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## Suicidal ideation in university students in Lithuania amid the COVID-19 pandemic: A prospective study with pre-pandemic measures

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### ABSTRACT

We aimed to identify patterns of changes in suicidal ideation among university students six months after the COVID-19 outbreak, in comparison to the pre-pandemic suicidal ideation. Furthermore, we explored the links among these patterns and mental health indicators. 474 university students participated in the study in October–December 2019 and October–December 2020. The latent class change analysis revealed four groups: no-ideation (68.1%), stable low ideation (16.2%), increased ideation (8.9%), and decreased ideation (6.8%). Increased, in comparison to decreased ideation, was positively linked to changes in depression, stress, and anxiety. More loneliness during the pandemic was related to higher suicidal ideation.

Experts have raised concern that suicide rates in the world might increase due to the impact of the COVID-19 (severe acute respiratory syndrome coronavirus 2, SARS-CoV-2) pandemic (Gunnell et al., 2020). Although, reports showed no rise in suicide rates across various countries in the early months of the pandemic (John et al., 2020), the long-lasting effect of the COVID-19 crisis might be more negative. For example, the analysis of suicide rates in Japan revealed that monthly numbers of suicides declined during the first five months, but increased amid the second outbreak of the pandemic (Tanaka & Okamoto, 2021). The same study reported a higher increase in suicide rates among females and individuals aged below 20.

Although young people are at lower risk of having a clinically severe course of COVID-19 (Gallo Marin et al., 2021), many aspects of emerging adults' lives have been affected by the measures taken to control the spread of the coronavirus. A large-scale global study on the impact of the COVID-19 pandemic on the lives of higher education students revealed that they experienced multiple pandemic-related stressors, such as quick and radical changes in the study process, uncertainty about a professional career in the future, changes in social life, and modification of certain habits and daily routines (Aristovnik et al., 2020).

Multiple stressors and restricted ways of coping with stress due to the lockdown measures could lead to various mental health issues.

The negative impact of the COVID-19 pandemic on students' mental health has been reported in several previous studies (Browning et al., 2021; Wenjun et al., 2020). Studies conducted in different countries during the first months of the pandemic revealed that younger age was associated with higher levels of distress, anxiety, and depression (Losada-Baltar et al., 2020; Ogrodniczuk et al., 2021). A longitudinal study in Switzerland revealed that students had lower levels of mental health during the first weeks of the first COVID-19 lockdown compared to seven months prior to the pandemic (Elmer et al., 2020). Another longitudinal study in the United Kingdom evaluating various aspects of mental health during the early weeks of the COVID-19 pandemic showed that the rates of suicide ideation increased during the initial weeks of the lockdown (O'Connor et al., 2021). Young adults had worse mental health outcomes and higher levels of suicidal ideation. Varga et al. (2021) analyzed data from four European countries and found that at the beginning of the lockdown the highest levels of loneliness were reported by respondents younger than 30 years, and people with a mental health diagnosis. Loneliness is a risk factor for suicidal

behavior (Raj et al., 2020; Wasserman et al., 2020). Therefore, high levels of loneliness during the pandemic might also be associated with elevated suicide risk of young adults.

In summary, there is a great concern about the mental health of emerging adults during the COVID-19 pandemic. However, there has been little research on mental health issues and suicidal ideation of emerging adults so far. Also, most studies are cross-sectional which precludes the possibility of comparing the pre-pandemic and pandemic levels of mental health problems. Moreover, many studies have focused on the effects of the initial months of the COVID-19 pandemic on mental health. However, the COVID-19 pandemic is a long-lasting and dynamic crisis and currently there is a lack of studies investigating long-term consequences of the COVID-19 pandemic. Furthermore, studies in countries with different pre-pandemic suicide rates are needed. The current study was conducted in Lithuania, with reported suicide rates being among the highest in the world for many years (Eurostat, 2017). In 2016, suicide rates among young people (aged from 20 to 29 years) in Lithuania were 27.1/100,000, which was one of the highest rates among young people worldwide (WHO, 2018). Although suicide is a major social problem in Lithuania, the research on suicidal behavior in the country is limited.

