

Levels and facets of university students' stress during the COVID-19 pandemic: Longitudinal evidence from the first two academic years in Germany and the U.S.

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Abstract

Following its outbreak, the COVID-19 pandemic had strong negative effects on university students' stress and mental health worldwide. Using two longitudinal datasets from Germany ($N = 504$) and the U.S. ($N = 893$), we investigated how students' stress developed over the first two academic years during the pandemic. In both studies, we found elevated levels of students' stress at the beginning of the pandemic. In Germany, we found a significant intra-individual decrease in students' general stress experiences even before universities had returned to in-person classes. When examining specific stress facets in the U.S., we found that students' academic stress increased during the first pandemic year with remote teaching and decreased significantly after the university resumed normal operations, that is, in-person classes and on-campus residence. Students' practical stress decreased towards all later time points compared to the onset of the pandemic, whereas health stress continuously increased until the university resumed normal operations. We report differences by

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students' demographic backgrounds (gender, college generation status, childcare status, ethnicity, academic year) and discuss our findings against the background of the course of the pandemic in the particular context in which both studies were conducted.

KEYWORDS

academic year, childcare status, college generation status, COVID-19 pandemic, ethnicity, gender, higher education, stress

1 | INTRODUCTION

The COVID-19 pandemic created the largest disruption of education systems in history, affecting nearly 1.6 billion learners (UN, 2020). In higher education institutions worldwide, the closure of campuses and the shift to remote instruction led to profound changes in students' private, academic, and social lives.

Considering the generally high prevalence of stress and mental health impairments among university students (Auerbach et al., 2018; Karyotaki et al., 2020) and research showing that situations involving high ambiguity and low controllability are perceived as stressful (Frazier et al., 2011), early attention was drawn to the potentially strong negative effects of the pandemic on students' psychological functioning (UNESCO, 2020).

Numerous studies have shown detrimental effects of the pandemic on students' stress and mental health, which were associated with stressors such as remote instruction, contact restrictions, financial worries, disruptions in living conditions, and health-related concerns (Elmer et al., 2020; Höhne et al., 2022; Matos Fialho et al., 2021; Son et al., 2020; von Keyserlingk et al., 2022). To our knowledge, however, no previous studies have investigated the development of students' stress beyond the first year of the pandemic compared to its onset (for longitudinal studies until January/February 2021 see Li et al., 2023; Zhang et al., 2023), even though stress can be particularly harmful if remaining at a high level over an extended period (Landow, 2006).

With the present studies, we aimed to help fill this gap in the literature by examining German (Study 1) and U.S. (Study 2) university students' stress experiences over the first two academic years during the pandemic. While the German and U.S. higher education systems differ in terms of residential character, financial cost, and other factors, universities in both countries operated fully online until they shifted back to in-person operations in the academic year 2021/22. We specifically addressed the question of whether students' stress decreased or increased from the first to subsequent time points. Possible explanations for a decrease could be habituation to the challenging circumstances of the pandemic, more support opportunities from universities and their return to in-person operations, and vaccination availability. On the other hand, stress might have increased due to sensitization to the prolonged pandemic-related stress exposure, financial hardships, and increases in COVID-19 incidence and death rates. Longitudinal evidence from the first pandemic year is mixed with some studies reporting decreases in university students' stress experiences (Charles et al., 2021; Li et al., 2021), other studies reporting no temporal changes (Hoyt et al., 2021; Wang et al., 2020), and yet others reporting increases (Rogowska et al., 2022).

Previous studies indicated that students from diverse backgrounds experienced different exposures to pandemic-related stressors and mental health impairments. Students who were at particular risk for experiencing high stress levels were females and students at the beginning of their studies (Aristovnik et al., 2020; Elmer et al., 2020), who were already found to have elevated stress levels in pre-pandemic studies (Bewick et al., 2010; Graves et al., 2021). Similarly, first-generation students and historically underrepresented minority (URM) students were at higher risk of experiencing elevated mental health impairments during the pandemic (Chirikov et al., 2020; Fruehwirth et al., 2021). One possible explanation could be that they were disproportionately affected by financial

hardships and housing insecurities (Soria, Horgos, et al., 2020; Soria, Roberts, et al., 2020). Communities of ethnic and racial minorities in the U.S. further suffered from higher COVID-19 infection rates (Boserup et al., 2020), which could have caused elevated health concerns among URM students. Asians, particularly Chinese Americans, experienced increased discrimination during the pandemic (Cheah et al., 2021), which may have also contributed to higher stress. Lastly, students who cared for children in their household were particularly vulnerable to pandemic-related stress, as they had to readjust their study, caregiving, and home responsibilities (Savage, 2023). Thus, besides the general development of students' stress experiences over the first two pandemic years, we examined differences by students' demographic backgrounds.

