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Research Article

Demographic Factors, COVID-19-related Factors, and PTSD Symptom Clusters: Exploring Associations and Implications for Mental Health

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Abstract

The COVID-19 pandemic was characterized as a continuous traumatic stressor and associated with high levels of posttraumatic stress disorder (PTSD). This study examines the associations between demographic factors, COVID-19-related factors (fear of COVID-19 and perceived stress), and PTSD, as well as the associations between PTSD and indices of mental health. The participants in the study were university students (n = 322) who completed the PTSD Checklist for the Diagnostic and Statistical Manual-5 (DSM-5), the Fear of COVID-19 Scale, the Perceived Stress Scale, short forms of the Beck Hopelessness Inventory, the Center for Epidemiological Studies Depression Scale, and the trait scale of the State-Trait Anxiety Inventory. We used multiple regression analyses to determine significant predictors of PTSD and mental health. The results revealed distinctive associations between PTSD symptom clusters and the study's variables. Perceived stress and fear of COVID-19 emerged as the strongest predictors of all PTSD symptom clusters. Participants who tested positive for COVID-19 reported high levels of intrusive re-experiencing. Age predicted negative alterations in cognition, mood, and hyperarousal. Furthermore, negative alterations in cognition and mood were the most

significant predictors of anxiety, depression, and hopelessness, while hyperarousal was a significant predictor of anxiety and depression. The findings suggest that the potential benefits of implementing a rapid assessment of mental health among students at the outset of a disease outbreak can facilitate targeted intervention efforts. In addition, interventions that enhance resilience and coping may serve a protective function in mental health outcomes. Given the central role of maladaptive cognitions in the persistence of PTSD, interventions that focus on enhancing adaptive appraisals may bolster students' capacity to cope with adversity.

Keywords
PTSD; fear of COVID-19; perceived stress; depression; hopelessness; anxiety

1. Introduction

The COVID-19 pandemic has been a continuous traumatic stressor [1]. It has been associated with high levels of posttraumatic stress disorder (PTSD) among various population groups. The current study aimed to investigate the associations between demographic factors, COVID-19-related factors, and PTSD, as well as the association between PTSD and indices of psychological distress. PTSD is a debilitating psychiatric disorder that can occur after exposure to or witnessing a traumatic event such as a natural disaster, a severe motor vehicle accident, sexual assault, war or combat, or a terrorist act [2]. The disorder is comprised of distinct symptom clusters, including intrusive re-experiencing in the form of flashbacks and nightmares of the traumatic event, negative alterations in cognition (e.g., appraisals that other people are untrustworthy or that the world is dangerous place) and mood, physiological hyperarousal (e.g., difficulty with concentration, sleep disturbances, and heightened startle responses), and cognitive and behavioral avoidance of reminders of the traumatic event, including suppressing thoughts of the trauma and avoiding events or people that may serve as reminders of the trauma [2]. Existing research has suggested that these symptom clusters are mediated by different mechanisms, including distress tolerance, emotional regulation, and the tendency to ruminate, which involves a passive focus on the trauma and its impact [3]. Several theoretical models have been proposed to explain the disorder's development and persistence, and these conceptualizations have been central in guiding the development of efficacious interventions. Prominent learning-based theoretical models [4], grounded in operant and classical conditioning principles, propose that PTSD arises from the acquisition of conditioned fear responses to stimuli and impaired extinction processes. These fear responses become overgeneralized to various triggers, leading to flashbacks and physiological hyperarousal. Extinction processes typically lead to conditioned fear responses diminishing over time when the fear-inducing stimuli are no longer paired with the traumatic event. However, impaired extinction processes maintain fear responses by associating with the original trauma through second-order conditioning [4]. This is hypothesized to lead to the persistence of PTSD.

Dominant cognitive-behavioral conceptualizations of the persistence of PTSD [5] have suggested that exposure to traumatic events produces a sense of a severe current threat to the individual's goals, plans, and experiences of self, others, the world, and their future. This perception of past threats as ongoing threats may be maintained by a range of processes, including poor elaboration

and integration of the traumatic event in autobiographical memory due to increased emotional arousal at the time of the trauma, negative appraisals of the trauma and its sequelae, conditioned fear responses and cognitive and behavioral avoidance strategies [5].