In the current study, we aimed to evaluate the changes in suicidal ideation in university students six months after the COVID-19 outbreak, in comparison to the pre-pandemic suicidal ideation rates. Latent change analysis was used to identify the patterns in changes of suicidal ideation over time. Further, we sought to explore how these identified patterns of changes in suicidal ideation were linked with changes in pre-pandemic and pandemic levels of mental health indicators. Additionally, we tested the role of loneliness and levels of burden due to COVID-19-related stressors in the identified groups of changes in suicidal ideation.

## Method

### Participants and procedure

This longitudinal study was conducted in October–December, 2019 (first assessment; T1) and October–December, 2020 (second assessment; T2). For the first assessment, all first-year students of one of the biggest universities in Lithuania were invited to participate in the study during regular lecture hours. The participants were asked to fill in online questionnaires using

**Table 1.** Baseline and COVID-19-related sample characteristics ( $N = 474$ ).

	<i>N</i>	%
Gender		
Male	114	24.1
Female	360	75.9
Age range ( <i>M</i> ( <i>SD</i> ))	18–28 (19.04 (0.90))	
In partnership		
No	261	55.1
Yes	208	43.9
N/A	5	1.1
Employed		
Yes	56	11.8
No	413	87.1
N/A	5	1.1
Diagnosed with COVID-19		
No	446	94.1
Had symptoms, but was not diagnosed	26	5.5
Yes, recovered	0	0.0
Yes, currently affected	2	0.4
Someone close diagnosed with COVID-19		
No	404	85.2
Had symptoms, but was not diagnosed	38	8.0
Yes, recovered	34	7.2
Yes, currently affected	18	3.8
Yes, loss of someone close	2	0.4

a secure survey platform. More information on the study sample and procedures of the first assessment can be found in Truskauskaite-Kuneviciene et al. (2020).

Due to COVID-19-related restrictions, for the second assessment, the same students were invited to participate in the study via e-mail. During the first assessment, 1630 participants completed the survey which is 39.3% of the total number of first-year bachelor students who joined the university in 2019. In total, 474 participants filled out the relevant measures at both assessment waves, which is 29.1% ( $N = 1630$  at T1) of the sample who filled out the same measures at T1. The sample included 360 (75.9%) female students. The mean age of the participants at T1 was 19.04 ( $SD = 0.90$ ; range 18–28). Two (0.4%) participants reported being diagnosed with COVID-19 at T2 assessment. More information on sample baseline and COVID-19-related characteristics can be found in Table 1.

The research was approved by the Vilnius University Psychological Research Ethics Committee. The study protocol was updated at T2 with items on COVID-19-related stressors and other measures relevant in the context of the pandemic. Ethical approval of amendments was granted by the Research Ethics Committee.

### The COVID-19 pandemic in Lithuania

In Lithuania, the first cases of SARS-CoV-2 infections were confirmed at the end of January 2020 (WHO,

2021). The first strict lockdown measures were taken between March 16 and June 16, 2020. The second strict lockdown was announced on November 7, 2020 and has not been withdrawn until the end of the second assessment of the current study (Thomas et al., 2020). There were 9331 confirmed COVID-19 cases (334 per 100,000 population) and 112 deaths (4 per 100,000 population) due to the infection in Lithuania at the beginning of the second assessment on October 22, 2020 (WHO, 2021).

### Measures

As part of a larger longitudinal study on the mental health of university students, participants completed a battery of self-report questionnaires. For the purposes of this analysis, data on suicidality, symptoms of depression, anxiety, and stress, as well as loneliness and COVID-19-related stressors were examined.

#### Suicidal ideation

The Suicidal Behavior Questionnaire (SBQ-R; Osman et al., 2001) is a brief self-report measure used for assessing the frequency of suicidal ideation, previous suicide attempts, suicidal communication, and the likelihood of future suicidal behavior. In this study, we included recent suicide ideation (Item 2; scale from 1 = *Never* to 5 = *Very often*) as the outcome variable. For the second assessment, the time frame for suicidal ideation was modified from a 12-month to 6-month period to cover only the period of the COVID-19 pandemic. The Cronbach's alpha coefficients of the total SBQ-R scale in a current study sample at T1/T2 were good ( $\alpha = .86/.86$ ).

