best predictor of future SA or death by suicide (Franklin et al., 2017; OMS | [Données et Statistiques Sur Le Suicide](#), n.d.): 40–55 % of patient hospitalized for a SA have already done a previous SA and 10–15 % of patients who did a SA will die by suicide (Monnin et al., 2012). However, approximately half of patients who did a SA will not re-attempt. Therefore, it is important to identify risk factors of re-attempt to adapt and optimize the care of patients most at risk of a new SA. Few studies explored risk factors of a

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suicide re-attempt in patients with history of previous SA, especially with a recent one. Indeed, most studies only use history of SA as a covariate in their analyses. In addition, the follow-up time after the index SA across studies focusing only on suicide attempters varied from 1 to 10 years. Yet, most re-attempts (30 %) occur within 2 years following the previous SA (Gibb et al., 2005; Grendas et al., 2019; Monnin et al., 2012; Parra-Urbe et al., 2017; Scoliers et al., 2009). These studies identified some risk factors, particularly female sex, young age, unemployment, alcohol and/or substance use disorder, cluster B personality disorder, more than one lifetime SA, SI recurrence, and higher severity of psychiatric symptoms (e.g. depression, anxiety) (Aguglia et al., 2020; Grendas et al., 2019; Irigoyen et al., 2019; Monnin et al., 2012; Parra-Urbe et al., 2017; Scoliers et al., 2009). However, some identified risk factors of re-attempts differed among studies. For example, in a study on 371 patients with a recent SA and followed for 2 years, among whom 19 % re-attempted suicide, the main risk factors of re-attempt were cluster B personality disorder, poor treatment adherence, more than one lifetime SA, and mood disorders (Irigoyen et al., 2019). In another study on 273 patients with recent SA and followed for 2 years, among whom about 30 % re-attempted suicide, main risk factors of re-attempt were: treatment received, having more than one lifetime SA, post-traumatic stress disorder, substance use disorder, and being smoker (Monnin et al., 2012). Even if some identified risk factors were similar between both studies some of them were different (e.g. smoking status, treatment received). A recent meta-analysis found that at least one in five patients will re-attempt suicide, particularly women, patients with a psychiatric diagnosis, and patients who used self-cutting as SA method (De La Torre-Luque et al., 2023).

Discrepancies between results studies can be explained by the methodology used (e.g. prospective, cross-sectional), population studied (e.g. inpatients, outpatients) and clinical assessments (e.g. medical register, clinical interview). More homogeneous studies are needed to better characterize this population, especially their personality traits, using adapted assessments (e.g. prospective studies with clinical interview) to identify strong risk factors of suicide re-attempt. None of previous studies concomitantly assessed a large panel of clinical symptoms (e.g. depression, anxiety), and the characteristics of the last SA (suicidal intent, lethality), and family history of suicidal behaviors, and personality traits (e.g. emotional lability, anger, hostility) and the associations between these dimensions altogether and risk of re-attempt. This is all the most important since very few studies assess a large panel of personality traits and their association with suicide re-attempt in a population composed only of recent suicide attempter. Yet, some personality traits such as anger, hostility and impulsivity are highly associated with suicidal behaviors (Giegling et al., 2009; Hawkins et al., 2014; Schafer et al., 2022). Furthermore, these personality traits are also highly correlated between them (Giegling et al., 2009; Ramírez and Andreu, 2006) and they also could have an additive effect on future suicidal risk (Oquendo et al., 2004). Thus, assessing association of these personality traits with suicide re-attempt by clustering them allow to also assess this potential additive effect. Altogether, these findings suggest a gap in suicide re-attempts research that could be addressed by more homogeneous research methodologies and a focus on less frequently examined factors like personality traits and family history. Therefore, our study aimed to explore a wide range of potential risk factors—including demographic data, familial history, clinical and SA characteristics, personality traits, and the additive effect of personality traits—over a 2-year follow-up period. This study, by comprehensively assessing these variables together, allows to identify a more accurate profile of patients at elevated risk for future SAs, acknowledging that certain personality traits may have an additive effect on this risk. By considering these diverse aspects, our study could provide valuable insights into the complex nature of suicidal behavior and re-attempts. The integration of personality traits acknowledges the multifaceted nature of suicidal behavior.

2. Materials and methods

2.1. Design and study population

This was a large, prospective, multicentric cohort of 545 adult (≥ 18 -year-old) French Caucasian patients consecutively and voluntarily hospitalized between 1999 and 2012 after a SA in specialized psychiatric wards for affective episodes in three French university hospitals: Montpellier ($N = 261$), Créteil ($N = 129$), and Nancy ($N = 155$). SA was defined as a non-fatal, self-injurious act done with a real intent to end life (not only self-mutilation) (Mann et al., 1999) and that required a pharmacologic treatment or at least a hospitalization. We only considered actual SA and did not include aborted or interrupted SA. Moreover, since the main initial purpose of this cohort was to perform genetic analysis, each patient's four grandparents needed to be from a Western European country (for genetic analysis purposes). Patients underwent a clinical examination and filled in standardized questionnaires at inclusion and at month 6, 12, 18, and 24 of the follow-up. Thus, inclusion criteria were: being currently hospitalized for a recent SA, being at least 18 years old, French speaking, and having four grandparents from a western European country.

All participants signed a consent form; patient anonymity was preserved. The local ethics committee (CPP Sud Méditerranée IV, CHU Montpellier, France) approved the study. *The authors assert that all procedures used in this work complied 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.*

2.2. Clinical assessment

The clinical assessment (half-day session) was done in the psychiatric department of the participating hospitals. Patients were included in the study and evaluated during their hospitalization but at distance from the acute episode that led to the hospitalization (i.e. the last days before hospital discharge). This was required for a dimensional assessment not biased by an acute psychiatric condition. There was no predefined interval between the first day of hospitalization and the clinical assessment, and the choice was based only on whether the patient's clinical condition allowed carrying out the assessment. Interviews were performed by trained psychiatrists or trained psychologists and self-report questionnaires were used.