Pandemics are typically classified as natural disasters and have the well-established potential to generate pervasive mental health problems, including PTSD [1]. Much of the research on COVID-19-related PTSD has been conducted on frontline healthcare workers such as doctors, nurses, and paramedics [6, 7]. In their systematic review of posttraumatic stress symptoms among healthcare workers, d'Ettorre and colleagues [8] reported that prevalence rates ranged from 2.1 to 73.4%. This variability was attributed to the timing of the various studies and differences in the workers' healthcare settings. Higher levels of risk perception and reduced access to personal protective equipment have been associated with higher rates of PTSD within this group [7]. Other systematic reviews and meta-analytic studies [9, 10] on PTSD related to the COVID-19 pandemic conducted on the general population have reported prevalence rates between 15 and 22%. Several studies of PTSD have also been conducted among survivors of severe COVID-19 infections. In their systematic review, Nagarajan and colleagues [10] found that 16% of survivors experienced PTSD. The increased prevalence of posttraumatic stress symptomology during the pandemic is attributed to high mortality rates, rapid transmission, uncertainty regarding the course of the disease, a lack of effective treatment before the development of vaccines, increased perceptions of a threat to wellbeing, and fear about the implications of infection for both loved ones and oneself [11, 12]. In addition to prevalence rates, various studies have investigated determinants of PTSD and risk and protective factors. Prior history of psychiatric illness, younger age, occupation, female gender, and high exposure level correlate with greater vulnerability to PTSD symptomology [13, 14]. In contrast, the use of adaptive coping strategies and personality-related qualities such as resilience and a sense of coherence have been reported to protect individuals against PTSD [15, 16].

In addition to studies investigating PTSD among healthcare workers and the general population, the impact of the pandemic on students attending institutions of higher learning has also been investigated. Some students are particularly vulnerable to experiencing distress arising from the pandemic due to their preexisting risk of developing adverse mental health outcomes and the distinct implications of pandemic prevention measures on the education sector [15]. The rapid migration to using virtual educational platforms following university closures, disruption to peer and academic networks, and challenges in engaging with academic material, mainly where digital resources were limited, contributed to elevated levels of distress [16]. Students' pandemic-related fears were reported to heighten anxieties about their loved ones or themselves contracting the disease, disrupt sleep patterns, make it more difficult to concentrate, and increase worries about their academic trajectories [17, 18].

Various international studies on student populations have confirmed that students are vulnerable to developing PTSD in relation to COVID-19. For example, Idoiaga and colleagues [18], through a systematic review and meta-analysis of studies mainly undertaken in Europe, the United States, China, France, and the United Kingdom, reported a PTSD prevalence rate of 23% among students. Increases in age were correlated with greater susceptibility to PTSD, but there were no gender differences in vulnerability. This study's findings contrasted with those of other studies [19, 20] that have reported that female participants had a greater risk of exhibiting posttraumatic stress symptomology. A Chinese nationwide survey [21] on the prevalence and correlates of mental health problems among university students reported that PTSD was the most prevalent condition (30.8%),

followed by depression (23.3%) and anxiety (15.5%). An international study [22] of young adults from Germany, Poland, Israel, and Slovenia found that student status and younger age predicted COVID-19-related PTSD risk. At the same time, female participants were associated with heightened levels of distress but not PTSD. Ochnik and colleagues [23] reported a rate of 23% for pandemic-specific PTSD in a study of university students across six countries, including Germany, Russia, Turkey, and Ukraine. A prior diagnosis of depression, being female, a worsening economic status, or losing a loved one from COVID-19 infection was associated with high levels of COVID-19-related PTSD.

Given that PTSD can lead to a lower quality of life and a higher risk of self-harm, suicidal ideation, and maladaptive coping responses among students [24], investigating the prevalence and correlates of this disorder remains imperative. The current study investigates PTSD and its correlates among South African university students enrolled at a historically disadvantaged institution (HDI). These institutions of higher learning were created by the apartheid government for Black South Africans and were significantly under-resourced by the state [25]. Although significant transformation has occurred in the higher education sector in South Africa, students at HDIs are predominantly from lower socioeconomic backgrounds, and the impact of the pandemic remains interconnected with poverty and continued socioeconomic inequalities [26]. Previous international studies (e.g., [23] on students have confirmed that concerns about deteriorating economic status are significant risk factors for anxiety and depression among this group. Furthermore, existing South African studies [16, 27] have reported that students at HDIs experience higher exposure to trauma, which may increase their vulnerability to developing pandemic-related PTSD. Most studies on PTSD among South African students were undertaken before the pandemic, and the majority are outdated [27, 28].