2 | STUDY 1

Study 1 investigated the development of German university students' general stress and potential differences in stress levels and changes by gender, college generation status, childcare status, and degree program.

2.1 | Method

2.1.1 | Sample and procedure

We used data from a study on students' experiences during the COVID-19 pandemic at the Faculty of Humanities of a large public university in Lower Saxony, Germany. Students were contacted twice per semester via a university mailing list and could enter the study at any time point by giving their written consent. All administered surveys (T1-T6) are depicted in Figure 1. Our overall sample consisted of 1909 students who provided information on at least one of our variables of interest to the present study. Of these, 504 students completed at least two surveys and were included in the analyses of our study (for a comparison between included and excluded participants see SI Table S1). Our sample represents all demographic groups of the faculty's student population, with an overrepresentation of female students (78% female; 68% Bachelor students¹). Moreover, 48% were first-generation students and 8% had childcare responsibilities. For further information on our sample see SI Tables S2 and S3.

2.1.2 | Measures

Stress. To measure students' general stress experiences, we used a shortened German version of the Perceived Stress Scale (Cohen et al., 1983). On two items, students indicated the degree to which they perceived their lives

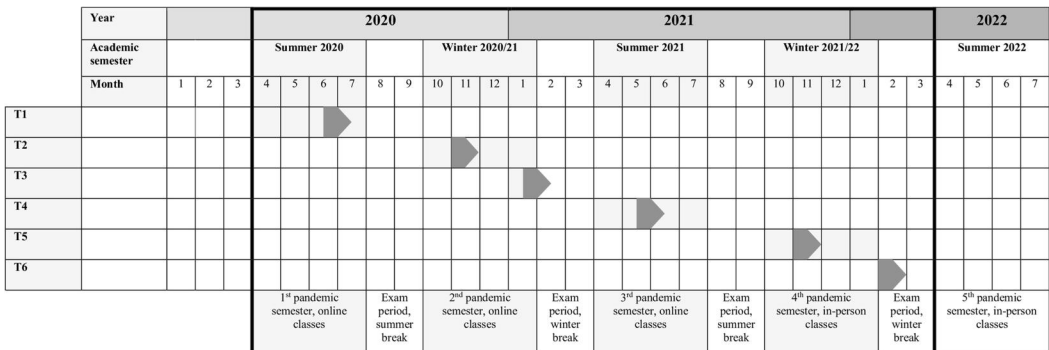


FIGURE 1 Study 1 (Germany): Study design.

overloaded and uncontrollable during the last month (e.g., "In the last month, how often have you felt nervous and 'stressed'?"; T1-T6 Spearman-Brown coefficient: 0.83-0.88). Students responded on a scale from 1-never to 5-very often.

Demographics. Students indicated their gender (0 = male, 1 = female), college generation status (0 = continuing-generation, 1 = first-generation), childcare status (0 = no childcare responsibilities, 1 = childcare responsibilities), and degree program (0 = B.A./B.Sc., 1 = M.A./M.Ed. at first participation).

2.1.3 | Statistical analyses

Analyses were performed using Mplus Version 8.1 (Muthén & Muthén, 1998–2017). First, we tested longitudinal measurement invariance (Liu et al., 2017; see SI Table S4). Next, we used a latent change score (LCS) model to investigate intraindividual change in students' general stress over time (Ferrer & McArdle, 2010). Because we were interested in the change of stress compared to the beginning of the pandemic, we used a baseline change model (Geiser, 2013). In a next step, we included the following predictors of students' stress at T1 and intraindividual change over time: gender, college generation status, childcare status, and degree program at first participation.

Missing values were assumed to be missing at random (MAR) and estimated using full information maximum likelihood (FIML), which has been shown to produce unbiased and efficient parameter estimates (Enders, 2010).

