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Research paper

First-onset and persistence of suicidal ideation in university students: A one-year follow-up study

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ABSTRACT

Background: Longitudinal evidence about risk and protective factors for suicidal ideation among university students is limited.

Methods: 12-month first-onset and persistence of suicidal ideation (SI) among Spanish first-year university students were estimated using baseline (T1) and 12-month follow-up (T2) online surveys. Information about STBs, childhood/adolescence adversities, positive relationships, mental disorders, recent stressful experiences, and university sense of membership was assessed. Logistic regression analysis was used to study risk/protective factors of first-onset and persistence of suicidal ideation (SI).

Results: A total of 1,248 respondents (58.9% response) were included. Mean age at baseline was 18.7 (SD = 1.3) and 56.0% were female. 7.3% reported 12-month SI at T2. Incidence of new SI cases was 3.4% and, among students with SI at T1, 21.2% also reported SI at T2 (persistence). Risk factors of T2 SI included 12-month mood disorder at T2 both without (aOR = 12.08 95% CI 5.45–26.80) or with (aOR = 7.2 95% CI 2.91–17.80)

Abbreviations: aOR, Adjusted Odd Ratio; aORs, Adjusted Odds Ratios; AUDIT-10, Alcohol Use Disorders Identification Test 10-items version; AUC, Area Under the curve; T1, Baseline survey; UPV-EHU, Basque Country University; BSI, Beck Scale for Suicide Ideation; UCA, Cádiz University; C-SSRS, Columbia-Suicide Severity Rating Scale; CIDI-3.0, Composite International Diagnosis Interview version 3.0; CI, Confidence Interval; CIs, Confidence Intervals; CIDI-SC, CIDI Screening Scales; UMH, Miguel Hernández University; MI, Multiple Imputation; IPW, Inverse-probability weighting; OR, Odd Ratio; ORs, Odds Ratios; OECD, Organisation for Economic Co-operation and Development; UPF, Pompeu Fabra University

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lifetime mood at T1, past lifetime suicide attempt (aOR = 8.79 95% CI 2.37–32.64) and plan without attempt (aOR = 4.72 95% CI 2.32–9.61), and 12-month physical or sexual assault (aOR = 3.28 95% CI 1.13–9.46). Twelve-month mood at T2 withoutT1 lifetime mood (aOR = 11.27 95% CI 3.02–42.14) and childhood/adolescence emotional abuse or neglect (aOR = 3.41 95% CI 1.10–10.57) or having been bullied (aOR = 3.2 95% CI 1.08–9.53) were associated with first-onset of SI. Twelve-month mood at T2 either without (aOR = 13.92 95% CI 3.76–51.59) or with (aOR = 8.03 95% CI 2.13–30.29) were associated to T2 SI persistence.

University sense of membership was protective for overall 12-month SI at T2 (aOR = 0.25 95% CI 0.12–0.53 for middle tertile), first-onset SI (aOR = 0.1 95% 0.02–0.55 for middle tertile) and persistence (aOR = 0.3 95% CI 0.11–0.81 for middle tertile).

Limitations: Analysis was based on self-report data focusing on SI only, and conclusions about the direction of the associations are limited.

Conclusions: High proportion of SI suggests the need of suicide prevention strategies. The potential role of university sense of membership in reducing suicidal behaviour among university students deserves further investigation.

1. Introduction

Suicide is the second worldwide leading cause of death for those between the ages of 15 and 29 years (World Health Organization, 2016a). In developed countries, an increasing proportion of this age group are university students (Organisation for Economic Co-operation and Development (OECD), 2016). Epidemiological studies show that 75% of several mental disorders start before the age of 24 (de Girolamo et al., 2012; Kessler et al., 2005). For some young people, the transition to university may be stressful and increase risk for mental disorder onset (Gollust et al., 2008; Stallman, 2010; Auerbach et al., 2018, 2016), with 30.6% of the students suffering from depression on average (Ibrahim et al., 2013). This high prevalence is significant not only for the distress it causes at a time of major life transition, but also because it is associated with severe impairment and decreased academic performance (Alonso et al., 2018; Auerbach et al., 2016; Bruffaerts et al., 2018, 2012) as well as suicidal thoughts and behaviors (STB) (Mortier et al., 2018a, 2018b).

Increasing evidence suggests that STB are common among university students. A meta-analysis of 36 college student samples worldwide found a pooled lifetime prevalence of suicidal ideation (SI) to be 22.3%, with about one in ten (10.6%) students SI in the past year (Mortier et al., 2018b). The World Mental Health International College Student initiative (WHM-ICS, 2015), representing 19 universities from eight countries, estimated 12-month SI (with a broad definition which included both passive and active ideation) to be 17.2%, with ranges between 7% (in Belgium) and 25.7% (Australia) and lifetime SI to be 32.7% (Mortier et al., 2018a). In Spain, 12-month SI prevalence was estimated at 9.9% (Blasco et al., 2018).

It is only recently that some studies are improving knowledge about risk and protective factors for STB among university students (Mortier & Auerbach, 2018). But a complete epidemiological understanding is still limited. In particular, evidence about factors associated with STB is fragmented (i.e., most studies have assessed individual factors in isolation) (Franklin et al., 2017) and mostly derived from cross-sectional studies (Mortier et al., 2018b). Moreover, although some prevention programs, such as classroom instruction, gatekeeper training, or campus-wide policies had demostrated their efficacy for some suicide related outcomes (e.g., knowledge, skills or self-eficacy), there is not sufficient evidence about their effectiveness in reducing STB prevalence and suicide rates (Harrod et al., 2014; Wolitzky-Taylor et al., 2019).

Recently, results from a university longitudinal survey conducted in Belgium reported a broad range of factors at university entrance as predictors for subsequent first-onset and persistence of STB during the first two university years (Mortier et al., 2017a, 2017b). One-year first-onset for STB were 3.7%−3.9% for SI, 0.9%−2.2% for suicide plans, and 0.2% for suicide attempts. Twelve-month persistence of STB was very similar to previous studies (Nkansah-Amankra, 2013; Steinhausen et al., 2006; Thompson et al., 2009; Wilcox et al., 2010), with estimations around 28% among those students who reported baseline STB (Mortier et al., 2017a, 2017b). Although these studies included a wide range of factors assessed at university entrance (i.e., parental psychopathology, early traumatic experiences, mental disorders and recent stressful experiences), no protective factors were considered.

Despite recommendations to take into consideration the interplay between risk and protective factors when attempting to understand which factors promote resiliency and vulnerability to STB (McLean et al., 2008), we are not aware of any prospective study among university students that assess the associations of distal and proximal risk and protective factors.

Based on a epidemiological working model (Mościcki, 2001), the objectives of the present study were to: (i) prospectively assess first-onset and persistence of SI among Spanish university students between their first and second year of university; and (ii) test the association of distal and proximal risk and protective factors with first-onset and persistence of SI during that 12-month time period. Unlike most previous studies, of a cross-sectional nature, we focused on prospective associations of a broad range of distal and proximal well-established risk and protective factors for STB found in prior studies (Nock et al., 2012): childhood adversities (Bridge et al., 2006; Bruffaerts et al., 2010; Castellví et al., 2017; King and Merchant, 2008); positive relationships in childhood (Borowsky et al., 2001; Mackin et al., 2017); recent stressfull experiences (Daniel et al., 2017; Nock et al., 2013); mental disorders (King et al., 2001; Nock et al., 2013; Wu et al., 2004); history of STB (Nock et al., 2013); and university sense of membership (Borowsky et al., 2001; Resnick et al., 1997) during the first year of university. The latter proximal protective factor was included as proxy for social connectedness, which has a well-documented positive association with mental and physical health (Drum et al., 2017; Marraccini and Brier, 2017). Our main hypotheses were that the interplay analysis of a broad range of SI risk and protective factors could improve current models.

