



Repeating a suicide attempt during adolescence: risk and protective factors 12 months after hospitalization

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Abstract

Suicide attempts (SAs) are a public health concern in adolescence. A brief hospitalization is recommended, but access to inpatient wards is often not available. In addition, numerous risk factors for SA recurrence have been identified, but few studies have explored protective factors. Here, we aimed to assess the role of both risk and protective factors on SA relapse in a context of free access to inpatient services. We performed a prospective follow-up study of 320 adolescents who were hospitalized for an SA between January 2011 and December 2014 in France. Assessments at baseline included socio-demographics, clinical characteristics, temperament, reasons for living, spirituality, and coping. Patients were re-evaluated at 6 months and 12 months for depression severity and SA relapse. A total of 135 and 91 patients (78 girls, 12 boys, aged 13–17) were followed up at 6 and 12 months, respectively. At the 12-month follow-up, 28 (30%) subjects had repeated an SA. Adolescents who either had a history of SA or were receiving psychotropic treatment at baseline were at higher risk of recurrence. Several variables had a protective effect: (1) productive coping skills, namely, *working hard and achieving*, *physical recreation*, and *seeking relaxing diversions*; (2) a particular temperament trait, namely, *cooperativeness*; and (3) having experienced more life events. We also found a significant interaction: the higher the depression score during follow-up, the lower the protective effect of productive coping. Our findings confirm that a history of SA and seeking psychiatric care with medication are risk factors for SA relapse. However, productive coping strategies and cooperativeness are protective factors, and the improvement of such strategies as well as treatment of persisting depression should be a goal of psychotherapy treatment offered to suicidal adolescents.

Keywords Suicide attempt · Suicidal behaviour · Cohort study · Adolescent · Protective factor · Coping

Angèle Consoli and Priscille Gerardin have equally contributed to the study.

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Introduction

Suicide is the second leading cause of death worldwide after road accidents in young people aged 15–24 years [1]. A history of suicide attempts (SAs) has consistently been found to be one of the strongest predictors of future attempts [2] and death by suicide [3]. In a large European

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adolescent sample, Hulten et al. [4] showed that a history of previous attempted suicide was the most important independent predictor of repetition. The first months after an SA have been identified as a period of high risk for recidivism [5–7]. The risk of dying by suicide or of making another SA has been estimated to be as high as 100 times greater than for those who have never made an attempt [8]. However, most young people who attempt suicide do not try again and do not die by suicide. Thus, the risk factors associated with an occasional SA may differ from those associated with repeated SAs. Moreover, recent data have emphasized the role of protective factors associated with the repetition of suicidal behaviours [9]. Protective factors have a moderating effect which minimizes the impact of the risk factor(s) [10, 11]. In a developmental approach combining stress vulnerability and resilience, the evaluation of risk factors remains crucial, because any factor is only protective insofar as it moderates the impact of the risk factor(s). In any individual, protection and vulnerability interact in an inversely proportional manner. Thus, faced with a risk situation, the individual will produce a more positive response if the “protection” pole is dominant and a more negative response if the “vulnerability” pole is dominant [9].”

Vulnerability is linked to life-long traits such as a personal or family history of SB [3], early adversity such as childhood sexual abuse [11], family dysfunction [12], serotonin dysfunction [13], and stress regulation by the hypothalamo-pituitary-adrenergic axis [14], as well as certain deficits in emotional, cognitive or metacognitive processes [15]. Social factors include social isolation and victimization via bullying [16], sexual discrimination [17] poor social adjustment and low peer connectedness [18]. Among the psychiatric disorders, the strongest associations have been found with all mood dysfunctions, including major depression, dysthymia and bipolar disorder [6, 19–21]. Prospective studies have shown that the risk of suicidal recurrence is increased with the severity of the initial depressive symptoms [6, 22, 23], a family history of mental health problems [24], family conflict [19], poor family cohesion [23], or borderline personality disorder [25]. Furthermore, alcohol and substance abuse or conduct disorder are also independent risk factors [18, 26]. It appears that the risk of recurrence seems to be linked more to the severity of the risk factors usually associated with suicidal behaviour than to any specific risk factors. However, we have found few prospective studies of adolescent clinical populations that evaluate suicidal behaviour. At the 3-month follow-up (FU), Spirito et al. [27] reported a 12% repeat attempt rate. At 6 months, Brent et al. [6] found a recidivism rate of nearly 15%, Consoli et al. [28] 14% and Yen et al. [29] 18%. At 12 months, King et al. [24] found a 25% rate of re-attempters in a cohort of 352 adolescents. At 5-year follow-up after hospitalization

for SA, recidivism rates vary from 30 to 54%, depending on the authors [30–32].

Furthermore, few studies using a longitudinal design, however, have focused on the protective factors in a high-risk clinical population [28, 33]. In one of the rare available studies in an adolescent clinical population, Consoli et al. [28] identified a positive coping strategy “hard work and achievement” as a protective factor for suicidality at 6-month FU. From general adolescent population samples and transversal inpatient studies, it is hypothesized that productive coping strategies [34], reasons for living [35], social support [36] and spirituality [9] may be protective factors against SA.