In the current study, we examined the associations between demographic factors, COVID-19-related factors (fear of COVID-19 and perceived stress), and PTSD, as well as the associations between PTSD and indices of mental health (i.e., hopelessness, depression, and anxiety). We postulated that the demographic and COVID-19-related variables were causally antecedent to PTSD, while the indices of mental health were consequences of PTSD. This is schematically presented in Table 1. PTSD, anxiety, and depressive symptoms co-occur after a traumatic event. The relationship can be bidirectional in that PTSD is a well-established risk factor for depression. Still, preexisting depressive symptoms can also render an individual vulnerable to posttraumatic stress symptoms through disruptions in social support networks, impairment in coping ability, and heightened distress [29]. Furthermore, anxiety and depression are frequently comorbid conditions, and their symptoms are highly correlated [30]. Nevertheless, anxiety symptoms have been found to predict depressive symptoms [30] strongly.

Table 1 Presumed Antecedents and Consequences of PTSD.

Antecedents	Dimensions of PTSD	Consequences
Age	Re-experiencing	Depression
Gender	Avoidance	Hopelessness
Tested positive for COVID-19	Hyperarousal	Anxiety
Fear of COVID-19	Negative alterations in cognition and mood	
Perceived stress		

2. Materials and Methods

2.1 Participants and Procedures

The participants in the study were students (*n* = 322) at a university in the Western Cape province of South Africa. The study was conducted in 2022 during the fifth wave of the pandemic in the country, which saw a sustained rise in infections. South Africa recorded the most COVID-19 cases and related deaths on the African continent [31]. The office of the university's registrar used a random number generator to select 1,700 students for the study randomly. An electronic link to a Google Forms version of questionnaires discussed in the Measures section was distributed to 1,700 students, along with a study description and an invitation to participate. The response rate was thus 18.9%.

2.2 Measures

Participants completed a brief demographic questionnaire as well as the following measures: the PTSD Checklist for DSM-5 [PCL-5] [32], the Fear of COVID-19 Scale [FCVS-19] [33], the Perceived Stress Scale [PSS] [34], short forms of the Beck Hopelessness Inventory [BHS-9] [35], the Center for Epidemiological Studies Depression Scale [CES-D10] [36], and the trait scale of the State-Trait Anxiety Inventory [STAI-T5] [37]. The measures are detailed in Appendix 1.

This study was conducted in accordance with the guidelines of the Declaration of Helsinki, and ethical approval was obtained from the Humanities and Social Sciences Ethics Committee of the University of the Western Cape (ethics reference number: HS22/2/9, February 2022). Participants provided informed consent, participation was voluntary and anonymous, and no incentives were offered for participation.

2.3 Data Analysis

IBM SPSS for Windows Version 28 (IBM Corp., Armonk, NY, USA) was used for all the statistical analyses. We obtained descriptive statistics, indices of kurtosis and skewness, as well as means and standard deviations. In addition, we calculated the reliability of the measuring instruments (alpha and omega) as well as the correlation (Pearson's r) between the symptom clusters and all the other variables (demographic variables, COVID-19-related variables, and indices of mental health). In the case of gender, female was coded 0 and male 1. When the relationship between a continuous and a dichotomous variable (such as gender) is determined, Pearson r is the equivalent of the point-biserial correlation. Lastly, we used multiple regression to determine significant predictors of PTSD and mental health. Since the system clusters of PTSD would be related, we also checked for potential multicollinearity by using the variance inflation factor (VIF). In general, VIF >10 indicates strong multicollinearity, and ideally, VIF should be lower than 5 [38]. In the prediction of indices of mental health, we also controlled for the possible confounding effect of age, gender, and whether participants had tested positive for COVID-19 by adding these variables in the first step of the regression equation.

3. Results

Most of the sample lived in an urban area (87.3%) and consisted of women (77%). At least a quarter of the sample (25%) had tested positive for COVID-19. This corresponds to the positivity rate in South Africa, which at the time of the study was 22% [39]. The mean age of the sample was 26.01 years (SD = 10.19). This standard deviation might appear relatively large for a population of university students, but this university has a large cohort of mature students. In the current study, 11.5% of the participants were in the age group 40-63 years.

The descriptive statistics (mean, SD, range, indices of skewness and kurtosis) and estimates of reliability (alpha and omega) are reported in Table 2.

Table 2 Descriptive Statistics and Reliabilities of Measuring Instruments.