#### Depression, anxiety, and stress

The short-form version of the Depression Anxiety and Stress Scales (DASS-21; Lovibond & Lovibond, 1995) is comprised of three 7-item self-report scales assessing the levels of depression, anxiety, and stress over the past week. The items have to be rated on a 4-point scale ranging from 0 (*Did not apply to me at all*) to 3 (*Applied to me very much, or most of the time*) depending on the frequency and severity of certain symptoms. The scores of the DASS-21 subscales range from 0 to 21, with higher figures indicating higher severity and frequency of the three mental health states. The DASS-21 scales have been widely used all over the world and showed good psychometric properties in different studies (Henry & Crawford, 2005). The Confirmatory Factor Analysis (CFA) across the two time-points yielded a good three-factor model

fit ( $\chi^2 (771) = 1530.20, p < .001, CFI/TLI = .927/.918, RMSEA [90\% CI] = .046 [.042, .049], SRMR = .017$ ). The Cronbach's alpha coefficients of the scales in a current full study sample at T1/T2 were good (Depression  $\alpha = .90/.90$ , Anxiety  $\alpha = .83/.82$ , Stress  $\alpha = .87/.86$ ).

#### Loneliness

The Three-Item Loneliness Scale (TIL Scale; Hughes et al., 2004) measuring loneliness was included in the T2 assessment. The items were rated on a 3-point scale ranging from 0 (*Never*) to 2 (*Often*). Total loneliness score ranged from 0 to 6, with the higher score showing higher levels of loneliness. A single factor CFA (with added gender covariance for model identification) yielded an excellent model fit ( $\chi^2 [2, N=474] = 0.75, p = .688, CFI/TLI = 1.000/1.012, RMSEA [90\% CI] = .000 [.000, .068], SRMR = .007$ ); (current reliability:  $\alpha = .75$ ).

#### COVID-19 stress

Five items covering COVID-19-related stressors were included at T2 for the assessment of the burden due to stressful experiences related to the COVID-19 pandemic. Each item on different kinds of stressors had to be rated on a 5-point scale ranging from 0 (*Not at all*) to 4 (*Very much*), depending on how much a participant has been affected by the stressor over the last six months. Each of the five items particularly relevant for students in the context of the COVID-19 pandemic (terminated/altered study process, lockdown/restricted traveling, restricted acquisition of goods and services, impaired health due to COVID-19, impaired health of the loved ones due to COVID-19) were included in the current analysis. The total burden due to COVID-19-related stressors was measured by summing up the scores of all items. A single factor CFA yielded a very good model fit ( $\chi^2 [4, N=474] = 5.09, p = .278, CFI/TLI = .998/.994, RMSEA [90\% CI] = .024 [.000, .077], SRMR = .017$ ); reliability of the scale:  $\alpha = .72$ .

#### Data analysis

Of the participants who filled the relevant measures at T1, 29.1% were reached at T2. Possible attrition bias (Miller & Hollist, 2007) was tested to identify whether the characteristics of retained participants were comparable to drop-out participants who were not reached at T2. MANOVA analysis (with included measures on suicidal ideation, stress, anxiety, and depression) revealed that there was a small but statistically

significant difference of baseline mental health indicators between retained and drop-out participants ( $F[4, 1146] = 3.88, p = .004, \text{Wilks}' \Lambda = .991, \text{partial } \eta^2 = .009$ ). In comparison to the drop-out group, retained participants had higher mean levels of suicidal ideation ( $\eta_p^2 = .007$ ), stress ( $\eta_p^2 = .005$ ), anxiety ( $\eta_p^2 = .006$ ), and depression ( $\eta_p^2 = .004$ ) at T1.

We then aimed to examine the changes in suicidal ideation after the COVID-19 outbreak, in comparison to the pre-pandemic suicidal ideation baseline rates. We used the latent change modeling approach, allowing to provide robust change estimates over time (Duncan et al., 2013). In latent change models with two measurement points, the *intercept* represents the estimated mean level of the measure at T1 and the *slope* represents the estimated mean change from T1 to T2. In the current latent change model, we also controlled for gender (0 vs. 1) and age (in years) effects on intercept and slope. To have the latent change model identified, first, we fixed the residuals to zero; second, we fixed non-significant gender effects to zero.