In addition to the understanding of the risk and protective factors of SA, in many countries, adolescent psychiatry faces issues regarding access to care. Free access to care is available in a minority of countries worldwide. In addition, specialized clinics for adolescents are not always available [37]. To prevent SA relapse, a brief hospitalization is recommended by many guidelines [38, 39] but access to inpatient wards is not possible in many locations due to economic pressure or lack of services.

The current naturalistic-prospective FU study aims to deepen our knowledge by examining the risk and protective factors associated with SA relapse in a high-risk sample of adolescents in the French context of free access to inpatient services. To ensure the availability of an inpatient ward for adolescents, we selected 5 sites that offered this service. We included 320 adolescents and followed up 135 patients at 6 months and 91 patients at 12 months. We built our model on our previous findings on a smaller sample and a 6-month FU [28] by examining interrelations between risk factors and protective factors in accounting for SA relapse within multivariate and mediational models, thereby providing a more thorough analysis of the processes underlying suicidality in this high-risk sample. Based on the existing literature on clinical populations, we assumed that we would be able to reproduce the effects reported in previous studies for the main risk factors. We also hypothesized that protective factors, including greater reasons for living, productive coping skills and spirituality, would be associated with a lower risk of recurrence at 12-month FU.

Method

Participants

The participants were 320 adolescents aged 13–17 who were hospitalized for a suicide attempt in five paediatric departments (Rouen, Amiens, Crépy, Creil, and Meaux) between January 2011 and December 2014. The length of hospital stay was 5 days on average. The hospitals were located in

two French administrative regions which included both urban and rural areas. All children and adolescents who visit an emergency department for a suicide attempt are hospitalized according to the French National Clinical Practice Guidelines. Self-harm behaviour without suicidal intent was not considered an SA. After discharge from the hospital, subjects were reassessed at 6 and 12 months. The mean age of the sample at baseline was 14.73 years ($SD = 1.29$).

Procedure and design

During hospitalization, the patients were evaluated by a senior psychiatrist. Participation in the study was systematically proposed to all adolescents who attempted suicide and met the inclusion criteria (ability to understand and give written consent, absence of intellectual disability, absence of any obvious organic disorder, and a home address within the geographical area of each included centre). If the written consent of the adolescent and both parents was obtained, they were contacted by the research team. The research team was made up of senior psychiatrists and psychiatry residents trained in the use of measurement scales and semi-structured interviews. The protocol was explained to each adolescent and his/her parents. It was possible for them to opt out of the study at any time. Ethics approval was obtained for the study from the North West I (Charles Nicolle CHU—University Teaching Hospital) Group Ethics and Medical Research Committee (2010 A00 330 - 39). Figure 1 shows the study's flow diagram. A total of 398 patients were eligible for the research programme, with 320 being included. There was no difference between the participating and non-participating groups in terms of age (participants = 14.7 years vs. refusals = 14.4 years) or gender (female participants = 83% vs. female refusals = 79%). At 6 months, 135 adolescents participated in the clinical assessment. At 12 months, 91 adolescents completed the final assessment.

Measures

Psychiatric disorders based on the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV) were determined using the Scale of Mood Disorders and Schizophrenia for Children and Adolescents of School Age, Current and Past Episodes version (Kiddie-SADS-PL) [40]. Depressive symptoms were also quantified using the Beck Depression Inventory-II (BDI-II), which quantifies the severity of depressive symptoms over the preceding 2 weeks [41]. We created a Beck Depression Composite score to assess depressive symptoms over the entire FU period. It was defined as the number of positive depression scores (BDI II scores ≥ 21) at baseline, 6-month and 12-month FU.

The Columbia-Suicide Severity Rating Scale (C-SSRS) [42] was used to quantify the severity of suicidal ideation