2. Methods

2.1. Study design

Longitudinal data assessments from baseline (T1) and 12-month follow-up (T2) from the UNIVERSAL (University and Mental Health) project were used for this study, which is part of the World Mental Health International College Student initiative (WMH-ICS) (WHM-ICS, 2015). A detailed description of the rationale and methods of the UNIVERSAL project is provided elsewhere (Blasco et al., 2016).

2.2. Participants and setting

The study was carried out in five public universities from different Autonomous Regions of Spain: University of Balearic Islands (UIB), Basque Country University (UPV-EHU), Cádiz University (UCA), Miguel Hernández University (UMH), and Pompeu Fabra University (UPF).

Universities were selected for convenience and represented 8.2% of the total students in public universities in Spain as of 2014–15, and their distribution in terms of age, percentage of foreign students and study field was similar to that of the overall population of students in public universities of Spain (further details available upon request).

All incoming first-year students of a bachelor degree program at the participating universities aged 18 to 24 years old that enrolled for the first time in a university were eligible to participate (N = 16,332). Students were recruited in two stages. In the first stage, all eligible students were invited to take part in the study. In a second stage, a random subsample of non-respondents to the first stage was personally contacted by mail and offered an incentive of €25 to complete the baseline survey ("endgame strategy"). In UPV-EHU university, only stage one was carried out. Invitation methods included advertising campaings (e.g., stands with information, information in the classrooms, university web) and e-mail invitation letters from university authorities.A raffle of accademic materials (€40) among all students who complete baseline and 12-month follow-up was announced in recruitment campaings. Secure online self-report surveys were completed at each assessment. Eligible students had to register to the survey and provide their informed consent before receiving a personalized link and password to access the survey. The baseline survey (T1) was carried out during the 1st year at university (between October 2014 and October 2015). Baseline respondents were then invited by e-mail with a link to complete the follow-up survey (T2) 12 months after completing the baseline survey. At 12-month follow-up no endgame strategy was carried out. Participation was voluntary. Power calculations were carried out according to different assumptions of participation have been published elsewhere (Blasco et al., 2016).

All respondents were given information on how to access local health services. Individuals with positive responses on suicide items received a specific alert with indications for consulting with a health professional. Ethical approval was provided by the Parc de Salut MAR-Clinical Research Ethics Committee (Reference: 2013/5252/I).

2.3. Variables

2.3.1. Suicidal thoughts and behaviors (STB)

At baseline (T1), respondents were asked about lifetime experiences of suicidal ideation (SI) *("Have you ever thought about killing yourself?"),* suicide plans ("*Have you ever thought about how you might kill yourself [*e.g.*, taking pills, shooting yourself] or work out a plan of how to kill yourself?"*) and suicide attempts *("Have you ever made a suicide attempt [*i.e.*, purposefully hurt yourself with at least some intent to die]?"*). At the 12-month follow-up (T2), respondents were presented an equivalent series of questions, with only the time frame adjusted to the previous 12-months. STB items were selected from modified versions of the Self-Injurious Thoughts and Behaviors Interview (SITBI)(Nock et al., 2007), and a screening version of the Columbia-Suicide Severity Rating Scale (C-SSRS)(Posner et al., 2007). Construct validity of the SITBI is moderate to good compared with the Schedule for Affective disorders and Schizophrenia for School Age Children (K-SADS-PL; K = 0.48–0.65) (Kaufman et al., 1997), and with the Beck Scale for Suicide Ideation (BSI; K = 0.59)(Beck et al., 1979). Inter-rater reliability and test-retest reliability after 6-month follow-up are high (K = 0.7–1.0)(Nock et al., 2007).

The outcome variable was 12-month SI at follow-up. Using data from lifetime baseline and 12-month follow-up we distinguished between: a) *overall* 12-month SI (i.e., 12-month SI at T2); b) *first-onset* of SI (i.e., 12-month SI at T2 among those who reported no lifetime SI at T1); and c) *persistence* of SI (i.e., 12-month SI at T2 among students who reported lifetime SI at T1).

Lifetime STB reported at baseline were considered risk factors for SI at T2 and for persistence of SI at T2. Four mutually exclusive T1 categories were defined: a) *lifetime attempt* (i.e., students who reported any lifetime attempt at T1); b) *lifetime plan without attempt* (i.e., students who reported any lifetime suicide plan at T1 but did not report ever having had any attempt); c) *lifetime ideation with neither plan nor attempt* (i.e., students who reported any lifetime suicidal ideation but no lifetime plans or attempts at T1); and d) *no lifetime STB* (i.e., students who never had suicidal ideation, plans or attempts at T1).

2.3.2. Mental disorders

Lifetime and 12-month assessments of probable cases of six common DSM-IV mental disorders (major depression, bipolar, generalized anxiety, panic, alcohol use disorder, and drug use disorder) at T1 and T2 were based on the Composite International Diagnostic Interview (CIDI; (Kessler et al., 2004) and the CIDI Screening Scales (CIDI-SC; (Kessler et al., 2013a, 2013b) as well as a modified version of the Alcohol Use Disorders Identification Test 10-item version (AUDIT-10)(Saunders et al., 1993). Based on previous results (Blasco et al., 2018) disorders were grouped in two broad categories, mood (i.e., probable case for major depression or bipolar disorders) and other common mental disorders (i.e., probable case for panic disorder and generalized anxiety disorder, alcohol or other substance abuse or dependence). This decision was further supported by preliminary analyses showing numerical problems due to small frequencies when anxiety and substance disorders were included as two separate categories in multivariable models for T2 SI (results not presented, but available upon request). For each category, respondents were classified into exclusive groups according to their lifetime history of probable case of mental disorders at T1 and the 12-month assessment at T2. In the case of mood: a) without mood disorders; b) 12-month mood at T2 with no previous history of mood (i.e., respondents with 12-month mood at T2 and not lifetime mood at T1); c) 12-month mood at T2 with a previous history of mood (i.e., respondent with both lifetime mood at T1 and 12-month mood at T2); and d) lifetime history of mood without 12-month mood at T2 (i.e., respondent with lifetime mood at T1 and not 12-month mood at T2). The same classification was applied for "other" and for "any" mental disorders.

Clinical calibration studies have shown that the CIDI-3.0 (Haro et al., 2006) and CIDI-SC scales (Kessler et al., 2013a, 2013b) assess mood, anxiety and substance use disorders with generally good validity in comparison to blinded clinical reappraisal interviews . The version of the AUDIT we used, which defined alcohol use disorder as either a total score of 16+ or a score 8–15 with 4+ on the AUDIT dependence questions (Lawford et al., 2012), has been shown to have concordance with clinical diagnoses in the range Area Under the Curve (AUC = 0.78–0.91)(Reinert and Allen, 2002).

2.3.3. Chronic health problems or physical impairment

Physical conditions were assessed using a cheklist adapted from WMH–CIDI (Chronic Conditions) (Kessler et al., 2004). Respondents were asked if they had any of the following health problems: epilepsy or seizure disorder, other chronic physical health condition or any serious physical impairment. Respondents were classified into three-groups depending on whether they reported any chronic health conditions or physical impairment: a) No Baseline (T1) and No 12-month follow-up problems (T2); b) No Baseline (T1) but 12-month follow-up (T2) conditions; and c) Baseline (T1) problems with or without 12-month follow-up (T2) conditions.