We also aimed to explore whether different patterns in the change of suicidal ideation may be observed. Therefore, we conducted latent class change analyses (Jung & Wickrama, 2008) and compared solutions with a different number of classes based on several criteria. First, the Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) statistic for a solution with  $k$  classes should be lower than for a solution with  $k-1$  classes. Second, a  $p$ -value of the adjusted Lo, Mendell, and Rubin test, which compares improvement in fit between neighboring class solutions after the inclusion of an additional class, should be statistically significant. Third, Entropy score, with relatively higher values equal or above .70 indicates a more accurate classification.

Finally, we sought to explore how these identified patterns of changes in suicidal ideation were linked with changes in pre-pandemic and pandemic levels of mental health indicators. Additionally, we tested the role of loneliness and levels of burden due to COVID-19-related stressors in the identified groups of changes in suicidal ideation. Therefore, we compared the resulting classes in terms of baseline and change rates (from T1 to T2) of stress, anxiety, depression as well as the levels of loneliness and COVID-19-related stressors at T2. In all analyses, the observed variables (i.e., the sum scores) of DASS-21 and the latent variables of loneliness and the COVID-19-related distress were used. To identify if the rates of change in mental health indicators differed across groups, we ran the

multivariate latent change model of mental health indicators as parallel processes, in particular, change in stress, anxiety, and depression sum scores (also controlling for possible gender and age effects) and included the class membership as moderator. To determine possible differences between groups, we assessed differences between the models with fixed versus free parameters of intercepts and slopes, indicating the same versus different levels of baseline levels and change in mental health indicators across suicidal ideation groups. To determine significant differences between the models with fixed versus free parameters, at least two of these three criteria had to be matched:  $\Delta\chi^2$  significant at  $p < .05$  (Satorra & Bentler, 2001),  $\Delta\text{CFI} \geq .01$ , and  $\Delta\text{RMSEA} \geq .015$  (Chen, 2007). To identify associations between changes in suicidal ideation and other mental health indicators, groups reporting suicidal ideation at any time-point were compared. Two groups with relatively stable average suicidal ideation were also compared.

To compare the suicidal ideation groups with one another in terms of intercepts and slopes of mental health indicators, we created the dummy variables by coding participants from the particular change in suicidal ideation class as 1 versus the participants from the reference class coded as 0, when the participants from the remaining groups were coded as missing values. We then ran the series of multivariate latent change structural equation models (SEM) of mental health indicators and regressed intercepts and slopes on created dummy variables, representing the change in suicidal ideation pattern groups. Finally, to compare the levels of loneliness and burden due to COVID-19-related stressors among the suicidal ideation groups, we ran the series of SEM models (based on group pairs) by regressing the latent variable of loneliness and COVID-19-related stressors on previously created dummy variables representing the change in suicidal ideation pattern groups. The associations between suicidal ideation groups and loneliness as well as COVID-19-related stressors were tested in separate models to increase the statistical power.

The model fit in CFA and SEM analyses was evaluated by using the Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), and the Root Mean Square Error of Approximation (RMSEA), following the goodness of fit recommendation provided by Kline (2011). Namely, CFI/TLI values higher than .90 indicated an acceptable fit, and values higher than .95 represented a very good fit; RMSEA values below .08 indicated an acceptable fit, and values less than .05 suggested a good fit. In all analyses, the MLR

**Table 2.** Descriptive statistics of mental health indicators at the baseline and after the COVID-19 outbreak.

	T1		T2		<i>t</i> (473)	<i>r</i>
	<i>M</i> ( <i>SD</i> )	$\gamma_1/\gamma_2$	<i>M</i> ( <i>SD</i> )	$\gamma_1/\gamma_2$		
Suicidal ideation	1.82 (1.16)	1.29/0.61	1.52 (1.06)	2.07/3.22	6.21***	.55***
Stress	10.17 (5.30)	.19/-.75	9.48 (5.00)	0.16/-.68	3.10**	.56***
Anxiety	6.99 (4.94)	.70/-.24	5.87 (4.58)	0.83/-.14	5.64***	.59***
Depression	7.88 (5.64)	.65/-.56	7.26 (5.27)	0.72/-.33	2.57*	.53***
Loneliness	–	–	3.07 (1.60)	0.10/-.57	–	–
COVID-19-related stressors	–	–	5.56 (4.10)	0.80/0.40	–	–