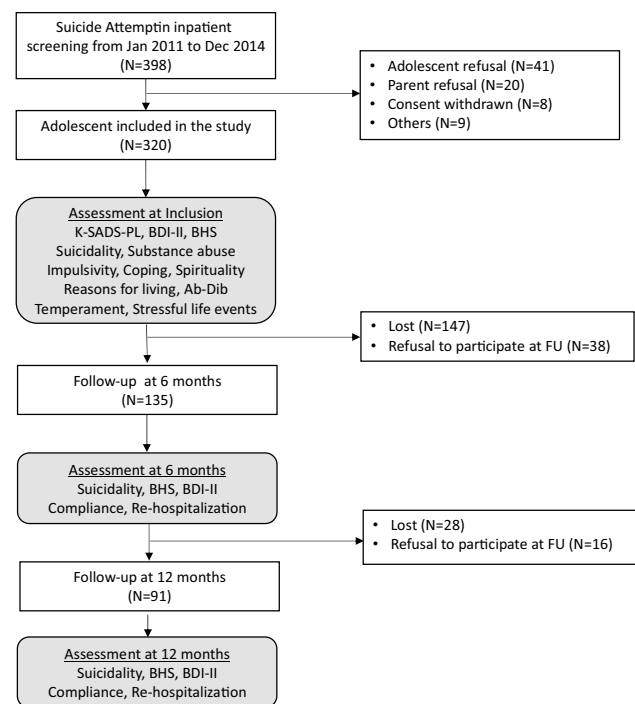


Fig. 1 Flow diagram of the study

and behaviour. This scale assesses suicidal behaviour and suicidal intentionality. It was completed by the clinician based on clinical interviews conducted with the adolescents. The Beck Hopelessness Scale (BHS) [43], a self-report scale for use in measuring hopelessness, is composed of 20 true/false items. This scale assesses levels of hopelessness in subjects in the 2 weeks preceding their hospitalization. We created a Beck Hopelessness Composite score to assess hopelessness symptoms over the entire FU period. We considered all BHS scores ≥ 9 at baseline, 6 months and 12 months. C-SSRS and BHS were repeated at FU assessments.

Borderline personality disorder (BPD) was assessed by the abbreviated diagnostic interview for borderlines (Ab-DIB) [44]. This self-questionnaire for 12–21 years covers the affective, cognitive and impulsive components of BPD. It demonstrates very good reliability and good convergent validity with the DIB-Revised. Impulsivity was assessed using the impulsivity section of the Eysenck Questionnaire [45]. We also explored life events using the Newcombe's Life Event questionnaire [46]. This 39-item self-questionnaire was developed to assess the stressful situations experienced by adolescents (14–18 years). Substance use and misuse were assessed with the Dependence Questionnaire for Adolescents (DEP-ADO) [47], self-esteem with the Rosenberg Self-Esteem Rating Questionnaire [48] and attachment style with Relationship Scales Questionnaire (RSQ) [49]. Temperament was assessed using the Temperament and Character Inventory (TCI) 56-item version [50],

a French version for youths of the original Cloninger TCI for adults [51] developed by a Swiss team and validated in a sample of 211 people aged 15–30. The Reasons for Living Inventory for Adolescents (RFL-A) was developed and validated by Osman et al. [52]. The inventory comprises 32 items grouped under 5 subscales: family alliance, suicide-related concerns, self-acceptance, peer acceptance and support, and future optimism. Labelle et al. [53] translated the adult version into French, and the instrument was recently validated among adolescents with depression and suicidal behaviour [54]. We also used Delaney's spirituality scale [48]. The construct of spirituality proposed by Delaney [55] is broad. It goes beyond religious practices and encompasses 3 key relational aspects: connection with self (personal), with others (interpersonal), and with the divine (transpersonal). Finally, we assessed coping. The Adolescent Coping Scale (ACS) was designed and validated for adolescents aged 12–18 [56]. The ACS assesses the specific behaviours used to cope with a situation or to solve a problem. This instrument comprises 77 items grouped into 18 subscales representing 18 specific coping strategies. According to the instrument manual, the 3 coping styles (productive coping, non-productive coping and reference to others) show sufficient internal coherence to justify their separate subscales (with alphas ranging from 0.62 to 0.75). A French translation of the ACS was validated in 492 adolescents in the general population [57].

Statistical analysis

The outcome variable of interest was a repeated SA during the 12-month FU period after a first suicide attempt at baseline based on C-SSRS. We first performed univariate analysis of the variables of interest between the two groups, namely, those who did not repeat SA and those who did. For continuous variables, we used either Student's *t* test (if assumptions of normality were met) or the Wilcoxon rank sum test. For binary variables, we used either the Pearson χ^2 test (if assumptions of normality were met) or the Fisher exact test. In the second phase, we modelled the main outcome using logistic regression. Variables were selected by first choosing variables to be forced into the model ("age at admission", "gender", "Beck depression composite score" and "number of suicide attempts"). Variables that were significant or almost significant in univariate analysis ($p < 0.1$) were then added into the model. We checked that the model did not overfit, using classical rules of thumb. Missing values were handled using random forest imputation (R *missForest* package). Variables used for the imputations were the outcome, selected variables and some auxiliary variables. Auxiliary variables were used to make the missing-at-random assumption required by multiple imputation methods more plausible. Auxiliary variables were either variables

correlated with model variables with missing data and/or variables correlated with their pattern of missingness. In statistical analyses, a significance level of 0.05 was applied. The statistical packages SPSS Release 16.0.2 [58] and R 3.4.0 were used for the analyses.

Results

Missing data and characteristics of the sample

Of the 320 suicidal adolescent inpatients initially included, 135 were followed up at 6 months. As the study was constructed to build a 1-year FU model, 290 (90%) adolescents from the baseline sample were re-contacted for evaluation at 12 months. Of these, 29 (10%) explicitly refused to continue the study, 170 (59%) were lost to FU, and 91 (31%) completed the evaluation. Given the low retention rate, we compared those with and without FU data across all predictor variables. Those who dropped out were more likely to have higher scores on the Beck Hopelessness Scale [mean (SD) 9.75 (5.46) vs. 8.22 (5.79), $p = 0.032$] and the Beck Hopelessness Composite score [1.42 (1.08) vs. 0.78 (0.81), $p = 0.046$]. In addition, those who failed to complete the study had a lower score on "work hard and achieve" productive coping [60.54 (16.68) vs. 65.93 (17.53), $p = 0.021$] and "self-awareness" and "collective consciousness" (Spirituality Scale) [13.91 (5.13) vs. 15.36 (4.79), $p = 0.027$]. No other variables were significantly different, including psychiatric disorders (K-SADS-P) and suicidal behaviour characteristics of (C-SSRS). The main demographic and clinical characteristics of the total sample are shown in Table 1 and the dimensional variables in Table 2. A total of 112 participants (35%) had a history of a prior suicide attempt, of which 53 (16.5%) were multi-attempters (more than 2 SAs).

