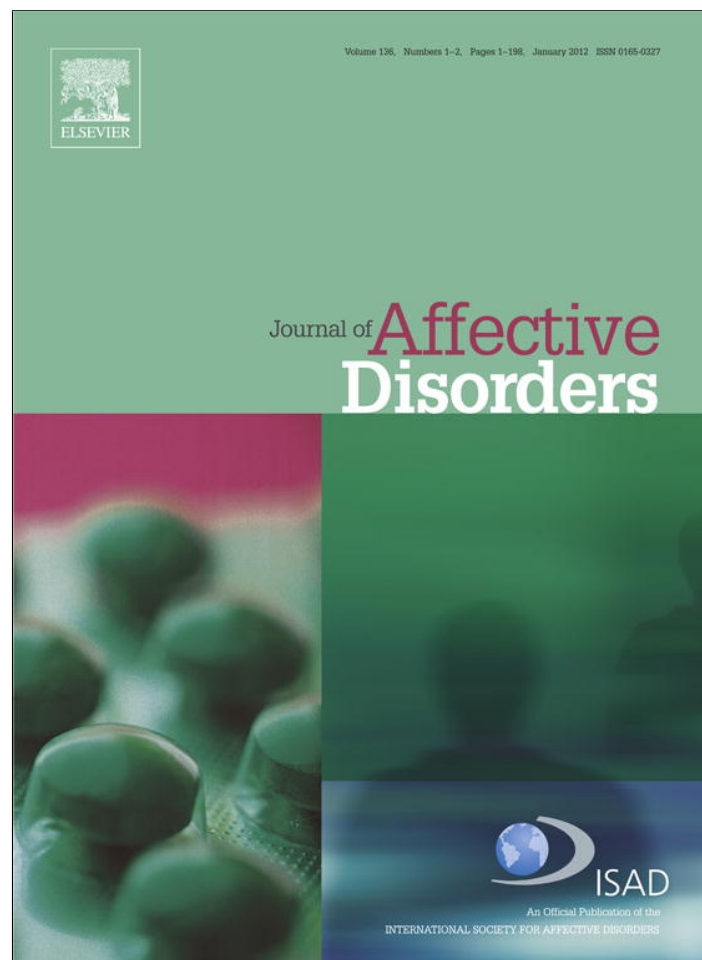


Provided for non-commercial research and education use.  
Not for reproduction, distribution or commercial use.



This article appeared in a journal published by Elsevier. The attached copy is furnished to the author for internal non-commercial research and education use, including for instruction at the authors institution and sharing with colleagues.

Other uses, including reproduction and distribution, or selling or licensing copies, or posting to personal, institutional or third party websites are prohibited.

In most cases authors are permitted to post their version of the article (e.g. in Word or Tex form) to their personal website or institutional repository. Authors requiring further information regarding Elsevier's archiving and manuscript policies are encouraged to visit:

<http://www.elsevier.com/authorsrights>



Contents lists available at ScienceDirect

## Journal of Affective Disorders

journal homepage: [www.elsevier.com/locate/jad](http://www.elsevier.com/locate/jad)

## Research report

## The impact of lifetime suicidality on academic performance in college freshmen



P. Mortier<sup>a,\*</sup>, K. Demyttenaere<sup>a</sup>, R.P. Auerbach<sup>b</sup>, J.G. Green<sup>d</sup>, R.C. Kessler<sup>e</sup>, G. Kiekens<sup>a</sup>, M.K. Nock<sup>c</sup>, R. Bruffaerts<sup>a</sup>

<sup>a</sup> Research Group Psychiatry, Department of Neurosciences, KU Leuven University, Herestraat 49, Leuven, Belgium

<sup>b</sup> Harvard Medical School, McLean Hospital, Center for Depression, Anxiety and Stress Research, Belmont, MA, USA

<sup>c</sup> Department of Psychology, Harvard University, Boston, MA, USA

<sup>d</sup> School of Education, Boston University, Boston, MA, USA

<sup>e</sup> Harvard Medical School, Department of Health Care Policy, Harvard University, Boston, MA, USA

## ARTICLE INFO

## Article history:

Received 25 May 2015

Received in revised form

17 July 2015

Accepted 28 July 2015

Available online 31 July 2015

## Keywords:

College student

Suicide attempt

Suicide plan

Grade point average

Academic performance

## ABSTRACT

**Background:** While suicidal thoughts and behaviors (STB) among college students are common, the associations between STB and academic performance are not well understood.

**Methods:** As part of the World Mental Health Surveys International College Student project, web-based self-reported STB of KU Leuven (Leuven, Belgium) incoming freshmen ( $N=4921$ ; response rate=65.4%) was collected, as well as academic year percentage (AYP), and the departments to which students belong. Single- and multilevel multivariate analyses were conducted, adjusted for gender, age, parental educational level, and comorbid lifetime emotional problems.

**Results:** Lifetime suicide plan and attempt upon college entrance were associated with significant decreases in AYP (3.6% and 7.9%, respectively). A significant interaction was found with average departmental AYP, with STB more strongly associated with reduced AYP in departments with lower than higher average AYP.

**Limitations:** Limited sample size precluded further investigation of interactions between department-level and student-level variables. No information was available on freshman secondary school academic performance.

**Conclusions:** Lifetime STB has a strong negative association with academic performance in college. Our study suggests a potential role for the college environment as target for treatment and prevention interventions.

© 2015 Elsevier B.V. All rights reserved.

