

## Original Article

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# Academic stress in Danish medical and health science students during the COVID-19 lock-down

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### ABSTRACT

**INTRODUCTION:** COVID-19 has disrupted normal life and resulted in an online transformation of teaching. Little is known about how these changes affected academic stress in students. This study examined the role of changes of teaching methods on academic stress among university students during the first lockdown in Denmark.

**METHODS:** The cross-sectional survey was part of the international “COVID-19 International Student Well-being Study” and included responses on socio-economic characteristics, infection worries, academic stress, work capacity and satisfaction with teaching from 1,541 Danish health and medical science university students in May-June 2020. Changes in academic stress were analysed using descriptive statistics and multi-variable analyses using stepwise logistic regression.

**RESULTS:** A considerable part (39%) of students reported academic stress due to COVID-19. One third reported that their study workload had increased significantly due to the COVID-19 outbreak and that they were concerned about their ability to complete the academic year. Factors associated with academic stress were female sex, young age, bachelor level, knowing a COVID-19 patient and being worried about becoming infected, whereas immigration background, sufficient financial resources and living arrangements were not.

**CONCLUSIONS:** Our findings suggest that the COVID-19 outbreak has influenced university students’ academic stress. It is important to set up structures to support students’ mental health and educational trajectory during the pandemic.

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By late March 2021, the COVID-19 outbreak, which the WHO declared a pandemic on 11 March 2020 [1], had caused more than 2.7 million deaths globally [2] and led to a global economic crisis [3]. On 11 March 2020, Denmark enforced severe restrictions to reduce the spread of the virus. Non-critical public sector employees were required to work from home; childcare facilities, schools and educational institutions were closed (converted to online teaching); an assembly ban was introduced; and shops, culture and sports facilities were closed, which was followed by a closure of the borders [4]. These changes are likely to have affected university students’ academic stress due to the rapid shift to online teaching and exams, elements that were unfamiliar to

the majority of students and teachers and led to fewer peer and teacher interactions. The university students' situation calls for special attention because they are in a transitional process while qualifying to enter the labour market and thus comprise a critical social resource. Additionally, academic stress was a concern even before COVID-19, when 32% of university students reported being stressed and these students have a greater drop-out risk [5]. Finally, universities have moral obligations to consider the stress levels of their students, especially during a crisis [6].

In Denmark, university education is free of charge and students receive a monthly allowance, which may be supplemented by student loans and/or part time work [7]. Denmark has eight universities; a bachelor's degree can be completed in three years, a master's degree in two additional years (three years for medical school) and a PhD in another three years. In 2019, 11% of Danish 25-45-year-olds were enrolled in or had completed a bachelor's degree, 7% a master's degree and less than 1% a PhD degree [8].

Research has established that the COVID-19 outbreak has negatively affected the mental health of university students in terms of stress [6, 9-11], anxiety [10-13], depression [10-12, 14] and distress [12, 14, 15]. Being female [6], having an immigrant background [6], being exposed to financial uncertainty [11, 13], knowing someone who has become infected with COVID-19 [13] and fear of infection [6, 9] have been found to be associated with poor mental health in university students during COVID-19, whereas living with parents has been established as a protective factor [13]. Very little is known about how COVID-19 has affected academic stress in university students. Increased concerns about academic performance [10] and concerns related to uncertainty about graduation [15] have been found to be associated with a decline in student mental well-being since the onset of COVID-19. A Chinese study found that academic workload and separation from school had negative effects on university students' stress [9], whereas an Irish study showed a significant association between reported stress and transition to online learning and assessment [6].

Thus, this study aimed to reduce this scarcity of knowledge by investigating 1) the role of changes in teaching methods due to the COVID-19 outbreak on academic stress among Danish health and medical science students, and 2) the association between students' academic stress and sociodemographic characteristics, financial resources, living arrangements and COVID-19 infection worries. These factors were selected based on the previous findings of factors associated with mental health during the COVID-19 pandemic. The health and medical science students are particularly interesting to study as they are likely to be more knowledgeable about COVID-19 and less worried about their future job options, which are less likely to be affected by the financial crisis triggered by COVID-19.

## METHODS

### Study design

This study was part of the cross-sectional "COVID-19 International Student Well-being Study" initiated by the University of Antwerp [16]. The survey was translated from English into Danish by three native-speaking Danish research staff independently, making sure to adapt the items for use among university students in Denmark.

