



Depression and Self-medication by Tertiary Students: A South African Case-Study

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Abstract

Background: Mental health disorders, such as depression, are one of the key factors shown to affect students' success in tertiary and working environments. With the rise in graduate unemployment rate in South Africa and a demanding workplace environment, student's mental health and stress-coping strategies need to be monitored. The progressive nature and taxing productivity requirements in the tertiary environment pertaining to creativity, resilience and job uncertainty necessitates the encouragement of healthy stress-coping strategies and healthy awareness on the controlled use of non-prescription medication. The aim of the study was to determine the prevalence of depression among students in a tertiary institution in South Africa, to assess the use of non-prescription medication and the type of coping strategy preferred when dealing with depression.

Method: Data were collected by cluster-randomized sampling, using a descriptive cross-sectional survey which was circulated to all South African campuses of the institution. Chi-square analysis ($\alpha = 0.05$), prevalence ratio, descriptive statistics and multiple regression were utilized for data analysis in Microsoft Excel 2016 and Minitab 17. Data were reported as frequencies, percentages and displayed in scatterplots, pie charts and tables where applicable.

Results: Of the participating students ($n = 1249$) the study found that 2 out of 5 conveyed symptoms of moderately severe depression (31.1%; $p < 0.05$) and severe depression (12.7%; $p < 0.05$) as determined by an adaptation of the Patient Health Questionnaire - 9 (PHQ-9) by Pfizer US Pharmaceuticals' categories for mental health. There was a linear association observed between depression and the use of unhealthy stress-coping strategies ($PR = 1.6$), as seen with males who had a higher preference for alcohol usage than highly caffeinated energy stimulants. Illicit substances such as amphetamines were observed to directly aggravate symptoms for depression.

Conclusion: There is a high prevalence of depression among participating tertiary students, with the majority also utilizing recreational substances such as alcohol. Universities should invest in anti-stress campaigns to expose students to healthier coping strategies and to better prepare them for competitive work-readiness.

Keywords: Mental Health Disorder; Depression; Non-prescription Medication; Tertiary Students; Stress-coping Strategy; South Africa

Abbreviations

α : Level of Significance (Alpha); AUD: Alcohol Use Disorder; CI: Confidence Interval; CNS: Central Nervous System; DAD: Drug Abuse Disorder; MDD: Major Depressive Disorder; MCAR: Missing Completely at Random; PHQ-9: Patient Health Questionnaire - 9; PR: Prevalence Ratio; p: P value; R: R squared (R^2); r: Pearson Correlation Coefficient; SADAG: South African Depression and Anxiety Group; US- United States of America

Introduction

Depression is a mental health disorder characterised by a persistent loss of interest in daily activities or depressed mood, which results in a dysfunction in daily life [1]. Depression negatively affects how the individual feels, thinks, acts and interacts with society and the environment. This results in a variety of emotional and physical problems that can decrease a person's ability to function [2]. Different individuals may experience different amalgamations of symptoms. Feelings of sadness, alterations in appetite, sleeping patterns, difficulty concentrating and suicidal thoughts are experienced [3].

There are multiple factors that may cause this disorder, which may include a combination of physiological, psychological and social sources of distress. Depression is a prevalent problem in tertiary institutions across South Africa. During tertiary level of study, students experience many "firsts", including new social expectations, academic performance expectations and living-circumstances, which can be overwhelming due to difficulties in adapting [4-6]. According to Nutt, these factors may cause changes in brain function by altering the activity of neural circuits [7].

The aim of antidepressant therapy is to correct the chemical imbalances in certain neurotransmitters that act on mood and behavioural changes of an individual, with one major class of these drug agents being selective serotonin reuptake inhibitors (SSRIs) [8]. According to the results from a study conducted in Bangladesh, many students preferred self-medication over seeking professional help and the authors stated that this is primarily due to influence by the media and internet advertising that promotes self-medication [9]. Such data are lacking within the context of the South African tertiary student community and requires further investigation. According to Weitzman, students use substances as a result of mental illness [10]. The researchers stated that alcohol and drug

abuse are often coping mechanisms for students with a variety of mental health conditions, including depression [10]. They also suggest that students gravitate towards the substance that alleviates their depressive symptoms most effectively. These substances are not effective for depression because the temporary euphoria subsides once the substances are eliminated from the body and the substances possess unfavourable long-term side effects.