Descriptive statistics and group differences

Of the 91 patients who completed the 12-month FU, 28 (30.7%) made a new suicide attempt, and 54 (60%) were hospitalized during the FU period. The mean age was 14.47 (SD 1.4), and eighty-five percent ($n = 78$) were girls. There was a high frequency of current comorbid disorders. The mean CGAS score for participants was 65.85 (SD 16.1). Substance abuse disorders and mood disorders were the most frequently observed diagnoses ($n = 64$, 69% and $n = 37$, 40%), followed by disruptive behaviours disorders ($n = 21$, 23%), anxiety disorders ($n = 18$, 19.7%), and ADHD ($n = 6$, 6.5%). Borderline personality disorder was found in 74% ($n = 66$) of the subjects. Table 3 presents socio-demographics, clinical data and treatment for participants who did or did not report a suicide attempt during FU. There was no difference in diagnoses according to the K-SADS, Ab-DIB,

Table 1 Sociodemographic and clinical characteristics

Variable	French (N=320)		Brazilians (N=45)	
	n	%	n	%
	<i>Sex</i>			
Boys	55	17.2	21	15.5
Girls	265	82.8	114	84.5
<i>Age group (years)</i>				
13–14	141	44.0	55	41
15–17	179	56.0	80	59
<i>Living arrangement</i>				
Without both parents	187	58	70	52
With both parents	133	42	65	48
Repeated grade at school, yes	101	31.5	48	35.8
Mental health treatment at admission	100	31	50	37.5
<i>Axis I diagnoses (DSM-IV-R)</i>				
Major depressive disorders	131	41.0	60	44.4
Adjustment disorder with depressed mood	106	33.5	51	38
Anxiety disorders	88	28.0	34	25.4
Psychotic disorders	3	1	0	0
Disruptive and oppositional behaviour	66	21.0	35	26
Attention deficit hyperactivity disorder	17	5.0	6	4.7
<i>Borderline disorder (Ad-DIB)</i>				
Yes	224	70	102	75
No	89	28	33	25
<i>Method of suicide attempt</i>				
Intoxication	242	75.6	107	79
Laceration	20	6.2	10	7.5
Strangulation	28	8.7	9	6.7
Precipitation	13	4.0	4	2.8
Others	17	5.5	5	4
<i>Number of suicide attempts</i>				
1	208	65	84	62
2	59	18.4	26	19
3	26	8.1	8	6
> 3	27	8.5	17	13
	Mean	SD	Mean	SD
Age at first suicide attempt	14.63	1.42	14.7	1.28

Ad-DIB Abbreviated Self-Questionnaire of the diagnostic interview for borderline personality disorder

or CGAS score; suicidal ideation; lifetime SA; self-injury events; recruitment centre; socio-economic status; number of children in the family; school results (repeating a year); non-productive and reference to other coping skills; spirituality total score; impulsivity total score; attachment style (RSQ); self-esteem (Rosenberg Self-Esteem Rating Questionnaire); or dependence total score (DEP-ADO). However, univariate analysis yielded several significant differences: age at admission, living with both parents, cooperativeness (TCI-56), productive coping skills (ACS), work hard and

achieving (ACS), seeking relaxing diversions (ACS), physical recreation (ACS), life events (total score) and medication and psychotherapy before the SA index. Other variables showed statistically significant trends, such as age at first SA, persistence (TCI-56) and ADHD lifetime.

Multivariate analyses

As explained in the “Methods” section, we included in the model all variables that were significantly different between