Variable	Minimum	Maximum	Mean	SD	Skewness	Kurtosis	α	ω
Fear CV	7.00	35.00	17.36	6.51	0.35	−0.44	0.87	0.87
Stress	6.00	39.00	23.89	6.28	−0.18	−0.18	0.85	0.86
RE	0.00	20.00	9.48	5.48	0.04	−0.95	0.89	0.89
Avoidance	0.00	8.00	4.29	2.62	−0.21	−1.18	0.89	0.89
NACM	0.00	28.00	13.45	7.45	0.02	−1.04	0.88	0.89
HA	0.00	24.00	11.24	5.99	0.02	-0.91	0.82	0.83
Hopelessness	0.00	9.00	2.29	2.44	1.21	0.59	0.84	0.84
Anxiety	5.00	20.00	12.36	4.13	0.03	−0.88	0.88	0.88
Depression	0.00	30.00	14.15	6.77	0.05	−0.73	0.84	0.85

Note. Fear CV = fear of COVID-19; RE = re-experiencing; NACM = negative alterations in cognition and mood; HA = hyperarousal, α = alpha, ω = omega.

Table 2 reflects that skewness and kurtosis indices were all within the acceptable range (−2 to +2) [40], indicating a reasonably normal distribution for all the scale scores. The estimates of reliability may be deemed satisfactory and were all >0.80. In all instances, the α and ω coefficients were very similar.

The correlations between the symptom clusters of PTSD and the variables that are presumed to be antecedents and consequences of PTSD are reported in Table 3.

Table 3 Correlation Between PTSD Symptom Clusters and Other Variables.

Variable	Correlation with			
	Re-experiencing	Avoidance	NACM	Hyperarousal
Age	-0.21**	-0.20**	-0.29**	-0.26**
Gender	-0.05	-0.05	-0.02	-0.03
Tested positive	-0.05	-0.04	0.06	-0.02
Fear of Covid-19	0.30**	0.26**	0.26**	0.26**
Perceived stress	0.54**	0.45**	0.65**	0.63**
Hopelessness	0.35**	0.26**	0.51**	0.43**
Anxiety	0.54**	0.48**	0.65**	0.59**
Depression	0.52**	0.46**	0.65**	0.66**

**Note*. NACM = negative alterations in cognition and mood, ** p < 0.001.

Table 3 demonstrates that there was a small significant association between re-experiencing and age (r = −0.21, p < 0.001), avoidance and generation (r = −0.20, p < 0.001), negative alterations in cognition and mood, and age (r = −0.29, p < 0.001), as well as between hyperarousal and age (r = −0.2, p < 0.001). All the relationships were negative, indicating that as age increases, the different dimensions of PTSD decrease.

Fear of COVID-19 had a small association with avoidance (r = 0.26, p < 0.001), negative alterations in cognition and mood (r = 0.26), and hyperarousal (r = 0.26, p < 0.001). In all instances, the relationships were positive, indicating that high levels of fear of COVID-19 were associated with high levels of PTSD. Perceived stress had a moderately strong relationship with avoidance (r = 0.45, p < 0.001) but a substantial connection with re-experiencing (r = 0.54, p < 0.001), negative alterations in cognition and mood (r = 0.65, p < 0.001), and hyperarousal (r = 0.63, p < 0.001). Since all the relationships were positive, it would indicate that high levels of perceived stress were associated with high levels of PTSD. Re-experiencing was moderately associated with hopelessness (r = 0.35, p < 0.001) and substantially associated with anxiety (r = 0.54, p < 0.001) as well as depression (r = 0.52, p < 0.001). Avoidance had a small association with hopelessness (r = 0.26, p < 0.001) and a moderate relationship with anxiety (r = 0.48, p < 0.001) and depression (r = 0.46, p < 0.001). Negative alterations in cognition and mood were substantially associated with hopelessness (r = 0.51), anxiety (r = 0.65, p < 0.001), and depression (r = 0.65, p < 0.001). Hyperarousal had a moderate association with hopelessness (r = 0.43, p < 0.001) and a substantial association with anxiety (r = 0.59, p < 0.001), and depression (r = 0.66, p < 0.001). All the relationships between PTSD and the indices of mental health were positive, indicating that high levels of PTSD were associated with high levels of hopelessness, anxiety, and depression.

The results of multiple regression analyses with the demographic variables and COVID-19-related variables as predictors and the symptom clusters as dependent variables are reported in Table 4.