Clinicians collected demographic data, personal and familial history of psychiatric disorders and of suicidal behaviors (number of SA, violent/serious SA). All psychotropic drug types (antipsychotics, antidepressants, anxiolytics) taken were recorded by the practitioner during the clinical assessment using the World Health Organization Anatomical Therapeutic Chemical (ATC) classification system. The Mini International Neuropsychiatric Interview was used for the diagnosis of DSM-IV axis I disorders. After this assessment, clinician and self-rated questionnaires were used to assess different psychiatric dimensions and personality traits.

Scales used to assess psychiatric dimensions:

- 17-item Hamilton Depression Rating Scale (HAM-D) and 13-item Beck Depression Inventory (BDI) (A. T. Beck et al., 1988; Zimmerman et al., 2013) to evaluate depression severity;
- State-Trait Anxiety Inventory (STAI) (Spielberger, 2012) to measure state anxiety. Higher scores indicate higher anxiety.
- Scale for Suicide Ideation (SSI) (A. T. Beck et al., 1979) to assess SI presence and intensity. Higher scores indicate higher current SI.
- Beck Hopelessness Scale (BHS) (Bouvard et al., 1992) to assess hopelessness. Higher scores indicate higher hopelessness.
- Reasons For Living Inventory (RFLI) (Laglaoui Bakhiyi et al., 2017). Higher scores indicate higher reasons for living.

- Childhood Trauma Questionnaire (CTQ) (Bernstein et al., 1997) to assess five dimensions of childhood trauma: physical abuse, physical neglect, emotional abuse, emotional neglect, and sexual abuse.

Current suicidal depression (Nobile et al., 2021) was defined as moderate to severe depression (HAM-D score ≥ 16) and active suicidal ideation (SSI score ≥ 4). Non-suicidal depression was defined by a HAM-D score ≥ 16 and SSI score < 4 .

Scales used to assess personality traits:

- Barrat's Impulsivity Scale (BIS10) (Baylé et al., 2000) to assess three dimensions of impulsivity: motor impulsivity, cognitive impulsivity, and planning difficulty. Higher scores indicate higher impulsivity.
- Buss-Durkee Hostility Inventory (BDHI) (Bendig, 1962) to measure six dimensions of hostility: aggressiveness, indirect hostility, irritability, resentment, suspicion, and verbal hostility. Higher scores indicate higher hostility.
- State-Trait Anger Expression Inventory (STAXI) (Forgays et al., 1997) to assess five dimensions of anger: anger control, anger out, anger in, trait anger, and state anger. Higher scores indicate higher anger.
- Life History of Aggression (LHA) (Dellazizzo et al., 2017) to assesses the number of occurrences of trait aggressive behavior since the age of 13 years. Different forms of aggressiveness are explored: directed toward others (verbal outburst or direct assault), directed toward inanimate objects, and directed toward oneself.
- Affective Lability Scale (ALS) (Harvey et al., 1989; Larsen and Diener, 1987) to assess six dimensions of emotional lability: elation, depression, biphasic affect, anger, anxiety, and anxiety/depression. Higher scores indicate higher emotional lability.
- STAI (Spielberger, 2012) to measure trait anxiety. Higher scores indicate higher anxiety.
- Tridimensional Personality Questionnaire (TPQ) (Le Bon et al., 1998) to evaluate personality. This questionnaire includes three axes: "Novelty Seeking", "Harm Avoidance" and "Reward Dependence".

2.3. Suicidal assessment

The index SA was defined as the last SA before inclusion (*i.e.* the SA before hospitalization). The median number of days between the index SA and patient's clinical assessment was 10 (25th–75th percentile = 7.75–19). The structured, semi-standardized "Columbia Suicide History Form" interview was used to describe the index SA: date of occurrence, precision, nature of the suicidal gesture (means used), context to identify the precipitating factor (*e.g.* marital, interpersonal, and professional conflict). Moreover, the index SA characteristics were evaluated in terms of lethality, impulsivity or premeditation, and motivation (*i.e.* call for help, manipulation of the environment, desire to flee, to die) using the Risk Rescue Rating Scale (RRRS) (Weisman, 1972) and Suicidal Intent Scale (SIS) (Beck et al., 1974). The RRRS assesses the SA lethality, defined as the probability of inflicting irreversible damage. This scale includes ten items (scored 1 to 3): five items describe risk factors (risk score) and five items describe rescue factors (rescue score). A high risk score indicates a more lethal SA, while a high rescue score indicates a more rescuable SA (Berardelli et al., 2022a). High RRRS risk/RRRS rescue ratio indicates high SA lethality. The SIS includes 15 items (scored from 0 to 2, to define the attempt severity) and is divided in two parts: objective circumstances of the SA (planning subscale), and patient's self-reported intentions and expectations regarding the SA (conceptualization subscale). High SIS scores (sub-scores and total scores) indicate high intent to die.

Moreover, age at first SA, number and type (*i.e.* violent, serious) of SA were recorded. SA by hanging, wrist-cutting, defenestration and firearm were considered as violent. SA leading to hospitalization in an intensive care unit or to bodily harm were considered as serious SA.

The occurrence of a new SA or death by suicide was assessed as follows:

- Direct question to the patient by the investigator during the follow-up visits
- Telephone call to the patient, if patient was absent at a follow-up visits
- Telephone call to the attending physician or the treating psychiatrist
- Hospital admission files for patients admitted due to SA (hospitalization in the emergency room, in a psychiatric/other service)
- For patients lost to follow-up or deceased, the Epidemiology Center on Medical Causes of Death (CEPIDC) was contacted to confirm the possible death and determine its cause. CEPIDC mission is to maintain the database of medical causes of death. This database is built using the information provided by the certifying practitioner in the death certificate.

Since the aim of this study was to assess association between multiples characteristics and suicide re-attempt, we decided to pull all re-attempt together (*i.e.* completed suicide and SA). Moreover, the number of deaths by suicide ($N = 6$) was too small to be analyzed separately.

Treatment change was assessed at each follow-up visit. However, since most of re-attempt were realized before the visit of 6 months (> 50 % of re-attempters) it was not possible to include change of treatment as a variable in the model. Indeed, date of treatment change was unknown, thus it was not possible to know if the treatment change occurs before or after the re-attempt. However, adherence to treatment was assessed at the follow-up visit at 6 months by clinicians with the question: "Was the adherence to treatment good these last 6 months".