In this research study the aim was to establish the prevalence of depression among students at a private institution and to test for any association with non-prescription medication and recreational substance use.

Methodology

Study design

A clustered-randomized was performed. A descriptive, cross-sectional survey was made available to four faculties of all campuses of a private tertiary institute in South Africa between March and May 2019. Participants completed a 20-question electronic survey which was made available on the institutions' Moodle-based learning management portal. Selection bias was eliminated by random sampling.

The survey consisted of three parts: 1) the first part of the questionnaire captured data on students' socio-demographic details specifically: age, gender and ethnicity, respectively. 2) The second part of the questionnaire evaluated presence and severity of depression symptoms along with their suspected duration in the form of six items that were adapted from the nine-question Patient Health Questionnaire (PHQ-9) to screen for the presence and severity of depression [11]. PHQ-9 was the preferred choice for assessing depression severity due to its established psychometric properties [11]. 3) The third part of the questionnaire included questions based on the utilization of substances, specifically alcohol, nicotine, amphetamines, and cannabis along with their respective usage frequency and the after-effects observed by the participants. The primary end goal of this questionnaire was to obtain qualitative and quantitative data to observe association between depression and the use of substances by the tertiary students. A scoring system was used to allocate a stress-coping score to students' responses for closed-ended (Table 1) and open-ended questions (Table 2), with a higher score being indicative of an unhealthy approach.

Recreational Substances						
Answers	Never	Hardly		Occasionally	Often	Always
Scoring	0	1		2	3	4
Sleeping Pattern			Eating Pattern			
Answers	8 Hours	Less than 8 Hours	More than 8 Hours	Every Day	Less than Usual	More than Usual
Scoring	0	1	1	0	1	1
Medication						
Answers	Yes			No		
Scoring	1			0		
Emotional Status						
Answers	Happy/Excited/Normal/Okay			Sad/Overwhelmed/Stressed/Tired		
Scoring	0			1		

Note: This scoring system was implemented to code students' self-assessment in closed-ended questions.

Table 1: The questionnaire scoring system for self-assessed coping strategies.

Category	Title	Score	Reference Support
A	Food and Drink or Consumption Habits	2	
B	Music, Media or Activities (e.g. relax or sleep)	0	
C	Religious Activities	0	[12]
D	No Strategy	1	
E	Time Management/Pro-activity	0	
F	Socializes	0	
G	Exercises	0	[13]
H	Unhealthy Substances (e.g. Nicotine, Alcohol)	3	[14]
I	Calming Substances (e.g. Camomile tea)	1	

Table 2: The questionnaire scoring system for open-ended responses on coping strategies.

A score of 0 refers to a negative depressive factor associated with the natural release of dopamine, serotonin and/or oxytocin [13] while a score of 1 refers to a negative depressive factor but with either the use of a substance or a total lack of coping strategy. A score of 2 referred to a positive depressive factor based on literature review [12-14]. A score of 3 refers to a positive depressive factor associated with short-term alleviation of depression. Figure 1 illustrates the total number of respondents including those who did not meet the criteria for inclusion of their responses.

Statistical analysis

The chi-square test was used for gender association ($\alpha = 0.05$) and the association between stress-coping strategies and depres-

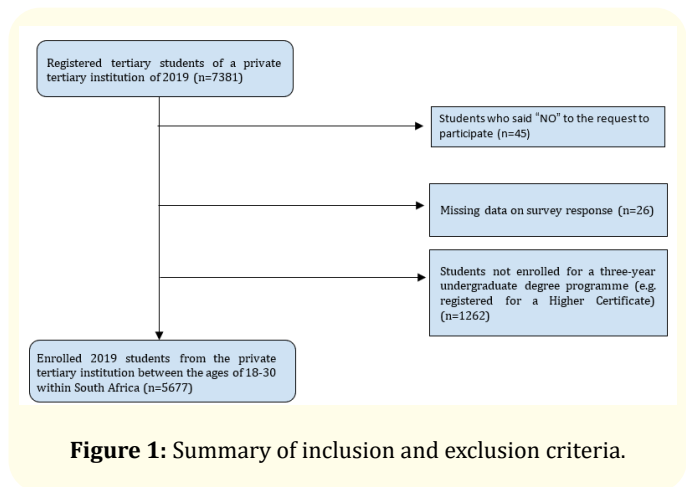


Figure 1: Summary of inclusion and exclusion criteria.