Table 4 Predictors of PTSD Symptom Clusters.

Variables	Re-experiencing		Avoidance		NACM		Hyperarousal	
	β	p	β	p	β	p	β	p
Perceived stress	0.48	<0.001	0.39	<0.001	0.59	<0.001	0.58	<0.001
Fear of COVID-19	0.17	<0.001	0.18	<0.001	0.14	0.002	0.13	0.003
Tested positive	-0.10	0.04	-0.08	0.11	-0.01	0.92	-0.08	0.07
Age	-0.09	0.08	-0.09	0.06	-0.11	0.02	0.10	0.03
Gender	-0.01	0.79	-0.02	0.75	0.02	0.59	0.02	0.72

[*]*Note*. NACM = negative alterations in cognition and mood, β = standardized coefficient, re-experiencing: $R^2 = 0.33$, avoidance: $R^2 = 0.24$, NACM: $R^2 = 0.45$, hyperarousal: $R^2 = 0.43$.

To some extent, the results reported in Table 4 correspond to the zero-order correlations in Table 3. They demonstrate that the strongest predictor of all the dimensions of PTSD is perceived stress (re-experiencing: β = 0.48, *p* < 0.001; avoidance: β = 0.39, *p* < 0.001; negative alterations in cognition and mood: β = 0.59, *p* < 0.001; hyperarousal: β = 0.58, *p* < 0.001), followed by fear of COVID-19 (re-experiencing: β = 0.17, *p* < 0.001; avoidance: β = 0.18, *p* < 0.001; negative alterations in cognition and mood: β = 0.14, *p* = 0.002; hyperarousal: β = 0.13, *p* = 0.003). While age was associated with all

symptom clusters in the zero-order correlations, in the multiple regression analyses, it was only associated with negative alterations in cognition and mood (β = −0.11, p = 0.02) and hyperarousal (β = −0.10, p = 0.03). In addition, whether a participant had tested positive for COVID-19 was associated with re-experiencing (β = −0.10, p = 0.04). Based on the coding direction, the obtained association indicated that participants who tested positive for COVID-19 reported high levels of re-experiencing. Gender was not a significant predictor of any of the dimensions of PTSD.

The results of multiple regression analyses, with the symptom clusters as predictors and the indices of mental health as dependent variables, are reported in Table 5. The VIFs ranged between 1.89 and 3.35, thus suggesting that multicollinearity is not a serious concern.

Table 5 PTSD Symptom Clusters as Predictors of Mental Health.

Symptom clusters	Hopelessness		Anxiety		Depression	
	β	p	β	p	β	p
Re-experiencing	-0.01	0.94	0.07	0.30	0.00	0.97
Avoidance	-0.05	0.41	0.09	0.10	0.07	0.23
NACM	0.47	0.001	0.39	<0.001	0.28	<0.001
Hyperarousal	0.09	0.28	0.14	0.04	0.39	<0.001

[*]*Note*. NACM = negative alterations in cognition and mood, β = standardized coefficient, hopelessness: R^2 = 0.26, anxiety: R^2 = 0.45, depression: R^2 = 0.48.

The zero-order correlations indicated that all the symptom clusters were related to all the indices of mental health. However, as reflected in Table 5, when the symptom clusters were considered together in a multiple regression analysis, only negative alterations in cognition and mood were a significant predictor of hopelessness (β = 0.50, p < 0.001), anxiety (β = 0.41, p < 0.001), and depression (β = 0.30, p < 0.001). In addition, hyperarousal was a significant predictor of anxiety (β = 0.16, p = 0.002) and depression (β = 0.39, p < 0.001).

4. Discussion

The COVID-19 pandemic has been a traumatic stressor that has led to the development of PTSD for many. The current study aims to expand the knowledge base on pandemic-related PTSD by investigating its association with demographic factors, COVID-19-related factors, and indices of distress. A novel contribution of the study is the focus on symptom clusters and their association with the study's variables. There were several significant findings. First, perceived stress and fear of COVID-19 emerged as the strongest predictors of all PTSD symptom clusters. Cognitive theories of PTSD have suggested that appraisals of ongoing threats are central to the onset and persistence of the disorder. The pandemic can be appraised as a threatening stressor and can thus lead to psychological distress. Two aspects of such disease outbreaks are believed to aggravate perceived stress and heighten levels of fear [41]. The first involves concern about infection for oneself and significant others. In contrast, the second entails the rapid and unprecedented changes to individuals' daily lives due to lockdown, social isolation, quarantine, and restrictions on freedom of movement. For students, perceived stress may have also been related to the closure of universities and difficulty negotiating digital platforms for educational purposes. Limited in-person contact with academic staff and peers and concerns about their academic achievement and future trajectory

could also heighten stress [18]. Furthermore, for students living in disadvantaged contexts, fear of COVID-19 may have been exacerbated by limited access to personal protective equipment and the implications of their family members and themselves contracting the virus [18].

