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Covid-19 Outbreak and Italian College Students' Well-being: Evidence for both Negative and Positive Consequences

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Abstract

Background: The Covid-19 virus rapidly spread worldwide, with Italy being one of the most affected countries. College students might have experienced psychological and physical impairment due to this threat to their health and the uncertainty concerning their academic path because of universities' unexpected and sudden closure. Hence, we aimed to analyze college students' well-being during the Covid-19 pandemic. Methods: We gathered 6075 Italian college students (M age = 23.60±5.02). They have been evaluated for depression, anxiety, stress, daytime sleepiness, and sleep quality impairment. MANOVAs, MANCOVAs, and one-sample t-tests (with students gathered before the pandemic as the reference group) have been performed. Results: During the Covid-19 pandemic, females and Humanities students experienced higher psychological and physical impairment than males and Technology students. Though, the participants generally experienced an amelioration in their well-being compared to students evaluated before the Covid-19 outbreak, indicating a positive effect of the pandemic. Conclusions: We suggest that Universities should increase their psychological services' offering, including group counseling interventions. They should also plan to reduce the burden felt by their students during the "regular" academic life. They could allow students to attend lessons from home through recording, and they should try to reduce the overstudying climate.

Keywords: anxiety; depression; pandemic; psychopathology; sleep

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Introduction

In December 2019, many cases of pneumonia of unknown etiology arose in Wuhan, Hubei province, China. The pathogenic agent was a novel Coronavirus: 2019-nCov, or Covid-19 (Ryu & Chun, 2020; Wang, Horby, Hayden, & Gao, 2020). This virus rapidly becomes a global public health emergency due to its substantial mortality rate and rapid transmission (Guan et al., 2020; Liu, Gayle, Wilder-Smith, & Rocklöv, 2020; Rocklöv, Sjödin, & Wilder-Smith, 2020). In the beginning, it seemed that the spread happened through direct contact with local fish and animal markets; next, Chan et al. (2020) highlighted that it could also be transmitted person-to-person, including contact with asymptomatic people (Rothe et al., 2020), hence increasing its diffusion rate.

Italy is among the most affected countries outside China. The first Italian case was registered on February 20, 2020, in a hospital in a small city of Northern Italy (Gagliano et al., 2020). On August 30, 2020, the World Health Organization (2020) reported 266.853 cases and 35.473 deaths for Italy. To contain the pandemic, the Italian government, among other measures, decided to allow individuals' movements only for well-motivated reasons (i.e., health or work) and, therefore, closed schools and universities. Hence, from March 2020, Italian college students suddenly found themselves in a home-confinement situation and without the possibility of attending courses and taking exams in person. Hence, they lived in great uncertainty concerning how their universities would have managed their lessons, exams, and graduation since their institutions provided information gradually, based on the epidemiologic situation's development and the government's decisions. Thus, their physical and psychological well-being could have been negatively affected since they experienced both a life-threatening situation and great vagueness concerning their academic path. In line with this speculation, Clabaugh, Duque, and Fields (2021) found high levels of uncertainty regarding the academic future and high levels of distress and difficulties in coping with the changes due to the pandemic in US university students. Moreover, Loscalzo and Giannini (2021) found that intolerance of uncertainty positively predicts Studyholism (or obsession towards studying; cfr., for more details concerning this construct, Loscalzo, 2019, 2021; Loscalzo & Giannini, 2017, 2018a, 2018b, 2020, 2022a), which in turn predicts an impairment in study quality and motivation.

In the literature, an increasing number of studies highlighted psychological and physical downsides among the general population during the Covid-19 outbreak (e.g., Dozois, 2021; Franceschini et al., 2020; Mazza et al., 2020; Pierce et al., 2020; Wang, Pan, Wan, Tan, Xu, Ho, & Ho, 2020). Concerning college students specifically, almost half of the wide Chinese sample analyzed by Ma et al. (2020) showed mental health issues, with the highest prevalence for probable acute stress (34.9%), followed by probable acute depression (21.1%) and anxiety (11.0%). Li, Cao, Leung, and Mak (2020) further highlighted the negative impact of the Covid-19 pandemic on college students' psychological health: when assessed after two weeks of lockdown, students reported increased anxiety and depressive symptoms and higher negative affect. About other countries, Bangladeshi university students experienced high levels of depression and anxiety (Islam, Barna, Raihan, Khan, & Hossain, 2020), and more than half of a (small) sample of Medical Sciences Iranian students suffered from psychological distress during the Covid-19 pandemic (Ghafari, Mrighafourvand, Rouhi, & Tabrizi, 2021). In the US, students evaluated their health as poorer than before the Covid-19 outbreak (Hagedorn, Wattick, & Olfert, 2022). In France, a study conducted on more than 69.000 university students by Wathelet et al. (2020) showed that a consistent percentage of students showed suicidal thoughts (11.4%), severe distress (22.4%), high levels of perceived stress (24.7%), severe depression (16.1%), and high anxiety (27.5%). Finally, also Italian college students have been negatively affected by the Covid-19 pandemic. Interestingly, Romeo, Benfante, Castelli, and Di Tella (2021) found that Italian university students experienced higher anxiety and depression than workers.