2.2 | Results

Table 1 and Figure 2 show the intraindividual change in students' general stress. We found that students reported having experienced stress regularly in the past month at T1 and that they had significant intraindividual decreases towards T3, T4, and T5.

TABLE 1 Study 1 (Germany): LCS model on students' general stress.

	T1	T1-T2	T1-T3	T1-T4	T1-T5	T1-T6
	Estimate (SE)	Estimate (SE)	Estimate (SE)	Estimate (SE)	Estimate (SE)	Estimate (SE)
Intercept	3.89 (0.05)	-0.11 (0.07)	-0.15 (0.06)	-0.21 (0.07)	-0.20 (0.07)	-0.07 (0.07)

Note: $N = 504$. Model fit: RMSEA = 0.042, CFI = 0.972, TLI = 0.961, SRMR = 0.054. Bold font: $p \leq 0.05$.

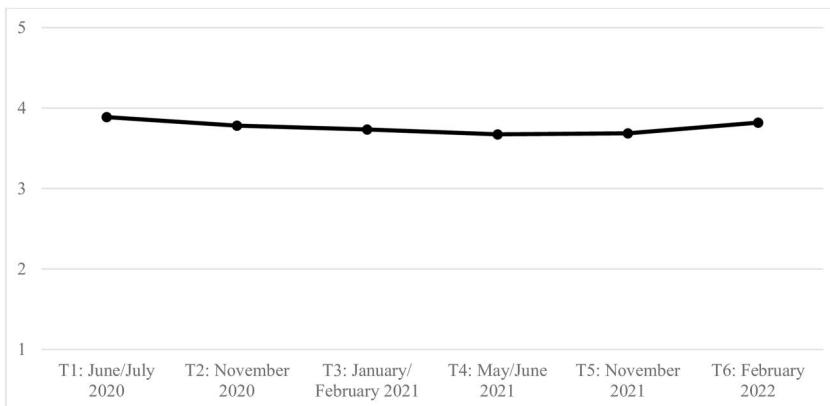


FIGURE 2 Study 1 (Germany): Development of students' general stress.

Table 2 shows differences in intraindividual changes in general stress among students from different demographic backgrounds. Female students reported higher general stress levels than male students at T1, but the change towards later time points did not differ by gender. First-generation students reported higher initial general stress levels and had steeper decreases towards T2 compared to continuing-generation students. Students with childcare responsibilities did not have higher initial general stress levels, but steeper decreases towards all later time points except T3 compared to students without childcare responsibilities.

3 | STUDY 2

Study 2 investigated the development of U.S. university students' stress facets (i.e., academic, practical, health). We examined potential differences in stress levels and changes by gender, college generation status, URM status, Asian/Asian American ethnicity, and academic year.

3.1 | Method

3.1.1 | Sample and procedure

We used data from a study on undergraduate students' college experiences and success at a large public university in California, U.S. (Arum et al., 2021). In summer 2019, 1270 undergraduates in their freshman/junior year consented to participate in repeated surveys across two academic years. After COVID-19 was declared a pandemic, additional surveys were used to capture students' experiences during remote learning. Figure 3 shows all administered surveys (T1-T7). We used a subsample ($N = 893$) of students who completed survey questions on stress at least once. All demographic groups of the study site's undergraduate population were represented in the sample, with an overrepresentation of female and freshman students (67% female; 54% first-generation students; 35% URM students, predominantly with Hispanic background; 47% Asian/Asian American students; 65% freshmen). For further information on our sample see SI Tables S5 and S6.

3.1.2 | Measures

Stress. We used the University Stress Scale (Stallman & Hurst, 2016) to measure different stress facets. All items used the item stem: "In the past 7 days, how often has the following caused you stress...?". Three items measured students' academic stress (e.g., "...academic/coursework demands"; T1-T7 Cronbach's α : 0.69-0.84), three items practical stress (e.g., "...finances"; T1-T7 Cronbach's α : 0.77-0.78), and two items health stress (e.g., "...mental health problems"; T1-T7 Spearman-Brown coefficient: 0.67-0.69). Students responded on a scale from 0-*never* to 7-*every day*.