2.4. Statistical analysis

Associations between socio-demographic and clinical characteristics, as well as personality traits at baseline and the occurrence of a new SA were examined using Cox regression. Hospital site and variables associated with the occurrence of a new SA at $p < 0.10$ in the univariable analysis were introduced in multivariable model to identify independent predictors of a new SA, estimating hazard ratios (HR) and their 95 % confidence intervals (CI). The choice of a 0.10 p -value cut-off was based on recommendations suggesting that the 0.05 threshold cannot identify variables known to be important (Hosmer et al., 2008).

The proportional hazards assumption was tested using Shoenfeld residuals. For patients reporting a new SA, the day of SA occurrence was recorded. Participants without a new SA during follow-up were censored at the last follow-up visit.

Given the high correlation among trait variables, a cluster analysis was used to reduce the variable set to a smaller representative subset. This method identified groups of variables that were correlated within themselves and minimally correlated with variables in other clusters. One variable from each cluster, displaying high correlation within its own cluster and low correlation with other clusters, was selected for inclusion in the multivariable model using the minimum R-square ratio. To facilitate the interpretation, the most representative variable of each cluster was divided into tertiles, categorizing patients into low, medium, and high levels.

The significance level was set at (two-sided) $p < 0.05$. Analyses were performed using SAS-version 9.4 (SAS Inc., Cary, NC, USA).

3. Results

Among the 545 inpatients recruited at the three hospitals, 80 (14.7 %) did not fill any self-report questionnaire at inclusion, and 86 (15.8 %) did not come to any follow-up visit, did not answer to telephone call, were not on CEPIDC files and did not come back to the hospital (and therefore no data on new SA). Thus, these patients were excluded from the analysis since it was either not possible to have all assessment of

personality traits or either having data on a new SA (main judgment criteria). After exclusion of these patients, the study sample consisted of 379 patients whose median age was 44.7 years [range = 18.1–72.6] and among whom 65.56 % were women. Patients excluded from the study ($n = 166$) were more likely to be men, with a level of school lower, had less frequently bipolar disorder, and higher BIS10 and BDHI total scores (Supplementary Table 1).

During a median follow-up of 1.7 years [IQR = 0.6–2 years], 100 (26.4 %) patients reported a new SA and 6 (1.6 %) died by suicide. The baseline sociodemographic and clinical characteristics of patients without ($N = 273$) and with ($N = 106$) and new SA during the follow-up are summarized in Table 1. The risk of new SA was higher in younger patients, without children, unemployed, with anxiety, with eating and alcohol disorders, with history of ≥ 2 SA, with first SA at younger age and non-violent SA. Psychotropic drug intake was not different between groups as well as adherence to treatment during the first 6 months of follow-up.

Depression/anxiety severity, characteristics of the index SA, and personality traits in patients with and without new SA during the follow-up are reported in Table 2. The risk of new SA was higher in patients with higher BDI score and especially in those with current suicidal depression (i.e. moderate to severe depression with current SI). Higher STAI-State (state anxiety), SSI (current suicidal ideation), and BHS scores and also higher RRRS-Rescue score were associated with the risk of new SA. STAI-Trait and ALS-Anxiety scores were higher in patients with than without new SA ($p = 0.002$ and 0.01 , respectively). Impulsivity also tended to be higher in re-attempters (higher BIS10-Motor impulsivity and total scores; $p = 0.05$ and 0.06 , respectively). Similarly, the scores of all scales assessing traits linked to an “angry” personality (LHA, STAXI total and subscale scores) and irritability (BDHI-Indirect hostility, Irritability, and total score) were higher in patients with than without new SA. Re-attempters also had higher TPQ-Harm avoidance and Novelty seeking scores.

The cluster analysis revealed three distinct clusters: Cluster 1, including LHA Total score, BIS10-Motor impulsivity, STAXI-Anger control, STAXI-Anger-out, STAXI-Trait anger, STAXI-State anger, TPQ-Noveltly seeking, BDHI-Verbal hostility, BDHI-Irritability scores; Cluster 2, consisting of STAI-Anxiety trait, STAXI-Anger-in, and TPQ-Harm avoidance scores; and Cluster 3 including only ALS-Lability in anxiety score. The personality traits that explained the highest proportion of variance within each cluster were STAXI-Trait anger score, STAI-Anxiety trait, and ALS-anxiety score (Fig. 1). The effect of these three factors on a new SA was found to be additive (HR = 4.66 95%CI = [2.24;9.73] for patients with two high scores and HR = 4.68 95%CI = [2.32;9.46] for those with the high scores) (Table 3).

In contrast, no association was observed between a new SA and RFLI total score or different CTQ scores, except for the sexual abuse sub-score (Table 4).

In the multivariable analysis, that included the hospital site and variables associated ($p < 0.10$) with the risk of new SA in the univariable analysis, only having no history of lifetime violent SA and having two or three higher levels of personality traits (STAI-Trait, STAXI-Trait anger, and ALS-anxiety scores) were independent predictors of a new SA. There was also a trend for an association between history of childhood sexual abuse and risk of a new SA ($p = 0.07$) (Table 5).

In additional analyses, factors associated with an early new SA were examined (Supplementary Tables 2, 3 and 4). Overall, 55 patients (51.9 % of re-attempters) reported a new SA within 6 months after the index SA. Younger age, comorbid anxiety disorder, no lifetime history of violent SA, younger age at first SA, higher levels of current depression, higher RRRS-Rescue score, higher STAI-Trait (but not State) score, higher TPQ-Harm avoidance score, and three personality traits were associated with early re-attempt. In multivariate analyses that included the hospital site and covariates with a $p < 0.10$, no factor was an independent predictor of early re-attempt maybe due to a too small statistical power or because factors identified do not distinguish early re-

Table 1

Associations between sociodemographic and clinical characteristics and new suicide attempt (SA) during the 2-year follow-up.

