Original Article

Epidemiological Determinants of Depression and Its Associated Coping Mechanisms among College Students Confined during COVID-19 Lockdown: A Cross-Sectional e-Survey in India

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Abstract

Introduction: During COVID-19 pandemic lockdown, mental health of students was highly pregnable to the loss of social connectedness, disarray of normal pattern of activities as well as academic issues. Adopted coping mechanisms may have played a significant role in surmounting the challenges related to the pandemic. The main aim of the survey is to evaluate the prevalence of depression, its determinants, and association with coping mechanisms among college students during COVID-19 lockdown. **Materials and Methods:** College students were invited during lockdown to participate in a nationwide cross-sectional e-survey using Snowball sampling technique (dated October 6th–30th, 2020). A total sample size of 920 was calculated. A self-administered questionnaire regarding sociodemographic characteristics, COVID-19 related experiences along with two scales (Patient Health Questionnaire-9 [PHQ-9], and Carver Brief-Coping Orientation to the Problem Experienced -28) for assessment of depression and adopted coping mechanisms was applied to participants. Chi-square test, independent *t*-test, Pearson's correlation, and hierarchical multiple regression analysis were used to investigate the determinants of depression and its association with coping mechanisms in college students. **Results:** On analysis of 884 qualified participants, it was revealed that 402 (45.5%) participants have depressive symptoms ranging from moderate to severe level. The mean score of PHQ-9 was 9.82 ± 6.61. Nearly 85% students were lagging behind in studies. Around 5%–10% of students initiated/increased the consumption of substances. The main determinants of depression in this study were age group of 21–24 years, thought of lagging behind in studies and family members/friends/relatives diagnosed with COVID-19. Adaptive coping mechanisms (emotional support, religion, and humor) were significantly associated with lower depressive symptoms and maladaptive coping mechanisms (self-distraction, denial, behavioral disengagement, and venting) were significantly associated with higher depressive symptoms among students. **Conclusions:** This survey revealed multiple determinants of depression, mainly including academic worries among college students. The college staff should provide a well-structured pedagogical framework to encourage them and alleviate the unpleasant psychological effects of pandemic on students.

Keywords: College students, COVID-19 lockdown, determinants, moderate to severe depressive symptoms

Introduction

COVID-19, a viral outbreak, started to spread across the globe rapidly and was declared a health emergency of international concern by the WHO in January 2020.[1] By March 11, 2020, around 114 countries were affected by the coronavirus which has quavered humankind to its core, thus WHO declared the COVID-19 a pandemic.[2] To restrict the spread of this contagion, most of the countries have adopted social distancing as a preventative approach. This brought about lockdown and mass closure of educational universities across the globe. Imposition of the same in India has forced 37.4 million students pursuing higher studies to remain confined at home which has

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Submitted: 01-Jan-2021 **Revised:** 28-Mar-2021
Accepted: 06-Apr-2021 **Published:** 26-Jun-2021

Access this article online

Quick Response Code:

Website: www.actamedicainternational.com

DOI: 10.4103/amit.amit_1_21

How to cite this article: Garg S, Chauhan A, Verma D, Chaudhary K, Singh S, Bansal K. Epidemiological determinants of depression and its associated coping mechanisms among college students confined during COVID-19 lockdown: A cross-sectional e-survey in India. Acta Med Int 2021;8:62-70.

increased the uncertainty and existential challenges regarding education at all levels.[3] Because of this, students were retracted from face-to-face learning, and entire curriculum was transitioned into a newer virtually delivered setup (online classes, virtual group discussions, and webcasting), mainly for the students who were at various levels in their academic year/courses.[4]

Among college students, greater level of mental distress about their professional career and academic problems was experienced even under normal situation, which might be further intensified due to online teaching and social isolation during the pandemic.[5] Along with the off-campus learning, concern about indefinite postponement of the examinations, increased barriers in professional identity formation, disruption of current admission procedures, difficulty in adapting to e-learning, and modified academic courses, also left the students in a more stressful and apprehensive situation.[4,6] Students may encounter the raised pressure of studying without any assistance and lower enthusiasm toward studying in general. Persistent lack of peer interaction, adverse lifestyle changes, fear of acquiring infection, worry about the well-being of their families, and economical distress faced by them also lead to loneliness in the students and increase the susceptibility to multifaceted psychological problems.[5] Previous surveys[7,8] identified that the pandemic is responsible for the exacerbation of preexisting mental health problems and straining the physical, emotional, and mental well-being of the students. In response to the pandemic and on the basis of lockdown experiences, recent literature observed the detrimental consequences on the psychological health of the students including depression, anxiety, PTSD, stress, sleep disturbances, and fear,[9,10] eventually leading to start or increased of potentially addictive behavior to overcome these negative impacts.[11] Those who were in recovery in protected environment experienced academic stresses and ultimately faced relapse due to a heightened desire to consume the substances. A systematic review analyzed that functional coping mechanisms adapted by individuals during infectious disease outbreaks help in alleviating the psychological consequences and maintaining their physical and psychological well-being.[12]