### Data collection

The online survey was distributed by e-mail to all health and medical science students at the University of Southern Denmark (USD) (n = 5,394), including PhD students on 11 May 2020 (a reminder was sent out one week later) and the University of Copenhagen (UCPH) (approx. N = 7,500), excluding PhD students, on 29 May 2020 (no reminder). By 5 June, 1,734 students had answered the survey: 958 students from the USD (response rate: 17.8%) and 766 students from the UCPH (response rate: 10.2%).

## Variables

For this study, we used the survey items [16] covering: 1) sociodemographic characteristics, financial resources and living arrangements, 2) COVID-19 infection worries and 3) academic stress, work capacity and satisfaction with teaching. To assess academic stress, students were asked if they believed that the change in teaching methods resulting from the COVID-19 outbreak had caused them significant stress. The response categories “strongly agree” or “agree” were considered a report of academic stress (versus neither agree nor disagree/disagree/strongly disagree). The questions for the included variables, their response categories and collapsed response categories for this study can be found in **Supplementary Table A** ([https://ugeskriftet.dk/files/a11200805\\_-\\_supplementary.pdf](https://ugeskriftet.dk/files/a11200805_-_supplementary.pdf)).

## Analytical strategy

Percentages were calculated to present the descriptive data. To check for selection bias, for academic stress and teaching satisfaction, additional sensitivity analyses were calculated regarding early (answering after the first e-mail) and late (after the reminder) responders for the sub-population of USD students. This was done because people who are concerned about the topic may answer more frequently but also earlier than people who are not concerned. In case selection bias was present, this would be visible particularly in early responders.

Multi-variable analyses using stepwise logistic regression was performed to assess the association between the independent contributions of the different factors and academic stress. For variable exclusion, variables with a p-value above 0.1 were dropped from the final model. Results are presented as crude odds ratios and multiple odds ratios with 95% confidence intervals. The significance level was set at a p-value below 0.05. Analyses were performed using Stata v. 16.1.

## Ethics

The study adhered to Danish standards for ethical conduct of scientific studies and was approved by the Research Ethics Committee of the USD on 7 May 2020 (Case no. 20/29519) and by the Independent Ethics Committee for Social Science and Humanities from the University Antwerp in 2020 (Case no. SHW\_20\_38). Survey participation was voluntary and an anonymous database was created.

*Trial registration:* not relevant.

## RESULTS

After omitting questionnaires with missing value(s) for the relevant variables (n = 193), answers from 1,541 students were used in the analyses.

Most respondents were female (80%), 22-30 years old (72%) (mean age = 26.23 years; standard deviation = 5.93), born in Denmark (85%), in a relationship (67%) and living with others (59%) (**Table 1**). Almost half of the respondents studied at bachelor level (44%), almost half at master level (45%) and very few at the PhD level (9%). A total of 92% agreed to have sufficient financial resources to cover monthly costs. Only 6% were very worried about becoming infected or getting seriously ill from a COVID-19 infection (5%) (**Table 2**).

**TABLE 1** Sociodemographic information about the health and medical science students at the University of Southern Denmark and the University of Copenhagen (N = 1,541).

	Total, % (n)
<i>Gender</i>	
Women	79.56 (1,226)
Men	19.86 (306)
Other	0.58 (9)
<i>Age group</i>	
≤ 21 yrs	13.37 (206)
22-24 yrs	35.37 (540)
25-30 yrs	36.53 (563)
> 30 yrs	15.06 (232)
<i>Relationship status</i>	
Single	32.90 (507)
<i>Born in Denmark</i>	
Yes	85.07 (1,311)
<i>Education programme</i>	
Bachelor	44.32 (683)
Master	44.97 (693)
PhD	9.15 (141)
<i>Sufficient financial resources</i>	
Yes	92.02 (1,418)
<i>Living arrangements</i>	
Together with parents	6.16 (95)
In a dormitory or similar	11.55 (178)
Together with others	59.18 (912)
Alone	19.47 (300)
Other	3.63 (56)

**TABLE 2** COVID-19 infection worries among health and medical science students at the University of Southern Denmark and the University of Copenhagen (N = 1,541).

	Total, % (n)
<i>COVID-19 infection</i>	
Yes, confirmed by a laboratory test	1.75 (27)
Yes, informed by a healthcare provider	1.36 (21)
I think I had or currently have it	9.02 (139)
No	87.87 (1,354)
<i>Knows a COVID patient</i>	
Yes	49.84 (768)
No	50.16 (773)
<i>Worried about being infected with COVID-19<sup>a</sup></i>	
Not at all <sup>b</sup>	68.25 (1,019)
Partly <sup>c</sup>	25.72 (384)
A lot <sup>d</sup>	6.02 (90)
<i>Worried about being seriously ill after a COVID-19 infection<sup>a</sup></i>	
Not at all <sup>b</sup>	79.50 (1,187)
Partly <sup>c</sup>	15.14 (226)
A lot <sup>d</sup>	5.36 (80)

a) We recorded a total of 48 missing values since the question was only put to students who were not/had not previously become infected with COVID-19.

b) 0-3 points.

c) 4-7 points.

d) 8-10 points.