Table 2 Dimensional characteristics

Variables	Baseline (N=320)		6-month FU		12-month FU (N=91)	
	(N=320)		(N=135)		(N=91)	
	Mean	SD	Mean	SD	Mean	SD
<i>Reasons for living inventory for adolescents</i>						
Family alliance	4.26	1.24	4.90	1.29	4.29	1.36
Suicide related concerns	3.19	1.44	3.05	1.40	3.3	1.49
Self-acceptance	3.78	1.27	3.68	1.21	3.85	1.31
Peer acceptance and support	4.34	1.24	4.55	1.33	4.33	1.41
Future optimism	4.07	1.22	4.29	1.34	4.13	1.3
<i>Temperament and character inventory</i>						
Novelty seeking	16.16	4.75	14.95	3.95	15.85	5.04
Persistence	15.24	5.08	16.12	5.39	15.61	5.33
Harm avoidance	17.75	5.09	16.9	5.12	16.94	4.9
Self-directedness	14.95	5.56	15.5	5.34	15.44	5.79
Reward dependence	17.25	5.72	16.95	5.55	17.56	6.54
Cooperativeness	18.59	6.06	17.93	5.95	17.76	6.38
Self-transcendence	10.30	5.92	10.84	5.76	9.94	5.97
<i>Spirituality Scale</i>						
Spiritual beliefs	17.84	8.09	18.45	7.88	18.15	7.34
Self-discovery	18.97	4.78	17.9	5.1	19.62	4.7
Self-awareness and collective consciousness	14.52	5.03	15.85	4.98	15.36	4.8
Respect of others and environment	18.61	3.87	17.8	3.97	18.8	2.8
Total	69.97	16.63	70.00	21.93	71.94	13.73
<i>Adolescent Coping Scale</i>						
Productive coping (total)	59.35	13.93	58.55	14.10	60.28	13.39
Focus on solving problem	51.12	16.06	53.45	15.96	52.8	16.67
Work hard and achieve	62.35	17.41	61.95	16.96	65.93	17.53
Focus on the positive	50.80	17.63	51.25	17.14	52.07	17.46
Seek relaxing diversions	73.45	19.66	74.20	18.98	73.41	19.34
Physical recreation	60.62	24.17	61.35	22.6	58.72	22.9
Non-productive coping (total)	54.42	12.10	53.96	12.9	53.7	11.37
Worry	52.66	17.42	51.45	17.8	53.65	16.95
Seek to belong	57.03	15.35	58.1	14.9	56.98	14.23
Wishful thinking	49.95	17.45	50.1	16.75	49.46	16.35
Not coping	50.07	16.69	49.8	17	49.51	17.38
Tension reduction	52.50	17.28	51.9	17.9	50.45	16.83
Ignore the problem	49.10	17.13	48.98	16.95	49.27	17.81
Self-blame	60.46	19.72	59.9	19.1	58.53	18.45
Keep to self	67.38	20.60	66.3	20.98	66.59	21.13
Reference to others (total)	41.35	10.82	43.1	10.7	42.23	10.6
Invest in close friends	58.51	17.61	59.23	16.97	60.42	16.43
Seek social support	49.9	18.42	50.8	18.97	51.2	19.75
Seek spiritual support	30.33	17.71	31.9	17.7	28.76	17.79
Social action	30.92	11.23	31.5	10.95	30.49	11.02
Seek professional help	39.66	18.99	39.2	18	40	19.55
Life Events Questionnaire total score	3.63	2.4	3.31	2.34	3.42	2.12
Impulsivity total score	12.18	4.68	13.4	5.3	12.37	4.9
Dependence total score	7.26	7.1	8.69	7.91	8.08	7.8

Table 3 Univariate analysis in adolescents hospitalized for a suicide attempt at 12-month follow-up

	No relapse SA (<i>n</i> = 63)		New SA (<i>n</i> = 28)		Test	<i>p</i> value
	Mean	SD	Mean	SD		
<i>Sociodemographic characteristics</i>						
Age of admission	14.81	1.36	14.13	1.37	<i>t</i>	0.036
Age of first suicide attempt	14.55	1.32	13.86	1.21	<i>w</i>	0.066
Living with both parents (<i>N</i> , %)	38	60.3	9	32.1	²	0.013
Socio-economic status	2.7	1.15	3.13	1.19	<i>w</i>	0.304
<i>Psychiatric diagnosis</i>						
Major depression (<i>N</i> , %)	26	41.3	12	44.4	²	0.78
Anxiety disorder (<i>N</i> , %)	16	25.4	6	22.2	²	0.73
Substance abuse (<i>N</i> , %)	42	66.7	22	81.5	²	0.155
Externalized disorder (<i>N</i> , %)	15	23.8	7	25.9	²	0.83
Borderline personality disorder (<i>N</i> , %)	45	72.6	21	75	²	0.81
Other (<i>N</i> , %)	8	12.1	6	21	<i>F</i>	1
CGAS	66.69	14.25	65.04	18.01	<i>w</i>	0.526
<i>Suicidality characteristics</i>						
Lifetime suicide attempt	1.38	0.73	2.04	1.71	<i>w</i>	0.142
Suicidal ideations	2.49	2.29	3.3	2.25	<i>w</i>	0.115
Self-injury events (<i>N</i> , %)	27	43.5%	13	48.1	<i>X</i> ²	0.688
Beck hopelessness baseline	7.83	5.69	9.33	6.01	<i>w</i>	0.29
Beck hopelessness 6 months	4.78	3.49	8.67	5.18	<i>w</i>	0.001
Beck hopelessness 12 months	4.06	3.66	7.07	5.9	<i>w</i>	0.101
Beck depression baseline	22.15	12.48	26.54	16.05	<i>w</i>	0.396
Beck depression 6 months	13.93	11.06	22.05	13.63	<i>w</i>	0.018
Beck depression 12 months	13.24	11.18	18.21	11.74	<i>w</i>	0.133
Beck depression composite	1.02	1.08	1.36	1.15	<i>w</i>	0.05
Beck hopelessness composite	0.68	0.82	1.29	0.83	<i>w</i>	0.015
<i>Dimensional characteristics</i>						
Cooperativeness (TCI-56)	18.68	6.1	15.5	6.49	<i>w</i>	0.01
Productive coping (ACS)	63.01	11.41	52.61	16.3	<i>w</i>	0.01
Work hard and achieve (ACS)	70.07	15.44	54.62	19.5	<i>w</i>	0.001
Seek relaxing diversions (ACS)	76.4	19.33	64.96	18.47	<i>w</i>	0.006
Physical recreation (ACS)	63.1	21.8	47.38	22.69	<i>w</i>	0.004
Life events (total score)	3.69	2.25	2.82	1.55	<i>t</i>	0.043
<i>Traitement</i>						
Medication before SA index (<i>N</i> , %)	6	9.5	9	33.3	<i>F</i>	0.011
Psychotherapy before SA index (<i>N</i> , %)	18	28.6	14	51.9	²	0.034
APA before SA index (<i>N</i> , %)	0	0	6	21.4	<i>F</i>	0.001