Recent research assessed that the mental health issues were comparable or exceeded the morbidities related to the virus itself.[13] Thus, a detailed investigation should be carried out during COVID-19 outbreak to measure the determinants of psychological problems in vulnerable population and to plan effective psychological interventions. As far as we are aware, there are already very few studies in India[6] about the prevalence of psychological morbidities in the college students but no such study about the coping mechanisms in students during the COVID-19 pandemic has been conducted in Indian context. Therefore, the current study is the first nationwide survey during COVID-19 outbreak which has been undertaken to evaluate the prevalence of self-reported symptoms of depression and its determinants among college students and to assess its association with coping mechanisms.

Materials and Methods

Study design and settings

This was a cross-sectional and observational study. It was an e-survey performed in India, using social media platforms in October 2020. This study was carried out after getting Ethical approval from the Institutional Ethical Committee Board (UHSR/PS/20/4803) and in accordance with Ethical Committee standards and the Helsinki declaration. Only one response per candidate was accepted to curb multiple responses from a single participant, and all the questions were made compulsory in order to eliminate the possibility of partial responses. During the study, the anonymity and confidentiality of the participants were maintained as their personal information like name or contact was not asked.

Sample size

The prevalence or expected proportion (P) is 34% as the prevalence of depressive symptoms in the previous survey.[14] Let us assume the relative precision 9% (d). The sample size (N) = 920 was needed to be studied after taking 95% confidence interval (Z). The value of Z is 1.96 (constant).

$$SAMPLE\ SIZE\,(N) = \frac{Z^2 P(1-P)}{d^2}$$

Study sample

Students enrolled in universities or colleges or in any other institutions across India were target population. All the students aged 18 years or older, able to read and understand English, and willing to give informed consent were included in the survey.

Data collection procedure

A snowball convenience sampling method was applied to collect data from students. A web-based questionnaire was created using Google Forms with an appended consent form, consisting of 45 didactic/multiple choice questions. A shareable link was sent to groups of students through WhatsApp, Facebook, and e-mails on October 6, 2020 at 11:00 AM. It was encouraged to fill the pro forma independently, and participants were requested to roll out the link to as many participants as possible through their contacts. On opening the link, study participants were directed to the consent form. Before taking part in the survey, it was imperative for the participants to read and choose "yes" on the consent form describing the purpose and nature of the study. Then, participants were autodirected to several consecutive questions which they had to answer, after giving the consent of their involvement in the survey. The survey was closed on October 30, 2020 at 10:00 PM as responses equal to calculated sample size (n = 920) of students were obtained. The data were examined, and 36 responses were removed as the participants clicked "No" on the consent form. Hence, finally, 884 participants were enrolled in this study for further analysis.

Measures

This self-reported e-questionnaire had five sections, consisting of brief information regarding the study in

section 1, informed consent in section 2, and about the basic information of students in section 3. Section 4 had Patient Health Questionnaire-9 (PHQ-9) to measure the current mental status of students. Section 5 had Brief-Coping Orientation to the Problem Experienced (COPE) 28 to analyze the coping mechanisms used by students during COVID-19 lockdown.

Basic information

This section of the survey had ten questions regarding sociodemographic characteristics along with student's experiences during the COVID-19 pandemic. Sociodemographic data were collected in the form of current age of student, gender of student (male/female), part of country to which the student belongs to (North/Central/East/West/South), their place of residence (urban/rural), and their course of the study. Student's experiences during the COVID-19 pandemic was assessed by asking the questions concerning, whether student is lagging behind in study (yes/no), whether they had contact with COVID-19-positive cases (yes/no), any family/friend/relative diagnosed with COVID-19 (yes/no), and about their tobacco smoking and alcohol drinking status (initiated or increased the consumption – yes/no).

