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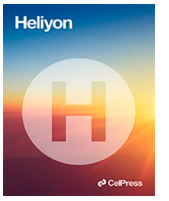

Research article

# Intolerance of uncertainty across stress, anxiety, and depression among university students in Pakistan: A descriptive cross-sectional study

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ABSTRACT

*Background:* The mental health issues due to COVID-19, such as intolerance of uncertainty (IOU), anxiety, stress, and depression, have attracted extensive attention from researchers. The challenges for Pakistani university students could be worse than developed countries due to the lack of online courses/programs and online mental health support provided by academic institutions. Therefore, the current study aims to assess the intolerance of uncertainty, depression, anxiety, and stress of Pakistani university students after the second wave of COVID-19 and the relationship among these constructs.

*Methods:* A convenience cross-sectional sampling method was used to collect data from university students in Pakistan between January 2021 and April 2022 via a structured online questionnaire. The Descriptive analysis focused on frequencies, percentages, mean, and standard deviation (SD) were calculated on IOU-12 and DASS-21. Covariance for the research model and confirmatory factor analyses fit indices for the IOU-12 and DASS-21 were analyzed by AMOS statistical packages.

*Results:* As expected, anxiety, depression, and stress persist among Pakistani university students. On average, they report mild to moderate mental health problems regarding anxiety, depression, stress, and intolerance of uncertainty. Our results indicate a strong positive relationship among the three emotional distress components - anxiety, depression, and stress. However, our results suggest no significant relationship between IOU and the three subcomponents of emotional distress (anxiety, depression, and stress).

*Limitations:* First, the cross-sectional survey design means we cannot conclude on the causal relations. Second, the self-report questionnaire embeds subjectivity issues. Last, the generalizability

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of the sample to the whole student population in Pakistan is limited, considering the sampling method.

*Conclusion:* This study expanded the current knowledge in the psychological health domain (intolerance of uncertainty, anxiety, depression, and stress) due to the COVID-19 pandemic. In practice, higher education institutions should further mitigate university students' mental health issues. For researchers, our findings inspire future studies to delve into the relationship between IOU and mental health issues due to COVID-19 since our findings display contrary evidence for various reasons.

## 1. Introduction

In Pakistan, the first case of COVID-19 was reported on February 26, 2020. The first wave infected more than 300,000, claimed many lives and affected millions socio-economically. The first wave peaked in June 2020, and the number of new cases per day drastically decreased. However, with the gradual easing of the lockdown and opening of many social, political, religious, and regular business activities, the number of COVID-19 cases started climbing again, and in Pakistan, the government announced a second wave of COVID-19 on October 28, 2020. The cases gradually decreased from 3,795 to 1,008 on February 9, 2021 [1,2].

Extensive research has demonstrated that the general population experienced affective disorders during the COVID-19 pandemic, such as symptoms of anxiety, stress, and depression [3–8]. In addition, university students' mental health was claimed to be more vulnerable to this pandemic [9,10]. However, psychological distress could further transform to health behaviours of university students. Stanton and colleagues (2020) reported a significant relationship between mental health problems (depression, anxiety, and stress) during COVID-19 and behavioural health changes (reduced physical activity participation and sleep quality, tobacco and alcohol misuse, and even self-harming or suicidal thoughts) both independently and collectively as a compound predictorOther researchers also demonstrated the association between emotional distress and actual unhealthy behaviours in general [11–14].

Uncertainties brought about by COVID-19 were one of the main reasons that contribute to mental health issues of university students [9]. The COVID-19 pandemic creates an unprecedented uncertain situation for university students, such as school closures, remote learning, cancellation or postponements of exams, limited social events, and economic depression. The empirical evidence across countries [15–19] indicated a strong effect of intolerance of uncertainties over the COVID-19 pandemic on mental well-being, like anxiety, stress, and depression symptoms. Del Valle and colleagues (2020) also reported a moderation role of age in this relationship, where young people with higher intolerance of uncertainties were more likely to experience physiological distress during the pandemic.