## 1. Introduction

The college years are a crucial period when students make the transition from late adolescence to adulthood (Arnett, 2000). Just as their young adult peers (Nock et al., 2012), high numbers of college students report lifetime suicidal thoughts and behaviors (STB), with estimates of suicidal ideation in the 8.1–53.0% range (Drum et al., 2009; Paul et al., 2014), and attempts in the 1.0–11.2% range (Engin et al., 2009; Wang et al., 2014). Importantly, STB during early life is associated with long-term adverse outcomes in later adult life, including persistent mental and physical health problems (Goldman-Mellor et al., 2014; Herba et al., 2007), relationship dysfunction (Goldman-Mellor et al., 2014; Kerr and Capaldi, 2011; Kessler et al., 1998), labor market marginalization

(Niederkrotenthaler et al., 2014), and unemployment (Ettner et al., 1997; Goldman-Mellor et al., 2014).

Mental health and academic performance are closely related (Clarke et al., 2014; Dalgard et al., 2007; Hooven et al., 2012; Keyes et al., 2012). General population studies suggest that early-onset mental disorders account for about 5% of college drop-outs and that students with psychiatric disorders are twice as likely as other students to drop out of college without obtaining a degree (Lee et al., 2009; Kessler et al., 1995; Hartley, 2010). Although one might expect from these results that STB would also be associated with low academic performance, studies on the direct effects of STB on academic performance among college students are scarce and findings are ambiguous. For example, no association was found between suicidal ideation and grade point average (GPA) in two smaller samples (Lester, 2013; Nyer et al., 2013). A larger study of 1296 medical students (Miletic et al., 2015) found that those with lifetime suicidal ideation and/or suicide attempt(s) had a lower GPA as compared to those who never experienced STB (7.90

\* Corresponding author. Fax: +32 16348700.

E-mail address: [philippe.mortier@uzleuven.be](mailto:philippe.mortier@uzleuven.be) (P. Mortier).

vs. 8.24;  $p=0.001$ ). Unfortunately, no separate analyses were conducted for those with more severe STB (e.g., plans or attempts), and those with suicidal ideation only, although a Spearman's coefficient of  $-1.25$  ( $p < 0.001$ ) was found between GPA and severity of suicidal behaviors. The inclusion of multiple STB indices (e.g., suicidal ideation, suicide plans, and attempts) may yield a more fine-grained analysis of the effect of increasing STB severity on academic performance. Moreover, previous studies all assessed academic performance by self-report, introducing the possibility of measurement errors, especially for those with lower grades (Kuncel et al., 2005). They also failed to adjust for relevant covariates such as comorbid psychopathology (Lee et al., 2009), or socioeconomic status (Spera et al., 2009).

We addressed these shortcomings using baseline data from the *Leuven College Surveys*, as a part of the WHO World Mental Health Surveys International College Student project (WMH-ICS). The WMH-ICS aims to obtain accurate longitudinal cross-national information about the prevalence and correlates of mental, substance, and behavioral disorders among college students worldwide. Goals of the project include assessing unmet need for treatment, identifying students in need of outreach, and evaluating preventive and clinical interventions. The aim of the present study is to investigate whether lifetime STB (i.e., death wish, suicidal ideation, suicide plan, or suicide attempt) upon college entrance is associated with academic performance during the first year of college, beyond the effect of sociodemographic variables and lifetime psychopathology.

## 2. Methodology

### 2.1. Procedures

As part of the WMH-ICS project, the *Leuven College Surveys* consist of a series of ongoing web-based self-report surveys of KU Leuven university students. Representing Belgium's largest university, the KU Leuven has an enrollment of over 40,000 students. In the academic years 2012 and 2013, a total of 7527 Dutch-speaking incoming freshmen aged 18 years or older were eligible for the baseline survey. The sample was recruited in three stages. In the first stage, the baseline survey was included in a routine psychomedical check-up organized by the university student health center. All incoming freshmen from all departments were sent a standard invitation letter for the check-up. Students arriving for their check-up were invited to complete the study survey on a desktop computer in the waiting room of the student health center. In a second stage, non-respondents to the first stage (i.e., the psycho-medical check-up) were personally contacted using customized emails containing unique electronic links to the survey. The third stage was identical to the second stage, but additionally included an incentive to complete the survey (i.e., a raffle for 20 euro store credit coupons). Each stage used reminder emails, setting the maximum amount of contacts at eight. The study's protocol was approved by the University Hospital Leuven Biomedical Ethical Board and by the Belgian Commission for the Protection of Privacy. Students who reported any past year STB or non-suicidal self-injury were presented with links to local mental health resources.

The KU Leuven is divided in 40 departments based on the academic content being offered to the enrolled students within that department (e.g., bio-engineering, law, romance languages, etc.). A department is a micro-unit within the larger campus environment, with shared structural (e.g., classrooms), interpersonal (e.g., sense of belongingness), and social (e.g., sports participation) elements. We obtained freshman departmental status from the KU Leuven administration office. This enabled us to run additional

multilevel analyses and to test for between-department variability in the association between STB and academic performance. Such an approach may be especially relevant since evidence suggests that students' wellbeing and performance is linked to peer-group effects, student-faculty interactions, and general institution characteristics (Astin, 1993; Fink, 2014; Pascarella and Terenzini, 2005).

### 2.2. Measures

The WMH-ICS survey instrument was developed by the *World Mental Health Survey Consortium* to include multiple screening instruments measuring a wide range of mental health outcomes. Survey data on lifetime emotional problems, and lifetime STB were linked for each participant to administrative unit-level data obtained at the KU Leuven students' administration office, including academic year percentage, and sociodemographic variables. Survey measures and administrative information for this study are briefly discussed below.

*Academic year percentage (AYP)*: The AYP is the final grade percentage (range 0.0–100.0%), as objectively calculated by the KU Leuven administration office. Examinations are held in June, and when students do not participate or fail, retakes are being held in September. The AYP is calculated after the September retakes, and consists of the weighted sum of all final course grades. When students do not participate in an examination, the obtained grade of this particular course is zero.