sion was determined by prevalence ratio analysis (PR) in Minitab 12 statistical software and Microsoft Excel 2013. The link between recreational substance use and the student’s depression score was established by simple regression. Multiple regression was used to determine the correlation of depression (via assessing the total scores obtained by students on the PHQ-9 adapted survey), energy stimulants, non-prescription recreational substances and herbal drugs in the statistical software Minitab 12 and Microsoft Excel 2013. Deletion of missing data or the best-fit model proposed by Rubin., *et al.* was utilised, within the chosen significance limits ($\alpha = 0.05$), by removing individual variables of the predictor [15]. The two hypothesis state that there is a statistically significant relationship between tertiary students developing symptoms for depression and the use of non-prescription substances, and between gender and depression, respectively.

Ethical consideration

Permission to conduct the study was granted by the Institute’s National Ethics Office in South Africa. Participants could withdraw

from taking part at the onset of the study via the online Moodle-based learning management portal. All students were required to read the ethical statement, which invited their voluntary participation prior to answering the questions in order to confirm their understanding of the expectations of the study and the limited risk and benefit in involvement. The ethical statement emphasized that the students could click ‘No’ for voluntary participation and would then have their responses (if any) excluded from use in the study results. Confidentiality was maintained by ensuring anonymity of the participants.

Results and Discussion

From the target population of 5677 students a response rate of 23% was obtained (1320 participated). A total of 71 respondents were excluded as their response values were “Missing Completely at Random” (MCAR) [15]. The remaining 1249 respondents answered 20 questions and the data was evaluated accordingly.

		Applied science		Commerce		Degree readiness programme		Humanities		Grand Total
Depression Category	Score	Male Count (%)	Female Count (%)	Male Count (%)	Female Count (%)	Male Count (%)	Female Count (%)	Male Count (%)	Female Count (%)	Count (%)
Not Present	0 - 4	3 (0.24)	1(0.08)	2 (0.16)	5 (0.40)	0 (0.00)	1 (0.08)	1 (0.08)	1 (0.08)	14 (1.12)
Mild	5 - 9	28 (2.24)	15 (1.20)	28 (2.24)	54 (4.32)	7 (0.56)	16 (1.28)	3 (0.24)	23 (1.84)	174 (13.93)
Moderate	10 - 14	74 (5.92)	55 (4.40)	74 (5.92)	143 (11.45)	24 (1.92)	60 (4.80)	20 (1.60)	64 (5.12)	514 (41.15)
Moderately Severe	15 - 19	56 (4.48)	44 (3.52)	47 (3.76)	108 (3.76)	10 (0.80)	43 (3.44)	7 (0.56)	74 (5.92)	389 (31.15)
Severe	20 - 27	26 (2.08)	14 (1.12)	15 (1.20)	39 (3.12)	9 (0.72)	18 (1.44)	11 (0.88)	26 (2.08)	158 (12.65)
Total		187 (14.97)	129 (10.32)	166 (13.29)	349 (27.94)	50 (4.00)	138 (11.05)	42 (3.36)	188 (15.05)	
Grand Total		316 (25.30)		515 (41.23)		188 (15.05)		230 (18.41)		1249 (100)

Note: Values are indicated as count (percentage: %) and percentages were calculated from the count over the total number of respondents multiplied by 100.

Table 3: Cross-tabulation of respondent’s faculty and gender versus their depression score adapted from the PHQ-9 scoring system.

The South African Depression and Anxiety Group (SADAG) stated that 1 in 4 South African tertiary students have been diagnosed with depression [16], yet the effect of substance-usage on the severity of depression among students is still to be established. This study found a 2-fold increase in the prevalence of depression, in that 2 out of every 5 students conveyed symptoms for moderately severe depression (31.1%; $p < 0.05$) and severe depression (12.7%; $p < 0.05$), as seen in table 3. The most prevalent severity of depression observed among the students was moderate depression (41.15%; $p < 0.05$) with mild depression observed among 13.93% of the participating students. Only 1.14% of the surveyed students did not convey any depressive symptoms. It has been established previously that a PHQ-9 score greater than 11 is predicted to convey a sensitivity of 81% and a specificity of 76% for major depression [17]. An obtained score greater than fifteen (>15) permits treatment for depression utilising antidepressants as monotherapy, a combination of treatments and psychotherapy [18]. The faculty of Commerce held the highest prevalence and the Degree Readiness Programme the lowest number of students conveying symptoms for depression at 16.7% and for moderate and severe depression at 6.7%, respectively.