2.3.4. Childhood/adolescence adversities

Childhood/adolescence adversities prior to the age of 17 were assessed at baseline using 20 items adapted from the CIDI-3.0 childhood scale (Kessler et al., 2004), the Adverse Childhood Experience Scale (Felitti et al., 1998), and the Bully Survey (Swearer and Cary, 2003). Childhood adversities included: breakdown of family structure (i.e., parental death, separation or divorce); family maladaptation (i.e., parental psychopathology, attempted or died by suicide, or household dysfunction such as criminal activities or violence); and childhood maltreatment. Childhood maltreatment was divided in emotional (i.e.,

emotional or neglect) and physical (i.e., physical or sexual)(Glaser, 2002; Mina and Gallop, 1998; Pears et al., 2008). For all items, response options consisted of five-point Likert-type items from "never" to "very often". The presence of “any” specific adversity was considered when corresponding item was different than “never”, except for bullying, that was considered positive when the frequency reported was "sometimes" or more.

2.3.5. Recent stressful experiences

A list of stressful experiences that included items from the Life Events Questionnaire (Brugha and Cragg, 1990), the Deployment Risk and Resilience Inventory (Vogt et al., 2008), and the Department of Defense Survey of Health Related Behaviors (Bray et al., 2009) were evaluated at T2 to assess recent stressful experiences. Items selected assessed relevant stressful experiences among young adults, and included: non-interpersonal experiences (i.e., including death, life-threatening illness or injury of a friend or family member, and life-treatening accident related), interpersonal experiences (i.e., breakup with romantic partner or cheating, betrayal, arguments or break up with friends or family), among others. Respondents indicated whether they had experienced any of these events in the previous 12 months.

2.3.6. Childhood/adolescence positive relationships

At baseline, childhood/adolescence positive relationships were assessed using 14 items adapted from the CIDI-3.0 childhood section (Kessler et al., 2004), Psychological sense of school membership scale (Goodenow, 1993), Adverse Childhood Experience Scale (Felitti et al., 1998), and Childhood Trauma Questionnaire (Bernstein et al., 1997). Response options consisted of five-point Likert-type items from “very often” to “never.” Three constructs were considered from the positive relationships items, representing relationships within: school (6 items); family (4 items); and peers/others (4 items). An exploratory factor analysis on a random half of the sample showed that the most parsimonious solution that provided adequate goodness of fit with the minimum set of factors was the three factor structure (RMSEA = 0.042, CFI = 0.995, TLI = 0.991). Confirmatory factor analysis showed good fit with the data (Comparative Fit Index = 0.986; Tucker-Lewis Index = 0.983; RMSEA = 0.055) and good reliability, with omega coefficient of 0.7 for peers/others, and 0.9 for school and family relationships. Scores for the constructs were obtained as the mean of the items and ranged from 1 through 5, with higher values indicating more positive relationships. Scales scores were then categorized into tertiles because the linearity assumption of the logit in the continuous variables was not fulfilled. At follow-up,equivalent items on school relationships were assesed in relation with university experience. The same scoring system and cut-off points used for categorizing positive relationships at school into tertiles were applied for constructing the sense of membership at university variable (Goodenow, 1993).

2.4. Covariates

Socio-demographic factors were asked at the baseline survey and included: age, gender, country of birth, parent's studies, as well a set of university-related characteristics, such as academic field and students’ first-term living location during the university period (parents’ home or other kind of residence).

2.5. Analyses

Missing item-level data among respondents were imputed using

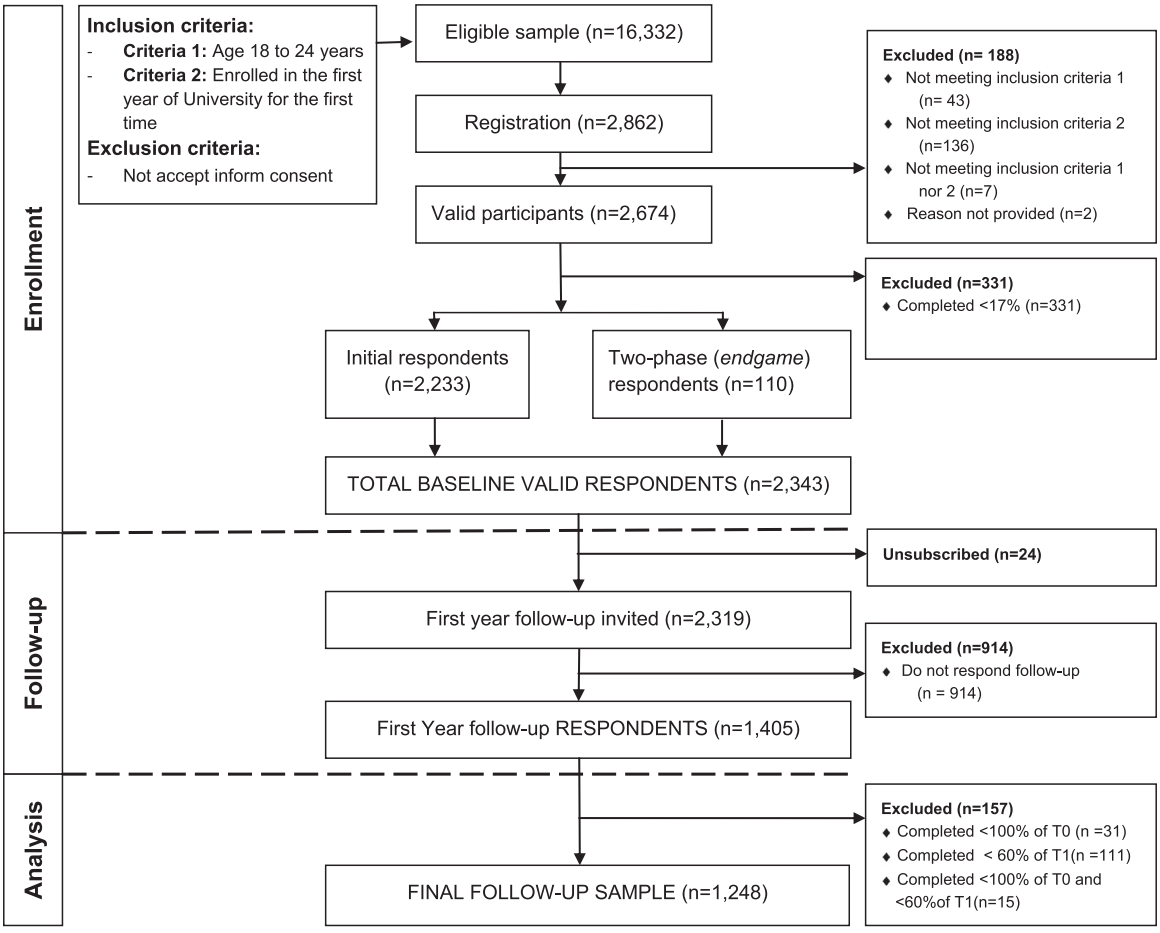

Fig. 1. Flow-chart of study population. *The UNIVERSAL* (University and Mental Health) project.

multiple imputation (MI) by chained equations (Buuren, 2012) with 43 imputed datasets, equivalent to the percentage of incomplete subjects (White et al., 2011), and 10 iterations per imputation. To correct the bias caused by lost to follow up missing values, inverse-probability weighting (IPW) (Seaman et al., 2012; Seaman and White, 2013) was applied, calculated as the inverse of the estimated probability of completing the follow-up survey on observed related covariates, using a logistic regression model. Additionally, post-stratification weights were used to restore population distribution of sex, country of birth, and academic field within each university, as well as population distributions across universities (further details available upon request). Pooled MI-based parameter estimates and standard errors (SE) and statistical inference were obtained from the weighted analysis of these MI datasets.