Demographics. We retrieved students' demographic information (i.e., gender: 0 = male, 1 = female; college generation status: 0 = continuing-generation, 1 = first-generation; URM status: 0 = non-URM, 1 = URM (i.e., American Indian/Alaskan Native, Black, Hispanic, Pacific Islander); Asian/Asian American ethnicity: 0 = non-Asian/Asian American ethnicity, 1 = Asian/Asian American ethnicity; academic year: 0 = freshman, 1 = junior in academic year 2019/20) from the student registrar data.

3.1.3 | Statistical analyses

Analyses were performed using Mplus Version 8.6 (Muthén & Muthén, 1998-2017). We used confirmatory factor analyses to model the three stress facets at each time point and tested longitudinal measurement invariance for

TABLE 2 Study 1 (Germany): LCS model on students' general stress predicted by demographic backgrounds.

	T1		T1-T2		T1-T3		T1-T4		T1-T5		T1-T6	
	Estimate	(SE)	Estimate	(SE)	Estimate	(SE)	Estimate	(SE)	Estimate	(SE)	Estimate	(SE)
Intercept	3.19	(0.12)	0.07	(0.16)	0.05	(0.15)	0.04	(0.16)	0.07	(0.16)	-0.00	(0.15)
Female	0.59	(0.12)	0.02	(0.15)	-0.14	(0.14)	-0.14	(0.16)	-0.09	(0.16)	0.03	(0.15)
First-generation	0.36	(0.12)	-0.51	(0.16)	-0.24	(0.15)	-0.27	(0.14)	-0.19	(0.14)	0.10	(0.13)
Childcare	0.10	(0.18)	-0.45	(0.22)	-0.32	(0.20)	-0.55	(0.23)	-0.50	(0.26)	-0.54	(0.23)
Master	0.12	(0.10)	0.19	(0.13)	0.10	(0.12)	0.14	(0.14)	-0.12	(0.15)	-0.24	(0.15)
R ²	0.15		0.22		0.09		0.15		0.08		0.12	

Note: N = 497. Students with diverse gender identity (n = 7) were excluded. Model fit: RMSEA = 0.055, CFI = 0.918, TLI = 0.887, SRMR = 0.076. Bold font: $p \leq 0.05$.

Year	2020												2021												2022								
Academic quarter	Winter 2020			Spring 2020			Summer 2020			Fall 2020			Winter 2021			Spring 2021			Summer 2021			Fall 2021			Winter 2022			Spring 2022			Summer 2022		
Month	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9
T1																																	
T2																																	
T3																																	
T4																																	
T5																																	
T6																																	
T7																																	
	First announcement that university will shift to online classes in Spring 2020			1 st pandemic quarter, online classes and off-campus residence			Summer break			2 nd pandemic quarter, online classes and off-campus residence			3 rd pandemic quarter, online classes and off-campus residence			4 th pandemic quarter, online classes and off-campus residence			Summer break			5 th pandemic quarter, hybrid classes and on-campus residence			6 th pandemic quarter, in-person classes and on-campus residence			7 th pandemic quarter, in-person classes and on-campus residence			Summer break		

FIGURE 3 Study 2 (U.S.): Study design.

each facet (Liu et al., 2017; see SI Table S7). Next, we estimated baseline LCS models to investigate intraindividual change in students' stress facets over time. To investigate differences by students' demographic backgrounds, we included gender, college generation status, URM status, Asian/Asian American ethnicity, and academic year in 2019/20 as predictors of students' stress experiences at T1 and intraindividual change over time.

We assumed missing data to be MAR and used FIML (Enders, 2010). To improve FIML in a sample with large percentages of missing data (Collins et al., 2001), we used the following auxiliary variables: high school GPA, K6 screening items on non-specific psychological distress (Kessler et al., 2002), and items on students' stress facets at T1 that were not part of the estimated model.

3.2 | Results

Table 3 and Figure 4 show the intraindividual change in students' stress facets. Students reported having experienced academic stress on nearly 5 days/week at T1 and had significant intraindividual increases towards T2, T3, and T5. Academic stress decreased significantly towards T6 and T7. Students reported having experienced practical stress on about 4 days/week at T1, with decreases towards all later time points. Students reported having experienced health stress on about 3 days/week at T1 and showed increases towards all later time points except T6.