Variables	New suicide attempt				HR [95 % CI]	p-value
	No		Yes			
	n	%	n	%		
	N = 273		N = 106			
Sex, women	176	64.47	74	69.81	1.22 [0.80;1.84]	0.35
Age, years ^(1,2)	43.4 (\pm 12.1)		40.5 (\pm 13.4)		0.82 [0.70–0.95]	0.01
Have children, Yes	193	70.70	62	58.49	0.61 [0.42;0.90]	0.01
Education level, ≥ 13 years	122	44.69	41	38.68	0.81 [0.54;1.19]	0.28
In employment						
Yes	196	72.06	61	57.55	1 1.88 [1.24;2.86]	0.01
No	51	18.75	34	32.08	1.29 [0.68;2.45]	
Other	25	9.19	11	10.38		
Smoking status						
Non-smoker	90	32.97	34	32.08	1 1.12 [0.73;1.72]	0.65
Current smoker	133	48.72	55	51.89	0.88 [0.49;1.57]	
Former smoker	50	18.32	17	16.04		
Family history of psychiatric disorders, Yes	164	62.36	67	65.69	1.11 [0.74;1.67]	0.62
Family history of suicidal behavior, Yes	127	47.57	51	50.00	1.17 [0.79;1.73]	0.43
Current major depressive episode, Yes	175	65.06	67	63.81	0.99 [0.67;1.48]	0.97
Bipolar disorder, Yes	68	25.76	35	33.98	1.38 [0.92;2.07]	0.12
Eating disorder, Yes	40	14.81	26	24.53	1.56 [1.00;2.43]	0.048
Anxiety disorder, Yes	193	70.96	85	80.19	1.65 [1.02;2.66]	0.04
Alcohol use disorder, Yes	75	27.68	41	39.05	1.51 [1.02;2.23]	0.04
Substance use disorder, Yes	54	19.78	19	18.10	1.03 [0.62;1.69]	0.91
Psychotic feature, Yes	28	11.11	9	9.18	0.83 [0.42;1.64]	0.58
Age at first suicide attempt, years ^(1,2)	36.58 (\pm 14.41)		32.53 (\pm 14.11)		0.81 [0.70;0.93]	0.003
Number of lifetime SA						
1	139	50.92	36	33.96	1 1.68 [1.02;2.77]	0.02
2	56	20.51	27	25.47	1.85 [1.19;2.88]	
≥ 3	78	28.57	43	40.57	0.50 [0.29;0.88]	0.02
History of lifetime violent SA, Yes	68	24.91	14	13.21	1.32 [0.86;2.01]	0.20
History of lifetime serious SA, Yes	58	21.32	30	28.30	0.93 [0.63;1.39]	0.73
Antidepressant intake on admission, Yes	182	66.67	68	64.15	0.97 [0.61;1.56]	0.92
Mood stabilizer intake at admission, Yes	57	20.88	22	20.75	1.61 [0.84;3.08]	0.15
Anxiolytic/hypnotic intake at admission, Yes	233	85.35	96	90.57	0.52 [0.16;1.64]	0.26
Lithium, Yes	17	6.23	3	2.83	1.42 [0.97;2.08]	0.07
Antipsychotic and neuroleptic intake at admission, Yes	121	44.32	57	53.77		

(1) Continuous variable, expressed as mean (\pm standard deviation).

(2) HR for a 10-year increase.

Table 2
Association of psychopathology symptom severity, characteristics of the last suicide attempt, personality traits with new suicide attempt during the 2-year follow-up.

Variable	New suicide attempt				HR [95 % CI]	p
	No		Yes			
	n	%	n	%		
Thymic state						
BDI score ⁽¹⁾⁽²⁾	14.84 (± 8.66)	18.39 (± 7.93)	1.22		[1.09;1.37]	0.0008
HAM-D score ⁽¹⁾⁽²⁾	11.70 (± 6.06)	12.98 (± 6.52)	1.16		[0.99;1.35]	0.07
Depression						
No	191	72.35	68	66.67	1	0.02
Non suicidal depression	44	16.67	11	10.78	0.76	
Suicidal depression	29	10.98	23	22.55	1.85	
STAI-State ⁽¹⁾⁽²⁾	53.18 (± 13.55)	56.67 (± 13.09)	1.09		[1.01;1.18]	0.02
Severity of the index suicide attempt and hopelessness						
RRRS-Risk score ⁽¹⁾⁽²⁾	8.97 (± 2.61)	8.82 (± 2.42)	0.88		[0.61;1.28]	0.51
RRRS-Rescue score ⁽¹⁾⁽²⁾	11.81 (± 2.57)	12.44 (± 2.07)	1.68		[1.09;2.59]	0.02
RRRS – Risk score x 100/Rescue score ⁽¹⁾⁽²⁾	46.95 (± 9.87)	46.37 (± 9.21)	0.97		[0.87;1.07]	0.48
SIS-Planning score ⁽¹⁾⁽²⁾	6.48 (± 3.45)	6.39 (± 3.25)	0.98		[0.74;1.30]	0.89
SIS-Conceptualization score ⁽¹⁾⁽²⁾	11.56 (± 4.51)	11.36 (± 4.31)	0.97		[0.78;1.20]	0.76
SIS-Total score ⁽¹⁾⁽²⁾	16.75 (± 5.77)	16.67 (± 5.72)	1.00		[0.84;1.18]	0.97
SSI score ⁽¹⁾⁽²⁾	3.64 (± 6.54)	6.99 (± 9.02)	1.23		[1.10;1.38]	0.0002
BHS score ⁽¹⁾⁽²⁾	10.16 (± 5.16)	11.78 (± 4.97)	1.31		[1.08;1.59]	0.005
Personality traits						
STAI-Trait score ⁽¹⁾⁽²⁾	56.08 (± 10.90)	59.73 (± 8.63)	1.16		[1.06;1.28]	0.002
LHA-Total score ⁽¹⁾⁽²⁾	5.62 (± 4.89)	6.69 (± 5.41)	1.20		[1.01;1.42]	0.04
BIS10-Motor impulsivity score ⁽¹⁾⁽²⁾	18.05 (± 8.02)	19.80 (± 8.73)	1.12		[1.00;1.26]	0.05
BIS10-Cognitive impulsivity score ⁽¹⁾⁽²⁾	20.32 (± 6.75)	20.73 (± 7.33)	1.04		[0.90;1.20]	0.59
BIS10-Planning score ⁽¹⁾⁽²⁾	19.02 (± 6.78)	20.38 (± 7.87)	1.13		[0.99;1.29]	0.08
BIS10-Total score ⁽¹⁾⁽²⁾	57.21 (± 17.23)	60.91 (± 19.49)	1.05		[0.99;1.11]	0.06
STAXI-Anger control score ⁽¹⁾⁽²⁾	22.39 (± 4.58)	21.02 (± 4.74)	0.75		[0.61;0.93]	0.0008
STAXI-Anger out score ⁽¹⁾⁽²⁾	15.05 (± 4.80)	16.79 (± 4.42)	1.34		[1.11;1.62]	0.002
STAXI-Anger in score ⁽¹⁾⁽²⁾	21.28 (± 5.41)	22.46 (± 4.39)	1.22		[1.01;1.48]	0.04
STAXI-Trait anger score ⁽¹⁾⁽²⁾	21.87 (± 6.29)	24.19 (± 6.10)	1.26		[1.09;1.47]	0.002
STAXI-State anger score ⁽¹⁾⁽²⁾	18.38 (± 7.12)	20.89 (± 7.52)	1.19		[1.06;1.34]	0.005
ALS-Elation score ⁽¹⁾⁽³⁾	3.43 (± 5.78)	4.17 (± 6.96)	1.03		[0.97;1.09]	0.34
ALS-Depression score ⁽¹⁾⁽³⁾	4.06 (± 6.32)	4.53 (± 7.02)	1.02		[0.96;1.08]	0.59
ALS-Biphasic affect score ⁽¹⁾⁽³⁾	2.79 (± 4.11)	3.65 (± 5.33)	1.07		[0.99;1.15]	0.10
ALS-Anger score ⁽¹⁾⁽³⁾	1.78 (± 2.57)	1.66 (± 1.48)	0.97		[0.81;1.17]	0.76
ALS-Anxiety score ⁽¹⁾⁽³⁾	2.48 (± 3.14)	3.50 (± 4.37)	1.12		[1.02;1.22]	0.01