Findings revealed that across all faculties, females conveyed a higher prevalence for depression compared to males (at 29.2% and 14.59%, respectively), however, there was no statistically significant association between gender and the prevalence of depression ($p < 0.1$). This finding was consistent with multiple previous findings [19,20]. Interventions currently utilized in tertiary institutions predominantly rely on traditional psychotherapy approaches, such as one-on-one counselling with students, which may not be suitable for all students. Current literature consulted does not address the outcomes of prolonged use of highly-caffeinated energy drinks or nicotine and any association with depression and suicidal ideation, and whether or not combined use of substances plays a significant role in the mental health of tertiary students especially during the transition from adolescence to adulthood [21].

With a high unemployment rate associated with negative health outcomes such as substance use, suicidal ideation, suicide attempts and subsequent deaths are strongly correlated with moderate and severe depressive episodes [22]. The study findings portray a

higher prevalence of depression among tertiary students than the accepted norm, a troubling finding requiring further investigation and intervention.

Stress-coping strategies were calculated via a scoring system with participant answers summed according to the criteria outlined in table 2. A higher stress-coping score was indicative of unhealthy stress-coping strategies, including recreational and illicit substance use. Regression analysis was performed with these scores to quantify any relationship between stress-coping strategies and the respondents' depression score. A strong, positive linear relationship between these two variables was observed ($r = 0.953$; $p < 0.05$). Thus, there is evidence of association between depression and recreational substance use (Figure 2).

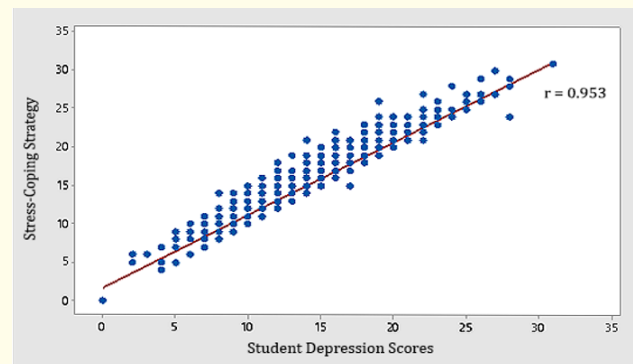


Figure 2: The strong, linear relationship between depression scores and stress-coping strategies of students.

There was evidence of a weak linear relationship between the presence of depression and recreational substances usage ($r = 0.464$; $p < 0.05$). Participants utilising unhealthy stress-coping strategies were twice as likely to convey symptoms for clinical depression ($p < 0.05$) as determined by prevalence ratio testing.

The study then revealed a statistically insignificant ($p = 0.325$) and weak, negative relationship ($r = -0.023$) between total scores for depression obtained and energy stimulants used, indicating that other factors not accounted for in this study may have a greater association. The results supported that there was no association

between total scores obtained and energy stimulants. This finding would suggest that tertiary students utilising unhealthy stress coping strategies were increasing their likelihood for developing symptoms for clinical depression, with recreational substance use the only factor positively associated with prevalence of depression among tertiary students.

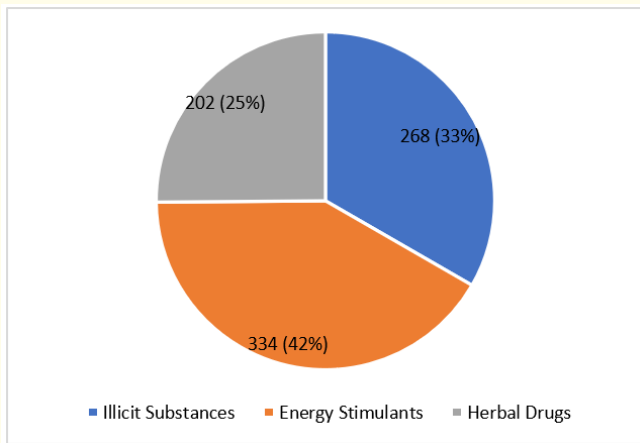


Figure 3: The strong, linear relationship between depression scores and stress-coping strategies of students.