The challenges for Pakistani university students could be worse than in developed countries due to the lack of online courses/programs and online mental health support provided by academic institutions [20]. The influence of COVID-19 on Pakistani university students' mental health has been documented via cross-sectional surveys [21–23]. Anxiety, depression, and stress symptoms were prevalent among Pakistani university students because they needed to cope with various personal and family issues caused by COVID-19, such as the university's closure, economic pressures, and the inefficiency of online courses. However, most of them concentrated on describing the mental health effect of COVID-19. Rare studies investigated the relationship between psychological distress symptoms, such as depression, anxiety, and stress. Only Aqeel and colleagues (2021) delved into this relationship and found a strong positive correlation between their anxiety and depression symptoms.

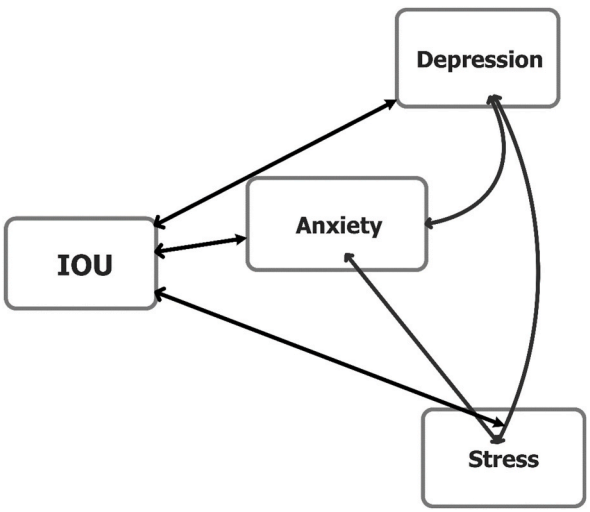


**Fig. 1.** Conceptual model.

Moreover, the association between intolerance of uncertainty over the COVID-19 pandemic and anxiety, depression, and stress was still unclear in the Pakistani context. Rehman and colleagues (2021) investigated the relationship between intolerance of uncertainty and mental well-being and reported a negative connection. However, they treated anxiety, depression, and stress as a combined component – mental well-being in the regression analysis of how the three individual sub-components related to intolerance of uncertainty remain unanswered.

## 2. Research questions, conceptual model, and hypotheses

RO1: Do undergraduate students experience intolerance of uncertainty, depression, anxiety and stress after the second phase of COVID-19?

RO2: Is there any relationship between intolerance of uncertainty, depression, anxiety and stress?

The current study aims to assess the intolerance of uncertainty, depression, anxiety, and stress of Pakistani university students while ending the second phase of COVID-19 using validated questionnaires IOU-12 and DASS-21. The study investigated the relationship between IOU-12 and DASS-21 and between each pair of the three components of DASS-21. Practically, the current study is vital for the understanding and mitigation of mental health issues of Pakistani university students during the COVID-19 pandemic. Considering the previous findings, we expected that intolerance of uncertainty is a significant determinant of each sub-components of mental well-being and that these three components positively correlate. The researcher developed the conceptual model, as illustrated in Fig. 1.

The six hypotheses considered in the conceptual model are.

**H1**. Stress is associated with depression among university students in Pakistan.

**H2**. Stress is associated with anxiety among university students in Pakistan.

**H3**. Depression is associated with anxiety among university students in Pakistan.

**H4**. Intolerance of uncertainty is associated with depression among university students in Pakistan.

**H5**. Intolerance of uncertainty is associated with stress among university students in Pakistan.

**H6**. Intolerance of uncertainty is associated with anxiety among university students in Pakistan.

## 3. Methods

### 3.1. Study design and setting

A convenience cross-sectional sampling method was used to collect the data from students in the universities in Pakistan between January 2021 till April 2022. A structured online questionnaire was distributed to gather information from the target population. The questionnaire link was distributed through survey monkey. The current study investigates the self-reporting post-COVID-19 relationship between the uncertainty of anxiety, depression, anxiety, and stress among students in Pakistan. For Medical Research Ethical matters, according to the local and national ethical instructions for research (National.

Committee for Clinical Research: http://www.nccr.gov.my/index.cfm) guidelines, this online form did not require ethical approval. The study does not involve any intervention. The human biological tissues, good clinical practice (GCP), and clinical trial research subjects were respected.

### 3.2. Study sample

The inclusion criteria were as follows: students of public and private universities in Pakistan; The exclusion criteria were as follows: participants who disagree with the term and conditions mentioned inside the questionnaire, invalid email addresses, incomplete data, irrelevant data, the participant completed the questionnaire are not the student of universities in Pakistan.