Table 2 (continued)

	New suicide attempt				
	No	Yes			
	N = 273	N = 106			
ALS-Anxiety-Depression score ⁽¹⁾⁽³⁾	2.87 (± 3.98)	3.27 (± 4.20)	1.05	[0.96;1.15]	0.27
ALS-Total score ⁽¹⁾⁽³⁾	2.78 (± 3.08)	3.42 (± 3.66)	1.09	[0.98;1.20]	0.11
TPQ-Novelty seeking score ⁽¹⁾⁽²⁾	15.91 (± 4.79)	17.03 (± 5.27)	1.22	[1.00;1.49]	0.05
TPQ-Harm avoidance score ⁽¹⁾⁽²⁾	19.25 (± 7.32)	21.43 (± 6.76)	1.23	[1.06;1.42]	0.006
TPQ-Reward dependence score ⁽¹⁾⁽²⁾	17.36 (± 4.17)	17.78 (± 3.95)	1.15	[0.91;1.46]	0.25
BDHI-Aggressivity score ⁽¹⁾⁽²⁾	3.51 (± 2.76)	3.63 (± 2.57)	1.12	[0.78;1.60]	0.55
BDHI-Indirect hostility score ⁽¹⁾⁽²⁾	4.60 (± 2.09)	5.17 (± 1.98)	1.73	[1.06;2.80]	0.03
BDHI-Irritability score ⁽¹⁾⁽²⁾	6.97 (± 2.35)	7.49 (± 2.08)	1.63	[1.04;2.54]	0.03
BDHI-Resentment score ⁽¹⁾⁽²⁾	4.47 (± 2.21)	4.89 (± 2.02)	1.51	[0.94;2.41]	0.09
BDHI-Suspicious score ⁽¹⁾⁽²⁾	5.04 (± 2.34)	5.30 (± 2.44)	1.29	[0.85;1.95]	0.23
BDHI-Verbal hostility score ⁽¹⁾⁽²⁾	6.75 (± 2.44)	7.35 (± 2.57)	1.49	[0.99;2.25]	0.06
BDHI-Total score ⁽¹⁾⁽²⁾	33.88 (± 10.39)	36.76 (± 10.29)	1.13	[1.02;1.24]	0.02

⁽¹⁾ continuous variables are expressed as mean (± standard deviation).

⁽²⁾ HR for a 5-unit increase.

⁽³⁾ HR for a 2-unit increase.

BDI: Beck Depression Inventory; HAM-D: Hamilton Depression Rating Scale; BHS: Beck Hopelessness Scale; STAI: State-Trait Anxiety Inventory; RRRS: Risk Rescue Rating Scale; SIS: Suicidal Intent Scale; SSI: Scale for Suicidal Ideation; LHA: Life History of Aggression; BIS10: Barrat's Impulsivity Scale; STAXI: State-Trait Anger Expression Inventory; ALS: Affective Liability Scale; TPQ: Tridimensional Personality Questionnaire; BDHI: Buss-Durkee Hostility Inventory; HR: Hazard-Ratio; CI: Confidence intervals.

attempt from a later occurrence (data not shown).

4. Discussion

To our knowledge, this is the first study to assess the association between a large panel of suicidal behavior psychopathology dimensions and the risk of new SA in a large cohort of recent suicide attempters followed for 2 years. Moreover, a cluster analysis was performed to identify the personality traits that better characterized our sample because all personality traits were highly correlated. This allowed constructing the “number of personality traits” variable that included at most the three most representative personality traits in the sample (highly correlated with variables from the same cluster and poorly correlated with variables from the other clusters): trait anxiety, anxious lability, and trait anger. This also allowed us to assess the additive effect of having more than one of these personality traits on the risk of re-attempt.