*Sociodemographic variables* included gender, age, and parental educational level. Parental education was divided in three levels: both parents completed a high degree of education (i.e., college bachelor degree or more), only one parent completed a high degree of education, and none of the parents completed a high degree of education. Parental education was included as covariate because it is a reliable proxy variable for socio-economic status (Hauser and Warren, 1997), but also for young people's educational success or achievement-related behaviors (Eccles et al., 2004).

*Lifetime suicidal thoughts and behaviors (STB)*: STB items were taken from the Self-Injurious Thoughts and Behaviors Interview (SITBI; Nock et al., 2007). STB was conceptualized as a continuum (Crosby et al., 1999), starting with a death wish (“Did you ever wish you were dead or would go to sleep and never wake up?”), which may proceed into suicidal ideation (“Did you ever in your life have thoughts of killing yourself?”), possibly accompanied by a suicide plan (“Did you ever think about how you might kill yourself [e.g., taking pills, shooting yourself] or work out a plan of how to kill yourself?”), and then leading in some cases to a suicide attempt (“Have you ever made a suicide attempt [i.e., purposefully hurt yourself with at least some intent to die]?”). Construct validity of the SITBI is good to excellent compared with the Schedule for Affective Disorders and Schizophrenia for School Aged Children (K-SADS-PL;  $\kappa=0.48-0.65$ ), and the Beck Scale for Suicide Ideation (BSI;  $\kappa=0.59$ ). Inter-rater reliability and test-retest reliability after 6-month follow-up are excellent ( $\kappa=0.7-1.0$ ; Nock et al., 2007).

*Lifetime emotional problems*: Number of lifetime emotional problems was assessed using the Global Appraisal of Individual Needs Short Screener, a well-validated screening instrument for mental disorders among both adolescent and adult populations (GAIN-SS; Dennis et al., 2006). The GAIN-SS consists of four five-item sub-screener, including an internalizing disorder sub-screener (depression, anxiety, sleep problems, post-traumatic stress, and suicidal ideation), an externalizing disorder screener (inattentiveness, hyperactivity, impulsivity, and conduct disorder), a substance disorder screener (substance issues, abuse, and dependence), and a crime/violence disorder sub-screener (interpersonal, property, and drug related crimes). Subscreeners show good internal consistency (Cronbach  $\alpha=0.65-0.81$ ), and they are

highly correlated with the original corresponding subscales of the 60–120 min DSM-IV-TR based GAIN structured interview (Pearson  $r=0.84-0.93$ ; Dennis et al., 2006). The internalizing sub-screener was adapted by eliminating the fifth item (i.e., suicidal ideation or attempt) due to overlap with the lifetime STB variables, resulting in a maximum GAIN-SS score of 19.

### 2.3. Statistical analyses

All analyses were performed with SAS (version 9.3) and MLwiN software (version 2.24; Rasbash et al., 2009). First, non-response propensity weighting techniques were applied on the data to adjust for sociodemographic differences between survey respondents and non-respondents. These techniques were applied to account for non-response bias and missingness of data. This approach enables us to obtain estimates representative for the full student population of incoming freshmen. Since response rates can be poor indicators of data representativity (Groves, 2006), we also calculated representativity indicators (*R*-indicators; Schouten et al., 2009) for each additional inclusion stage. Values of *R*-indicators vary between 0 and 1, the latter indicating data are fully representative of the population under study.

Generalized linear modeling (GLM; using SAS GENMOD procedure) was used to estimate the effect of each lifetime STB outcome on AYP, with gender, age, parental educational level, and number of lifetime emotional problems as covariates. Subsequently, two-level linear regression models were fitted, with students (level one) nested within college departments (level two). We estimated between- and within-department random slopes for significant lifetime STB effects on AYP, again adjusting for covariates in the fixed part of the model. Significance testing from zero of fixed effects and (co)variances was performed using the univariate Wald test. Finally, we estimated Spearman's ranking correlation coefficients (using SAS PROC CORR procedure) between the predicted slope values of STB impact on AYP from the multilevel models, and departmental proportions in gender, age, parental educational level, any lifetime STB, and departmental mean values in AYP, number of lifetime emotional problems, and number of students enrolled.

Prevalence estimates are reported as weighted numbers (*n*), weighted proportions (%), and associated standard errors (SE) corrected for finite population sampling without replacement (SAS PROC SURVEYFREQ procedure). To describe between-department variance in study variables, median values, with interquartile range (IQR) were calculated. Model parameters are reported as weighted unstandardized regression coefficients ( $\beta$ ), associated standard errors (SE), and 95% confidence intervals (95%CI).

## 3. Results

### 3.1. Sample description

Sample and department characteristics are presented in Table 1. The final sample consisted of 4921 freshmen (response rate=65.4%). *R*-indicators increased from 0.803 after inclusion stage 1 to 0.815 after inclusion stage 3, suggesting a high representativity of the final data. Sampled freshmen were distributed over 38 different departments (two departments were left out of the analysis due to  $n < 10$ ). The median number of students per department was 61 (IQR=37–162). The median departmental response rate was 67.4% (IQR=59.7–73.2). The average AYP was 50.3% (SE=0.2), and lifetime death wish, suicidal ideation, suicide plan, and suicidal attempt were reported by 5.3%, 6.0%, 5.5%, and 1.4% of the sample, respectively. When calculating prevalence estimates for the different STB transition stages with