Sample characteristics are reported as weighted percentages and SE. Differences in baseline characteristics between those who did and those who did not participate in the follow-up survey were evaluated using chi-square tests. Proportions of 12-month SI at T2, as well as first-onset and persistence of SI in the 12-months prior to T2, were reported as percentages and associated SE, for the total sample and by candidate factors. Bivariate analyses were performed to examine the association between candidate factors and outcome variables (overall SI, first-onset and persistence of SI). Crude Odds Ratios (ORs) were estimated and MI-based confidence intervals (CIs) were calculed at the 95% level, and statistical significance was assessed with F test based on MI. Statistical significance was set at the 5% level based on two-sided tests, after adjustment for multiple comparisons using the Benjamini-Hochberg procedure (Benjamini et al., 2001). Finally, multiple logistic regression models including all risk and protective factors were estimated for overall 12-month SI at T2, and first-onset of SI and persistence of SI in the 12-months prior to T2. All models were adjusted by age, gender, university, academic field, country of birth, parents' studies, and living location. Adjusted odds ratios (aORs) and MI-based CIs were obtained. Statistical significance was evaluated with two-side F test based on MI and α level of significance of 0.05. The area under the curve (AUC) was estimated to assess discriminant capacity of the models.

MI were carried out using package *mice* from R (Buuren and Groothuis-Oudshoorn, 2011). Analyses were performed using R v3.4.2 (R Core Team, 2017), SAS v9.4 (SAS Institute Inc, 2014) and Mplus v7.11 (Muthén and Muthén, 2015).

3. Results

3.1. Participants

Out of the 2118 students that completed the baseline survey (overall weighted response rate (RR) = 19%), a total of 1248 students completed at least 60% of the 12-month follow-up survey (**see flow diagram in Fig. 1** for detailed numbers of individuals at each stage of study), which constitutes the sample used for the analyses in this paper. The overall follow-up RR conditional on T1 participation was 58.9%, ranging from 49.0% (Miguel Hernández University) to 65.3% (Basque Country University). The overall 12-month follow-up RR was higher among those students from the endgame strategy (65.3% vs 58.6%). No statistically significant differences with regard to the main study variables at baseline were found between non-incentive and endgame students (results not shown, available upon request).

Attrition analyses identified differences among students who responded at T2 and those who did not (i.e., attriters) **(see Supplementary Table S1).** Item-missing values within variables ranged from 0.1% to 3.2%, and 43% of the 1248 respondents in both surveys had isolated missing values in at least one of the variables. The mean number of days between baseline and follow-up surveys was 421.52 days (SD = 93.9).

Baseline characteristics of the whole T1 sample (n = 2118) and the follow-up T2 subsample (n = 1248) are shown in **Table 1**. Results show

Table 1
Comparison of sample characteristics of overall and 12-month follow-up samples after weighting.

	Baseline[a] n = 2118			12-month follow-up[b] n = 1248		
	n	%	SE	n	%	SE
Sociodemographics (T1)						
Age						
18	1506	62.1	1.05	926	67.9	1.33
>18	612	37.9	1.05	322	32.1	1.33
Gender						
Male	582	44.6	1.08	302	44.0	1.41
Female	1536	55.4	1.08	946	56.0	1.41
University						
Balearic Islands University (UIB)	300	12.3	0.71	168	12.3	0.93
Basque Country University (UPV-EHU)	642	43.9	1.08	419	43.9	1.40
Cadiz University (UCA)	299	19.7	0.86	149	19.7	1.12
Miguel Hernandez University (UMH)	292	10.6	0.67	143	10.6	0.87
Pompeu Fabra University (UPF)	585	13.5	0.74	369	13.5	0.97
Country of birth						
Spain	1963	94.8	0.48	1156	95.1	0.61
Other	155	5.2	0.48	92	4.9	0.61
Parents University Studies						
At least one	961	43	1.09	596	43.4	1.44
Neither	1157	57	1.09	652	56.6	1.44
University Sociodemographics (T1)						
Academic Field						
Arts and Humanities	242	9.8	0.64	149	9.8	0.84
Engineering and Architecture	291	18.6	0.85	158	18.6	1.10
Health Sciences	543	15.7	0.79	340	15.7	1.03
Science	203	8.4	0.6	119	8.4	0.78
Social and Legal Sciences	839	47.6	1.09	482	47.6	1.41
Living at first term						
Parents home	1193	56.2	1.08	723	58.5	1.41
Other	925	43.8	1.08	525	41.5	1.41
Childhood/adolescence (T1)						
Adversities						
Breakdown of family structure	429	17	0.82	250	18.5	1.11
Family maladaptation	760	32.7	1.03	439	34.6	1.37
Childhood maltreatment						
Emotional abuse or neglect	520	22.7	0.93	301	23.5	1.24
Physical or sexual abuse	222	10.1	0.67	141	11.1	0.91
Any maltreatment	586	26.5	0.97	346	27.4	1.30
Bully victimization	670	31.1	1.02	410	32.5	1.37
Any adversities	1348	60.7	1.07	790	62.4	1.41
Positive relationships[c]						
Family						
High	826	35.3	1.06	488	35.6	1.42
Middle	718	35.3	1.07	410	34.0	1.43
Low	574	29.4	1.01	350	30.4	1.33
Pees/others						
High	594	28.4	1	325	25.6	1.29
Middle	854	36.6	1.12	494	38.7	1.45
Low	670	35	1.11	429	35.7	1.42
School						
High	621	29.1	0.99	381	28.9	1.29
Middle	823	38.1	1.06	474	38.6	1.40
Low	674	32.8	1.03	393	32.5	1.35
Physical and mental conditions (T1)						
Chronic health problems or physical impairment						
Yes	401	20.4	0.88	232	18.3	1.12
No	1717	79.6	0.88	1016	81.7	1.12
Lifetime mental disorders[d]						
Mood	614	24.5	0.94	373	26.0	1.25
Other	628	28	0.99	355	26.8	1.27
Any mental	880	37.5	1.07	513	37.6	1.39

(*continued on next page*)

Table 1 (*continued*)