Second, age predicted two symptom clusters-namely, negative alterations in cognition and mood and hyperarousal. Studies examining the association between age and PTSD have produced mixed results, which have been attributed to the influence of moderating variables, differences in the timing of studies and research designs, the nature of traumatic events, the type of instrument used to assess PTSD, and cultural differences [42]. Although it is impossible to compare studies directly, the findings in the existing literature can offer insights to understand age related differences better. For example, in a comparison of the effects of culture and age on PTSD after natural disasters in the United States, Mexico, and Poland, Norris and colleagues [41] reported that while middle and older age were associated with more significant PTSD symptomology in the US and Poland, younger people were more likely to experience PTSD in Mexico. These authors concluded that the effect of age was dependent on social, economic, and cultural factors. Other studies on age differences [43] have reported that avoidance and re-experiencing symptoms are less prominent among older adults, potentially due to the time since the traumatic event occurred; this may influence appraisal and recall, thus reducing the likelihood of the trauma evoking strong negative emotions. In addition, life experiences may lead to older adults appraising traumatic events in both a negative and positive light (e.g., as a challenging life event that they were able to overcome), potentially reducing the sense of a threat associated with the trauma and instead evoking positive emotions (e.g., confidence and pride in being able to cope). Older adults are also more likely to have developed resources for dealing with adversity, including close interpersonal relationships and greater cognitive reappraisal capacities [44, 45]. The majority of participants in the current study were young adults, and a possible explanation for the current findings is that this population group has a greater tendency to retain and retrieve discrete memories of distressing events [45], thereby increasing the likelihood of experiencing symptoms of hyperarousal. In addition, they may not have developed sufficient coping responses to adequately manage their fears and stressors, potentially enhancing the possibility of negative appraisals of the pandemic and related emotional reactions [16].

Third, participants who tested positive for COVID-19 reported high levels of intrusive re-experiencing. This finding aligns with those in existing research [24]. Contracting the virus may have aggravated appraisals of threats due to participants' awareness of the high mortality associated with the disease and the danger it posed to physical health. COVID-19 infection also requires self-isolation or quarantine and potential medical care, which can impact access to social support networks and lead to rumination (i.e., passively focusing on the impact and possible consequences of being infected). Rumination is associated with reduced fading of memory-related negative emotion. It leads to overgeneralized memory (i.e., a tendency to recall abstract life themes, possibly that match the individual's emotional state).

Fourth, gender did not predict PTSD symptomology. This finding was noteworthy as prior studies [46, 47] have demonstrated that women are at increased risk for traumatic stress reactions and are more likely to experience intrusive re-experiencing, changes in mood and cognition, and hyperarousal. This has been attributed to women's increased risk of exposure to particular types of traumatic events (e.g., sexual assault) that confer greater vulnerability to traumatic stress reactions [46]. In the context of the pandemic, women are also more likely to be in occupations (e.g., as nurses or teachers) at the frontlines of the disease outbreak, increasing their vulnerability. Furthermore,

within the domestic realm, women tend to take greater responsibility for caring for ill family members, enhancing their exposure to COVID-19. Despite studies [46, 47] documenting greater risk for traumatic stress responses among women, there is also evidence that the relative risk for PTSD is equivalent across genders for specific high-risk traumatic events (e.g., childhood abuse) and within specific subpopulations (e.g., among war veterans, police officers and emergency service personnel), even when the level of exposure to trauma is controlled [48]. Differences in socializing practices and coping responses used by men and women to manage traumatic stress responses have been suggested to contribute to differential outcomes [48]. In terms of the current study, individual variability in responses to traumatic events and the nature of the coping strategies used, may have a bearing on the results [48].