Table 4 shows differences in intraindividual changes in stress facets among students from different demographic backgrounds. Regarding academic stress, female students reported higher stress levels at T1 than male students, but the extent of change to later time points did not differ by gender. URM students showed steeper increases in academic stress from T1 towards T4 and T5 compared to non-URM students. Juniors had higher initial academic stress levels compared to freshmen, but steeper decreases from T1 to T3, T4, T5, and T6 (see SI Table S8 for robustness checks on decreases in academic stress at T6 and T7). Regarding practical stress, first-generation students had steeper increases from T1 to almost all later time points compared to continuing-generation students. Regarding health stress, female students reported higher levels at T1 and steeper increases towards T2 compared to male students.

4 | DISCUSSION

Previous research has shown the negative impact of the COVID-19 pandemic on university students' stress and mental health. Our findings add to the literature in two ways: (1) the investigation of students' stress over the first two academic years during the pandemic in two countries and (2) the consideration of different student demographics and stress facets.

TABLE 3 Study 2 (U.S.): LCS models on students' stress facets.

	T1		T1-T2		T1-T3		T1-T4		T1-T5		T1-T6		T1-T7	
	Estimate	(SE)	Estimate	(SE)	Estimate	(SE)	Estimate	(SE)	Estimate	(SE)	Estimate	(SE)	Estimate	(SE)
a) Academic stress	5.18	(0.06)	0.67	(0.07)	0.19	(0.08)	0.09	(0.09)	0.27	(0.08)	-0.89	(0.13)	-0.73	(0.14)
b) Practical stress	3.87	(0.09)	-0.19	(0.10)	-0.58	(0.08)	-0.52	(0.08)	-0.16	(0.08)	-0.58	(0.12)	-0.65	(0.15)
c) Health stress	3.04	(0.10)	0.45	(0.09)	0.78	(0.11)	0.79	(0.11)	0.82	(0.10)	0.11	(0.15)	0.32	(0.16)

Note: N = 893. Model fits: a) RMSEA = 0.028, CFI = 0.980, TLI = 0.966, SRMR = 0.047; b) RMSEA = 0.039, CFI = 0.956, TLI = 0.927, SRMR = 0.075; c) RMSEA = 0.027, CFI = 0.994, TLI = 0.977, SRMR = 0.028. Bold font: $p \leq 0.05$.

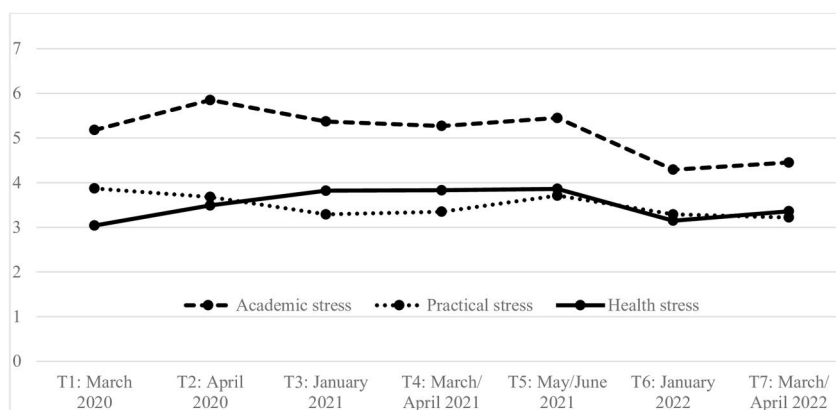


FIGURE 4 Study 2 (U.S.): Development of students' stress facets.