	Baseline[(a)] *n* = 2118			12-month follow-up[(b)] *n* = 1248		
	n	%	SE	*n*	%	SE
Lifetime STB (T1)						
Attempt	46	1.8	0.29	25	1.4	0.34
Plan without attempt	260	11.8	0.8	165	13.0	0.96
Idea without plan nor attempt	202	9.3	0.73	125	7.7	0.76
Any STB	508	23	0.91	316	22.1	1.18
Past-year stressful experiences (T2)						
Death illness injury or accident	n.a.	n.a.	n.a.	592	44.8	1.42
Breakup or betrayal arguments	n.a.	n.a.	n.a.	651	50.3	1.43
Physically or sexually assaulted	n.a.	n.a.	n.a.	44	3.7	0.55
Any stressful experiences	n.a.	n.a.	n.a.	923	71.7	1.30
University sense of membership (T2)[(e)]						
High	n.a.	n.a.	n.a.	137	11.0	0.90
Middle	n.a.	n.a.	n.a.	446	37.8	1.40
Low	n.a.	n.a.	n.a.	665	51.2	1.43
Physical and mental conditions (T1-T2)						
Chronic health problems or physical impairment						
No Baseline and No 12-month	n.a.	n.a.	n.a.	901	72.5	1.29
12-month and No Baseline	n.a.	n.a.	n.a.	114	9.2	0.83
Baseline	n.a.	n.a.	n.a.	232	18.3	1.12
Mental disorders [(d)(f)]						
Mood						
No Mood Baseline and No Mood 12-month	n.a.	n.a.	n.a.	775	65.6	1.36
Mood 12-month and No Mood Baseline	n.a.	n.a.	n.a.	100	8.4	0.80
Mood Baseline and No Mood 12-month	n.a.	n.a.	n.a.	230	16.1	1.06
Mood Baseline and 12-month	n.a.	n.a.	n.a.	143	9.9	0.85
Other						
No Other Baseline and No other 12-month	n.a.	n.a.	n.a.	658	53.2	1.43
Other 12-month and No other baseline	n.a.	n.a.	n.a.	235	20.0	1.15
Other Baseline and No other 12-month	n.a.	n.a.	n.a.	150	11.0	0.91
Other Baseline and 12-month	n.a.	n.a.	n.a.	205	15.8	1.05
Any mental						
No Mental Baseline and No Mental 12-month	n.a.	n.a.	n.a.	520	43.0	1.42
Mental 12-month and No Mental Baseline	n.a.	n.a.	n.a.	215	19.4	1.14
Mental Baseline and No Mental 12-month	n.a.	n.a.	n.a.	210	15.1	1.03
Mental Baseline and 12-month	n.a.	n.a.	n.a.	302	22.5	1.20

SE, Standard Error adjusted for multiple imputation; SD, Standard deviation; STB, Suicidal Thoughts and Behaviors; n.a., not applicable; T1, baseline; T2, 12-month follow-up;.

(a) unweighted *n*,% weighted by full sample weight (inverse probability of selection for end-game and post-stratification); (b) unweighted *n*,% weighted follow-up sample weight (inverse probability weighting and post-stratification). (c) Family: lowest tertile [1–3.75], middle tertile (3.75–4.5], highest tertile (4.5–5.0]; Peers/others: lowest tertile [1–2.75], middle tertile (2.75–3.5], highest tertile (3.5–5.0]; School: lowest tertile [1–3.33], middle tertile (3.33–4.17], high tertile (4.17–5.0]. (d) Mood includes probable cases of major depression or bipolar; Other includes probable cases of panic disorder, generalized anxiety disorder, alcohol and other substances abuse or dependence. (e) University sense of membership: lowest tertile [1–3.33], middle tertile (3.33–4.17], high tertile (4.17–5.0]. (f) According: lifetime probable case of (mood, other, any mental) at baseline and probable case of 12-month of (mood, other, any mental) at follow-up.

that after IPW weighting to correct for attrition, there were not substantial differences in the distribution of baseline variables in the T2 subsample as compared to the baseline sample, indicating that baseline distributions. Mean age at baseline of the T2 subsample was 18.7 (SD = 1.3). More than half of the sample were female (56.0%), had neither parent with a university degree (56.6%) and lived with their parents at first term of university (58.5%). A majority was enrolled in a Social Sciences or Legal Sciences program (47.6%). About six in ten (62.4%) students reported at least one adversity prior to the age of 17, most frequently: family maladaptation (34.6%) and being bullied (32.5%).

At T1, 20.4% of the respondents reported some chronic health problem or physical impairment. A little more than one in three students (37.6%) screened positive for T1 lifetime mental disorder, including 26.0% for mood and 26.8% for other mental disorders, and 1.4% a lifetime suicide attempt, 13.0% a lifetime suicide plan without attempt and 7.7% lifetime SI without a lifetime plan or attempt at T1. The distribution of variables assessed at follow-up (T2) are also presented in Table 1.

Fig. 2 shows overall 12-month SI and first-onset and persistence of SI in the 12 months prior to T2. A total of 7.3% (95% CI 5.85% − 8.77%) reported SI at T2. Of the respondents who did not report lifetime SI at T1, 3.4% (95% CI 2.26% − 4.54%) reported 12-month first-onset at T2. Of the students with T1 lifetime SI, 21.2% (95% CI 16.30% − 26.10%) reported persistence 12-month SI at T2. No statistically significant differences were found by gender either in overall, onset or persistence.

3.2. Risk and protective factors associated with SI at 12-month follow-up

The association analyses of 12-month SI at T2 (T2 SI) are presented in Table 2. They include bivariate associations (left panel) and the results of the multiple logistic regression model (right panel).

Bivariate analyses revealed that majority of factors were significantly associated with 12-month SI at T2. The strongest associations were with 12-month mood disorder at T2 with (OR = 19.80 95% CI 10.41–37.63) or without (OR = 17.55 95% CI 8.97–34.32) lifetime mood disorder at T1; lifetime suicide attempt(s) at T1 (OR = 24.87 95% CI 9.16–67.53); lifetime suicide plan without attempt at T1 (OR = 8.68 95% CI 5.21–14.45); lifetime SI without plan or attempt at T1 (OR = 4.22 95% CI 2.11–8.45); childhood/adolescence adversities before the age of 17 (OR = 5.67 95% CI 2.76–11.63); 12-month other mental disorders at T2 with lifetime other mental disorder at T1 (OR = 4.35 95% CI 2.52–7.50); and any 12-month stressfull experience at T2 (OR = 2.27 95% CI 1.26–4.10).

A statistically significant protective association was observed for childhood/adolescence positive experiences before the age of 17 [protective family (OR = 0.34, 95% CI 0.19–0.60 for the highest tertile); peers (OR = 0.46, 95% CI 0.26–0.79, and 0.28, 95% CI 0.16–0.48 for highest and middle tertile, respectively); and school experiences (OR = 0.32, 95% CI 0.17–0.59, and 0.43, 95% CI 0.26–0.70, for highest and middle tertile, respectively)] as well as for university sense of membership at T2 (OR = 0.21, 95% CI 0.07–0.64 and 0.33, 95% CI 0.19–0.56, for highest and middle tertile).

In the multivariable analysis, the strongest association with T2 SI were for: 12-month probable cases of mood disorder at T2 without T1 lifetime mood disorder (adjusted OR [aOR] = 12.08 95% 5.45–26.80); T1 lifetime suicide attempt (aOR = 8.79 95% CI 2.37–32.64); 12-month mood disorder at T2 with T1 lifetime mood disorder (aOR = 7.2 95% CI 2.91–17.80); lifetime suicide plan without lifetime suicide attempt at T1 (aOR = 4.72 95% CI 2.32–9.61); emotional abuse or neglect at childhood (aOR = 2.53 95% CI 1.31–4.86); and reporting physical or sexual assault at T2 (aOR = 3.28 95% CI 1.13–9.46). The only protective factor that remained statistically significant after adjustment for

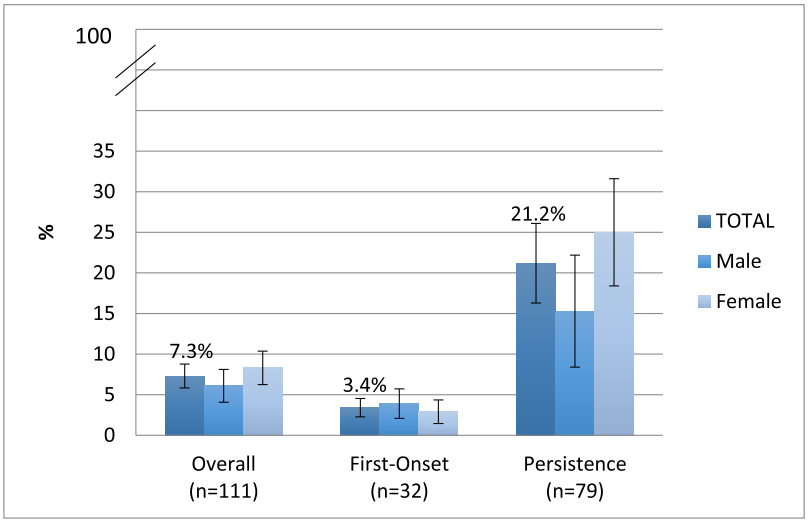

Fig. 2. First-onset and persistence of suicidal ideation (SI) at 12-month follow-up by gender.

other variables under study was university sense of membership (aOR = 0.25 95% CI 0.12–0.53 for middle tertile). In the multivariable analysis, a protective association was found between chronic health problems or physical impairment and SI at follow-up (aOR = 0.4 95% CI 0.18–0.87). The area under the curve (AUC) of the final model was 0.88 (SE = 0.02).