Hence, this study aims to analyze further Italian students' well-being during the Covid-19 pandemic. More specifically, it evaluates if some demographic and study-related variables are associated with a higher psychological and physical impairment (also controlling for negative affect as a personality trait). Moreover, we compare students' well-being with that of students assessed before the pandemic to evaluate if there is a difference in their health. We did not posit a hypothesis about the increase or decrease in well-being during the pandemic since we speculate that both cases could apply. The qualitative analysis conducted on 202 Italian college students showed that most participants experienced negative effects on their study (83.70%), such as anxiety for the uncertainty concerning the exams' format, the fear of being forced to delay graduation, and difficulties in their study concentration. However, almost half of the participants also reported positive effects, including using the study to cope with the distress due to lockdown and more time for studying (Loscalzo, Ramazzotti, & Giannini, 2021). Therefore, this qualitative study suggested both positive and negative study-related consequences for many students. In the same line, Loscalzo and Giannini (2021) showed that, when compared to a group of students gathered before the Covid-19 outbreak, Italian college students experienced higher levels of Studyholism (as a negative study-related variable) but also lower dropout intention. Therefore, we can speculate that, for some students, the abrupt changes in the academic and social life, jointly with the worry about contracting the virus, might have caused higher distress. Though, at the same time, other students might have benefited from these changes, as the lockdown might have allowed them to have more time for studying and following online lessons, with a consequent ameliorating in their well-being.

By shedding light on college students' well-being during the Covid-19 pandemic, this study might provide valuable insights for university-based interventions to manage the consequences of the Covid-19 outbreak.

Methods

Participants

We recruited a sample of 6075 Italian college students aged between 18 and 68 years (M age = 23.60±5.02) during the

first lockdown imposed by the government in 2020. Most of them are females (74.6%) and not working besides studying (76.5%). The majority of them live in Tuscany (80.3%), across 10 of its Counties (46.7% living in Florence). Though, all Italian regions are represented, with the following distribution concerning the three macro-areas (there are some missing data): North, 10.3%; Center, 83.4%, South, 5.8%. In line with this geographic distribution, most students are enrolled at the University of Florence (78.3%). Among the other most represented universities there are Bologna (1.7%), Bergamo (1.3%), and Pisa (1.1%). All other universities report a percentage of enrolled students below .9%. About the major of study, we recruited students from all the main courses. Among the ones most represented, there are Educational studies (9.8%), Economy (9.5%), Engineering (8.4%), Psychology (7.8%), Social Sciences (6.6%), Medical Studies (6.5%), Architecture and Design (6.1%), and Law (5.2%). Finally, the proportions of students in years 1 to 5 were 19.4%, 17.1%, 29.0%, 14.3%, 18.9% (1.3% is missing). This sample has also been used for different analyses reported in other papers (Loscalzo & Giannini, 2021, 2022b; Loscalzo et al., 2021).

To compare the levels of the psychological and physical well-being of the current participants with that of students evaluated before the Covid-19 outbreak, we used the sample gathered by Loscalzo and Giannini (2019), which is similar to our current sample concerning age (Mean = 23.53±4.43) and gender prevalence (females: 75.4%). Moreover, the University of Florence is again the most represented, even with a lower percentage (i.e., 39.2%). The samples are similar also concerning the distribution for the seven macro-areas related to the major of study. More specifically, the values for each macro-area are, for Loscalzo and Giannini (2019) and the present sample respectively: Technology, 11.2% and 15.4%; Social Sciences, 31.0% and 40.4%; Humanities, 25.9% and 15.4%; Medical Studies, 13.0% and 6.5%; Sciences, 12.8% and 9.2%; Nursing (and other courses under the label of "Health Professions", for Loscalzo and Giannini, 2019), 1.1% and 2.5%; Other Medical studies (labeled "Para-Medical studies" in Loscalzo and Giannini, 2019), 5.0% and 3.5%. The distribution of Loscalzo and Giannini (2019) is also similar concerning the proportion of students in years 1 to 5: 16%, 20.9%, 26.7%, 14.2%, and 15.2%.