Patient Health Questionnaire-9 scale

PHQ-9 was proved to be a very useful tool to detect depression in general population, it being the main reason of selecting this tool for the present study.[15] PHQ-9, a 9-item depression module, is easy to administer and used to measure the level of depression. Participants were asked, over the past 2 weeks, how often they had been bothered by the depressive symptoms due to COVID-19. Each item is scored from 0 to 3 (0 = not at all, 1 = several days, 2 = more than half the days, and 3 = nearly every day). A total score ranges from 0 to 27. The level of depression is categorized as "0–4 = minimal," "5–9 = mild," "10–14 = moderate," "15–19 = moderately severe," and ">20 = severe." In context of the present study, during the analysis, two groups were created using score <10 for nondepressed group and >10 for depressed group, because the cutoff score of ten had shown good sensitivity (82%) and specificity (93%) in a structured diagnostic interview.[16] The reliability score of the scale in terms of Cronbach's alpha in the present study is 0.894.

The Carver Brief-Coping Orientation to the Problem Experienced inventory

The coping mechanisms adopted by students during pandemic were assessed by the Brief COPE-28 scale. It consists of 28 multidimensional items, measuring 14 coping mechanisms (Self-distraction: active coping, denial, substance use, use of emotional support, use of instrumental support, behavioral disengagement, venting, positive reframing, planning, humor, acceptance, religion, and self-blame). The instruction in the scale was modified to capture COVID-19-related coping mechanisms, changed to "these items deal with ways you have been coping with the COVID-19 in your life…" Each dimension contains two items. These items are rated using a 4-point Likert type scale from 1 to 4 with 1 being "I have not been doing this at all" and 4 being "I have been doing this a lot." Scores are summed and averaged for each dimension. The higher average score represents the more frequent use of that particular coping mechanism.[17] It was found that "self-blame," one of the mechanisms, was not applicable to the pandemic and was not included in this study. The Cronbach's alpha for the present study is 0.91, with a range from 0.90 to 0.91, showing good internal reliability.

Statistical analysis

The data were entered and analyzed using SPSS 25.0 (IBM, Chicago, IL, USA). Cronbach's alpha coefficient was calculated to assess the internal consistency or reliability of the scales. Categorical variables were calculated as frequencies and percentages and were compared by Chi-square test to analyze the association between depression and categorical variables. Continuous variables were calculated as mean and standard deviations and were compared by independent Student's *t*-test (parametric) and Mann–Whitney U-test (nonparametric). Pearson's correlation and Spearmen first rank order correlation was used to find the correlation between depression and coping mechanisms. Finally, Hierarchical Multiple Regression analysis was applied to find out the significant association between continuous independent variable (coping mechanisms) and dependent variable (depression) after controlling the sociodemographic factors and COVID-19-related experiences of the students. Statistically significant level was set at $P < 0.05$ (two tailed).

Results

Description of variables (sociodemographic characteristics and COVID-19-related experiences) of students

Eight hundred and eighty-four students were enrolled in the present study. Out of them, 75% (662) students were female, and the remaining 222 were male. The mean age of the students was 21.34 years (standard deviation = 1.98) and the ages ranged between 18 and 28 years. Most of the participating students (61%) were within the age group of 21–24 years followed by age group of 18–20 years (34%). Almost all of the students (90%) lived in Northern India and more than half of them (56%) belonged to rural areas. A large number (710) of students were from higher academic courses (MBBS 60%, Ayurvedic 15%, and Engineering 6%) [Table 1]. Table 2 explained that only 33% students' family members/friends/relatives were diagnosed with COVID-19. Around 88% students were protected from any direct contact with positive cases of COVID-19. A high proportion (85.3%) of students believed that they were lagging behind in studies during the pandemic and the rest had satisfactory feelings about their studies. In addition, a minimal number of participants, 42 (one in 20) and 88 (one in 10), respectively, initiated or increased the consumption of tobacco and alcohol during the lockdown.