Note. *M*: mean; *SD*: standard deviation,  $\gamma_1$ : skewness,  $\gamma_2$ : kurtosis, \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ .

estimator was used. All modeling analyses were conducted with the Mplus 8.2 version (Muthén & Muthén 1998–2017). The descriptive analyses were conducted using SPSS 24.

## Results

The descriptive statistics of study variables are presented in Table 2.

### Change in suicidal ideation

The latent change analysis of suicidal ideation in a full study sample yielded an excellent model fit ( $\chi^2 [2, N = 474] = 0.83, p = .661, CFI/TLI = 1.000/1.021, RMSEA [90\% CI] = .000 [.000, .070], SRMR = .010$ ). When controlling for gender and age effects on intercept and slope, overall, we found a marginally significant increase in suicidal ideation over time ( $M_{slope} = 1.97, p = .056$ ). We have also found significant age effect on slope ( $\beta_{slope} = -.10, p = .033$ ), indicating that increase in suicidal ideation was associated with younger age.

The latent class change analysis indicated that four classes solution fitted the data best (Table 3). Four identified change patterns were found to be distinguishable in terms of baseline and change rates of suicidal ideation (Figure 1). The majority of study participants (68.1%) were classified into a group with on average nearly absent suicidal ideation at the baseline and no change over time; we labeled this group as *no-ideation*. The second most prevalent class (16.2%) reported some average suicidal ideation at the baseline with no change over time and we labeled this class as *stable low ideation*. The third class (8.9%) reported moderate average rates of suicidal ideation at the baseline and a significant increase over time; we labeled this class as *increased ideation*. The last group of study participants (6.8%) reported moderate average baseline suicidal ideation rates and a significant decrease over time; we labeled this class as *decreased ideation*. The intercepts and slopes of suicidal ideation among groups are presented in Table 4.

**Table 3.** Model fit indices of latent class change analysis.

Solution	Loglikelihood	AIC	BIC	Entropy	LMR-A <i>p</i> -value
1 class	–2990.576	6001.152	6042.764	–	–
2 classes	–2641.296	5312.592	5275.010	.992	.000
3 classes	–2503.437	5046.875	5130.099	.931	.019
<b>4 classes</b>	<b>–2400.345</b>	<b>4850.691</b>	<b>4954.721</b>	<b>.969</b>	<b>.022</b>
5 classes	–2362.791	4785.582	4910.418	.949	.364

Note. AIC: Akaike Information Criterion; BIC: Bayesian Information Criterion; LMR-A: Lo-Mendell-Rubin Adjusted Likelihood Ratio Test (LMR-A). Best fitting solution is in bold.

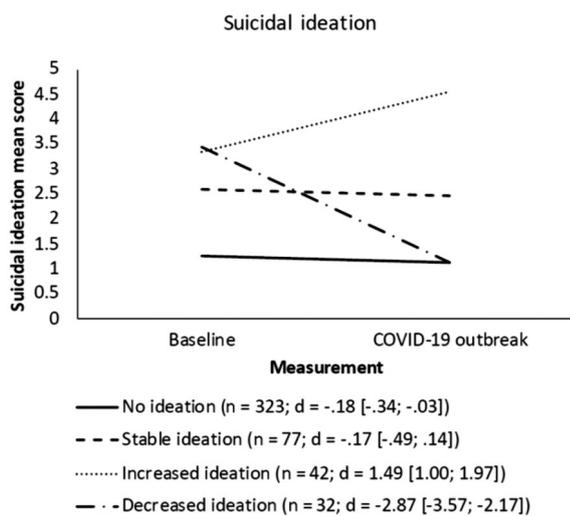
### Mental health among the classes of change in suicidal ideation

The results of moderation analysis indicated that the model with free intercept and slope parameters of mental health indicators across suicidal ideation groups fitted data better than the model with fixed intercept and slope parameters ( $\Delta CFI = .025, \Delta RMSEA = .058$ ). The intercepts and slopes of mental health indicators among suicidal ideation groups are presented in Table 4. The moderated latent change model yielded stability in stress rates over time in all three suicidal ideation groups. In the *stable low ideation* group, stability was also observed in rates of anxiety and depression. The *increased ideation* group reported increased rates of depression and stable rates of anxiety. In the *decreased ideation* group, both anxiety and depression also decreased. The *no-ideation* group reported stability in stress rates when both anxiety and depression decreased over time.