### 3.3. Sample size

There was an enrolment of 1.6 million students among 186 universities, with 56.9 thousand teachers, in the country. The report was presented by the economic survey of Pakistan (2017–18) [24]. The minimum targeted sample size was 400, determined by identifying the smallest acceptable size of a demographic subgroup with a ±5% margin of error and a confidence level of 95% [25]. However, 907 students participated in the current study. Sixty-seven (n = 67) participants were removed as they disagreed with the terms and conditions. Four (n = 4) participants had an invalid email address. The records of seventy-nine (n = 79) participants were incomplete or irrelevant. Eight (n = 8) participants who were not students were excluded according to the eligibility criteria. The eligible participants in the study were 749.

### 3.4. Data collection

The researchers utilised several strategies to reach as many respondents as possible nationwide. The researchers visited different

universities using convenience methods to contact students from different departments and faculties. They requested them to fill out the survey forms from different departments and faculties and to fill out the forms on the spot using their electronic devices. The researcher encouraged students to engage their network to obtain considerable diversity in the responses. The researchers requested their family members to spread the survey forms to all their relatives and friends, persuaded them to forward them to many as possible, and requested feedback on the questionnaire. Moreover, Whatsapp and Facebook were selected as two of the most popular communication and social platforms in Pakistan; these platforms led the researchers to collect data from individuals at far. They sent the form to various groups and each individual in their contact list. Additional data collection methods were sending the link through email such as; Outlook, Gmail, and Hotmail. The researchers used Zoom video meetings and LinkedIn to share the questionnaire link.

### 3.5. Measurements

Intolerance of uncertainty was measured with the short version of the Intolerance of Uncertainty Scale (IUS-12) [26,27] consisting of 12 items, including "It frustrates me not having all the information I need". Participants assessed how often this statement applies to them using a 5-point scale where one (1) indicates always and five (5) indicates never. The total score of intolerance of uncertainty ranges from 12 to 60. The lower the total value means, the higher level of intolerance of uncertainty. Other scholars, including Satici (2020) and Rehman (2021), applied this scale and reported excellent reliability. Anxiety, depression, and stress were measured with the Depression, Anxiety, and Stress Scale- 21 items Scale (DASS-21), which was commonly used to assess the emotional status of anxiety, depression, and stress during the COVID-19 pandemic across countries [6, 28–30].

### 3.6. Statistical analysis

The collected data were analyzed using the Statistical Package for the Social Sciences (SPSS), version 28, and analysis of moment structures (AMOS). The descriptive analysis of frequencies, percentages, mean, and standard deviation (SD) was calculated on IOU-12 and DASS-21. The statistical significance level was set at $p < 0.05$. Internal consistency of the instruments was tested using a reliability test where the Cronbach alpha coefficient and McDonald's ω aided in determining the reliability of the variables. The symmetry or asymmetry of data distribution was calculated by skewness and kurtosis. The study uses t-tests and cohen's d-test to determine the differences between groups for early response and late response using non-response bias analysis. Inspection of Mahalanobis distances indicated no significant outliers in the sample. Covariance for the research model and confirmatory factor analyses fit indices for the IOU-12 and DASS-21 were analyzed by AMOS statistical packages.

## 4. Results

### 4.1. Characteristics of the study participants

The eligible participants in the study were seven forty-nine (n = 749). Most participants were female (57.8%) compared to male (42.2%). The study indicates the highest prevalence among adults aged 18–24 (84.3%). Most students were studying in a university graduate program (84.8%). The presence of PhD scholars in the sample size was the lowest (1.7%). The demographic characteristics of the study respondents are presented in Table 1.

### 4.2. Descriptive statistics of intolerance of uncertainty scale (IOU-12)

The current study examines the prevalence of uncertainty evaluated through the frequency, percentages and means of intolerance of uncertainty scale (IOU-12) of university students in Pakistan. The participants were usually frustrated when they did not have all the information they needed (32.8%). 29.4% of the participants agree that we should always look ahead to avoid surprises. When the question asked whether *"person always want to know what the future has in store for them",* 35.8% agreed with the given statement. 36.2% of students agree strongly that they should be able to organise everything in advance. The frequency and percentage of the IOU-12 scale of participants are presented in Table 2. The mean and standard deviation (SD) of the study participants were given in Table 4. The mean and SD of IOU-12 of the participants was 30.85 ± 8.10.