3.3. Risk and protective factors associated with first-onset and persistence of SI at 12-month follow-up

Multivariable associations between risk and protective factors and first-onset (first panel) and persistence (second panel) of T2 SI at are presented in **Table 3**. (Bivariate results are presented in **supplementary Table S3**.) First-onset of T2 SI was significantly associated with presence of 12-month mood disorder at T2 without lifetime mood disorder at T1 (adjusted OR [aOR] = 11.27 95% CI 3.02–42.14) and having suffered emotional abuse or neglect at childhood (aOR = 3.41 95% CI 1.10–10.57) or having been bullied (aOR = 3.2 95% CI 1.08–9.53). Persistence of SI at T2 was associted with presence of 12-month mood disorder at T2 among those without (aOR = 13.92 95% CI 3.76–51.59) and those with (aOR = 8.03 95% CI 2.13–30.29) lifetime mood disorder at T1. A significant negative association was found for university sense of membership with both first-onset (aOR = 0.1 95% 0.02–0.55 for middle tertile) and persistence of T2 SI (aOR = 0.3 95% CI 0.11–0.81 for middle tertile), suggesting a protective effect of this variable on both outcomes. A negative association was found between reporting chronic health problems or physical impairment at T1 and first-onset of SI at follow-up (0.08 95% CI 0.01–0.54).The areas under the curve (AUCs) of the multivariable logistic regression models integrating all candidate factors under study, were 0.83 (SE = 0.05) for first-onset of SI and 0.80 (SE = 0.03) for persistence of SI.

4. Discussion

4.1. Main results

This study provides the first prospective data on first-onset and persistence of suicidal ideation during the first year among Spanish university students. There are five noteworthy findings. First, SI is common during the first year of university. Second, there is a high incidence of SI-onset between their first and second year of university. Third, around one in five students with a history of SI at university entrance persisted with SI in the subsequent year. Four, effect of 12-month follow-up disorder surpassed those for two other strong and independent risk factors in our study (i.e., lifetime suicide plans and/or attempts at baseline for persistence of SI, and exposure to emotional abuse or neglect before the age of 17 for first-onset of SI). Finally, our data suggest that a higher sense of membership during the first year at university is associated with reduced risk of overall 12-month SI at T2, as well as onset and persistence of SI.

12-month prevalence of SI is high and within the range of previous results from cross-sectional analysis of T1 (baseline) (Blasco et al., 2018), also of those found in other university survey studies using same instrument (Mortier et al., 2018a), as well as other studies (Drum et al., 2009; Engin et al., 2009; Wilcox et al., 2010). Although Spain is among the countries with the lowest rates of suicide (World Health Organization, 2016b), our estimates of SI are very similar to those obtained in studies in other countries among university students, with 12-month SI among university students between 5% and 35% (Mortier et al., 2017a, 2017b; Wilcox et al., 2010) and young adults (Gunnell et al., 2004; ten Have et al., 2009). The prevalence reported in our study was higher than that of the Spanish general population (Gabilondo et al., 2007), however, differences in the questions addressing SI limit direct comparisons. The high incidence of first-onset and persistence of SI among first-year university students might indicate a need for active detection and intervention of high risk students when accessing to the university, in order to prevent the transitions from ideation to more severe forms of STB (Nock et al., 2008; ten Have et al., 2013).

Hence university might be considered an adequate target setting to implement interventions aimed at preventing the onset of ideation to progress into subsequent suicide plans or attempts (King et al., 2015).

Our finding that 12-month mood disorder was the main risk factor associated with 12-month SI, as well as with first-onset and with persistent SI during the first year of university is consistent with previous studies (King et al., 2001; Nock et al., 2013; Wilcox et al., 2010; Wu et al., 2004). Also, childhood adversities, one of the most extensively studied risk factors for STB (Castellví et al., 2017), are found to be associated with SI in our study. However, when we analyzed separately the associations with first-onset and with persistent SI, childhood adversities are a risk factor for first-onset, but not for persistence. This is consistent with a previous report (Mortier et al., 2017a, 2017b) were it was hypothesized that dysfunctional traits, such as affective-behavioral dysregulation (Carvalho Fernando et al., 2014) or interpersonal stress sensitivity (Huh et al., 2014), which are highly associated with childhood adversities (Miller et al., 2013), mediate the effect of childhood adversities on SI, only among those with a previous history of SI, but not among those who have their first SI onset in later ages. Moreover,

Table 2
Bivariate and multivariable associations of risk and protective factors under study with suicide ideation (SI) at 12-month follow-up.