The SEM modeling of parallel latent change processes of mental health indicators revealed that *stable low ideation* group, in comparison to *no-ideation* group ( $\chi^2 [8, N = 400] = 4.26, p = .833, CFI/TLI = 1.000/1.009, RMSEA [90\% CI] = .000 [.000, .035], SRMR = .011$ ) reported higher rates of stress ( $\beta_{intercept} = .15, p = .001$ ), anxiety ( $\beta_{intercept} = .18, p < .001$ ), and depression ( $\beta_{intercept} = .26, p < .001$ ) at the baseline with no statistically significant differences in mental health change rates over time. The *increased ideation* group in comparison to *stable ideation* group, ( $\chi^2 [8, N = 119] = 8.13, p = .420, CFI/TLI = 1.000/.999, RMSEA [90\% CI] = .012 [.000, .109], SRMR = .037$ ) reported higher baseline rates of depression

( $\beta_{intercept} = .25, p = .008$ ) with no significant differences in baseline rates of stress ( $\beta_{intercept} = .08, p = .363$ ) and anxiety ( $\beta_{intercept} = .08, p = .365$ ). In contrast, *increased ideation* group in comparison to *decreased ideation* group, ( $\chi^2 [8, N=119]=11.71, p = .164, CFI/TLI = .985/.937, RMSEA [90\% CI] = .078 [.000, .170], SRMR = .040$ ) reported lower baseline rates of stress ( $\beta_{intercept} = -.27, p = .005$ ) and anxiety ( $\beta_{intercept} = -.31, p = .002$ ) with no significant differences in baseline rates of depression ( $\beta_{intercept} = -.02, p = .860$ ). Finally, *stable low ideation* group in comparison to *decreased ideation* group, ( $\chi^2 [8, N=74]=7.05, p = .531, CFI/TLI = 1.000/1.010, RMSEA [90\% CI] = .000 [.000, .101], SRMR = .028$ ), reported lower rates of all mental health indicators at the baseline, that is, stress ( $\beta_{intercept} = -.33, p < .001$ ), anxiety ( $\beta_{intercept} = -.36, p < .001$ ), and depression ( $\beta_{intercept} = -.25, p = .005$ ).

*Increased ideation*, in comparison to *stable low ideation* was positively associated with change in stress



**Figure 1.** The trajectories in changes of suicidal ideation. *Note.*  $d$  = effect size with 95% confidence intervals. A negative score indicates a decrease, a positive score indicates an increase.

( $\beta_{slope} = .18, p = .044$ ) and depression ( $\beta_{slope} = .23, p = .005$ ), but not anxiety. *Increased ideation*, in comparison to *decreased ideation* was positively linked to all mental health change processes, that is, stress ( $\beta_{slope} = .43, p < .001$ ), anxiety ( $\beta_{slope} = .53, p < .001$ ), and depression ( $\beta_{slope} = .43, p < .001$ ). Similarly, *stable low ideation*, in comparison to *decreased ideation* was also positively associated with change rates in stress ( $\beta_{slope} = .28, p = .001$ ), anxiety ( $\beta_{slope} = .42, p < .001$ ), and depression ( $\beta_{slope} = .21, p = .021$ ).