**Table 1**
Demographic characteristics of participants (n = 749).

| Demographic characteristics | | n(%) |
|---|---|---|
| Gender | Male | 316(42.2) |
| | Female | 433(57.8) |
| Age | 18–24 | 635(84.3) |
| | 25–34 | 92(12.3) |
| | 35–44 | 22(2.9) |
| Education | University Graduate | 639(84.8) |
| | Masters | 71(9.5) |
| | Ph.D. Scholar | 13(1.7) |
| | Others | 26(3.5) |

### 4.3. Descriptive statistics of depression anxiety & Stress Scales (DASS-21)

The current study examining the prevalence of collective depression, anxiety, and stress was evaluated through the frequency, percentages, and mean of DASS-21 university students in Pakistan. The frequency and percentage of the DASS-21 scale of participants are presented in Table 3. Most students have some degree or some of the time have depression, anxiety, and stress, according to the DASS-21 scale. The mean and standard deviation (SD) of the study participants are given in Table 4. The mean and SD of DASS-21 of the participants was 24.08 ± 12.46.

### 4.4. Reliability statistics

Table 5 shows Cronbach's alpha (α) and McDonald's (ω) for IOU-12 and DASS-21 scales. The study observed α = 0.805 and ω = 0.802 for the IOU-12 scale. The results for DASS-21 were α = 0.910 and ω = 0.912. The literature suggests that above 0.70 is acceptable for α (Cortina, 1993). The cut-off value for Mcdonald's Omega is 0.70 and above [31].

### 4.5. Skewness and kurtosis

The skewness range of the IOU-12 item was between (−0.059 to +0.708). The mean skewness of the IOU-12 scale was 0.334 ± 0.23. The skewness range of the DASS-21 item was between (+0.743 to +0.264). The mean skewness of the DASS-21 scale was 0.482 ± 0.09. The mean items of skewness in IOU-12 and DASS-21 were reasonably symmetrical. The kurtosis range of the IOU-12 item was between (−1.103 to −0.272). The mean kurtosis of the IOU-12 scale was −0.698 ± 0.25. The kurtosis range of the DASS-21 item was between (−1.106 to −0.102). The mean kurtosis of the DASS-21 scale was −0.784 ± 0.23. The mean items of kurtosis in IOU-12 and DASS-21 were also reasonably symmetrical. The absolute values of the skewness and kurtosis of all the items are in an acceptable range of <3 and < 10, respectively [32].

### 4.6. Bias analysis

The study performed a non-response bias analysis of the IOU-12 and DASS-21 scales by taking an equal number (n = 250) of eligible participants as early and late responses. The mean, standard deviation, and standard error mean of early and late response have given in Table 6. There is no significant difference between early and late respondents in the IOU-12 scale; t-value (t) = -2.233, degree of freedom (df) = 249, and significant value (p) = 0.026. Moreover, no significant difference between early and late respondents on the DASS-21 scale; t-value (t) = 0.382, degree of freedom (df) = 249, and significant value (p) = 0.703. The predefined <0.01 level significantly differs between early and late participants in the eligible sample size (n = 250).

The instrument was assessed using common method bias (CMB) using Harman single factor test to investigate the eligibility of the instrument IOU-12 and DASS-21 in a post-covid-19 environment in university students in Pakistan. The total % of the variance in the IOU-12 instrument was 26.054%, whereas the total % in the DASS-21 instrument was observed at 24%. Common method bias was present if the study variance exceeded 50% [23]. The current study does not contain CMB.