SA suicide attempt, AAP atypical antipsychotics

Bold values indicate *p* < 0.05

participants who did and did not report a suicide attempt during FU and variables that tended to be associated (see Table 3 and above). In addition, we forced into the model the following variables: age at admission, gender, Beck depression composite score, and the number of SAs. Table 4 summarizes the main characteristics of the multivariate model. Three-dimensional variables associated with productive coping (ACS) proved their protective effect on repeating SA during FU: working hard and achieving [OR = 0.9

(95% CI 0.86–0.94)], physical recreation [OR = 0.94 (95% CI 0.91–0.97)] and seeking relaxing diversions [OR = 0.94 (95% CI 0.91–0.98)], plus one variable associated with temperament (TCI-56): cooperativeness [OR = 0.92 (95% CI 0.86–0.99)]. Life events (total score) and age at admission were negatively associated with the dependent variable SA relapse: OR = 0.73 (95% CI 0.6–0.88) and OR = 0.57 (95% CI 0.41–0.79), respectively. Less expected was that we failed to find any significant results regarding composite

Table 4 Variables associated with suicide attempt relapse at 12 months using multivariate regression

	Estimate	OR	Std. error	z value	Pr(> z)
(Intercept)	18.19		3.33	5.46	< 0.001
Life events (total score)	-0.31	0.73	0.1	-3.21	0.001
Beck hopelessness composite	-0.53	0.59	0.59	-0.9	0.367
Cooperativeness (TCI-56)	-0.08	0.92	0.04	-2.17	0.03
Work hard and achieve (ACS)	-0.1	0.9	0.02	-4.69	< 0.001
Seek relaxing diversions (ACS)	-0.06	0.94	0.02	-3.22	0.001
Physical recreation (ACS)	-0.06	0.94	0.02	-3.6	< 0.001
Productive coping (ACS)	0.06	1.07	0.05	1.31	0.19
Psychotherapy before SA index	0.29	1.34	0.51	0.57	0.569
Living with both parents (N, %)	-0.61	0.54	0.44	-1.39	0.165
Medication before SA index	1.71	5.53	0.62	2.75	0.006
AAP before SA index	0.32	1.38	0.97	0.33	0.741
Age of admission	-0.56	0.57	0.17	-3.35	0.001
Male	0.42	1.52	0.57	0.74	0.462
Beck depression composite	0.58	1.78	0.4	1.43	0.152
Lifetime suicide attempt	0.42	1.52	0.2	2.13	0.033

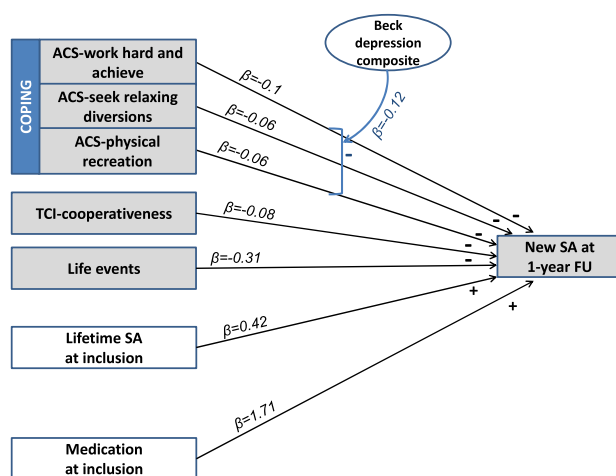
AAP atypical antipsychotics
 Bold values indicate $p < 0.05$

hopelessness score or composite depression score. Regarding gender, we found no significant result as well. However, we identified two risk factors associated with SA recurrence: the total number of suicide attempts [OR = 1.52 (95% CI 1.03–2.23)] and receiving medication at baseline [OR = 5.53 (95% CI 1.67–19.45)].

The second set of analyses tested the possible interaction between variables. We found a significant negative interaction only between productive coping total score (ACS) and Beck Depression Composite score [$\beta = -0.12$, OR = 0.89 (95% CI 0.83–0.95), SE = 0.04, Z = -3.3, $p = 0.001$]. The effect of productive coping on suicidal recurrence was not constant and depended on the value of Beck Depression Composite score: the higher the Beck Depression Composite score, the lower the protective effect of productive coping on SA recurrence. Figure 2 summarizes all the analyses predicting SA recurrence during follow-up.