### Loneliness and COVID-19-related stressors among the classes of change in suicidal ideation

The mean scores of loneliness and burden due to COVID-19-related stressors across the suicidal ideation groups are presented in Table 4. The results of SEM analyses with the latent variable of loneliness revealed that *stable low ideation* group, in comparison to *no-ideation* group ( $\chi^2 [2, N=400]=6.27, p = .043, CFI/TLI = .984/.951, RMSEA [90\% CI] = .073 [.011, .141], SRMR = .028$ ) reported higher rates of loneliness ( $\beta = .25, p < .001$ ) after the COVID-19 outbreak. Similarly, higher rates of loneliness were characteristic to *increased ideation* group, in comparison to *stable low ideation* group ( $\chi^2 [2, N=119]=2.03, p = .362, CFI/TLI = .999/.998, RMSEA [90\% CI] = .012 [.000, .182], SRMR = .032; \beta = .26, p = .009$ ) and *decreased ideation* group ( $\chi^2 (2) = 2.28, p = .319, CFI/TLI = .995/.985, RMSEA [90\% CI] = .044 [.000, .239], SRMR = .044; \beta = .39, p < .001$ ). No significant differences were found among *stable low ideation* and *decreased ideation* groups in terms of loneliness ( $\chi^2 [2, N=109]=1.38, p = .502, CFI/TLI = 1.000/1.029, RMSEA [90\% CI] = .000 [.000, .170], SRMR = .024; \beta = .14, p = .198$ ). No significant differences were found among the suicidal ideation groups in terms of levels of burden due to COVID-19-related stressors.

**Table 4.** Baseline and change rates of mental health indicators, COVID-19-related stressors, and loneliness in the groups of suicidal ideation.

	No ideation (n = 323)		Stable ideation (n = 77)		Increased ideation (n = 42)		Decreased ideation (n = 32)	
	$M_{intercept}$	$M_{slope}$	$M_{intercept}$	$M_{slope}$	$M_{intercept}$	$M_{slope}$	$M_{intercept}$	$M_{slope}$
Suicidal ideation	1.27 <sup>a</sup>	-0.15 <sup>a</sup>	2.62 <sup>b</sup>	-.14 <sup>a</sup>	3.36 <sup>c</sup>	1.19 <sup>***b</sup>	3.44 <sup>c</sup>	-2.31 <sup>***c</sup>
Stress	11.69 <sup>a</sup>	0.19 <sup>a</sup>	14.83 <sup>b</sup>	0.56 <sup>a</sup>	15.04 <sup>b</sup>	1.79 <sup>b</sup>	19.45 <sup>c</sup>	-2.15 <sup>c</sup>
Anxiety	8.68 <sup>a</sup>	-1.11 <sup>***a</sup>	12.16 <sup>b</sup>	-0.46 <sup>a</sup>	13.59 <sup>b</sup>	0.60 <sup>a</sup>	15.45 <sup>c</sup>	-5.09 <sup>***b</sup>
Depression	8.16 <sup>a</sup>	-0.70 <sup>**a</sup>	10.52 <sup>b</sup>	-0.66 <sup>a</sup>	12.66 <sup>c</sup>	2.19 <sup>*b</sup>	12.45 <sup>c</sup>	-3.44 <sup>***c</sup>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Loneliness	2.77 <sup>a</sup>	1.52	3.60 <sup>b</sup>	1.52	4.29 <sup>c</sup>	1.57	3.25 <sup>b</sup>	1.68
COVID-19-related stressors	5.44 <sup>a</sup>	4.26	5.91 <sup>a</sup>	3.66	5.95 <sup>a</sup>	4.29	5.47 <sup>a</sup>	3.17

*Note.*  $M$ : mean,  $*p < .05$ ,  $**p < .01$ ,  $***p < .001$ . <sup>abcd</sup>different letters within the same row indicate significant differences in same parameters between groups; if two groups share the same letter, this indicates that the difference between the groups was not statistically significant.

## Discussion

In the current study, we found an increase in suicidal ideation six months after the COVID-19 outbreak, in comparison to pre-pandemic suicidal ideation rates in a sample of university students in Lithuania. However, the detected change in suicidal ideation was only marginally significant. The latent class change analysis revealed four participant groups in terms of the changes in the levels of suicidal ideation at pre-pandemic and pandemic measurements: *no-ideation group*, *stable low ideation group*, *increased ideation group*, and *decreased ideation group*. We identified 8.9% of the participants with a significant increase, and 6.8% with a significant decrease in suicidal ideation over time. The results indicate that the majority of the sample did not develop suicidal thoughts in the course of the COVID-19 pandemic. However, the level of mental health of some students decreased during the COVID-19 crisis: almost 9 percent of the participants who had had moderate average levels of suicidal ideation before the pandemic were at even higher suicide risk six months after the start of the global pandemic. However, we cannot claim that such results were caused only by the pandemic as fluctuation in suicide ideation could also be observed during other than pandemic times.