Finally, the study found that negative alterations in cognition and mood were the most significant predictors of anxiety, depression, and hopelessness. At the same time, hyperarousal was a significant predictor of anxiety and depression. Since the pioneering work of Beck [49] and Lazarus and Folkman [50], individuals' appraisals of events have been recognized as a significant determinant of mental health outcomes. According to these theorists, appraising events as having uncertain outcomes or as being incompatible with goals and desires and thinking that little can be done to change a situation are central factors in depression and hopelessness. For students in the current study, the closure of educational institutions and migration to digital modes of learning may have contributed to their appraisals that their future was uncertain and precipitated negative perceptions about their ability to achieve their academic goals. These appraisals may have led to the adverse mental health outcomes documented in the present study.

Existing research (e.g., [51]) has confirmed that specific hyperarousal indicators such as hypervigilance and exaggerated startle responses are more closely related to anxiety than depression. It is probable that these symptoms of hyperarousal (e.g., difficulty concentrating, sleep disturbances, and increased startle responses) may be appraised by individuals as being indicative of permanent dysfunction and lead to concerns about whether they will ever be able to return to their pre-trauma levels of functioning [5]. These perceptions can produce elevated levels of anxiety and a sense of sadness and despair, which may account for the present study's findings.

The study's findings offer helpful recommendations for university officials, particularly in the context of future pandemics. At the outset of a pandemic, it may be beneficial to implement a rapid assessment of mental health among students to facilitate targeted interventions for those who are most vulnerable to psychological distress. During a national lockdown or quarantine, online psychological services can provide additional support for students. It is acknowledged that resource constraints, particularly for HDIs, can impact mental health service delivery [26]. Thus, external mental health agencies and the government may need to collaborate to support students effectively. Most students use social networking sites and mobile phone applications for communication purposes. Universities could use similar platforms to disseminate reliable information about the pandemic, distribute motivational messages and psychoeducational material on mental health, and cultivate protective internal resources (e.g., optimism, adaptive coping responses, and sense of coherence). It has been well-established [16, 52] that appraisals related to the perceived capacity to adapt to change and perceived problem-solving ability can be modified with training and are associated with improvements in PTSD symptomology and other indices of psychological distress. As such, interventions that enhance these appraisals may bolster students' capacity to cope with adversity.

While the current study had specific strengths, including the focus on a distinct population group (i.e., university students from an HDI) and validated assessment tools, there were certain limitations. First, our sample predominantly consisted of female participants from one geographic region, impacting the generalizability of our findings. However, women are generally overrepresented in higher education in South Africa, and at the current institution, 68% of students are women. Second, it is probable that there was a bidirectional relationship between mental health outcomes (e.g., PTSD, depression, and anxiety), and future studies using a clinician-administered instrument may assist in confirming causal associations. Third, due to the use of a cross-sectional design, it is impossible to conclude causal relationships or the directionality of relationships. Fourth, it is probable that stressors apart from COVID-19 could account for the mental health outcomes in the study. Finally, using self-reported measures means that scores may be influenced by interpretation and social desirability biases. Future studies using structured interviews and clinician-administered instruments may be beneficial in confirming the results.

5. Conclusions

To the best of the authors' knowledge, this is the only current study to emerge from the South African context investigating PTSD symptom clusters and their association with COVID-19-related variables, demographic factors, and mental health outcomes among university students. The results revealed distinctive associations between PTSD symptom clusters and the study's variables. Perceived stress and fear of COVID-19 emerged as the strongest predictors of all PTSD symptom clusters. Participants who tested positive for COVID-19 reported high levels of intrusive re-experiencing. Age predicted negative alterations in cognition, mood, and hyperarousal. Furthermore, negative alterations in cognition and mood were the most significant predictors of anxiety, depression, and hopelessness, while hyperarousal was a significant predictor of anxiety and depression. The findings complement the existing literature and highlight the potential need for targeted intervention among this population group, particularly given that PTSD is associated with serious disability, medical illness, suicidal ideation, and problematic coping strategies.

Appendix 1: Description of Instruments

The PCL-5 is a 20-item measure of PTSD and is based on the Diagnostic and Statistical Manual of Mental Disorders [2]. The 20 items are grouped into four clusters of symptoms: re-experiencing (five items: e.g., *repeated, disturbing and unwanted memories of the stressful experience*), avoidance (two items: e.g., *avoiding memories, thoughts, feelings related to the stressful experience*), negative alterations in cognitions and mood (seven items: e.g., *trouble remembering important parts of the stressful experience*), and hyperarousal (six items: e.g., *irritable behavior, angry outbursts, or acting aggressively*). The items are responded to on a 5-point scale ranging from *not at all* (0) to *extremely* (4). In the development study of the PCL-5, the authors reported satisfactory reliability coefficients (α = 0.94 and 0.95) and provided evidence of convergent and discriminant validity. In addition, confirmatory factor analysis demonstrated that the four factors fit the data to an acceptable degree [32]. Sveen and colleagues reported reliability coefficients for the four subscales ranging between 0.57 and 0.78 [53]. In South Africa, Padmanabhanunni and Wiid reported a Cronbach's alpha of 0.93 for the PCL-5 [15].