Discussion

This 12-month prospective study is, to our knowledge, the first to report both potential protective and risk factors for the recurrence of SA in a clinical cohort of high-risk suicidal adolescents. SA was best predicted by a personal history of SA and by a psychotropic treatment at baseline. In addition, the study showed the protective role of productive coping strategies, namely, working hard and achieving, physical recreation, seeking relaxing diversions, and a particular temperament trait, namely, cooperativeness. A more detailed discussion of these findings along with their clinical



ACS: Adolescent Coping Scale, SA: Suicide Attempt, TCI: Temperament and Character Inventory, FU: Follow-up

Fig. 2 Modelling suicidality at the 12-month follow-up in adolescent inpatients who had attempted suicide

implications will follow a delineation of the limitations of this project.

Strengths and limitations

The main limitation of the study is the low follow-up rate (31%). The 12-month FU sample appeared representative of the total, but we recognize that the non-respondents indeed differed on few important variables (e.g., Beck Hopelessness Scale). Concerning variables of interest such as coping strategies, those who failed to complete the study had a lower score only for one productive coping on the existing

18 specific coping skills, namely, working hard and achieving ($p=0.021$). Several reasons may help to explain this high nonresponse rate. First, access to psychiatric care in France is free of charge and open to all. Participating in a research protocol involves no financial benefits, and no travelling reimbursements were offered to those taking part in the follow-up evaluations. Second, the explanation of the study we gave initially failed to place sufficient emphasis on the importance of the post-discharge assessments (as opposed to treatment FU). In addition, we did not obtain enough contact information to be able to easily get in touch with patients in the event of their changing phone numbers or moving. Third, the sample consisted entirely of inpatients, meaning that the findings may not be generalizable to patients in other types of treatment settings or to community samples. Fourth, the limited size of the sample may have affected our ability to detect important small effects. Last, certain risk factors such as the family component were not taken into account, whereas several studies have suggested that family discord or a parental history of mental health problems are related to the onset and recurrence of suicidality [5, 24]. Similarly, it is likely that adolescents who experienced only one SA at baseline may constitute a different research group (see supplementary material, table S1 for baseline differences between single SA vs. multiple SAs). It would have been of some value to explore first attempters separately and identify the risk factors in this group. However, the low attrition rate at FU prevented us to run separate multivariate models.

However, this study includes a number of strengths: (1) the sample is homogeneous as to the main characteristic under study, namely, that all the adolescents were hospitalized following an SA; (2) the study was prospective in its design, with rigorous evaluation performed by trained clinicians, and the sample was not random but multicentre, including different geographical regions and different types of hospital services; (3) the size of the sample was large given that we were dealing with a high-risk adolescent population; (4) most importantly, the sample was not biased by non-access to care, a frequent limitation in many settings. This last point is important when discussing treatment seeking in adolescents with mood disorders [59].

Post-hospitalization course and SA relapse

The study found a high incidence of SA recurrence (30%) for the total cohort within the 12-month post-hospitalization period of suicidal adolescents. Although this rate is higher than those reported by other teams [6, 19, 30] it is consistent with other studies including high-risk adolescents, such as the study by King et al. [18], which found a recidivism rate of 25% at 12-month FU. The disparities in recidivism rates may potentially be explained by the strong heterogeneity between study samples. For example, the King et al. [24]

study included adolescents who were hospitalized for suicidal ideation and SA, while others included all adolescents hospitalized in psychiatric wards for whatever reason [30].

Risk factors

At 6 months the adolescents who repeated SAs had higher Beck hopelessness scores ($p=0.01$) and Beck depression scores ($p=0.018$) than non-recidivists. This result highlights the importance of prevention for early recurrence. Several authors have pointed out that the first 6 months after an SA was a period of high risk of recurrence (12–19% for new SA) [4, 12, 24, 29]. Contrary to our expectations, at 12 months there was no significant difference for these two scores, however, since we have a large number of patients lost to follow-up at 12 months, our results be interpreted cautiously.

However, the presence of depressive symptoms interacted negatively with productive coping skills ($p=0.001$). In other words, the higher the depression score during follow-up, the lower the protective effect of productive coping on SA recurrence. These results are fairly consistent with earlier cross-sectional and longitudinal studies. Outpatient [33] and inpatient samples [22, 23] have shown that mood disorders are a proximal risk factor for SA. This is also the case in psychological autopsy studies on adolescent completed suicide [20]. We found no significant difference between the two groups in psychiatric diagnoses, including borderline personality disorder. However, there was more SA relapse among adolescents who were receiving treatment before the index SA, namely, medication ($p=0.011$), psychotherapy ($p=0.034$) or atypical antipsychotic drugs ($p=0.001$). It is likely that receiving treatment indirectly indicates the severity of the psychiatric conditions of the adolescents included at baseline. The likelihood and severity of an SA have been correlated with both the chronic status of an affective disorder and the co-occurrence of comorbid disorders [22]. In the multivariate models, two risk factors remained: having a history of SA and receiving a psychotropic treatment at baseline. Previous suicidal behaviour has been repeatedly found to be one of the most powerful predictors of subsequent SA in both adolescents and adults [2, 6]. This is also the case for high-risk cases.