### 4.7. Research model

#### 4.7.1. Confirmatory factor analyses

Confirmatory factor analysis indicates that the model is poorly fitted. x2/df ratio = 2.366 (values should be < 2.0). Secondly, the comparative fit index = 0.906 (CFI; values should be > 0.95). Third, the Root Mean Square Error of Approximation = 0.043 (RMSEA; values should be < 0.06). Fourth, Expected Cross- Validation Index = 1.841 (ECVI; lower values indicate increasingly better fit) (Hu and Bentler, 1998)(Browne and Cudeck, 1993). Fig. 2 represents a confirmatory analysis model with factor loadings and correlations

**Table 2**
Descriptive statistics Intolerance of Uncertainty Scale (IOU-12) (n = 749).

| Sr. No | Items | Always n (%) | Usually n (%) | Sometimes n (%) | Rarely n (%) | Never n (%) |
|---|---|---|---|---|---|---|
| 1 | Unforeseen events upset me greatly. | 147(19.6) | 224(29.9) | 269(35.9) | 68(9.1) | 41(5.5) |
| 2 | It frustrates me not having all the information I need. | 218(29.1) | 246(32.8) | 177(23.6) | 82(10.9) | 26(3.5) |
| 3 | Uncertainty keeps me from living a full life. | 138(18.4) | 226(30.2) | 221(29.5) | 105(14.0) | 59(7.9) |
| 4 | One should always look ahead so as to avoid surprises. | 220(29.4) | 165(22.0) | 213(28.4) | 88(11.7) | 63(8.4) |
| 5 | A small unforeseen event can spoil everything, even with the best of planning. | 168(22.4) | 163(21.8) | 236(31.5) | 134(17.9) | 48(6.4) |
| 6 | When it's time to act, uncertainty paralyses me. | 113(15.1) | 156(20.8) | 182(24.3) | 174(23.2) | 124(16.6) |
| 7 | When I am uncertain I can't function very well. | 166(22.2) | 197(26.3) | 199(26.6) | 127(17.0) | 60(8.0) |
| 8 | I always want to know what the future has in store for me. | 268(35.8) | 166(22.2) | 180(24.0) | 78(10.4) | 57(7.6) |
| 9 | I can't stand being taken by surprise. | 98(13.1) | 169(22.6) | 243(32.4) | 157(21.0) | 82(10.9) |
| 10 | The smallest doubt can stop me from acting. | 155(20.7) | 163(21.8) | 211(28.2) | 140(18.7) | 80(10.7) |
| 11 | I should be able to organise everything in advance. | 273(36.4) | 201(26.8) | 183(24.4) | 59(7.9) | 33(4.4) |
| 12 | I must get away from all uncertain situations. | 197(26.3) | 199(26.6) | 212(28.3) | 98(13.1) | 43(5.7) |

**Table 3**
Descriptive statistics Depression Anxiety & Stress Scales (DASS-21) (n = 749).

| Sr. No | Items | Did not apply to me at all n (%) | Applied to me to some degree, or some of the time n(%) | Applied to me to a considerable degree or a good part of time n(%) | Applied to me very much or most of the time n(%) |
|---|---|---|---|---|---|
| 1 | I found it hard to wind down. | 202(27.0) | 370(49.4) | 137(18.3) | 40(5.3) |
| 2 | I was aware of dryness of my mouth. | 233(31.1) | 281(37.5) | 146(19.5) | 89(11.9) |
| 3 | I couldn't seem to experience any positive feeling at all. | 260(34.7) | 256(34.2) | 155(20.7) | 78(10.4) |
| 4 | I experienced breathing difficulty (e.g. excessively rapid breathing, breathlessness in the absence of physical exertion). | 302(40.3) | 267(35.6) | 123(16.4) | 57(7.6) |
| 5 | I found it difficult to work up the initiative to do things. | 195(26.0) | 325(43.4) | 152(20.3) | 77(10.3) |
| 6 | I tended to over-react to situations. | 185(24.7) | 290(38.7) | 167(22.3) | 107(14.3) |
| 7 | I experienced trembling (e.g. in the hands) | 273(36.4) | 254(33.9) | 136(18.2) | 86(11.5) |
| 8 | I felt that I was using a lot of nervous energy. | 181(24.2) | 289(38.6) | 158(21.1) | 121(16.2) |
| 9 | I was worried about situations in which I might panic and make a fool of myself. | 174(23.2) | 274(36.6) | 156(20.8) | 145(19.4) |
| 10 | I felt that I had nothing to look forward to. | 244(32.6) | 262(35.0) | 131(17.5) | 112(15.0) |
| 11 | I found myself getting agitated. | 210(28.0) | 292(39.0) | 158(21.1) | 89(11.9) |
| 12 | I found it difficult to relax. | 200(26.7) | 288(38.5) | 149(19.9) | 112(15.0) |
| 13 | I felt down-hearted and blue. | 260(34.7) | 237(31.6) | 148(19.8) | 104(13.9) |
| 14 | I was intolerant of anything that kept me from getting on with what I was doing. | 214(28.2) | 293(38.9) | 156(20.8) | 86(11.5) |
| 15 | I felt I was close to panic. | 211(28.0) | 291(39.1) | 153(20.4) | 94(12.6) |
| 16 | I was unable to become enthusiastic about anything. | 212(28.3) | 308(41.1) | 144(19.2) | 85(11.3) |
| 17 | I felt I wasn't worth much as a person. | 250(33.4) | 232(31.0) | 147(19.6) | 120(16.0) |
| 18 | I felt that I was rather touchy. | 237(31.6) | 283(37.8) | 131(17.5) | 98(13.1) |
| 19 | I was aware of the action of my heart in the absence of physical exertion (e.g. sense of heart rate increase, heart missing a beat). | 236(31.5) | 295(39.4) | 135(18.0) | 83(11.1) |
| 20 | I felt scared without any good reason. | 225(30.0) | 277(37.0) | 136(18.2) | 111(14.6) |
| 21 | I felt that life was meaningless. | 277(37.0) | 213(28.4) | 133(17.8) | 126(16.8) |