Materials

Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1998). It is a 20-item self-report instrument that assesses Positive and Negative Affect. The response format is a 5-point Likert scale ranging from 1 (*Very slightly* or *not at all*) to 5 (*Extremely*). There are two versions of the PANAS that refer, in the instruction, to affect as a trait or state. We used the trait version for this study since we aimed to include negative affect as a covariate. We administered the Italian version by Terracciano, McCrae, & Costa (2003), which reported a Cronbach's *alpha* of .87 for negative affect, trait version.

Mini Sleep Questionnaire (MSQ; Zoomer, Peder, Rubin, & Lavie, 1985). It is a 10-item self-report instrument comprehending two scales: Sleep (or Sleep Quality Impairment) and Wake (or Daytime Sleepiness). The participants answer a 7-point Likert scale ranging between 1 (*Never*) and 7 (*Always*), referring to their last 7 days. We administered the Italian version (Natale, Fabbri, Tonetti, & Martoni, 2014), which does not include one item (snoring) in the scoring, and that is characterized by a Cronbach's *alpha* of .75 for both scales.

Depression Anxiety Stress Scales-21 (DASS-21; Lovibond and Lovibond, 1995a). It is a 21-item self-report scale derived from the 42-item version (DASS; Lovibond and Lovibond, 1995b). It comprehends three scales: Depression, Anxiety, and Stress. The participants answer through a 4-point Likert scale ranging between 0 (*Did not apply to me at all - Never*) and 3 (*Applied to me very much, or most of the time – Almost always*), referring to the symptoms experienced in the last 7 days. We used the Italian validation by Bottesi et al. (2015), which retained the three-factor and one-factor structures. The internal reliability (Cronbach's α) of the DASS-21 scales (in the community sample) are .82 (Depression), .74 (Anxiety), and .85 (Stress).

Procedure

First, we asked for approval from the Ethical Committee of the University of Florence. Next, we created an online questionnaire, including the instruments described in the previous section and other scales not used for the present paper. Moreover, we asked for demographic data (e.g., gender, age) on the first page of the questionnaire. Concerning the Informed Consent, we wrote the related information on the first page of the questionnaire; hence, we asked the participants to check a box saying they agreed to participate in the research by filling out the questionnaire on the following pages.

To get a broad sample of participants, we asked for our University Office's collaboration: students attending courses in Florence received the questionnaire's link through an invite sent to their institutional email address. Moreover, to gather students from other Italian cities, we spread the link on Facebook University groups (including University of Florence groups).

Data Analysis

We performed analyses using SPSS.26.

First, we investigated the percentages of students characterized by severely impaired physical and psychological well-being. We used Natale et al. (2014)'s cut-off score for sleep quality and daytime sleepiness (or wake quality). For selecting the cut-offs for the three DASS-21 scales, we used Mazza et al. (2020) approach: we calculated the scores corresponding to one (average symptoms) and two (high symptoms) standard deviations referring to the Mean values reported by Bottesi et al. (2015) for the Italian community sample on which they validated the Italian DASS-21.

Next, we analyzed through 10 MANOVAs if there are differences in psychopathology and sleep concerning gender, area of living (i.e., North, Center, South Italy), year of study, major of study (as coded in seven macro groups, in line with

Loscalzo and Giannini, 2022b and Loscalzo and Giannini, 2019), and professional condition (i.e., student or student and worker). Then, when statistically significant, we repeated MANOVAs analyses, including trait negative affect as a covariate (MANCOVAs). Given the high number of multiple comparisons (37 follow-up ANOVAs in total), we adjusted the alpha level through the Bonferroni correction for multiple comparisons; hence, we used an adjusted alpha level of .001 (Chen, Feng, & Yi, 2017).

Finally, for evaluating if the levels of psychological and physical well-being changed during the Covid-19 outbreak, we performed five one-sample t-tests, calculating Cohen's *d* for effect size. We used the *Mean* found by Loscalzo and Giannini (2019) in their broad sample of Italian college students as the reference value for these analyses.