The FCV-19S is a seven-item self-reported measure of COVID-19 fear-related emotional reactions. Items are scored on a 5-point scale ranging from *strongly disagreeing* (1) to *strongly agreeing* (5). An example item of FCV-19S is *my heart races or palpitates when I think about getting coronavirus-19.* In the development study, Ahorsu and colleagues reported satisfactory reliability estimates (composite reliability = 0.88, α = 0.82), and the relationship between fear of COVID-19 and depression, anxiety, and perceived vulnerability to disease served as evidence for validity [33]. In South Africa, Pretorius and colleagues used both classical test theory and item response theory to demonstrate that the FCV-19S is a reliable (α = 0.91, composite reliability = 0.91, Mokken scale reliability = 0.92), valid, and unidimensional measure of COVID-19-related reactions of fear [54].

The PSS is a 10-item measure of participants' perceptions of the degree to which they experience stress in their daily lives. An example of an item on the PSS is: *How often have you found that you could not cope with all the things that you had to do?* Responses to the items are scored on a five-point scale ranging from *never* (0) to *very often* (4). In the development study, the authors reported satisfactory reliability coefficients between 0.84–0.86. Validity was demonstrated through the relationship between the PSS and life events and depression [34]. Le Roux and Wright translated the PSS into Afrikaans in South Africa. They found that the Afrikaans version had a reliability of 0.89, while the reliability of the combined group (English and Afrikaans) was 0.90 [55].

The BHS-9 is a nine-item version of the original 20-item Beck Hopelessness Scale [56]. It is a self-reported measure of pessimism and hopelessness about the future. An example of an item of the BHS-9 is "*the future seems vague and uncertain to me.*" The response format for the BHS-9 is a dichotomous *yes/no* scale. Balsamo and colleagues used nonparametric item response theory to develop the nine-item version, reported a satisfactory reliability estimate (Mokken scale reliability = 0.86), and found that the nine-item version had good discriminant validity in being able to categorize psychiatric patients with and without suicide attempts [35]. In South Africa, Padmanabhanunni and colleagues used the full-length version of the BHS in a study with school teachers and reported satisfactory reliability estimates [α = 0.89, ω = 0.89] [57].

The CES-D10 is a 10-item version of the original 20-item Center for Epidemiological Studies Depression Scale [58], which assesses depressive symptomatology. An example of an item from the CES-D10 is *I had trouble keeping my mindthat I had trouble focusing on what I was doing.* Items Articles from the CES-D10 are scored on a four point scale ranging from *rarely or none of the time* (0) to *most or all of the time* (3). Zhang and colleagues reported a satisfactory reliability estimate (α = 0.88) for the 10-item version of the CES-D. They demonstrated that the CES-D10 was as accurate as the CES-D20 in classifying participants with depression [36]. In South Africa, Pretorius and Padmanabhanunni reported an alpha coefficient of 0.92 for the 20-item version of the CES-D [59].

The STAI-T5 is a five-item version of the original 20-item State-Trait Anxiety Inventory [60], which assesses trait anxiety. An example of an item of the STAI-T5 is *I get in a state of tension or turmoil as I think over my recent concerns and interests.* Responses to the five items are made on a 4-point scale ranging from *not at all* (1) to *very much so* (4). The study that described the development of the five-item version of the STAI-T, reported a satisfactory reliability estimate (α = 0.86), and reported a very strong association between the short and long versions of the STAI-T (r = 0.88) [37]. In South Africa, Padmanabhanunni and colleagues reported very satisfactory internal consistency estimates for a sample of schoolteachers [57].

Author Contributions

Conceptualization and methodology: Anita Padmanabhanunni and Tyrone Pretorius; Analysis and data curation: Tyrone Pretorius. All authors discussed and interpreted obtained results. All authors contributed to the writing and editing of the manuscript over several iterations.

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Competing Interests

The authors have declared that no competing interests exist.

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