**Table 4**
Mean and SD of IOU-12 and DASS-21 (n = 749).

| Scale | Mean | SD |
|---|---|---|
| IOU-12 | 30.8531 | 8.1032 |
| DASS-21 | 24.0841 | 12.4617 |

**Table 5**
Reliability statistics (n = 749).

| Reliability Statistics | | | Scale |
|---|---|---|---|
| Cronbach's Alpha | McDonald's ω | N of Items | |
| 0.805 | 0.802 | 12 | IOU-12 |
| 0.910 | 0.912 | 21 | DASS-21 |

**Table 6**
Non-response bias analysis on IOU-12 and DASS-21 (n = 749).

| Variables | | N | Mean | Standard Deviation | Std Error Mean | t-statistics | df | Sig.(2-tailed) | Cohen's d | 95%CI | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Lower | Upper |
| IOU-12 | Early | 250 | 2.5113 | .64910 | .04105 | −2.232 | 249 | 0.026 | −.141 | −.266 | −.016 |
| | Late | 250 | 2.6470 | .64530 | .04081 | | | | −.141 | −.265 | −.016 |
| DASS-21 | Early | 250 | 2.1865 | .57408 | .03631 | 0.382 | 249 | 0.703 | .024 | −.100 | .148 |
| | Late | 250 | 2.1657 | .63469 | .04014 | | | | .024 | −.100 | .148 |

between IOU-12, depression, anxiety, and stress. The values are presented in Table 7.

A positive covariance was observed between stress and depression (0.961), stress and anxiety (0.972), and depression and anxiety (0.979). A negative covariance was observed between intolerance of uncertainty (IOU) and depression (−0.447); intolerance of

uncertainty (IOU) and Stress (−0.440); intolerance of uncertainty (IOU) and anxiety (−0.428). The negative covariance may indicate the absence of a relationship between intolerance of uncertainty (IOU) and depression, anxiety, and stress. The model does not fit. The covariance path for the research model were given in Table 8. Similar results were observed in the correlation path for the research model in Table 9.

## 5. Discussion

The continued COVID-19 pandemic has become the most challenging, unprecedented, and devastating worldwide public health crisis since 2000. Moreover, there seems to be no specific solution for the future. The extensive existing studies only illuminate the impact of COVID-19 in its early stages. The relationship underlined these psychological and dispositional components – IOU, anxiety, depression, and stress remain unclear. Thus, the present paper explores Pakistani university students' mental health status and provides an overview of the critical mental health concerns (IOU, anxiety, depression, and stress) of 749 students after the second wave of COVID-19 in Pakistan. In addition, this paper investigates the relationship among each pair of these dispositional and physiological components during the COVID-19 pandemic.