	Bivariate			Multivariable		
	OR	CI	p-value	aOR	CI	p-value
Gender (ref = Female)	0.72	(0.46–1.13)	0.15	0.81	(0.44–1.49)	0.50
Age (ref = 18)	1.07	(0.68–1.69)	0.77	1.02	(0.54–1.92)	0.96
Childhood/adolescence (T1)						
Adversities						
Breakdown of family structure	1.43	(0.86–2.37)	0.17	0.69	(0.34–1.38)	0.30
Family maladaptation	2.27	(1.47–3.51)	<0.01*	1	(0.52–1.90)	1.00
Childhood maltreatment						
Emotional abuse or neglect	5.92	(3.78–9.28)	<0.01*	2.53	(1.31–4.86)	<0.01
Physical or sexual abuse	4.19	(2.55–6.88)	<0.01*	1.62	(0.80–3.29)	0.18
Any maltreatment	6.07	(3.81–9.68)	<0.01*	n.a.	n.a.	n.a.
Bully victimization	2.4	(1.55–3.70)	<0.01*	1.51	(0.80–2.84)	0.20
Any adversities	5.67	(2.76–11.63)	<0.01*	n.a.	n.a.	n.a.
Positive relationships[a]						
Family (ref = Low)						
High	0.34	(0.19–0.60)	<0.01*	1.18	(0.51–2.72)	0.90
Middle	0.63	(0.39–1.03)		0.98	(0.52–1.83)	
Peers/others (ref = Low)						
High	0.46	(0.26–0.79)	<0.01*	0.9	(0.41–2.01)	0.20
Middle	0.28	(0.16–0.48)		0.53	(0.27–1.08)	
School (ref = Low)						
High	0.32	(0.17–0.59)	<0.01*	1.16	(0.49–2.79)	0.64
Middle	0.43	(0.26–0.70)		1.4	(0.70 - 2.78)	
Past-year stressful experiences (T2)						
Death illness injury or accident	1.52	(0.99–2.34)	0.06	1.79	(1.01 - 3.15)	0.05
Breakup or betrayal arguments	2.86	(1.77–4.62)	<0.01*	1.39	(0.73–2.65)	0.31
Physically or sexually assaulted	4.68	(2.24–9.76)	<0.01*	3.28	(1.13–9.46)	0.03
Any stressful experiences	2.27	(1.26–4.10)	<0.01*	n.a.	n.a.	n.a.
University sense of membership (ref = Low) (T2)[b]						
High	0.21	(0.07–0.64)	<0.01*	0.35	(0.09–1.37)	<0.01
Middle	0.33	(0.19–0.56)		0.25	(0.12–0.53)	
Physical and mental conditions (T1–T2)						
Chronic health problems or physical impairment						
12-month and No Baseline	1.91	(1.03–3.54)	0.08	1.23	(0.52–2.91)	0.04
Baseline	0.86	(0.47–1.57)		0.4	(0.18–0.87)	
Mental disorders[c]						
Mood						
Mood 12-month and No Mood Baseline	17.55	(8.97–34.32)	<0.01*	12.08	(5.45–26.80)	<0.01
Mood Baseline and No Mood 12-month	3.72	(1.75–7.87)		1.94	(0.79–4.77)	
Mood Baseline and 12-month	19.8	(10.41–37.63)		7.2	(2.91–17.80)	
Other						
Other 12-month and No other baseline	1.98	(1.09–3.61)	<0.01*	1.06	(0.49–2.28)	0.88
Other Baseline and No other 12-month	2.33	(1.15–4.71)		0.75	(0.28–2.00)	
Other Baseline and 12-month	4.35	(2.52–7.50)		1.1	(0.49–2.48)	
Any mental						
Mental 12-month and No Mental Baseline	6.14	(2.81–13.40)	<0.01*	n.a.	n.a.	n.a.
Mental Baseline and No Mental 12-month	1.95	(0.68–5.54)		n.a.	n.a.	
Mental Baseline and 12-month	13.08	(6.37–26.89)		n.a.	n.a.	
Lifetime STB (ref = Without history of SI) (T1)						
Attempt	24.87	(9.16–67.53)	<0.01*	8.79	(2.37–32.64)	<0.01
Plan without attempt	8.68	(5.21–14.45)		4.72	(2.32–9.61)	
Idea without plan nor attempt	4.22	(2.11–8.45)		1.67	(0.68–4.06)	
Any STB	7.68	(4.87–12.10)	<0.01*	n.a.	n.a.	n.a.
AUC (SE)				0.88 (0.02)		

OR, Odd Ratio; aOR, adjusted Odds Ratio; CI, 95% Confidence Interval; ref, reference category; AUC, Area under the curve; SE, Standard Error; STB; Suicidal Thoughts and Behaviors; SI, Suicidal Ideation; n.a., not applicable; Multivariable model adjusted by: Age, gender, university, academic field, country of birth, parents' studies and living location; T1, baseline; T2, 12-month follow-up.
Raw p-value statistically significant after adjustment for multiple comparisons using Benjamini-Hochberg procedure with false discovery rate 0.05.
(a) Family: lowest tertile [1–3.75], middle tertile (3.75–4.5], highest tertile (4.5–5.0]; Peers/others: lowest tertile [1–2.75], middle tertile (2.75–3.5], highest tertile (3.5–5.0]; School: lowest tertile [1–3.33], middle tertile (3.33–4.17], high tertile (4.17–5.0]; (b) University sense of membership: lowest tertile [1–3.33], middle tertile (3.33–4.17], high tertile (4.17–5.0]. (c) Mood includes probable cases of major depression or bipolar; Other includes probable cases of panic disorder, generalized anxiety disorder, alcohol and other substances abuse or dependence. According: lifetime probable case of (mood, other, any mental) at baseline and probable case of 12-month of (mood, other , any mental) at 12-month follow-up.

although a previous STB is a well-document risk factor for SI (Bridge et al., 2006; Mościcki, 1997; Nock and Kazdin, 2002) in our study, we observed no effects on the persistence subsample most likely due to the low numbers involved."

Moreover, although one of the well-document risk factors (Bridge et al., 2006; Mościcki, 1997; Nock and Kazdin, 2002) for SI were previous SI, in this study, due to low prevalence, it was no observed the effect on the persistence subsample. A unique issue of our study was the inclusion of potential protective factors for SI, which have been much less studied than risk factors. Based on cross-sectional analyses of the baseline data, we reported that positive relationships with peers/others during childhood or adolescence have a protective effect on youth-adult STB (Blasco et al., 2018). In prior research among adolescents (Kuramoto-Crawford et al., 2017), youth reporting higher parent-child

Table 3
Multivariable associations of risk and protective factors under study with first-onset and persistence of suicidal ideation (SI) at 12-month follow-up.

	First-onset			Persistence		
	aOR	CI	*p*-value	aOR	CI	*p*-value
Gender (ref = Female)	1.2	(0.43–3.39)	0.73	0.39	(0.15–1.04)	0.06
Age (ref = 18)	0.72	(0.22–2.39)	0.60	1.5	(0.61–3.69)	0.38
Childhood/adolescence (T1)						
Adversities						
Breakdown of family structure	0.33	(0.06–1.70)	0.18	0.8	(0.33–1.92)	0.62
Family maladaptation	0.84	(0.24–2.89)	0.78	1.58	(0.61–4.09)	0.34
Childhood maltreatment						
Emotional abuse or neglect	3.41	(1.10–10.57)	0.03	2.4	(0.86–6.67)	0.09
Physical or sexual abuse	3.3	(0.79–13.82)	0.10	1.07	(0.43–2.66)	0.88
Bully victimization	3.2	(1.08–9.53)	0.04	0.95	(0.37–2.43)	0.92
Positive relationships[(a)]						
Family (ref = Low)						
High	1.48	(0.35–6.17)	0.83	1.13	(0.28–4.45)	0.92
Middle	0.96	(0.28–3.22)		0.86	(0.34–2.18)	
Peers/others (ref = Low)						
High	0.81	(0.22–3.04)	0.37	0.83	(0.19–3.50)	0.78
Middle	0.4	(0.11–1.50)		0.71	(0.27–1.84)	
School (ref = Low)						
High	0.41	(0.08–2.18)	0.58	1.61	(0.44–5.96)	0.30
Middle	0.67	(0.19–2.30)		2.23	(0.82–6.07)	
Past-year stressful experiences (T2)						
Death illness injury or accident	1.11	(0.37–3.29)	0.85	1.37	(0.61–3.07)	0.45
Breakup or betrayal arguments	2.71	(0.76–9.70)	0.13	1.11	(0.45–2.78)	0.82
Physically or sexually assaulted	4.74	(0.74–30.33)	0.10	2.22	(0.55–8.92)	0.26
University sense of membership (ref = Low)[(b)] (T2)						
High	0.6	(0.10–3.59)	0.03	0.18	(0.01–2.28)	0.04
Middle	0.1	(0.02–0.55)		0.3	(0.11–0.81)	
Physical and mental conditions (T1–T2)						
Chronic health problems or physical impairment						
12-month and No Baseline	0.38	(0.06–2.57)	0.03	3.64	(1.02–13.01)	0.08
Baseline	0.08	(0.01–0.54)		0.74	(0.27–2.04)	
Mental disorders[(c)]						
Mood						
Mood 12-month and No Mood Baseline	11.27	(3.02–42.14)	<0.01	13.92	(3.76–51.59)	<0.01
Mood Baseline and No Mood 12-month	0.95	(0.15–5.89)		1.93	(0.53–7.06)	
Mood Baseline and 12-month	6.05	(1.17–31.34)		8.03	(2.13–30.29)	
Other						
Other 12-month and No other baseline	2.11	(0.58–7.72)	0.36	0.75	(0.22–2.60)	0.88
Other Baseline and No other 12-month	0.37	(0.02–5.64)		0.64	(0.16–2.57)	
Other Baseline and 12-month	2.58	(0.63–10.53)		0.62	(0.19–2.03)	
Lifetime STB (T1)[(d)] (ref = SI without plan or attempt)						
Attempt	n.a.	n.a.	n.a.	4.64	(1.06–20.36)	0.07
Plan without attempt	n.a.	n.a.		2.5	(0.95–6.63)	
AUC (SE)	0.83 (0.05)			0.80 (0.03)		