Results

Psychological and physical well-being of college students during the Covid-19 outbreak

First, we analyzed how many students might be classified as poor sleepers and experiencing high and extremely high depression, anxiety, and stress symptoms.

Regarding physical well-being, the participants reported scores ranging between 4 and 28 (M = 15.91±5.83) for wake quality (or daytime sleepiness) and scores ranging between 5 and 35 (M = 17.24±6.97) for sleep quality impairment. In line with these high *Mean* values, more than half of the participants scored higher than the clinical cut-off for daytime sleepiness (59.7%, n = 3629) and sleep quality (52.5%, n = 3192).

Concerning psychological health, the scores for depression, anxiety, and stress range between 0 and 21 for all the DASS-21 scales, and the *Mean* values are higher than those found by Bottesi et al. (2015) in their community sample. There are high percentages of students with "high" and "extremely high" scores for depression, anxiety, and stress symptoms. Table 1 shows the frequency and the percentages for each score's category and DASS-21 scale, while Table 2 reports the *Mean* values for the three scales.

Tab. 1. Frequencies and percentages for the DASS-21 scores.

DASS-21 scale	Score	*f*	%
Depression	Average	2596	42.7
	High	1084	17.8
	Extremely High	2395	39.4
Anxiety	Average	3730	61.4
	High	684	11.3
	Extremely High	1661	27.3
Stress	Average	2883	47.5
	High	1521	25.0
	Extremely High	1671	27.5

Note. Average, High, and Extremely High cutoff scores have been calculated using Mazza et al.'s (2020) method.

Demographic and study-related differences concerning psychological and physical well-being during the Covid-19 outbreak

Next, to evaluate if, during the Covid-19 outbreak, there have been differences in students' well-being concerning some demographic and study-related variables, we performed 10 MANOVAs with DASS-21 and MSQ scales as dependent variables.

For gender, the multivariate test showed a statistically significant effect on both the DASS-21 [F(3, 6071) = 64.11, p < .001, partial η2 = .03] and the MSQ [F(2, 6072) = 127.36, p < .001, partial η2 = .04]. More specifically, follow-up ANOVAs showed that females, as compared to males, have higher levels of Depression, Anxiety, Stress, Daytime Sleepiness, and Sleep Quality Impairment. Table 2 shows the descriptive statistics and ANOVAs results.

About the area of living (i.e., North, Center, South Italy), using the Bonferroni correction for the alpha level (i.e., .001), the multivariate test did not show a statistically significant effect on the DASS-21: F(6, 12072) = 2.53, p = .019, partial η^2 = .001. Instead, the area of living has a statistically significant multivariate effect on the MSQ: F(4, 12074) = 5.96, p < .001, partial η^2 = .002. Though, follow-up ANOVAs showed a statistically significant effect on Daytime Sleepiness only: students living in Central Italy reported lower levels (M = 15.75±5.87) than both students living in North (M = 16.73±5.69, p < .001) and South (M = 16.62±5.40, p = .021) Italy.

Moreover, being a full-time student, or a student who also works, does not have an effect on the DASS-21 [F(3, 6071) = .97, p = .406, partial η^2 < .001] and on the MSQ [F(2, 6072) = 2.45, p = .086, partial η^2 = .001]. Neither the year of study have an effect on the DASS-21 and MSQ, respectively: F(12, 15837.76) = 1.80, p = .043, partial η^2 = .001; F(8, 11974) = 1.54, p = .137, partial η^2 = .001.

Finally, the major of study, as coded in seven areas (i.e., Technology, Social Sciences, Humanities, Medical Studies, Sciences, Nursing, and Other Medical Studies), has a multivariate statistically significant effect on both DASS-21 [F(18, 15933.02) = 5.69, p < .001, partial η^2 = .01] and MSQ [F(12, 11268) = 4.26, p < .001, partial η^2 = .005]. Follow-up ANOVAs showed a statistically significant effect for all the subscales (Table 2 shows the descriptive statistics and the ANOVAs results). Bonferroni post-hoc analyses highlighted that students from Humanities majors have higher Depression and Anxiety than students from Technology, Social Sciences, and Medical areas (p < .001), and – marginally – higher Depression as compared to Other Medical students (p = .051) and higher Anxiety than Sciences students (p < .001). Also, they have higher Stress than Technology (p = .001), Social Sciences (p = .001), and Sciences (p = .005) students. Humanities students also have higher Daytime Sleepiness than Technology (p < .001), Social Sciences (p < .001), Sciences (p = .028), and Other Medical (p = .031) students. Finally, Humanities students have higher Sleep Quality Impairment than Technology (p < .001) and Social Sciences (p = .002) students. Moreover, Technology students have lower Sleep Quality Impairment than Social Sciences (p = .052) and Nursing (p = .007) students.