**Table 1**  
Characteristics of the sample ( $N=4921$ ), and departments ( $N=38$ ).

	Sample			Departments	
	% (w)	SE	<i>n</i> (w) <sup>a</sup>	Median	IQR
<b>Gender</b>					
Female	55.5	0.4	2725	53.0	32.3–68.9
Male	44.6	0.4	2189	47.0	31.1–67.7
<b>Age</b>					
18 Year	73.9	0.4	3633	72.6	64.4–77.7
19 Year or more	26.1	0.4	1283	27.5	22.3–35.6
<b>Parental education</b>					
Both high	60.0	0.5	2540	61.1	51.8–67.4
Mixed	24.3	0.4	1028	23.3	20.9–29.8
Both low	15.7	0.3	664	15.8	10.9–21.2
<b>Lifetime STB<sup>b</sup></b>					
Death wish	5.3	0.2	222	4.6	3.3–6.8
Suicidal ideation	6.0	0.2	250	5.1	4.1–6.6
Suicide plan	5.5	0.2	230	5.2	3.7–7.6
Suicide attempt	1.4	0.1	59	0.8	0.0–2.5
	<b>Mean</b>	<b>SE</b>	<b>SD</b>	<b>Median</b>	<b>IQR</b>
<b>Academic year percentage (AYP)</b>	50.3	0.2	18.3	49.5	45.9–53.2
<b>Number of lifetime emotional problems</b>	4.9	0.0	3.2	4.8	4.4–5.4

<sup>a</sup> Missing values are within the 0.2 –13.8% range.

<sup>b</sup> Non-overlapping categories, i.e., death wish does not include students with suicidal ideation, plans, and attempts, etc.

overlapping categories (i.e. cases of subsequent stages also included in the estimation), lifetime death wish, suicidal ideation, suicide plan, and suicidal attempt were reported by 18.2%, 13.0%, 6.9%, and 1.4% of the sample, respectively. Of those with a lifetime death wish, 64.9% report a last occurrence of this death wish more than 12 months prior to the survey. For ideation, plan, and attempt, this was 60.4%, 48.8%, and 84.7%, respectively. The mean number of lifetime emotional problems was 4.9 (Table 1).

### 3.2. Associations between lifetime STB and AYP

Table 2 shows the generalized linear model parameters estimating the association of lifetime STB and AYP. Lifetime suicide

**Table 2**  
Impact of lifetime suicidal thoughts and behaviors on academic year percentage.

	$\beta$	SE	95%CI	$\chi^2$	<i>p</i> -Value
(intercept)	59.075	0.652	57.797	60.352	8213.20 < 0.001
<b>Lifetime suicidal thoughts and behaviors<sup>a</sup></b>					
Death wish	-1.802	1.403	-4.552	0.948	1.65 0.199
Suicidal ideation	-0.925	1.317	-3.506	1.657	0.49 0.483
Suicide plan	-3.572	1.453	-6.420	-0.724	6.04 0.014
Suicide attempt	-7.931	2.714	-13.250	-2.611	8.54 0.004
<b>Covariates</b>					
Being male (vs. female)	-0.832	0.617	-2.040	0.377	1.82 0.177
Age 19 or more (vs. 18)	-7.709	0.746	-9.171	-6.248	106.93 < 0.001
Low parent education (vs. both high)	-7.481	0.890	-9.225	-5.737	70.66 < 0.001
One parent with low education (vs. both high)	-3.988	0.726	-5.411	-2.566	30.19 < 0.001
Number of lifetime emotional problems	-0.822	0.103	-1.024	-0.621	64.11 < 0.001

<sup>a</sup> Never experienced any STB is the reference category.

**Table 3**  
Multilevel analysis of impact of suicide plan, and suicide attempt on academic year percentage (AYP).

	Parameter <sup>a</sup>	SE	95%CI		p-Value
<b>Suicide plan<sup>b</sup></b>					
<b>Fixed effect on AYP</b>					
<b>Random effect on AYP (departmental level)</b>					
(Mean departmental AYP) <sup>2</sup>	12.702	4.143	4.582	20.822	0.002
(Impact suicide plan) <sup>2</sup>	0.000 <sup>c</sup>	–	–	–	–
Mean departmental AYP*impact suicide plan	8.360	3.357	1.780	14.940	0.013
<b>Suicide attempt<sup>b</sup></b>					
<b>Fixed effect on AYP</b>					
<b>Random effect on AYP (departmental level)</b>					
(Mean departmental AYP) <sup>2</sup>	12.211	4.029	4.314	20.108	0.002
(Impact suicide attempt) <sup>2</sup>	21.563	29.759	–36.765	79.891	0.469
Mean departmental AYP*impact suicide attempt	18.717	7.178	4.648	32.786	0.009

<sup>a</sup> Beta-coefficient for fixed effect; variance/covariance for random effects.

<sup>b</sup> Never experienced any STB is the reference category.

<sup>c</sup> Parameter set at zero due to negative variance.