Protective factors

The current study identifies several variables as potential protective factors for suicidal recidivism. Hard work and achievement is a productive coping skill and refers to the adolescent's work and, more specifically, to school work and study achievement. Success at school thus continues to be a protective factor, just as under-achieving at school is associated with suicidal behaviour risk [28]. This result should draw the attention of clinicians to the value of school

assessment as part of an overall assessment of adolescents being treated for mental health issues. As with other disorders, school achievement is a valuable indicator [60]. Two additional productive coping strategies, namely, physical recreation and seeking relaxing diversions, are also associated with a reduction in the risk of suicidal recurrence. This result is particularly interesting in light of recent data from a large study of European adolescents (the SEYLE study) [61]. The authors reported that more frequent physical activity and participation in sport independently contributed to greater well-being and lower levels of anxiety and depressive symptoms in both sexes [61]. One temperament trait, namely, cooperativeness, was also associated with a lower risk of recidivism. Cooperativeness indicates how well the individual is able to get along with other people in a fair and flexible manner. Lower scores have been found in personality disorders and mood disorders [62]. More generally, TCI scores can be used to measure an intrinsic aspect of overall mental health [63]. This means that helping adolescents to increase their cooperativeness may be beneficial.

Concerning stressful life events, we found that adolescents who had negative experiences were significantly less likely to relapse at the 12-month follow-up. This association should be interpreted within a particular care system and deserves additional exploration. Knowing that vulnerability to suicide is associated with personal or family history [3], early life adversity [11], family dysfunction [5] and bullying [17], this result may appear paradoxical. We propose three hypotheses to interpret the protective effect of stressful situations experienced by adolescents. First, the self-report questionnaire we used does not include questions about sexual or physical abuse [46]. Therefore, it is possible that we failed to capture this important risk factor for adolescent psychopathology [64]. Second, the questionnaire lists several stressful situations and events and quantifies how adolescents perceived it. Previous research has shown that exposure to different events influences the way that perceptions of events evolve [65]. An event that was perceived as negative by inexperienced adolescents was perceived as slightly less negative by experienced ones. In other words, experience causes a change in the perceived negativity of the event. An important implication is that prior exposure to an event may have a prophylactic effect against the disorienting stressfulness of experiencing the event again in the future. It may then be assumed that the previous exposure is an internal mediator that can help to reduce the perceived stressfulness of an event by the appraisal process. It is possible that the lack of distinction between recent and past events has modified the way we could capture this signal in our models. Finally, apart from possible biases, we would like to point to an explanation linked to the specificity of the French healthcare system. Having recourse to hospital emergency services is easy, because these are free of charge and

open to all. Reactive stress situations caused by life events (such as interpersonal conflicts) are frequent precipitating factors from suicidal ideation to suicide attempt in adolescence [66]. The effect of hospitalization of quickly creating a physical distance from the adolescent's home environment may effectively reduce the intensity of the initial symptoms and lead to a better FU.

Gender differences

Regarding gender, our sample is over-represented by girls (80% at 12 months). Other studies on clinical adolescent population have found a similar distribution. For example, the samples of Yen et al. [29] and King et al. [24] are made up of more than 70% of girls. Several hypotheses have been proposed to explain this difference. Adolescence is a developmental stage during which gender can have great influence on behaviour. The "gender paradox" also applies to the adolescent population, since nonlethal SAs are more common in girls, while the suicide rate is two to three times higher in boys [67]. For suicide attempt rates, the gender difference ($F > M$) increases with age, peaking in mid adolescence, whereas for suicide rates, the gender difference ($M > F$) continues to increase ($M > F$) until adulthood [1]. Genetic/neurodevelopment hypotheses, psychiatric comorbidities, emotion and cognition regulations, or gender/social contexts have been advanced to explain these differences [68]. Given the reality of such gender differences, the accepted approaches to suicide prevention should also be expected to take gender differences into account.

Conclusions

We believe that the findings from the current study are informative with regard to prevention and intervention efforts with high-risk adolescents. First, we confirm that the 12 months following hospitalization of adolescents who committed suicide are a particularly high-risk period for suicide re-attempts. Second, we also confirm that history of SA and seeking psychiatric care with medication are risk factors for recidivism. Special attention should be paid to adolescents who have already made an SA and those who receive psychotropic treatment on admission to the emergency wards. These simple points should be taken into consideration by all caregivers in the treatment decision making and the planning of hospital care. Third, the study provides new information on the role of protective factors in high-risk clinical populations. Indeed, several variables of productive coping or temperament traits had a protective effect. This could encourage clinicians to take more account of, and better evaluate, coping strategies, as this may be an interesting way to combat re-attempts. In addition, if productive

coping strategies and cooperativeness are protective factors, the improvement of such strategies, together with the treatment of persisting depression, which interacts with these protective factors in predicting relapse, should be a goal of any psychotherapy treatment offered to suicidal adolescents.

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Compliance with ethical standards

Conflict of interest None.

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