Tab. 2. ANOVAs results of DASS-21 and MSQ scales by gender and area of study

Variable		Group	*n*	*M(SD)*	*F*	*df*	*p*	partial η*2*
Depression	Gender	Male	1542	7.55(5.44)	57.97	1,6073	<.001	.01
		Female	4533	8.81(5.67)				
		Tot	6075	8.49(5.64)				
	Area of Study	Technology	933	8.49(5.66)	8.37	6,5635	<.001	.01
		Soc.Sciences	2455	8.27(5.48)				
		Humanities	935	9.66(5.92)				
		Medical	395	7.86(5.69)				
		Sciences	558	8.84(5.81)				
		Nursing	154	8.21(5.77)				
		Other.Medical	212	8.35(5.46)				
		Total	5642	8.56(5.66)				
Anxiety	Gender	Male	1542	4.05(4.14)	128.46	1,6073	<.001	.02
		Female	4533	5.63(4.93)				
		Tot	6075	5.23(4.79)				
	Area of Study	Technology	933	4.81(4.64)	7.95	6,5635	<.001	.01
		Soc.Sciences	2455	5.23(4.70)				
		Humanities	935	6.12(5.26)				
		Medical	395	4.90(4.51)				
		Sciences	558	4.83(4.64)				
		Nursing	154	5.84(5.04)				
		Other.Medical	212	5.47(5.00)				
		Total	5642	5.27(4.81)				
Stress	Gender	Male	1542	9.26(5.35)	163.97	1,6073	<.001	.03
		Female	4533	11.29(5.38)				
		Tot	6075	10.78(5.44)				
	Area of Study	Technology	933	10.55(5.42)	3.88	6,5635	.001	.004
		Soc.Sciences	2455	10.75(5.30)				
		Humanities	935	11.58(5.60)				
		Medical	395	10.67(5.44)				
		Sciences	558	10.51(5.63)				
		Nursing	154	11.03(5.80)				
		Other.Medical	212	10.91(5.49)				
		Total	5642	10.84(5.45)				
Daytime Sleepiness	Gender	Male	1542	14.01(5.58)	227.38	1,6073	<.001	.04
		Female	4533	16.55(5.78)				
		Tot	6075	15.91(5.83)				
	Area of Study	Technology	933	15.45(5.83)	5.31	6,5635	<.001	.01
		Soc.Sciences	2455	15.90(5.79)				
		Humanities	935	16.86(5.91)				
		Medical	395	16.07(5.66)				
		Sciences	558	15.86(5.84)				
		Nursing	154	16.06(5.67)				
		Other.Medical	212	15.46(6.06)				
		Total	5642	15.98(5.83)				
Sleep Quality Impairment	Gender	Male	1542	15.24(6.70)	175.66	1,6073	<.001	.03
		Female	4533	17.92(6.93)				
		Tot	6075	17.24(6.97)				
	Area of Study	Technology	933	16.45(6.97)	6.57	6,5635	<.001	.01
		Soc.Sciences	2455	17.26(6.88)				
		Humanities	935	18.30(7.06)				
		Medical	395	17.09(7.01)				
		Sciences	558	17.19(7.24)				
		Nursing	154	18.62(6.99)				
		Other.Medical	212	17.01(7.03)				
		Total	5642	17.31(6.70)				

Note. Anxiety, Depression, and Stress are from the DASS-21 (Depression Anxiety Stress Scale-21). Daytime Sleepiness and Sleep Quality Impairment are from the MSQ (Mini Sleep Questionnaire). Technology = Engineering, Architecture, Design, Informatics; Soc.Sciences = Social Sciences: Psychology, Sociology, Economy, Law, Educational Studies, …; Humanities: Literature, Language, Philosophy, History, …; Other.Medical = Other Medical studies, that is, majors of the medical area but different from the Medicine and Surgery course (here labeled "Medical studies"): Biotechnology, Pharmacy, Odontoiatry. In Loscalzo and Giannini (2022b) and Loscalzo and Giannini (2019), this group is labeled "Para-Medical".