In both samples, we found elevated stress among all students at the beginning of the pandemic, which is in line with prior findings (Elmer et al., 2020; von Keyserlingk et al., 2022) and literature on stress experiences in situations of high uncertainty (Frazier et al., 2011). Results on students' general stress in the German sample showed significant decreases towards the beginning and spring 2021, and thus, even before the university had returned to in-person classes in winter semester 2021/22. A possible explanation for the decrease could be the temporal proximity to the start of the COVID-19 vaccination campaign in Germany and the number of daily vaccine doses administered (see SI Table S9). Furthermore, the university president's office began to highlight testing opportunities from spring 2021 and to offer vaccinations from summer 2021. While the vaccination rates remained high, students' stress did not decrease towards the beginning of 2022, when a large proportion of faculty members had returned to remote instruction due to rising incidence rates caused by the SARS-CoV-2 Omicron variant. Students with childcare responsibilities showed larger decreases in general stress from the onset of the pandemic towards all later time points except January/February 2021, when Germany was in lockdown (see SI Table S9). Possibly, they were able to adjust well to the pandemic due to the university's support options (e.g., financial support, emergency childcare). First-generation students had higher initial general stress levels, but a comparable intraindividual change towards most subsequent time points as continuing-generation students. Interestingly, stress has been found to be related to institutional support for first- but not continuing-generation students (Garriott & Nisle, 2018), but, in contrast to students with childcare responsibilities, there was no comparable university support system.

Longitudinal analyses of different stress facets in the U.S. sample showed a more differentiated picture. Academic stress continuously increased during remote teaching and decreased once the university had resumed normal operations indicating that in-person interactions with faculty and peers and campus facilities are important resources, which were not available during remote instruction. Decreasing trends in practical stress showed that housing and finances were not a major concern of students, even though they had to make new arrangements for their housing and study routines during the pandemic. Health stress was the least pronounced stress facet at the pandemic onset, but continuously increased over time. Hence, mental and physical health continued to be an ongoing concern, which could be related to high COVID-19 prevalences (see SI Table S10) or increasing mental health impairments during the pandemic (Buizza et al., 2022). Analyses on group differences in students' stress facets revealed interesting findings that support prior cross-sectional findings on aggravated stressors for minoritized students. URM students experienced more academic struggles during the pandemic (Soria, Roberts, et al., 2020), while first-generation students were more vulnerable to practical stress, which could be related to higher uncertainty because of financial concerns or less convenient housing situations during off-campus operations (Soria, Horgos, et al., 2020). A positive finding is that Asian/Asian American students did not experience more stress than non-Asian/Asian American students despite the increases in anti-Asian discrimination in California

TABLE 4 Study 2 (U.S.): LCS models on students' stress facets predicted by demographic backgrounds.

	T1		T1-T2		T1-T3		T1-T4		T1-T5		T1-T6		T1-T7	
	Estimate	(SE)	Estimate	(SE)	Estimate	(SE)	Estimate	(SE)	Estimate	(SE)	Estimate	(SE)	Estimate	(SE)
a) Academic stress														
Intercept	4.55	(0.18)	0.58	(0.20)	0.44	(0.22)	0.15	(0.23)	0.37	(0.22)	-0.90	(0.41)	-0.44	(0.36)
Female	0.51	(0.12)	-0.05	(0.14)	-0.05	(0.15)	-0.11	(0.16)	0.12	(0.15)	0.40	(0.25)	-0.06	(0.23)
First-generation	0.17	(0.12)	0.06	(0.13)	-0.13	(0.15)	-0.07	(0.16)	-0.06	(0.15)	-0.09	(0.25)	-0.40	(0.22)
URM	0.03	(0.18)	0.36	(0.20)	0.09	(0.22)	0.68	(0.24)	0.46	(0.23)	0.06	(0.43)	0.39	(0.38)
Asian	0.14	(0.17)	0.08	(0.18)	0.09	(0.20)	0.20	(0.21)	0.09	(0.21)	0.10	(0.39)	0.16	(0.34)
Junior	0.24	(0.12)	-0.14	(0.13)	-0.58	(0.15)	-0.73	(0.16)	-0.92	(0.15)	-1.29	(0.45)	-0.05	(0.35)
R ²	0.06		0.03		0.08		0.14		0.20		0.22		0.04	
b) Practical stress														
Intercept	3.39	(0.22)	-0.50	(0.24)	-0.86	(0.24)	-0.67	(0.24)	-0.16	(0.23)	-0.82	(0.36)	-1.04	(0.37)
Female	0.13	(0.14)	0.06	(0.16)	0.17	(0.16)	0.04	(0.16)	0.09	(0.15)	0.17	(0.23)	-0.06	(0.23)
First-generation	0.12	(0.14)	0.39	(0.15)	0.48	(0.16)	0.32	(0.16)	0.31	(0.15)	0.40	(0.23)	0.44	(0.22)
URM	0.50	(0.21)	0.06	(0.23)	-0.04	(0.24)	0.03	(0.24)	-0.21	(0.23)	-0.24	(0.39)	0.16	(0.37)
Asian	0.29	(0.19)	-0.22	(0.21)	-0.19	(0.22)	-0.23	(0.22)	-0.34	(0.21)	-0.24	(0.35)	0.02	(0.34)
Junior	0.06	(0.14)	0.40	(0.15)	0.06	(0.16)	0.16	(0.16)	0.16	(0.15)	0.28	(0.39)	0.65	(0.34)
R ²	0.03		0.12		0.11		0.07		0.11		0.07		0.15	
c) Health stress														
Intercept	2.31	(0.29)	0.16	(0.31)	0.59	(0.32)	0.53	(0.32)	0.47	(0.30)	-0.03	(0.51)	0.82	(0.47)
Female	0.75	(0.20)	0.32	(0.21)	0.50	(0.22)	0.28	(0.22)	0.39	(0.21)	0.39	(0.32)	0.13	(0.31)
First-generation	0.03	(0.19)	-0.11	(0.20)	-0.31	(0.21)	0.02	(0.22)	-0.04	(0.20)	-0.02	(0.31)	-0.40	(0.30)
URM	-0.22	(0.28)	0.38	(0.31)	0.32	(0.32)	0.49	(0.33)	0.59	(0.31)	0.38	(0.54)	0.06	(0.50)
Asian	-0.00	(0.26)	-0.08	(0.28)	0.04	(0.29)	0.14	(0.30)	0.28	(0.28)	-0.14	(0.48)	-0.53	(0.45)