In our study, 26.4 % of the included patients did a new SA during the 2 years of follow-up and 51.9 % of them did it in the first 6 months of follow-up. This is in accordance with other studies that also found ~30 % of re-attempts in the 2 years after the index SA (Grendas et al., 2019; Monnin et al., 2012), mostly in the first 6 months (Irigoyen et al., 2019). These high numbers of early re-attempters highlight the need of a close follow-up after a SA, using for instance brief suicide prevention interventions in which patients after a SA are frequently contacted (e.g. by phone, post-cards) or by establishing a psychiatric follow-up (Doupnik et al., 2020; Duhem et al., 2018). Indeed, initiation of a psychiatric follow-up after discharge has been found to be strongly protective and to

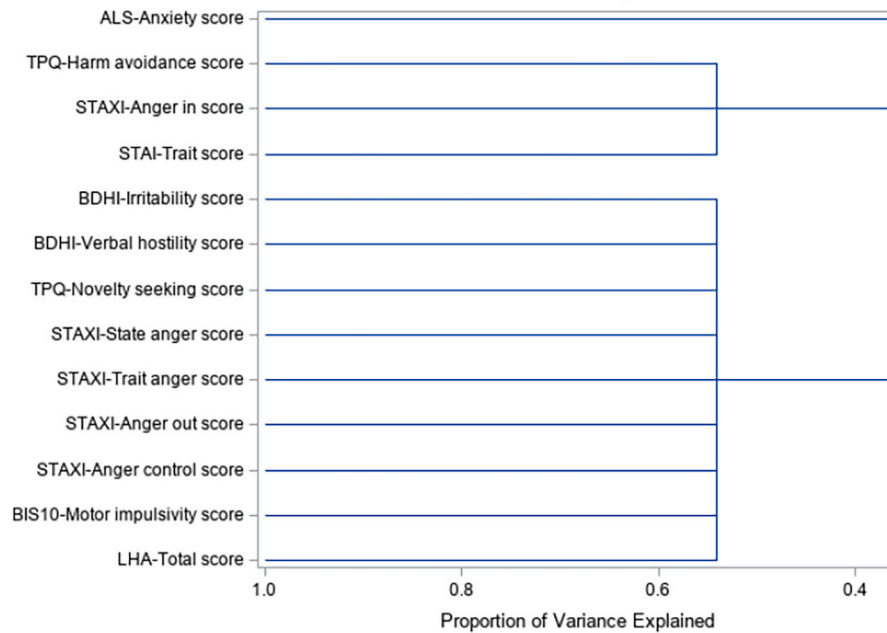


Fig. 1. Dendrogram of the clustering patterns of personality traits and the proportion of explained variance (three clusters explained 100 % of variance). Cluster 1: LHA Total score, BIS10- Motor impulsivity score, STAXI-Anger control score, STAXI-Anger out score, STAXI-Trait anger score, STAXI-State anger score, TPQ-Novely seeking score, BDHI-Verbal hostility score, BDHI-Irritability score; Cluster 2: STAI-Anxiety trait, STAXI-Anger-in, TPQ-Harm avoidance scores; Cluster 3 – ALS-Anxiety score.

Table 3

Association of the most representative personality traits with new suicide attempt during the 2-year follow-up.

Variable	New suicide attempt				HR [95 % CI]	p
	No N = 273		Yes N = 106			
	N	%	n	%		
ALS-Anxiety score (tertile)						
<1.43	87	33.08	17	16.83	1	0.01
[1.43–2.14]	103	39.16	42	41.58	1.74 [0.99;3.06]	
≥2.14	73	27.76	42	41.58	2.39 [1.36;4.19]	
STAI-Trait score (tertile)						
<54	104	38.38	21	20.00	1	0.002
[54–63]	81	29.89	43	40.95	2.48 [1.47;4.18]	
≥63	86	31.73	41	39.05	2.20 [1.30;3.73]	
STAXI-Trait anger score (tertile)						
<19	95	35.71	18	17.65	1	0.004
[19–25]	82	30.83	39	38.24	2.33 [1.33;4.08]	
≥25	89	33.46	45	44.12	2.42 [1.40;4.18]	
Number of personality traits (1)						
0–1	93	35.63	9	9.00	1	<0.0001
2	62	23.75	34	34.00	4.66 [2.24;9.73]	
3	106	40.61	57	57.00	4.68 [2.32;9.46]	

(1) The two highest tertiles of the STAI-Trait score distribution, of the STAXI-Trait anger score distribution and of the ALS – Anxiety Score distribution.

Table 4

Associations between reasons for living, childhood trauma and new suicide attempt during the 2-year follow-up.

Variable	New suicide attempt				HR [95 % CI]	p-value
	No N = 273		Yes N = 106			
	n	%	n	%		
RFLI – Total score	158.07 (± 46.94)		153.76 (± 38.75)		1.00 [0.99;1.00]	0.56
CTQ – Physical Abuse						
None/Low	202	81.45	65	71.43	1	0.07
Moderate/Severe	46	18.55	26	28.57	1.53 [0.97;2.41]	
CTQ – Emotional Neglect						
None/Low	152	59.38	51	53.68	1	0.51
Moderate/Severe	104	40.63	44	46.32	1.15 [0.77;1.72]	
CTQ – Physical Neglect						
None/Low	184	70.23	61	65.59	1	0.50
Moderate/Severe	78	29.77	32	34.41	1.16 [0.76;1.78]	
CTQ – Sexual Abuse						
None/Low	205	79.46	65	69.15	1	0.02
Moderate/Severe	53	20.54	29	30.85	1.72 [1.11;2.67]	
CTQ – Emotional Abuse						
None/Low	161	61.45	51	52.58	1	0.11
Moderate/Severe	101	38.55	46	47.42	1.38 [0.93;2.06]	

RFLI: Reasons For Living Inventory; CTQ: Childhood Trauma Questionnaire; HR: Hazard-Ratio; CI: Confidence intervals.

significantly reduce the risk of dying by a suicide re-attempt (Bostwick et al., 2016). Our analysis identified several characteristics associated with suicide re-attempt: younger age, being single, unemployed, higher

Table 5
Multivariable proportional hazards model of potential predictors of new suicide attempt.