Psychological and physical well-being of college students during the Covid-19 outbreak controlling for trait negative affect

We found that gender, area of living, and major of study are associated with students' well-being during the Covid-19 outbreak. Hence, we performed MANCOVAs analyses adding trait negative affect as a covariate to evaluate if they still predict students' well-being when controlling for the tendency to experience negative affect as a stable trait.

The MANCOVAs we run on DASS-21 and MSQ, using gender as independent variable, highlighted that negative mood has a statistically significant effect on both the scales, respectively: $F(3, 6070) = 1442.76$, $p < .001$, partial $\eta^2 = .42$; $F(2, 6071) = 776.31$, $p < .001$, partial $\eta^2 = .20$. Though, controlling for negative affect, gender still has a multivariate effect on both the DASS-21 and the MSQ, respectively: $F(3, 6070) = 24.59$, $p < .001$, partial $\eta^2 = .01$; $F(2, 6071) = 65.34$, $p < .001$, partial $\eta^2 = .02$. However, subsequent ANOVAs highlighted that gender does not have a statistically significant effect on Depression when controlling for negative mood. It still affects Anxiety and Stress instead. About Daytime Sleepiness and Sleep Quality Impairment, gender still has a statistically significant effect on them when controlling for negative affect (see Table 3 for follow-up ANCOVAs results).

Tab. 3. ANCOVAs results of DASS-21 and MSQ scales by gender and area of study (trait negative affect as control variable)

Variable		*F*	*df*	*p*	partial $\eta 2$
Depression	Gender	.18	1,6072	n.s.	<.001
	Area of Study	5.60	6, 5634	<.001	.006
Anxiety	Gender	32.96	1,6072	<.001	.005
	Area of Study	6.25	6, 5635	<.001	.007
Stress	Gender	41.85	1,6072	<.001	.007
	Area of Study	2.59	6, 5634	n.s.*	.003
Daytime Sleepiness	Gender	116.32	1,6072	<.001	.019
	Area of Study	4.80	6, 5634	<.001	.005
	Area of Living	11.40	2, 6037	<.001	.004
Sleep Quality Impairment	Gender	78.89	1,6072	<.001	.013
	Area of Study	6.00	6, 5634	<.001	.006
	Area of Living	1.52	2, 6037	n.s.	.001

Note. Anxiety, Depression, and Stress are from the DASS-21 (Depression Anxiety Stress Scale-21). Daytime Sleepiness and Sleep Quality Impairment are from the MSQ (Mini Sleep Questionnaire). Area of Study has been coded in 7 areas: Technology; Social Sciences; Humanities; Medical studies; Nursing; Other Medical studies [In Loscalzo and Giannini (2022b) and Loscalzo and Giannini (2019), this group is labeled "Para-Medical"]; Area of Living = North, Center, South Italy. * p = .017, it is not statistically significant using the adjusted alpha level of .001.

Concerning the area of living, we performed a MANCOVA with the MSQ scales as dependent variables. We did not perform the MANCOVA for the DASS-21 since the previous MANOVA did not show a statistically significant effect on this scale. The MANCOVA showed that negative mood has a multivariate statistically significant effect on the MSQ: $F(2, 6036) = 850.51$, $p < .001$, partial $\eta^2 = .22$. However, the area of living is still significant as well: $F(4, 12072) = 6.11$, $p < .001$, partial $\eta^2 = .002$. More specifically, follow-up ANOVAs confirmed the previous MANOVAs' results since it still predicts Daytime Sleepiness only: it is lower in students living in Central Italy as compared to students living in North ($p < .001$) and South ($p = .035$) Italy (see Table 3 for follow-up ANOVAs results).