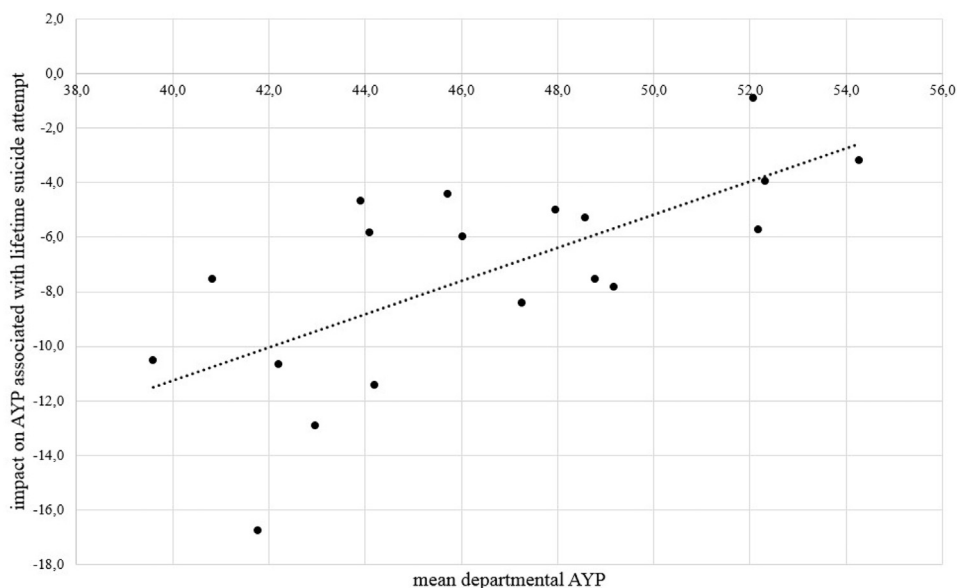
plan and attempt were associated with significant decreases in AYP of 3.6% and 7.9%, respectively, above and beyond the effect of the covariates. No significant decrease was found for the associations between lifetime death wish or suicidal ideation and AYP. Each additional lifetime emotional problem was associated with an additional decrease in AYP of 0.8%, indicating a reduction in AYP of 2.6% for one increase, and 5.3% for two increases in standard deviation of number of lifetime emotional problems. Being older than 18 year and having parents who completed fewer years of education were also significantly associated with decreases in AYP (i.e. in the 4.0–7.7% range).

### 3.3. Between-department variance in impact of lifetime STB on AYP

Table 3 shows the results of the multilevel linear models that estimated the between-department variance in the association

between suicide plans and attempts on the one and AYP on the other hand (a full overview of multilevel analyses is provided in the online supplementary materials). The fixed effect of lifetime suicide plan on AYP was no longer significant ( $p=0.070$ ) after adjusting for within- and between-department variance. Decrease in AYP associated with lifetime suicide attempt remained significant ( $p=0.034$ ) and was estimated at 6.4%. The median departmental decrease in AYP associated with lifetime suicide attempt was 6.0% (interquartile range=4.8–9.5) and varied between 0.9% and 16.8%. For those respondents with lifetime suicide attempt, 18.1% of the variance in AYP was explained by department membership, compared to only 4.4% for those without any lifetime STB. In addition, we found a significant interaction ( $p=0.009$ ) between departmental AYP and departmental decrease in AYP associated with lifetime suicide attempt. More specific, freshmen enrolled in lower performing departments (i.e., departments with a lower departmental average AYP) showed a higher decrease in AYP associated with lifetime suicide attempt than those from higher performing departments (Fig. 1).

Spearman's ranking correlation coefficients between the estimated departmental decrease in AYP associated with lifetime suicide attempt (19 departments), and other departmental characteristics are shown in Table 4. Spearman's  $\rho$  between decrease in AYP associated with lifetime suicide attempt and departmental AYP was  $-0.658$  ( $p=0.002$ ). Interestingly, decreases in AYP associated with lifetime suicide attempt were negatively correlated with departmental proportion of males (Spearman's  $\rho=-0.478$ ;  $p=0.038$ ) and departmental proportion of students with highly educated parents (Spearman's  $\rho=-0.470$ ;  $p=0.042$ ), and positively correlated with departmental mean number of lifetime emotional problems (Spearman's  $\rho=0.521$ ;  $p=0.022$ ). After calculating partial Spearman ranking correlation coefficients (adjusting for departmental composition of gender, parental educational level, lifetime emotional problems, and AYP), decreases in AYP associated with lifetime suicide attempt remained significantly correlated with departmental AYP ( $\rho=-0.645$ ;  $p=0.007$ ), departmental proportion of males ( $\rho=-0.583$ ;  $p=0.018$ ), departmental proportion of students with highly educated parents (Spearman's  $\rho=0.531$ ;  $p=0.034$ ), but no longer with departmental mean number of emotional problems ( $\rho=0.263$ ;  $p=0.325$ ).



**Fig. 1.** Relation between departmental academic performance and estimated impact of lifetime suicide attempt on AYP.

**Table 4**  
Spearman's rank correlation coefficients between department characteristics ( $N=19$ ).

Departmental mean values and proportions		1.	2.	3.	4.	5.	6.	7.	8.
1.	Reduction in AYP associated with suicide attempt	1.000							
2.	Mean AYP	−0.658**	1.000						
3.	Mean size (number of students)	−0.181	0.104	1.000					
4.	Proportion of males	−0.478*	0.302	−0.046	1.000				
5.	Proportion of students aged 18	−0.281	0.568*	0.489*	0.236	1.000			
6.	Proportion with parents with high educational level	−0.470*	0.864***	0.175	0.454	0.570*	1.000		
7.	Mean number of lifetime emotional problems	0.521*	−0.697***	−0.171	−0.194	−0.662**	−0.660**	1.000	
8.	Proportion with any STB	0.190	−0.403	−0.612**	−0.165	−0.626**	−0.431	0.491*	1.000

\*  $p < 0.05$ .

\*\*  $p < 0.01$ .

\*\*\*  $p < 0.001$ .

#### 4. Discussion

Incoming college freshmen with lifetime suicide plan and attempt had a significant decrease in academic year percentage (AYP) of 3.6% and 7.9%, respectively. Further, the association of academic performance with lifetime suicide attempt was dependent upon department membership, with a stronger decrease in AYP in low performing departments.