**Academic stress, work capacity and teaching satisfaction**

Academic stress caused by the change in teaching methods triggered by COVID-19 was reported by 39% (Table 3). Regarding work capacity, 31% reported that their study workload had increased significantly and 30% were concerned that they would be unable to complete the academic year. In relation to teaching, 49% reported that they received poorer educational quality during the outbreak than before, and 54% knew less about what was expected of them in the courses. Overall, 53% reported that the university had informed them sufficiently about the COVID-19 changes, 28% felt that they could talk to a university employee about their concerns related to the outbreak, whereas 60% were satisfied with the way their university had introduced protective measures after the outbreak.

**TABLE 3** Study-related stress during COVID-19 and satisfaction with teaching during COVID-19 health and medical science students at the University of Southern Denmark (USD) and the University of Copenhagen. The values are % (n).

	Total (N <sub>tot</sub> = 1,541)	Subpopulation USD	
		early responder (N <sub>e</sub> = 571)	late responder (N <sub>l</sub> = 289)
<i>Academic stress</i>			
Significantly stressed due to changes in teaching methods since COVID-19	38.87 (599)	30.30 (173)	30.10 (87)
<i>Work capacity</i>			
Significantly increased workload since COVID-19	31.02 (478)	26.09 (149)	29.07 (84)
Concerned with ability to complete the academic year due to COVID-19	30.37 (468)	27.85 (159)	27.34 (79)
<i>Satisfaction with teaching</i>			
Quality of education during COVID-19 outbreak is poorer than before	48.99 (755)	37.83 (216)	44.64 (129)
Has less knowledge about expectations in courses since COVID-19	53.54 (825)	45.01 (257)	46.02 (133)
Satisfied with the university's information about changes due to COVID-19	52.63 (811)	60.07 (343)	50.17 (145)
Can talk to a member of the university staff about concerns due to COVID-19	28.29 (436)	31.79 (181)	31.49 (91)
Satisfied with the university's protective measures concerning the COVID-19 outbreak	59.96 (925)	70.23 (401)	63.32 (183)

The sensitivity analysis demonstrated no difference between early and late responders with regard to academic stress. However, teaching satisfaction might be biased by selection bias. Thus, compared with late responders, early responders less often believed that the quality of education provided during the outbreak was poorer than before COVID-19 and more frequently stated that they were sufficiently informed about changes and that protective measures were implemented satisfactorily.

#### The association between academic stress and sociodemographic characteristics and infection worries

The multi-variable analyses showed that the odds of experiencing academic stress during the COVID-19 outbreak were 47% higher for women than for men (Table 4). Compared with students under the age of 21 years, students between 25-30 years were 37% less likely and students over 30 years old were 44% less likely to be experiencing academic stress. Compared with bachelor students, students enrolled in a master's programme were 42% less likely and PhD students 75% less likely to be experiencing academic stress. Students who did not know a COVID-19 patient were 22% less likely to report academic stress than students who did know a COVID-19 patient. Compared with students who were not at all worried about being infected with COVID-19, students who were partly worried were 43% more likely to be experiencing academic stress.

**TABLE 4** Association of sociodemographic characteristics, infection behaviour and worries with academic stress among health and medical science students at the University of Southern Denmark and the University of Copenhagen (N = 1,533).

	OR (95% CI)	
	crude analysis	multiple analysis
<i>Gender (ref. men)</i>		
Woman	1.44 (1.10-1.87)**	1.47 (1.11-1.94)**
Other	1.05 (0.25-4.27)	0.74 (0.17-3.11)
<i>Age group (ref. ≤ 21 yrs)</i>		
22-24 yrs	0.68 (0.49-0.93)*	0.83 (0.59-1.17)
25-30 yrs	0.38 (0.27-0.52)***	0.63 (0.42-0.93)*
> 30 yrs	0.25 (0.17-0.38)***	0.56 (0.34-0.92)*
<i>Relationship status (ref. not single)</i>		
Single	0.72 (0.57-0.89)**	-
<i>Immigrant background (ref. no)</i>		
Yes	0.82 (0.62-1.11)	-
<i>Education programme (ref. bachelor)</i>		
Master	0.48 (0.38-0.59)***	0.58 (0.44-0.77)***
PhD	0.17 (0.11-0.28)***	0.25 (0.14-0.44)***
<i>Sufficient financial resources (ref. no)</i>		
Yes	1.15 (0.79-1.68)	-
<i>Living arrangements (ref. together with parents)</i>		
In a dormitory or alike	1.10 (0.67-1.82)	-
Together with others	0.69 (0.44-1.05)	
Alone	0.83 (0.52-1.33)	
Other	0.73 (0.36-1.43)	
<i>Knows a COVID-patient (ref. yes)</i>		
No	0.75 (0.61-0.92)**	0.78 (0.63-0.97)*
<i>Worried about being infected with COVID-19 (ref. not at all)</i>		
Partly <sup>a</sup>	1.43 (1.13-1.82)**	1.43 (1.11-1.83)**
A lot <sup>b</sup>	1.12 (0.72-1.74)	1.12 (0.71-1.78)
Having had COVID-19 infection	1.91 (1.07-3.42)*	1.38 (0.76-2.52)