As expected, anxiety, depression, and stress are still prevalent among Pakistani university students. Consistent with previous studies conducted during the first wave of COVID-19 in 2020 in Pakistan [21–23], on average, university students report mild to moderate mental health problems in terms of anxiety, depression, and stress. The participants show a mild level of IOU. Compared to the result of Rehman and colleagues (2021), the students declare a relatively higher resilience towards uncertainty during the pandemic. Our results suggest that the unprecedented and unpredictable COVID-19 has presented a considerable challenge to people, especially the students' mental health status. After two waves, Pakistani students are still at risk of emotional distress, like anxiety, depression, and stress. However, the exposure to COVID-19 increased their resilience towards the pandemic compared to when they experienced the first wave in 2020.

Consistent with previous studies [33–36], our results indicate a strong positive relationship among the three emotional distress components - anxiety, depression, and stress. The internal consistency of the three subscales of DASS-21 has been well established across samples. Therefore, it can be concluded that these three subcomponents correlate positively and combine as valid measurements for emotional distress across contexts.

However, inconsistent with previous findings [9, 15–18], our results suggest no significant relationship between IOU and these three subcomponents of emotional distress (anxiety, depression, and stress). The disparity of the measurement scales for the same construct may contribute to the inconsistency of the relationship. For example, Del Valle and colleagues (2020) selected 17 items from the original Intolerance of Uncertainty Scale (IUS) [37], adapted the State-Trait Anxiety Inventory (STAI) [38]; , and applied the Beck Depression Inventory-II (BDI-II) [39]. Another potential reason that fails our hypothesis regarding the relationship between IOU and emotional distress (anxiety, depression, and stress) could be the lack of mediators, such as the perceived threat of COVID-19 [15] and fear of COVID-19 [17,18]. Though Seco Ferreira and colleagues (2020) demonstrated a strong correlation without mentioning the mediator, their data were collected at the beginning of COVID-19 when people were shocked by the sudden pandemic. In other words, the correlation between IOU and emotional distress during the pandemic only exists when the participants feel fear or threat of the situation. After experiencing two waves of COVID-19, Pakistani university students have become more accustomed to and familiar with this situation. Thus, even though the pandemic is unpredictable and leads to an uncertain future, the students may feel less threatened. Therefore, the lack of fear or threat of COVID-19 explains the insignificant relationship between IOU and

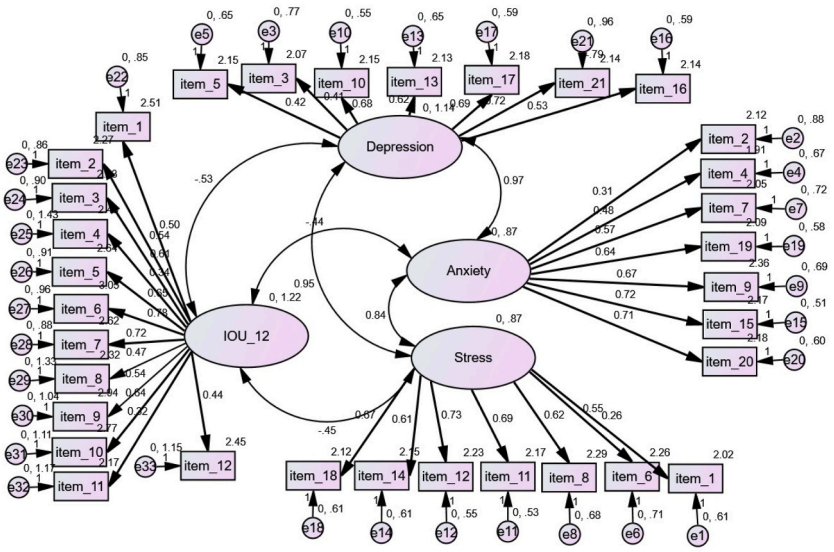


**Fig. 2.** Confirmatory analysis model with factor loadings and correlations between IOU-12, depression, anxiety and stress.