aOR, adjusted Odd Ratio; CI, 95% Confidence Interval; ref, reference category; AUC, Area under the curve. SE, Standard Error; SI, Suicidal Ideation; Multivariable model adjusted by: Age, gender, university, academic field, country of birth, parents' studies and living location; T1, baseline; T2, 12-month follow-up; (a) Family: lowest tertile [1–3.75], middle tertile (3.75–4.5], highest tertile (4.5–5.0]; Peers/others: lowest tertile [1–2.75], middle tertile (2.75–3.5], highest tertile (3.5–5.0]; School: lowest tertile [1–3.33], middle tertile (3.33–4.17], high tertile (4.17–5.0]; (b) University sense of membership: lowest tertile [1–3.33], middle tertile (3.33–4.17], high tertile (4.17–5.0]. (c) Mood includes probable cases of major depression or bipolar; Other includes probable cases of panic disorder, generalized anxiety disorder, alcohol and other substances abuse or dependence. (d) Lifetime STB not applicable at first-onset model given that individuals with previous STB have been excluded from the model.

connections had lower relative risk of having ideation in their adulthood. Similar results were found among those who perceived being loved from caregivers during childhood (Susukida et al., 2016). However, in the present study, we failed to replicate these results. We did find that university sense of membership, which was our follow-up measure of positive relationships, was significantly associated with a lower likelihood of both first-onset SI and persistence. Our hypothesis is that childhood positive relationships could help in the development of further ability for forming social bonds (Macrynikola et al., 2018) and then the protective effect of childhood relationships is mediated by current relationships, that bring on sense of membership. This hypothesis remains to be fully tested, as we did not include items for assessing social abilities or other related measures in our survey. Finally, and somewhat unexpectedly, we found that suffering from a chronic condition or physical impairment at baseline was associated with a lower risk of SI at follow-up. A similar association had been reported in the cross-sectional analyses of the baseline data of our study (Blasco et al., 2018). This negative association is in contrast with the risk factor role of chronic conditions in adults. We are not aware of other studies reporting similar results. We speculate that suffering from a chronic health problem in young age may drive some resilience protecting from SI. We believe that hypotheses about possible differences between youth people and adults deserve further study..

4.2. Strengths and limitations

This study has several strengths. First, the prospective assessment of a wide range of risk and protective factors, both proximal and distal, providing a more comprehensive view of associations with SI than previous studies. Second, we analyzed two distinct SI outcomes (i.e., overall, first-onset and persistence), resulting in a more fine-grained evaluation of STB occurrence and their course in university settings.

Finally, the online methodology used tends to deliver more reliable information about STB than fact-to-face assessments (Tourangeau and Yan, 2007).

On the other hand, several study limitations should be taken into account when interpreting our results. First, a low response rate at baseline might have rendered our baseline results a biased representation of the total population of university students. Also, although at a lower extent, we experienced some loss of at 12-month follow-up. We addressed these limitations by applying population-based adjustments and inverse-probability weights, which has proven to be an effective method for reducing non-response bias (Brick, 2013; Dey, 1997). Moreover, we studied a convenience sample of universities; nevertheless, their geographical dispersion over Spain was wide. Moreover, the characteristics of the included universities are very similar to the overall Spanish university students in terms of sex, mean age, and percentage of foreign students and study field. Also, monetary incentives were offered in our study. Incentives may encourage participation of individuals that would otherwise not be motivated to respond and thus, improve sample representativeness. But the evidence on this issue is not conclusive, with some studies indicating that they may also introduce bias (Moyer and Brown, 2008). Second, the assessment of mental and substance abuse disorders was based on self-reports and not on direct clinical assessment. Therefore, they should be better considered "probable cases" of disorder. Nevertheless, a good diagnostic agreement has been reported with clinical judgment (Haro et al., 2006; Wittchen, 1994). Although the surveys used well-validated scales in general population samples, calibration studies have not yet been carried out in samples of college students. Scales of positive relationships and university of sense of membership were used as a proxy for the social connectedness construct, for feasibility reasons. Studies using more specific and comprehensive measures are needed. Third, due to the infrequency of STB outcomes and of some risk factors, we had to collapse information in order to avoid numerical problems in logistic regression models. For example, although the importance of alcohol and drugs use in universities (Karam et al., 2007; Wicki et al., 2010) and their importance in the study of STB it was not possible to analyze it separately due to the low frequencies of students with substance use disorders. Similarly, our analyses were limited to suicidal ideation (SI), without taking into account other important outcomes such as suicide plan or attempt, or trajectories from ideation to plan or attempt. In addition, the measure of persistent SI was defined as the presence of SI in the 12-month follow-up among those with a history of past suicidal episodes, without a more fine-grained definition that would identify if persistence was in fact a relapse or a recurrence (Frank et al., 1991). However, our definition of persistence is consistent with previous longitudinal studies among university students (Mortier et al., 2017a; Wilcox et al., 2010), which enhances the comparability of results.

Fourth, we do not know the direction of the association between proximal factors (i.e., 12-month factors) and SI, because both occurred between baseline and 12-month follow-up. Although there is high probability of stressful experiences or mental disorders preceded temporally the SI (Gili et al., 2019; Liu and Miller, 2014), it is not so clear for the sense of membership, that may be a consequence or correlate rather than a cause of low SI (Fisher et al., 2015).

However, it should be noted that including information about issues taking place close to the outcome is very relevant (Forkmann et al., 2018; Mościcki, 1997). In future research it would be useful to gather information about the exact timing of onset of particular risk factors such as mental disorders. Finally, although we examined a broad set of potential risk and protective factors, many other potential factors were not included in this study (e.g., treatment, sexual orientation, academic performance, and family support or household socioeconomic status among others). Whereas no study can assess all risk and protective factors, the limited focus used should be born in mind when interpreting the results.

4.3. Implications

The high incidence of SI among Spanish university students reported in our study requires seriously consideration of the opportunity of an active strategy for both detection and intervention of STB. University services should take into account potential interventions among those with previous STB for reducing more severe suicidal thoughts and behaviors, including persistence SI, but also among those students without previous STB in order to prevent SI onset. Although more specific research is needed, our results suggest that strategies focused on increasing the sense of membership among first-year university students should be considered by the academic authorities as a possible universal strategy for prevention suicide among students (Calear et al., 2016; Whitlock et al., 2014). Summer programs, extra curricular activities and training personal for identify students with a risk of exclusion, among other strategies, have been proposed to increase connectedness at University (Whitlock et al., 2012).

Conflict of interest

In the past 3 years, Dr. Kessler received support for his epidemiological studies from Sanofi Aventis; was a consultant for Johnson & Johnson Wellness and Prevention, Shire, Takeda; and served on an advisory board for the Johnson & Johnson Services Inc. Lake Nona Life Project. Kessler is a co-owner of DataStat, Inc., a market research firm that carries out healthcare research.

Contributors' statements

Author Contributions: Jordi Alonso had full access to all of the data in this study and takes responsibility for the integrity of the data, and the accuracy of the data analysis.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.jad.2019.05.035.

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