Results should be interpreted against the following limitations. First, a relatively low case load in students with lifetime STB precluded the simultaneous testing of level two effects, or cross-level effects, for all covariates in fully adjusted multilevel models. Such analyses require very large sample sizes (e.g.,  $N > 400,000$ ; Jablonska et al., 2009), generally not available for self-reported STB. Accordingly, the number of departments was limited in our study. However, a low amount of level-two units comes mainly at the cost of *underestimating* level two variances (Hox, 2010), leaving other estimates unbiased. Second, we did not have information on freshman secondary school performance. We assumed that departments' current academic performance is in line with prior high school performance for both students with and without lifetime STB, and that this performance is not a better explanation for the observed interaction effects. However, the fact that we adjusted the fixed effects in the multilevel models for both age and parental educational level (i.e. proxies for fall-behinds in high school-Spera et al., 2009) may limit this possible bias. Third, limited additional statistical power precluded the inclusion of additional covariates (such as family environment or peer relationships) in the regression models. Further research may focus on adding these in the statistical models because these variables may possibly provide more explanations for the association between STB and academic performance. Fourth, findings were adjusted using a screener score for psychopathology (i.e., the GAIN-SS total score). Despite the fact that this is a well-validated screener, showing good internal and external validity among both adults and adolescents, findings might have been different when adjusting for clinical diagnoses of mental disorders. Fifth, non-response bias might hamper our findings. We addressed this limitation by using a random sampling design with different refusal conversion strategies. Finally, our findings are based on data from one university, and can therefore not be generalized to other universities, or to college students in general.

We found that lifetime STB has a strong negative association with early college performance, (i.e., a decrease of 3.6% in AYP for suicide plan and of 7.9% in AYP for suicide attempt), even after adjusting for the effects of gender, age, socio-economic status, and lifetime emotional problems. These figures roughly correspond to a loss in grade point average (GPA) of 0.2, and 0.4, respectively. Our data confirm previous studies (Lester, 2013; Nyer et al., 2013) in which no effects were found for lifetime death wish or suicidal

ideation on (self-reported) AYP. They are also in line with recent findings (Miletic et al., 2015) in showing a significant association between suicide attempt and academic performance, and, in addition, a significant association between STB plans and reduction in GPA. This suggests that only severe STB, suicide plans and attempts, may have a negative impact on academic performance. Interestingly, 85% of the suicide attempts in our sample happened before the 12 months preceding the survey. This means that, even when students may be in remission for their STB, a suicide attempt early in life may render people with residual functional or psychological impairment, which is a thought similar to the scar hypothesis in depression (Shahar and Davidson, 2003; Steiger et al., 2015). Our data add to the current knowledge on the association of early-existing mental disorders with academic functioning and college dropout (e.g. Kessler et al., 1995; Lee et al., 2009), as we found that a suicide attempt, even when this attempt happened several years ago, may lead to a decrease in academic performance of about 8% in students' AYP. As such, lower AYP leads to higher dropout for individuals but also to loss of human capital for societies (Freudenberg and Ruglis, 2007), making the problem of STB among college students not just a clinical or educational, but also a societal problem.

Another novel finding is that for those with a lifetime suicide attempt, context-specific factors moderate the impact on academic performance. Indeed, 18% of the variance in AYP was explained by differences in departmental environment, with decreases in AYP associated with lifetime suicide attempt widely varying between departments (in the 0.9–16.8% range). More importantly, the impact of lifetime suicide attempt on AYP was higher in departments with lower AYPs. Poor performing educational environments are associated with low sense of connectedness, inclusion, and social support (Organisation For Economic Co-Operation And Development 2005). It may be that departments with active engagement in social events may stimulate academic performance but also may attenuate the impact of suicide attempt and emotional problems on academic results. The decrease in AYP following lifetime suicide attempt was also associated with higher levels of lifetime emotional problems within departments. In line with Eisenberg and colleagues (Eisenberg et al., 2013), we could not confirm the hypothesis that this effect may be explained by social contagion (which has been documented for depression-Rosenquist et al., 2011) as we found that after adjusting for departmental composition of gender and parental educational level, decrease in AYP associated with lifetime suicide attempt was no longer associated with departmental lifetime emotional problems. Further study is needed in order to generate hypotheses on why this is the case.

Our study strongly suggests that college departments, as contextual factors, are related to the association of severe lifetime STB and academic outcomes. To the extent that this is the case, one implication would be that, in addition to interventions aimed at

targeting the total population of college freshmen (e.g. Hartley, 2010), an innovative approach to the problem of suicidality may be the development and implementation of department-specific interventions (such as increasing connectedness or mutual support; Drum and Denmark, 2012). These interventions may be more focused on students from low performing academic departments, which may be easily identified through analysis of student administrative data.

## 5. Conclusion

Severe lifetime STB upon college entrance has a strong negative association with early academic performance during college. Without adequate intervention, this most likely defines a group of young adults at risk for academic failure and long-term negative consequences. The detrimental academic outcomes associated with early STB depend to a considerable extent on the specific college environment, and this result suggests opportunities for targeted intervention and prevention strategies. In the absence of additional research, our findings suggest that resources should be preferentially directed to low performing college environments. Future studies could focus on variables related to the environmental performance level, resulting in a more refined knowledge on effective prevention strategies for the growing population of college students worldwide.

## Contributors

All authors contributed to and have approved the final manuscript.

Philippe Mortier 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.

Study concept and design: Demyttenaere, K., Auerbach, R.P., Green, J.G., Kessler, R.C., Nock, M.K., and Bruffaerts, R.

Acquisition of data: Mortier, P., Kiekens, G., and Bruffaerts, R.

Analysis and interpretation of data: Mortier, P., Kiekens, G., and Bruffaerts, R.

Drafting of the manuscript: Mortier, P.

Critical revision of the manuscript for important intellectual content: Mortier, P., Demyttenaere, K., Auerbach, R.P., Green, J.G., Kessler, R.C., Kiekens, G., Nock, M.K., and Bruffaerts, R.