**Table 7**
Confirmatory factor analyses fit indices for the IOU-12 and DASS-21 (n = 749).

| Model fit indices | Values |
|---|---|
| x2 | 1156.737 |
| x2/df | 2.366 |
| df | 489 |
| CMIN | 1156.737 |
| CFI | .906 |
| NPAR | 110 |
| PRATIO | .926 |
| PNFI | .785 |
| PCFI | .839 |
| NCP | 667.737 |
| FMIN | 1.546 |
| RMSEA | .043 |
| ECVI | 1.841 |

**Table 8**
Covariance path for the research model (n = 749).

| Hypothesis | Covariance Path | Estimate | Remarks |
|---|---|---|---|
| H1 | Stress <–> Depression | .961 | Supportive |
| H2 | Stress <–> Anxiety | .972 | Supportive |
| H3 | Depression <–> Anxiety | .970 | Supportive |
| H4 | IOU_12 <–> Depression | −.447 | Not-supportive |
| H5 | Stress <–> IOU_12 | −.440 | Not-supportive |
| H6 | IOU_12 <–> Anxiety | −.428 | Not-supportive |

**Table 9**
Correlation path for the research model (n = 749).

| Hypothesis | Correlation Path | Estimate | Remarks |
|---|---|---|---|
| H1 | Stress <–> Depression | .961 | Supportive |
| H2 | Stress <–> Anxiety | .972 | Supportive |
| H3 | Depression <–> Anxiety | .970 | Supportive |
| H4 | IOU_12 <–> Depression | −.447 | Not-supportive |
| H5 | Stress <–> IOU_12 | −.440 | Not-supportive |
| H6 | IOU_12 <–> Anxiety | −.428 | Not-supportive |

anxiety/depression/stress.

The findings highlight the importance of virtual mental health support for Pakistani university students during the COVID-19 pandemic to decrease mental health problems that may transfer to actual self-harming behaviours or suicide [40]. The continued pandemic urges the growth of telehealth, such as incorporating cognitive-behavioural therapy (CBT) in virtual service delivery, which is believed to exceed traditional office-based clinical interactions in terms of convenience and fostering empathy [41,42]. The evolution of Pakistan's clinical systems to computer-mediated interactions is necessary, especially during the pandemic when mental health problems become increasingly common while face-to-face interactions are more limited.

Universities should be responsible for identifying and mitigating students' mental health issues exaggerated by the COVID-19 pandemic and all uncertainties in their academic and career futures. Higher educational institutions should plan and implement psychological interventions for university students to increase their resilience towards uncertainty and self-efficacy and to decrease anxiety, depression, and stress level. Additionally, the Pakistani government should deliver, more precisely, more transparent messages to the public to reduce uncertainty and its psychological and behavioural consequences.

### *5.1. Limitation*

Although the present study contributes to identifying and mitigating Pakistani university students' mental health problems, it still has some flaws. First, the cross-sectional survey design means we cannot conclude the causal relations. Second, the self-report questionnaire embeds subjectivity issues. Last, the generalizability of the sample to the whole student population in Pakistan is limited, considering the sampling method.

## 6. Conclusion

Our study expanded the current knowledge of psychological health (intolerance of uncertainty, anxiety, depression, and stress) due to the COVID-19 pandemic. The findings revealed that Pakistani university students still face the challenges of COVID-19 and suffer from anxiety, depression, and stress even after two waves. The correlation between each pair of our results corroborates these three emotional distress. However, the relationship between IOU and this three emotional distress is statistically insignificant, contrary to the results found in the first stage of COVID-19. In practice, higher education institutions should further mitigate university students' mental health issues. For researchers, our findings inspire future studies to delve into the relationship between IOU and mental health issues due to COVID-19 since our findings display contrary evidence for various reasons.

## Consent to participate

The consent was electronically obtained from every participant.

## Availability of data and materials

The datasets used and analyzed during the current study are available from the corresponding author upon reasonable request.

## Author contribution statement

Yun Jin Kim: Conceived and designed the experiments; Analyzed and interpreted the data.
Ruolan Deng: Analyzed and interpreted the data; Wrote the paper.
Qurratul ain Leghari: Performed the experiments; Contributed reagents, materials, analysis tools or data.
Solomon Naseem: Performed the experiments.
Muhammad Muneeb Ul Hassan: Performed the experiments; Contributed reagents, materials, analysis tools or data.
Ejaz Nadeem: Performed the experiments; Contributed reagents, materials, analysis tools or data.
Linchao Qian: Conceived and designed the experiments; Analyzed and interpreted the data.
Dulmaa Lkhagvasuren: Conceived and designed the experiments; Wrote the paper.
Muhammad Shahzad Aslam: Conceived and designed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

## Data availability statement

Data included in supplementary material.

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## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2023.e16636.

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