Prevalence of Depression on Patient Health Questionnaire-9

A large number 402 (45.5%) of students had depressive symptoms including 24% students with moderate, 10.4%

Table 1: Sociodemographic characteristics of students with prevalence of depression in subgroups

Variables	Sub groups	Total students (*n*=884), *n* (%)	Nondepressed group (minimal/mild) (*n*=482), *n* (%)	Depressed group (moderate/moderately severe/severe) (*n*=402), *n* (%)	*P*
Age (years)	18-20	298 (33.7)	166 (34.4)	132 (32.8)	0.043*
	21-24	538 (60.9)	282 (58.5)	256 (63.7)	
	24-28	48 (5.4)	34 (7.1)	14 (3.5)	
Gender	Female	662 (75)	352 (73)	310 (77)	0.163
	Male	222 (25)	130 (27)	92 (23)	
Residence	Urban	388 (44)	216 (44.8)	172 (42.8)	0.545
	Rural	496 (56)	266 (55.2)	230 (57.2)	
Indian region	North	792 (89.6)	428 (88.8)	364 (90.5)	0.235
	South	10 (1.1)	8 (1.7)	2 (0.5)	
	East	16 (1.8)	6 (1.2)	10 (2.5)	
	West	30 (3.4)	18 (3.7)	12 (3)	
	Central	36 (4.1)	22 (4.6)	14 (3.5)	
Stream	MBBS	528 (59.7)	288 (59.8)	240 (59.7)	0.063
	Ayurveda	132 (14.9)	60 (12.4)	72 (17.9)	
	Engineering	50 (5.7)	28 (5.8)	22 (5.5)	
	Arts	174 (19.7)	106 (22)	68 (16.9)	

*Represent $P<0.05$

Table 2: COVID-19 related experiences of students during pandemic along with the prevalence of depression in their subgroups

Variables	Sub groups	Total students (*n*=884), *n* (%)	Nondepressed group (minimal/mild) (*n*=482), *n* (%)	Depressed group (moderate/moderately severe/severe) (*n*=402), *n* (%)	*P*
Any family member/friends/relative diagnosed with COVID - 19	Yes	294 (33.3)	140 (29)	154 (38.3)	0.004**
	No	590 (66.7)	342 (71)	248 (61.7)	
Have you come in direct contact with COVID-19 positive patient?	Yes	106 (12)	52 (10.8)	54 (13.4)	0.228
	No	778 (88)	430 (89.2)	348 (86.6)	
Do you think that you are lagging behind in study?	Yes	754 (85.3)	378 (78.4)	376 (93.5)	<0.001***
	No	130 (14.7)	104 (21.6)	26 (6.5)	
Have you initiated or increased the consumption of tobacco during COVID-19 pandemic?	Yes	42 (4.8)	24 (5)	18 (4.5)	0.727
	No	842 (95.2)	458 (95)	384 (95.5)	
Have you initiated or increased the consumption of alcohol during COVID-19 pandemic?	Yes	88 (10)	40 (8.3)	48 (11.9)	0.072
	No	796 (90)	442 (91.7)	354 (88.1)	

**Represent $P<0.01$, ***Represent $P<0.001$

with moderately severe, and 11.1% with severe depressive symptoms. Mean score on PHQ-9 was 9.82 (Standard deviation = 6.16) as shown in Table 3. Around 47% female and 41% male students reported depressive symptoms. The severity of depressive symptoms did not vary among sociodemographic factors except between the age groups, where students in their early twenties (21–24 years of age group) were significantly ($P = 0.043$*) associated with depressive symptoms as compared to other age groups [Table 1]. The severity of depressive symptoms also varied in students who had any family member/relative/friend diagnosed with COVID-19 infection (38% vs. 29%; $P = 0.004$**). Chi-square analysis also showed that a larger percentage of students in depressive group thought that they were lagging behind in studies during this pandemic (93% vs. 78%; $P < 0.001$***). The survey did not reveal any significant effect of other COVID-19 related experiences of students on depressive symptoms [Table 2].

Coping mechanisms adopted by students during confinement and its correlation

Adaptive coping mechanisms were more often used in this survey than maladaptive coping mechanisms. Acceptance, positive reframing, and self-distraction were the most commonly used, and substance use, venting, and behavioral disengagement were rarely used coping mechanisms in students [Figure 1]. Adaptive coping mechanisms (except humor) and self-distraction were more likely to be used by female students, while substance use (2.77 vs. 2.44), behavioral disengagement (3.80 vs. 3.70), venting (4.37 vs. 4.33), and humor (4.32 vs. 4.29) were used by male students as shown in Figure 1. Emotional support ($P = 0.021$*), religion ($P < 0.001$***), and humor ($P < 0.001$***) were the coping mechanisms significantly and most likely to be used by students in nondepressed group, while self-distraction ($P = 0.024$*), denial ($P < 0.001$***), behavioral