Statistical expertise: Mortier, P., Kiekens, G., and Bruffaerts, R.

Administrative, technical, or material support: Mortier, P. Kiekens, G.

Supervision: Demyttenaere, K., Auerbach, R.P., Green, J.G., Kessler, R.C., Nock, M.K., and Bruffaerts, R.

## Role of funding

This research was funded by the Research Foundation – Flanders (FWO).

## Conflict of interest

In the past three years, Dr. Kessler has been a consultant for Hoffman-La Roche, Inc., Johnson & Johnson Wellness and Prevention, and Sanofi-Aventis Groupe; has served on advisory boards for the Johnson & Johnson Mood Advisory Board, Plus One Health Management, and the Lake Nona Institute; and owns stock in DataStat, Inc. On behalf of all authors, the corresponding author states that there are no further potential conflicts of interest.

## Acknowledgements

We thank the Student Health Centre and the Administration Offices of the KU Leuven for their kind support in the data collection.

## Appendix A. Supplementary material

Supplementary data associated with this article can be found in the online version at <http://dx.doi.org/10.1016/j.jad.2015.07.030>.

## References

- Arnett, J.J., 2000. Emerging adulthood. A theory of development from the late teens through the twenties. *Am. Psychol.* 55, 469–480.
- Astin, A., 1993. *What Matters in College?*. Jossey-Bass, San Francisco, CA.
- Clarke, M.C., Coughlan, H., Harley, M., Connor, D., Power, E., Lynch, F., Fitzpatrick, C., Cannon, M., 2014. The impact of adolescent cannabis use, mood disorder and lack of education on attempted suicide in young adulthood. *World Psychiatry* 13, 322–323.
- Crosby, A.E., Cheltenham, M.P., Sacks, J.J., 1999. Incidence of suicidal ideation and behavior in the United States, 1994. *Suicide Life Threat Behav.* 29, 131–140.
- Dalgard, O.S., Mykletun, A., Rognerud, M., Johansen, R., Zahl, P.H., 2007. Education, sense of mastery and mental health: results from a nation wide health monitoring study in Norway. *BMC Psychiatry* 7, 20.
- Dennis, M.L., Chan, Y.F., Funk, R.R., 2006. Development and validation of the GAIN Short Screener (GSS) for internalizing, externalizing and substance use disorders and crime/violence problems among adolescents and adults. *Am. J. Addict.* 15 (Suppl. 1), S80–S91.
- Drum, D.J., Brownson, C., Burton Denmark, A., Smith, S.E., 2009. New data on the nature of suicidal crises in college students: shifting the paradigm. *Prof. Psychol.—Res. Pract.* 40, 213–222.
- Drum, D.J., Denmark, A.B., 2012. Campus suicide prevention: bridging paradigms and forging partnerships. *Harv. Rev. Psychiatry* 20, 209–221.
- Eccles, J.S., Vida, M.N., Barber, B., 2004. The relation of early adolescents' college plans and both academic ability and task-value beliefs to subsequent college enrollment. *J. Early Adolesc.* 24, 63–77.
- Eisenberg, D., Golberstein, E., Whitlock, J.L., Downs, M.F., 2013. Social contagion of mental health: evidence from college roommates. *Health Econ.* 22, 965–986.
- Engin, E., Gurkan, A., Dulgerler, S., Arabaci, L.B., 2009. University students' suicidal thoughts and influencing factors. *J. Psychiatr. Mental Health Nurs.* 16, 343–354.
- Ettner, S., Frank, R., Kessler, R., 1997. The impact of psychiatric disorders on labor market outcomes. *Indus. Labor Relat. Rev.* 51, 64–81.
- Fink, J.E., 2014. Flourishing: exploring predictors of mental health within the college environment. *J. Am. Coll. Health* 62, 380–388.
- Freudenberg, N., Ruglis, J., 2007. Reframing school dropout as a public health issue. *Prev. Chronic Dis.* 4, 1–11.
- Goldman-Mellor, S.J., Caspi, A., Harrington, H., Hogan, S., Nada-Raja, S., Poulton, R., Moffitt, T.E., 2014. Suicide attempt in young people: a signal for long-term health care and social needs. *JAMA Psychiatry* 71, 119–127.
- Groves, R.M., 2006. Nonresponse rates and nonresponse bias in household surveys. *Public Opin. Q.* 70, 646–675.
- Hartley, M.T., 2010. Increasing resilience: strategies for reducing dropout rates for college students with psychiatric disabilities. *Am. J. Psych. Rehab.* 13, 295–315.
- Hauser, R.M., Warren, J.R., 1997. Socioeconomic indexes for occupations: a review, update, and critique. In: Raftery, A.E. (Ed.), *Sociological Methodology*. Basil Blackwell, Cambridge, MA, pp. 177–298.
- Herba, C.M., Ferdinand, R.F., van der Ende, J., Verhulst, F.C., 2007. Long-term associations of childhood suicide ideation. *J. Am. Acad. Child Adolesc. Psychiatry* 46, 1473–1481.
- Hooven, C., Snedker, K.A., Thompson, E.A., 2012. Suicide risk at young adulthood: continuities and discontinuities from adolescence. *Youth Soc.* 44, 524–547.
- Hox, J., 2010. *Multilevel Analysis*, 2nd ed. Routledge, Oxon, UK.
- Jablonska, B., Lindberg, L., Lindblad, F., Rasmussen, F., Ostberg, V., Hjern, A., 2009. School performance and hospital admissions due to self-inflicted injury: a Swedish national cohort study. *Int. J. Epidemiol.* 38, 1334–1341.
- Kerr, D.C., Capaldi, D.M., 2011. Young men's intimate partner violence and relationship functioning: long-term outcomes associated with suicide attempt and aggression in adolescence. *Psychol. Med.* 41, 759–769.
- Kessler, R.C., Foster, C.L., Saunders, W.B., Stang, P.E., 1995. Social consequences of psychiatric disorders, I: educational attainment. *Am. J. Psychiatry* 152, 1026–1032.
- Kessler, R.C., Walters, E.E., Forthofer, M.S., 1998. The social consequences of psychiatric disorders, III: probability of marital stability. *Am. J. Psychiatry* 155, 1092–1096.
- Keyes, C.L.M., Eisenberg, D., Perry, G.S., Dube, S.R., Kroenke, K., Dhingra, S.S., 2012. The relationship of level of positive mental health with current mental disorders in predicting suicidal behavior and academic impairment in college students. *J. Am. Coll. Health* 60, 126–133.