TABLE 4 (Continued)

c) Health stress														
Junior	0.65	(0.19)	0.09	(0.20)	-0.18	(0.21)	-0.36	(0.22)	-0.49	(0.21)	-0.57	(0.54)	0.01	(0.45)
R ²	0.08		0.04		0.07		0.06		0.26		0.17		0.10	

Note: N = 893. Model fits: a) RMSEA = 0.038, CFI = 0.940, TLI = 0.913, SRMR = 0.075; b) RMSEA = 0.044, CFI = 0.917, TLI = 0.904, SRMR = 0.075; c) RMSEA = 0.033, CFI = 0.997, TLI = 0.944, SRMR = 0.047. Bold font: $p \leq 0.05$.

during the pandemic (California Department of Justice, 2021). Junior students reported higher initial academic stress levels and a steeper decline over time compared to freshmen. Possibly, initial concerns about study interruptions were higher among students who were closer to degree completion.

Female students in both studies reported higher stress levels than male students, which is consistent with (pre-)pandemic studies (Aristovnik et al., 2020; Bewick et al., 2010). Higher pressure to perform, higher anxiety, and a greater use of emotion-focused coping strategies that can be less effective to reduce stress than problem-focused coping strategies might explain this pattern among female students (Gefen & Fish, 2012). However, similar change patterns in general, academic, and practical stress indicate that they were not generally more susceptible to stress over time.

4.1 | Limitations and future directions

Our research was conducted in one state per country and should therefore not be generalized to German and U.S. university students' stress experiences. The pandemic-related situation (e.g., COVID-19 cases, vaccinations) varied, sometimes significantly, by state. Both in Lower Saxony and California, the average daily new cases and prevalence rates within our survey periods were below the respective national average at most time points (see SI Tables S9 and S10). Moreover, the comparability of the pandemic-related situation for both student populations is limited due to differences in, for example, prevalence rates and public health measures. Another limitation concerns the time points of our studies, which were not entirely parallel due to the different structure of the academic year in both countries. Finally, it is possible that actual stress is generally underestimated because students with very high stress levels may have not participated. In Study 1, students who participated only once had higher stress levels at two out of six time points (January/February 2021, May/June 2021) than students in our longitudinal subsample (see SI Table S1). Thus, we may overestimate the intraindividual decrease in students' general stress at these two time points before they had returned to in-person classes.

Future research should investigate which aspects of remote and in-person instruction are associated with changes in students' stress experiences and which resources might help students to cope with stressful experiences to gain insights into how they can be supported in their studies.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

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ENDNOTE

¹ PhD students were not included.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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