CI = confidence interval; OR = odds ratio.

\*) p < 0.05; \*\*) p < 0.01; \*\*\*) p < 0.001.

a) 4-7 points.

b) 8-10 points.

Immigration background, sufficient financial resources and living arrangements were not associated with academic stress. In the crude analysis, single students were 28% less likely to be experiencing academic stress than students who were in a relationship. However, this variable was dropped in the multiple analysis due to p-value below 0.1.

**DISCUSSION**

**Main findings**

This cross-sectional study found that 39% of Danish health and medical science students reported academic stress due to changes in teaching methods since COVID-19, which is in line with findings from Ireland [6] and China [9]. This may be explained by the fact that teaching was converted to an online format, which altered study methods and removed the possibilities of in-class interaction with teachers and peers. Many Danish students experienced a substantial increase in study workload due to COVID-19. They also experienced that they knew less about what was expected of them in the courses and that they experienced a poorer educational quality. This is supported by a previous study, which found that the majority of university students experienced an increased workload, worries and stress about academic performance during COVID-19 [9]. Consistent with our findings, a large body of research indicates that the outbreak has negatively influenced the mental health of university students [6, 9-15]. In mutually adjusted analyses, factors associated with academic stress were female sex, young age, bachelor level, knowing a COVID-19 patient and being worried about becoming infected. Female sex and being worried about becoming infected has been found previously [6], while bachelor level has not been established in earlier studies, where no significant differences were found between year groups [15] and undergraduate/graduate students [6]. This finding may be rooted in the fact that students who are in the earlier parts of their training and of younger age are less experienced as students (how to study, how to handle exams, etc.) and are less established with student peers and teachers. Older students who are closer to graduation may have overcome their initial doubts about their ability to complete the education and are therefore not so exposed to academic stress.

We found that immigration background was not associated with academic stress in contrast to a previous finding [6]. Likewise, sufficient financial resources and living arrangements were not associated with academic stress in our sample. Denmark has an extensive welfare system, including student allowances, which could explain why financial resources was not associated with academic stress, but more research is needed to investigate risk and protective factors.

### **Strengths and limitations**

The main limitation lies in the cross-sectional character of this study where perceived change in academic stress was assessed retrospectively. This approach may induce cognitive and motivational biases affecting the validity of the results [17, 18]. Furthermore, completing a back translation of the survey was not possible due to the time pressure triggered by the need to conduct the survey before the lockdown was lifted. This could potentially affect the validity of the items; however, the problem is limited since three research staff conducted the translation independently and thoroughly discussed differences in translation until agreement.

The low response rate may suggest selection effects where those who have chosen to participate may be more stressed than those who did not participate. Even so, the opposite could also be the case. Therefore, despite these low response rates being common in online surveys, the reported prevalences should be considered with caution. However, a sensitivity analysis showed that information about academic stress seemed not to be confounded by selection bias. Even though we included only health and medical sciences students, previous Danish studies have not found a marked difference between the stress level among students from the Faculty of Health and other faculties [19, 20]. Strengths include the large sample which can provide more accurate mean values and a smaller margin of error. Furthermore, the data collection time point was optimal as the survey was distributed at the end of the Danish lockdown in the spring of 2020.

### **CONCLUSIONS**

Our findings suggest that the COVID-19 outbreak has affected health and medical science university students' academic stress negatively, and that this is mainly seen in students who are female, less than 21 year of age,

bachelor students and who knew a COVID-19 patient and were worried about infection. Although these results are not surprising, they may help identify students who are most in need of special attention. It is important to continue to monitor students' mental health and to facilitate structures to support the mental health and academic career of this "corona generation".

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