Variable	HR [95 % CI] ⁽¹⁾	p ⁽¹⁾
Age, years, for 10-year increase	0.85 [0.65–1.10]	0.21
Children, Yes	1.15 [0.59;2.26]	0.68
In employment		
Yes	1	0.18
No	1.65 [0.94;2.88]	
Other	1.48 [0.64;3.41]	
Eating disorder, Yes	0.77 [0.40;1.46]	0.42
Anxiety disorder, Yes	0.90 [0.48;1.69]	0.74
Alcohol use disorder, Yes	1.04 [0.61;1.80]	0.88
Number of lifetime SA		
1	1	0.94
2	1.11 [0.59;2.08]	
3 or more	1.10 [0.58;2.08]	
History of lifetime violent SA, Yes	0.45 [0.21;0.99]	0.04
Antipsychotic and neuroleptic intake at admission, Yes	0.97 [0.59;1.61]	0.91
Depression		
No	1	0.87
Non-suicidal depression	1.08 [0.48–2.41]	
Suicidal depression	1.22 [0.56–2.63]	
STAI-State score, for 5-unit increase	0.95 [0.84;1.07]	0.36
RRRS-Rescue score, for 5-unit increase	1.11 [0.59;2.09]	0.76
SSI score, for 5-unit increase	1.06 [0.86;1.31]	0.56
BHS score, for 5-unit increase	1.26 [0.91;1.74]	0.16
Number of personality traits (anxiety, anger, anxious lability)		
0–1	1	0.002
2	6.40 [2.30;17.84]	
3	4.73 [1.67;13.39]	
CTQ-Sexual Abuse, Moderate/Severe	1.71 [0.97;3.03]	0.07
CTQ-Physical Abuse, Moderate/Severe	1.14 [0.65;2.03]	0.64

⁽¹⁾ Adjustment for study hospital site.

SA: suicide attempt; STAI: State-Trait Anxiety Inventory; RRRS: Risk Rescue Rating Scale; SSI: Scale for Suicidal Ideation; BHS: Beck Hopelessness Scale; CTQ: Childhood Trauma Questionnaire.

numbers of psychiatric comorbidities (specifically anxiety, eating and alcohol use disorders), higher numbers of lifetime SA, and higher levels of hopelessness, SI, and depression. As most of these clinical characteristics have been associated with suicide re-attempt in previous studies (Aguglia et al., 2020; Irigoyen et al., 2019; Monnin et al., 2012; Parra-Urbe et al., 2017), patients presenting these characteristics should be carefully monitored. Moreover, patients with suicide re-attempt had higher RRRS-rescue score at the index SA, suggesting that multiple attempters tends to present more often rescue behaviors when attempting suicide (e.g. location, accessibility to rescue) (Chawla et al., 2022). However, there were no differences between groups when analyzing the RRRS risk ratio, meaning that there were no differences between lethality of the index SA between groups.

Interestingly, having history of non-violent SA was associated with suicide re-attempt during follow-up. This raises the question of access to lethal means. Indeed, non-violent SA corresponds to deliberate self-poisoning (DSP) and patients mainly used their current treatments (available at their home) to commit suicidal act since it is easy of access. It has been found that risk factors of the choice of a non-violent or a violent method are partly circumstantial factors temporally close to the SA such as access to a method (Stenbacka and Jokinen, 2015). Thus, restricting access to treatments by implementing weekly fractioned delivery of their medication (in collaboration with pharmacist) or having a nurse for daily medications delivery could reduce suicide risk. This is all the most important since it has been showed that following a DSP patients are at very high risk of death by suicide (Finkelstein et al., 2015).

In addition, suicidal depression (i.e. moderate to severe depression with current SI) was associated with suicide re-attempt. Growing evidence suggests that suicidal depression could be a specific depression subtype with its own clinical characteristics and higher risk of suicidal

behavior (Nobile et al., 2020, 2021, 2022). Although not significant in the multivariate model (probably due to the small number of patients with current depression), it is interesting to note that patients with current suicidal depression were at higher risk of new SA. This reinforces the necessity of rapidly acting treatments for patients with current suicidal depression (e.g. ketamine) to limit the suicide risk (Courtet et al., 2020). This is all the most important since close to 60 % of patients died at their first SA, high lightening the necessity and the emergency to rapidly act on SI to prevent the transition from SI to SA (Bostwick et al., 2016).

Most of the assessed personality traits were associated with suicide re-attempt. According to the cluster analysis, the three most representative personality traits of suicide attempters (whole sample) were: trait anxiety, anxious lability, and anger. Analysis of the variable “number of personality traits”, which was composed of these three personality traits, showed that having two or three of these traits was associated with a 4.66- and 4.68-fold higher risk of re-attempt, respectively, compared with having none or only one of these traits. Anger has been already associated with suicidal risk (Hu et al., 2023; Schafer et al., 2022), although the underlying mechanisms remain unclear (Hawkins et al., 2014). One possible hypothesis is that anger is associated with suicidal behavior via perceived burdensomeness and thwarted belongingness, two major components of the interpersonal theory of suicide (Hawkins et al., 2014). Anxiety is a known risk factor of suicidal behavior. Some studies found that comorbid anxiety disorder is associated with more than a 2-fold higher risk of suicidal behavior and SI, independently of other psychiatric comorbidities (Batterham et al., 2013; Boden et al., 2007; Kanwar et al., 2013). In our study, trait anxiety was one of the most representative personality traits of suicidal patients, and a risk factor of re-attempt. State anxiety and having a comorbid anxiety disorder also were associated with the risk of suicide re-attempt (in univariate analysis), suggesting a strong link between anxiety (trait, state, and comorbid anxiety disorder) and new SA. To support this, the third personality trait the most representative of our sample and associated with re-attempt was anxious lability. Anxious lability can be seen as the proneness to the rapid shift from non-anxious to anxious state (Aas et al., 2015). Thus, not only trait and state anxiety seem to have a major role in suicide re-attempt but also the rapid shift from a non-anxious to an anxious state. Trait anxiety was the only personality trait associated with early re-attempt (within 6 months), reinforcing the importance of this dimension.

The only childhood trauma significantly associated with suicide re-attempt was sexual abuse, and there was a trend for physical abuse. All childhood trauma types are associated with increased suicidal risk; however, physical and sexual abuse seem to be directly associated with suicidal behavior while emotional abuse, neglect and physical neglect seem to be indirectly associated (Berardelli et al., 2022b; Ernst et al., 2022). In a study on 215 adult psychiatric inpatients, sexual abuse directly affected SI, while emotional abuse and neglect indirectly increased SI via other factors (i.e. hopelessness and dissociation) (Berardelli et al., 2022b).