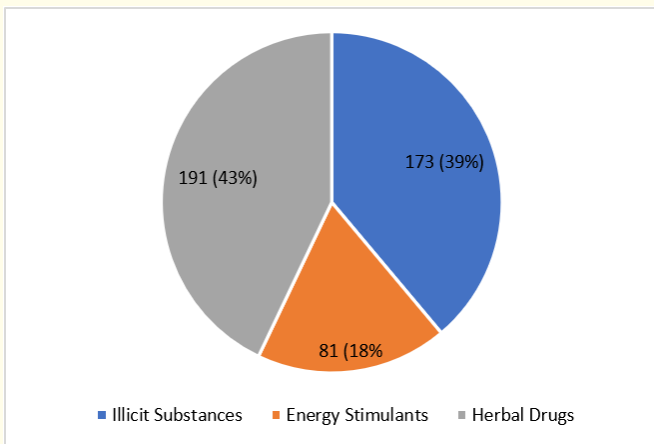


Figure 4: Pie chart of male preferences for substance use.

It was found that females preferred more herbal drugs (25%, with 71% utilising green tea), whereas males preferred energy

stimulants (43%) and illicit and recreational substances (39%). An overall 41% of participants admitted to never using recreational substances. A total of 59.5% of students made use of substances to cope with stress, which included alcohol (59%), illicit cannabis (22.2%), any route of administration of nicotine (17.4%) and illicit amphetamines (1.4%). Interestingly, 24.2% of the students admitted to hardly using any of the above recreational substances, however a large majority were occasional users (49.52%). Although females gravitated to healthier stress-coping strategies (e.g. herbal teas), a higher prevalence of depression was still found to occur among females in this and other studies [19,20]. Thus, additional studies on risk factors contributing to depressive symptoms are required in the presence of substance use.

Students making use of recreational substance were further asked how their depressive symptoms changed after using their chosen substance(s). A majority (47%) of the respondents admitted that no notable change especially in the presence of stress factors such as assessments (tests, exams, assignments). This contradicts a study that found non-medical marijuana users conveyed higher symptoms for depression and that usage over time resulted in improved depressive symptoms and decreased suicidal ideation [23]. The study did not eliminate all confounding variables such as respondent exaggeration and inaccurate responses due to prejudice. Several socio-demographic factors were not considered during sampling of students for this study.

Only 33.1% of the recreational substance users admitted to feeling better after using their preferred substance while 16.4% admitted to feeling amazing and only 3.1% felt worse. Kuria, *et al.* found that the more a person consumes alcohol the higher the probability of developing Major Depressive Disorder (MDD) and Alcohol Use Disorder (AUD) [24] with the study revealing that 38% of the participants utilized alcohol. A longitudinal study investigating association between depression and substance dependence in adolescence through early adulthood revealed that females had a significantly higher risk for Drug Abuse Disorder (DAD) and well as Major Depression Disorder (MDD) [25]. In this study, 25% of females preferred herbal substances. Yet, this was the least preferred substance as majority (42%) chose energy stimulants followed by illicit substances (33%) with no South African studies (to date) exploring the association and impact of highly-caffeinated beverages

and depression among tertiary students. With the results obtained revealing that there was no observed positive association between stress coping strategies and the presence of depression, along with known positive effects of caffeine on mood and concentration [26], these results are not surprising for students in a demanding tertiary environment. Still, effects of long term usage, dependence and other unfavourable effects make this a worrisome finding.