Finally, the two MANCOVAs performed with the major of study as independent variable showed that negative mood has a multivariate effect on both the DASS-21, $F(3, 5632) = 1388.64$, $p < .001$, partial $\eta^2 = .43$, and the MSQ, $F(2, 5633) = 780.65$, $p < .001$, partial $\eta^2 = .22$. Though, the major of study still has a multivariate statistically significant effect on both the DASS-21, $F(18, 15930.19) = 4.88$, $p < .001$, partial $\eta^2 = .005$, and the MSQ, $F(12, 1266) = 850.51$, $p < .001$, partial $\eta^2 = .004$. However, compared to MANOVA results, when controlling for negative affect as a trait and using the Bonferroni correction, the study's major does not predict Stress (see Table 3 for follow-up ANOVAs results). About Bonferroni post-hoc comparisons, Humanities students still have higher Depression than Technology ($p = .006$), Social Sciences ($p < .001$), Medical ($p = .006$), and Other-Medical ($p = .008$) students, as well as higher Anxiety than Technology ($p < .001$), Social Sciences ($p = .054$), and Sciences ($p < .001$) students. Though, they do not have higher Anxiety than Medical students, controlling for negative affect. Moreover, Social Sciences students have higher Anxiety than Technology students ($p = .017$). About the MSQ, Humanities students still have higher Daytime Sleepiness than Technology ($p < .001$) and Other Medical ($p = .008$) students, but not than Social Sciences and Sciences students. Moreover, they still have higher Sleep Quality Impairment than Technology students ($p < .001$), but not than Social Sciences students. Finally, Technology students still have lower Sleep Quality Impairment compared to Social Sciences ($p = .003$) and Nursing ($p = .002$) students.

Comparison of students' well-being before and during the Covid-19 pandemic

Finally, to evaluate if the well-being of Italian college students worsened or ameliorated during the Covid-19 pandemic, we performed five one-sample t-test to compare the levels of anxiety, depression, and stress (psychological disorders), as well as the levels of sleep quality impairment and daytime sleepiness (physical impairment), of the present sample with another wide sample of Italian college students gathered before the Covid-19 outbreak ($n = 1958$; Loscalzo and Giannini, 2019). The result of these analyses showed that Italian students, during the Covid-19 pandemic, feel better. More specifically, as compared to the previous Italian sample, they scored lower on all the scales: Depression, $M = 8.49 \pm 5.64$, $t(6074) = -8.36$, $p < .001$, $d = -.11$; Anxiety, $M = 5.23 \pm 4.79$, $t(6074) = -26.21$, $p < .001$, $d = -.34$; Stress, $M = 10.78 \pm 5.44$, $t(6074) = -15.35$, $p < .001$, $d = -.20$; Daytime Sleepiness, $M = 15.91 \pm 5.83$, $t(6074) = -28.26$, $p < .001$, $d = -.36$; Sleep Quality Impairment, $M = 17.24 \pm 6.97$, $t(6074) = -15.54$, $p < .001$, $d = -.20$.

Discussions

This study aimed to analyze the impact of the Covid-19 pandemic on college students' psychological (depression, anxiety, stress) and physical (daytime sleepiness and sleep quality impairment) well-being.

The results showed that many Italian college students experienced high levels of sleep quality impairment during the lockdown since more than half of the participants scored higher than the cut-off for both daytime sleepiness and sleep quality impairment. This result aligns with Franceschini et al. (2020) since they found that about half of their sample is a poor sleeper (using a different scale than ours and a total score only). Hence, our study provides further evidence about the sleep quality impairment of Italians, with a specific focus on college students and highlighting that this impairment concerned both sleep and wake quality. In addition, our participants also have high levels of stress, depression, and anxiety symptoms. More specifically, the *Mean* values of the students who participated in this study are much higher compared to both Bottesi et al. (2015) community sample and Mazza et al. (2020) sample of Italian people gathered during the Covid-19 outbreak. In line with this, the percentage of students scoring high or extremely high are considerable, especially for depression (57.2%) and stress (52.5%), as they affected more than half of the participants. Anxiety, even if widespread at high levels, has a lower prevalence (38.6%). Mazza et al. (2020) found, like in our college sample, that high or extremely high depression (32.8%) and stress (27.2%) are more spread than anxiety (18.7%) in the general population during the Covid-19 pandemic. However, their values of prevalence are considerably lower than the ones we found in college students. Hence, the present study further supports the ample prevalence of very high symptoms of depression, stress, and (to a lower extent) anxiety in the Italian population during the Covid-19 lockdown. Also, our study provides further support to Romeo et al.'s (2021) findings, namely that Italian university students experienced higher anxiety and depression (and stress, like we found) than Italian workers or, more generally, than the Italian population taken as a whole. Also, our study provides further evidence to previous studies highlighting a consistent spread of psychological symptoms across various countries during the Covid-19 pandemic (e.g., Ghafari et al., 2021; Islam et al., 2020; Ma et al., 2020; Wathelet et al., 2020).