Our multivariable analysis indicated that the two strongest risk factors of suicide re-attempt were history of non-violent SA and having at least two of personality traits among trait anxiety, anger, and anxious lability (6.4- and 4.7-fold higher risk for two and three of these traits, respectively). This result showed an additive effect of these personality traits on suicidal risk within suicidal patients from one to two personality traits, that is a quite novel finding, since none of the previous studies cited assessed this additive effect within patients with recent SA. In addition, these factors are associated with the risk of re-attempt, independently of psychiatric comorbidity (e.g. alcohol use disorder), number of lifetime SA, hopelessness, depression, and SI severity at inclusion. This result also suggests that most of factors known to be associated with suicidal risk (e.g. number of lifetime SA) diminished in importance when taking into account number of personality traits and history of non-violent SA. This result is of great importance since most of

the studies on suicidal patients, as well as clinician, focused on patients with risk factors such as higher number of lifetime SA while they may should focused on personality traits and their additive effects on suicidal risk. The analysis focused on early re-attempters (in the first 6 months) showed that the risk of early re-attempt was strongly associated with having all three personalities traits. Thus, clinicians should closely follow recent suicide attempters with history of non-violent SA and trait anxiety and/or anxious lability and/or anger. In other words, clinicians should treat the comorbid psychiatric disorder(s) and evaluate personality traits to reduce the risk of suicide re-attempt. In that way, in addition to pharmacological treatments, clinicians could offer appropriate cognitive behavioral therapy focused on these personality traits, especially anxiety, to reduce suicidal risk. Furthermore, even if not measured in our study, psychological pain is also a major component in pathophysiology of suicidal behavior (Pompili, 2024). Thus, it is important to note that in addition to identification of personality traits associated with suicide re-attempt, it is primordial for clinicians to explore the source of patients' sufferance by establishing an empathic relation with their patients (Pompili, 2024). Finally, in addition to psychometric assessment research should focus on potential biomarkers in suicidal behaviors such as inflammatory markers or autonomic nervous system (ANS) (Lengvenyte et al., 2019; McCall et al., 2021, 2022). Indeed, for example, measures of ANS have been shown to be a promising biomarker of suicidal behaviors and could be easy to implement in clinical practice (McCall et al., 2021, 2022). It could be also interesting to assess the relation between physiologic hyperarousal observed in suicidal patients and personality traits found to be predictors of suicide re-attempt to better understand suicide pathophysiology.

Our study presents some limitations. First, 166 patients were excluded from the analysis because they were lost to follow-up ($N = 86$) or did not fill in any questionnaire ($N = 80$). This reflects the difficulty for suicidal patients to adhere to care. Indeed, it is important to note that some patients did not come to follow-up visit of the current study but came back for their clinical follow-up allowing us to collect data on the occurrence of the new SA. Here, patients who were lost to follow-up did not even come back for their clinical follow-up. Importantly, patients with poor care adherence are at higher risk of suicide re-attempt or death by suicide (Qin et al., 2022). This strengthens the need of a closer follow-up, such as through brief suicide interventions, as previously proposed (Doupnik et al., 2020). Moreover, the presence of borderline personality disorder was not assessed in our sample, although it can be associated with suicide re-attempt (Irigoyen et al., 2019). However, personality traits known to be representative of borderline personality disorder (e.g. emotional lability, impulsivity, anger) (Edwards et al., 2021; Turner et al., 2017) were investigated. Furthermore, suicidal behavior must be seen as a transdiagnostic phenomenon. Therefore, the suicide risk should be assessed beyond the psychiatric diagnosis. Sleep disturbances were not assessed in our study while insomnia is highly associated with suicidal behaviors (Geoffroy et al., 2021), it could have been interesting to have this measure. Future studies on suicide re-attempt should incorporate sleep measures in their assessment. Then, we did not differentiate death by suicide from SA partly due to the few numbers of death by suicide during follow-up. However, a death by suicide is a succeeded SA thus when assessing recurrence of a new SA, including also death by SA does not seem illegitimate. Finally, possible treatment changes during the follow-up, that might influence the suicidal risk, were not included in our analysis. Indeed, it was impossible to know if this change occurs before or after a large number of re-attempt, since treatment change was assessed at 6 months and a large part of re-attempt occur before 6 months. However, no difference in treatment at inclusion was observed between participants with/without suicide re-attempt. Future studies including this parameter is needed. Our study presents some strengths. Among them, the large sample of patients included in the analysis: almost 400 inpatients who recently attempted suicide with many data on personality traits, clinical characteristics, and index SA characteristics. Lastly, the cluster analysis to overcome the

important correlation among personality traits led to the identification of the three most representative personality traits of suicidal patients and also allow us to demonstrate the additive effect of these personality traits on suicidal risk rather having only one of them.

In conclusion, our study shows that clinicians must systematically assess the presence of lifetime non-violent SA, trait anxiety, anger, and anxious lability in recent suicide attempters because these variables are strong risk factors of suicide re-attempt in the middle term (2 years). Patients presenting these characteristics should be closely followed a SA and should benefit from specific interventions to target these personality dimensions such as cognitive behavioral therapy focused on these dimensions, especially anxiety. Finally, implementation of weekly fractioned delivery of medications for patients who did DSP should be considered.

CRediT authorship contribution statement

B. Nobile: Writing – original draft, Conceptualization. **I. Jaussent:** Writing – review & editing, Methodology. **J.P. Kahn:** Writing – review & editing, Investigation, Conceptualization. **M. Leboyer:** Writing – review & editing, Investigation, Conceptualization. **N. Risch:** Writing – review & editing. **E. Olié:** Writing – review & editing. **Ph. Courtet:** Writing – review & editing, Supervision, Investigation, Conceptualization.

Declaration of competing interest

None of the authors declare conflict of interests related to this manuscript.

Data availability statement

Due to ethical and legal restrictions, data involving clinical participants cannot be made publicly available.

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Author contribution

BN contributed to data interpretation and wrote the manuscript. IJ performed statistical analysis and contributed to the writing. EO and NR contributed to the writing. ML and JPK contributed to patients' recruitment and to the design of the study. PC designed the study, contributed to data interpretation and to the writing of the manuscript. All Authors have contributed to the manuscript and have accepted the final version of the paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jad.2024.04.058>.

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