Of the energy stimulant users, several preferred coffee followed by highly caffeinated energy drinks (37.4%). Only 1.1% preferred tea and 0.4% of the surveyed energy stimulant users specifically mentioned using Bioplus® (a product produced by Adcock Ingram containing B-complex vitamins, guarana and ginseng. Interestingly, a study conducted on coffee consumption and the risk of depression found that there was no significant relationship between the two variables, authors stipulated that this could be due to the stimulatory effects of caffeine on the central nervous system. Caffeine modulates the neural activity of the A1/A2 adreno-receptors via nonspecific antagonism [26]. Regarding herbal substances, 59% of the total respondents admitted to not taking any herbal substances. Of those using herbal substances to alleviate depressive symptoms, green tea was the most popular (71.9%). Green tea contains polyphenols as a major constituent, which has been indicated to function through multiple neural pathways such as the ERK/CREB/BDNF signaling pathway (modulating dopaminergic activity), the dysregulated hypothalamic-pituitary-adrenal (HPA) axis (which activates the 'flight-or-fight' response via a hormonal pathway) and an undetermined pathway noted for inducing anti-stress effects via decarboxylation of glutamate into GABA, simultaneously working together to lower the risk of depression [27]. Chamomile tea (21.2%), *Ginkgo biloba* tea (5.1%) and Rooibos tea (1.79%) were less popular. Simple regression analysis revealed that there was no evidence of association between herbal drugs and the presence of depression ($r = 0.02$; $p > 0.05$). This is noteworthy because a number of these herbal extracts contain high levels of caffeine (average 35 - 61 mg per cup) and caffeine is generally associated with increased brain neurotransmission [26], an action linked with the presence of depression during caffeine withdrawal.

The findings obtained from the study indicate a worrisome problem regarding depression among tertiary students, espe-

cially at a private tertiary institution in which classrooms have a smaller student number as compared to public tertiary institutions in South Africa. Also, the concomitant use of substances such as highly-caffeinated energy drinks and alcohol whose long term effects among tertiary students is not yet fully understood yet such substances are the most preferred among students.

Conclusion

A clustered-randomized study using a descriptive, cross-sectional survey among students at a private tertiary institute in South Africa was conducted. Survey questions were adapted from the PHQ-9 questionnaire to assess the degree and severity of depression amongst this cohort and found a high prevalence of depression amongst participating tertiary students. Furthermore, 3 in 5 students occasionally utilised recreational substances such as alcohol and nicotine, and a significant number making use of unhealthy stress-coping strategies, irrespective of non-prescription drug usage.

The study also concluded that students that took recreational substances, such as alcohol, were twice as likely to develop symptoms of depression. Finally, the link between highly caffeinated beverages and the presence of depressive symptoms is noteworthy, especially since herbal substances such as tea also contains caffeine.

A longitudinal study may be more conclusive to assess the stress factors that contribute to students' use of non-prescription drugs and utilisation of unhealthy stress coping strategies. The study found that nearly double the projected number of depressed students was evident among private tertiary students in an educational environment utilising traditional one-on-one psychotherapy approaches, and that the concomitant use of recreational substances and unhealthy stress-coping strategies increased the risk of student conveying depressive symptoms. Male students showed a higher preference for recreational substances yet had an overall lower prevalence of depression as opposed to female students.

Awareness of depressive symptoms and proper management of such symptoms (including counselling and debriefing sessions) should be encouraged among all students (by tertiary institutions

and employers), along with additional stress - mitigation measures such as provision of time-management educational content and anti-stress campaigns to promote a healthy mental framework.

Study Limitations

The cross-sectional study design prevented assessment of changes in severity of depression symptoms over time, decreasing the strength of analysis and quality of interpretation of findings. The limitation was establishment of correlation and association and not causation.

The study was not specific in assessing the types of prescription medication utilised by students and whether they were in relation to psychotherapy prescribed through reputable health professionals or obtained through other means, e.g. friends or family. Several socio-demographic factors (such as marital status, socioeconomic status, immigration status, family income level) are known to contribute to stress factors but these were not recorded.

The presence of comorbidities such as disease and/or infection was not assessed. Quota sampling, to draw comparison between results from different faculties or genders for example, was not performed and would have improved integrity of results.

Recommendations for future studies would include assessing socio-demographic factors of the participants and conducting a longitudinal study to assess the potential cause, variation and effect of depression over a prolonged period, especially during test/assessment times. The assessment of varying intervention treatments for long term effects (among students from various socio-demographic backgrounds) for depression alleviation would be a worthy addition. Comparison of trends between South African students from private and non-private universities may also be valuable, as the stress factor of financial stability may considerably impact severity and degree of depression [28] with Higher Education Institutions in South Africa being a prime example due to the 2015-2017 student protests where students called for free quality education and spoke up against, primarily, financial exclusion [29], while a subsequent 2020 study conducted on medical students conveyed that these protests may have had a direct impact on the student's mental health as finances were the most aggravating stress factor for these protesting students [30].

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