- Kuncel, N.R., Credé, M., Thomas, L.L., 2005. The validity of self-reported grade point averages, class ranks, and test scores: a meta-analysis and review of the literature. *Rev. Educ. Res.* 75, 63–82.
- Lee, S., Tsang, A., Breslau, J., Aguilar-Gaxiola, S., Angermeyer, M., Borges, G., Bromet, E., Bruffaerts, R., de Girolamo, G., Fayyad, J., Gureje, O., Haro, J.M., Kawakami, N., Levinson, D., Oakley Browne, M.A., Ormel, J., Posada-Villa, J., Williams, D.R., Kessler, R.C., 2009. Mental disorders and termination of education in high-income and low- and middle-income countries: epidemiological study. *Br. J. Psychiatry* 194, 411–417.
- Lester, D., 2013. Depression and suicidal ideation in college students: a preliminary study of campus variables. *Psychol. Rep.* 112, 106–108.
- The Leuven College Surveys, 2015. Webpage: (<http://www.mindmates.be/page.php?id=28>).
- Miletic, V., Lukovic, J.A., Ratkovic, N., Aleksic, D., Grgurevic, A., 2015. Demographic risk factors for suicide and depression among Serbian medical school students. *Soc. Psychiatry Psychiatr. Epidemiol.* 50, 633–638.
- Niederkrotenthaler, T., Tinghog, P., Alexanderson, K., Dahlin, M., Wang, M., Beckman, K., Gould, M., Mittendorfer-Rutz, E., 2014. Future risk of labour market marginalization in young suicide attempters—a population-based prospective cohort study. *Int. J. Epidemiol.* 43, 1520–1530.
- Nock, M., Borges, G., Ono, Y., 2012. *Suicide: Global Perspectives From the WHO World Mental Health Surveys*. Cambridge University Press, Cambridge.
- Nock, M.K., Holmberg, E.B., Photos, V.I., Michel, B.D., 2007. Self-injurious thoughts and behaviors interview: development, reliability, and validity in an adolescent sample. *Psychol. Assess.* 19, 309–317.
- Nyer, M., Holt, D.J., Pedrelli, P., Fava, M., Ameral, V., Cassiello, C.F., Nock, M.K., Ross, M., Hutchinson, D., Farabaugh, A., 2013. Factors that distinguish college students with depressive symptoms with and without suicidal thoughts. *Ann. Clin. Psychiatry* 25, 41–49.
- Organisation For Economic Co-Operation And Development, 2005. *School Factors Related to Quality And Equity: Results From PISA 2000*. Organisation For Economic Co-Operation And Development.
- Pascarella, E.T., Terenzini, T.P., 2005. *How College Affects Students: A Third Decade of Research*. Jossey-Bass, San Francisco, CA.
- Rasbash, J., Charlton, C., Browne, W.J., Healy, M., Cameron, B., 2009. *Centre for Multilevel Modelling*. University of Bristol, Bristol, UK, MLwiN, 2.1 ed..
- Paul, E., Tsypes, A., Eidlitz, L., Ernhout, C., Whitlock, J., 2014. Frequency and functions of non-suicidal self-injury: associations with suicidal thoughts and behaviors. *Psychiatry Res.*
- Rosenquist, J.N., Fowler, J.H., Christakis, N.A., 2011. Social network determinants of depression. *Mol. Psychiatry* 16, 273–281.
- Schouten, B., Cobben, F., Bethlehem, J.G., 2009. Indicators for the representativeness of survey response. *Surv. Methodol.* 35, 101–113.
- Shahar, G., Davidson, L., 2003. Depressive symptoms erode self-esteem in severe mental illness: a three-wave, cross-lagged study. *J. Consult. Clin. Psychol.* 71, 890–900.
- Spera, C., Wentzel, K.R., Matto, H.C., 2009. Parental aspirations for their children's educational attainment: relations to ethnicity, parental education, children's academic performance, and parental perceptions of school climate. *J. Youth Adolesc.* 38, 1140–1152.
- Steiger, A.E., Fend, H.A., Allemand, M., 2015. Testing the vulnerability and scar models of self-esteem and depressive symptoms from adolescence to middle adulthood and across generations. *Dev. Psychol.* 51, 236–247.
- The WHO World Mental Health Surveys International College Student Project (WMH-ICS), 2015. Webpage: ([http://www.hcp.med.harvard.edu/wmh/college\\_student\\_survey.php](http://www.hcp.med.harvard.edu/wmh/college_student_survey.php)).
- The World Mental Health Survey Initiative, 2015. Webpage: (<http://www.hcp.med.harvard.edu/wmh/>).
- Wang, L., He, C.Z., Yu, Y.M., Qiu, X.H., Yang, X.X., Qiao, Z.X., Sui, H., Zhu, X.Z., Yang, Y.J., 2014. Associations between impulsivity, aggression, and suicide in Chinese college students. *BMC Public Health* 14, 551.