The changes in the levels of depression, stress, and anxiety differed across the four compared suicidal pattern groups. Increased ideation, in comparison to decreased ideation, was positively linked to changes in all three mental health indicators. This finding corresponds to previous studies that described significant relations between suicidal ideation and depressive symptoms as well as stress levels among university students (Akram et al., 2020; Gonçalves et al., 2016; Li et al., 2020). Higher levels of loneliness during the COVID-19 pandemic were also related to higher suicidal ideation. This finding confirms that loneliness is a risk factor for suicidal behavior (Raj et al., 2020; Wasserman et al., 2020). Former studies also showed associations between suicidal ideation and loneliness or lack of social support during the COVID-19 pandemic (Killgore et al., 2020; Mortier et al., 2021). A recent study on suicidality of the general population amid the COVID-19 pandemic in Lithuania and Poland also found significant associations between loneliness and suicidal ideation (Gelezelyte et al., *in press*).

We found no differences between the burden due to COVID-19-related stressors among the four suicidal ideation groups. Some studies have identified relations between COVID-19-related stress and

suicidal ideation during the first months of the pandemic (Caballero-Domínguez et al., 2020; Mortier et al., 2021). In contrast, the results of the study conducted in the United States at the beginning of the COVID-19 pandemic showed that physical distancing measures were not associated with suicide risk and only some stressors were related to the past-month suicidal ideation (Bryan et al., 2020). So the results of the studies from the first months of the COVID-19 crisis are ambiguous, and the links between suicidal ideation and the effects of COVID-19-related distress might be even vaguer in the longer term as the reasons behind suicide are very complex. Also, it is debated that the lockdown measures suspended some people from facing certain everyday stressors (e.g., bullying, social anxiety) (Tanaka & Okamoto, 2021). So the role of stressors in the course of the pandemic might vary for different people. In the current study, we also found, that the change rates of stress scores were rather stable in all four suicidal ideation groups, meaning that the influence of stress might not be as important in the suicidal process as other mental health issues, such as depressive symptoms.

Several limitations of the study have to be taken into account. First of all, the data were collected with self-report measures. Moreover, the drop-out rates from T1 to T2 were rather high. The comparison of mental health indicators between retained and drop-out participants revealed that the retained sample had slightly higher mean levels of suicidal ideation and other mental health issues. Studies show that preexisting mental health problems are associated with worse mental health outcomes during the COVID-19 pandemic (O'Connor et al., 2021). So the results of the study could be more reflecting the situation of people with a worse baseline mental health state. Furthermore, we evaluated only the mean levels of exposure to COVID-19-related stressors. A more detailed analysis of various stressors could reveal a more nuanced picture of how different stressors might impact suicidal ideation in the course of the pandemic. Also, as some measures in the current study were only assessed at T2, we could not explore the relations of changes of COVID-19-related distress and suicidal ideation patterns. Moreover, not many participants were directly affected by the COVID-19 illness. Therefore, the evaluation of the impact of the COVID-19 infection was limited in the current study. Longitudinal studies adding the evaluation of various COVID-19-related measurements would be further needed for a better understanding of how the

pandemic affects the suicidal process of emerging adults with different COVID-19-related experiences.

Despite the limitations, this is the first study investigating the effects of the COVID-19 pandemic on suicide ideation in university students in a European country with high suicide rates. The results indicate that although many of the students did not develop higher levels of suicidal ideation in the course of the COVID-19 crisis, almost 9% of the participants were at even higher suicide risk six months after the pandemic outbreak. Significant differences in changes in mental health indicators, such as depression, anxiety, and stress, over time were found after comparing the four different suicidal pattern groups. Elevated levels of loneliness were also found to be significantly related to increased suicide risk. Targeting emerging adults with such mental health issues as a part of suicide prevention actions has to be a priority amid the pandemic.

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