About demographic-related differences, we found that females experienced higher psychological (except for depression) and physical impairment than males during the pandemic, even when controlling for negative affect as a trait. We found instead only a difference for the area of living, also when controlling for negative affect: students living in Central Italy reported lower daytime sleepiness than students living in North or South Italy. Therefore, living in Italy's areas less affected by the virus (the North has been the part of Italy affected the most) is not associated with higher psychological well-being; though, students of Central Italy feel better concerning one of the sleep variables. No differences in well-being arisen about being a full-time student (compared to a student who also works) and concerning the year of study. Finally, being a Humanities student (e.g., Literature, Language, Philosophy, History) is associated with the highest well-being impairment during the Covid-19 pandemic. More specifically, controlling for the effect of negative mood, they reported higher depression and anxiety than Technology and Social Sciences students, higher depression than Medical and Other-Medical students, and higher anxiety than Sciences students. They also had higher daytime sleepiness than Technology and Other-Medical students and higher sleep quality impairment than Technology students. Instead, Technology students (e.g., Engineering, Architecture, Informatics) seem to be the ones who experienced the slightest impairment since they also have lower anxiety than Social Sciences students and lower sleep quality impairment than Social Sciences and Nursing students.

In sum, Italian college students, especially females and Humanities students, experienced a high psychological and physical impairment during the pandemic, while males and Technology students experienced lower impairment levels.

However, comparing the whole sample with another sample of Italian college students gathered before the pandemic, we found that the participants experienced an amelioration in both their physical and psychological well-being, suggesting a positive effect of the pandemic on Italian college students. Hence, in contrast with Li et al. (2020) and Hagedorn et al. (2022), we found that Italian college students' mental health improved during the pandemic. The different results could be due to differences in the countries concerning both cultural and virus-related aspects. Though it should also be noted that our study compared two different groups of students gathered at different times, while Li et al. (2020) performed a longitudinal study – they found an increase in psychological symptoms after two weeks of lockdown – and Hagedorn et al.'s (2022) results are based on students' self-evaluation concerning their health before and after the Covid-19 outbreak. Hence, including our study, we have three research using three different methodologies for evaluating an increase/decrease in symptoms during the Covid-19 pandemic. Therefore, other studies comparing mental and physical health before and during the Covid-19 pandemic could help disentangle the reasons for these different results.

Among the limitations of this study, there is a lower representation of North and South Italy students than Central Italy and a higher prevalence of females and Social Sciences students. However, it has the merit of having analyzed a wide sample of Italian college students, which is heterogeneous for year and major of study, and that has been gathered during the Covid-19 outbreak. Moreover, it highlights that there has been a high prevalence of physical and psychological symptoms among college students during the Covid-19 pandemic. However, when comparing the whole sample of participants with a previous sample of college students, it arose that, in general, the Covid-19 pandemic, with the consequent closure of universities and the online format for lessons and exams, seems to have alleviated physical and psychological symptoms. In sum, in line with other studies (Loscalzo & Giannini, 2021; Loscalzo et al., 2021), we found evidence for both positive and negative consequences associated with the Covid-19 pandemic. However, we would like to stress that in the context of a general trend showing that students experienced an ameliorating in their symptoms, we should not underlook

the results highlighting the high prevalence of extremely high levels of anxiety and, especially, depression, stress, and sleep issues, as they characterize a large part of the individuals who took part in our research.

In conclusion, taking into account that a large part of Italian college students has been affected by high psychological and physical impairment and that college students seem to have been affected by this impairment to a greater extent than both the general and the working population, we recommend universities to take care of these negative consequences associated with the Covid-19 outbreak. They could implement psychological counseling interventions – even in an online format – aiming to improve students' well-being. They should provide students with counseling services to detect those still experiencing a high level of impairment and offer them psychological intervention to reduce their symptoms. At the same time, it would be helpful to make available group counseling interventions to allow students to share their feelings and thoughts related to the pandemic and the impact on their study, hence reducing the risk for psychopathology and dropout. Since we found that students generally experienced an ameliorating of their psychological and physical well-being during the lockdown, the students who found some positive consequences on their studying and their health might constitute a role model for the students who faced higher distress instead. Finally, considering the improvement in students' well-being during the home-confinement, universities should also plan to reduce the burden felt by their students during the "regular" academic life. For example, they could allow them to attend lessons from home through recorded lessons and provide them with psychological support throughout their studies. Also, they should try reducing the overstudying climate, which might favor higher academic distress.

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