disengagement ($P < 0.001$***), and venting ($P < 0.001$***) were the coping mechanisms significantly and most likely to be used by students in depressed group [Table 4]. Depression among students was weakly negatively correlated to emotional support ($r = -0.078$, $P = 0.04$*), and strongly negatively correlated to religion ($r = -0.445$, $P < 0.001$***) and humor ($r = -0.297$, $P < 0.001$***) which explained that these coping mechanisms were associated with lower prevalence of depression. In addition, depression was also weakly positively correlated to self-distraction ($r = 0.076$, $P = 0.024$*) and moderately positively correlated to behavioral disengagement ($r = 0.288$, $P < 0.001$***), venting ($r = 0.286$, $P < 0.001$***), and denial ($r = 0.209$, $P < 0.001$***) which explained that these coping mechanisms were associated with higher prevalence of depression in students during COVID-19 outbreak [Table 4].

Hierarchical multiple regression analysis of depressive symptoms

Hierarchical Multiple Regression Analysis of depressive symptoms (only significant variables) [Table 5] revealed that Model 2 (F (10,873) =9.847, $P < 0.001$***) and the final Model 3 (F (23,860) =34.842, $P < 0.001$***) were statistically significant which represents that the present multiple regression model is a good fit of the data. The value (0.620) of multiple correlation coefficient (R) suggested a moderate level of relationship between coping mechanisms and depression. The value (0.385) of coefficient of determination (R^2) suggested that coping mechanisms explained a total of 38.5% variance of depression. This study generalizes well because value of adjusted R^2 (0.378) is very close to value of R^2 (0.385). Standardized coefficient (β) indicates the impact of independent variable on dependent variable. Coping mechanisms such as humor (β = −0.622, $P < 0.001$***), venting (β = −0.499, $P = 0.007$**), religion (β = −0.396, $P < 0.001$***), emotional support (β = −0.160, $P < 0.001$***), active coping (β =0.143,

Table 3: Numbers and percentages of student showing different levels of depression on Patient Health Questionnaire-9

Level of depression (PHQ-9 score)	*n* (%)
None - minimal depression (0-4)	216 (24.4)
Mild depression (5-9)	266 (30.1)
Moderate depression (10-14)	212 (24.0)
Moderately severe depression (15-19)	92 (10.4)
Severe depression (>20)	98 (11.1)
PHQ-9 Scale Score, mean±SD	9.82±6.616

PHQ-9: Patient health questionnaire - 9, SD: Standard deviation

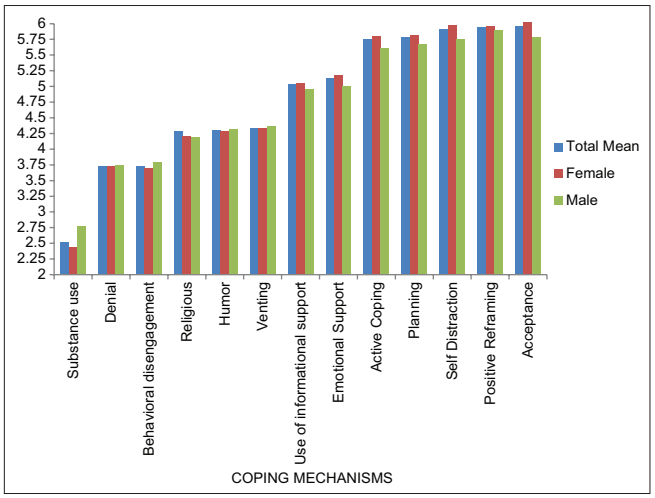

Figure 1: Coping mechanisms adopted by students during the COVID-19 pandemic. Adaptive coping mechanisms includes (active coping; emotional support; use of informational support; positive reframing; planning; acceptance; religious; and humor). Maladaptive coping mechanisms include (self-distraction; denial; substance use; behavioral disengagement; and venting)

Table 4: Comparison of coping mechanisms used by students and correlation with depressed group

Coping mechanisms	Mean±SD			*P*	Depressed group (*r*)
	Total	Nondepressed group (minimal/mild)	Depressed group (moderate/moderately severe/severe)		
Active coping	5.66±1.78	5.66±1.89	5.87±1.64	0.088	0.057
Emotional support	5.13±2.01	5.27±2.02	4.96±1.98	0.021*	−0.078**
Use of informational support	5.03±2.05	5.06±2.06	5.00±2.05	0.676	−0.014
Positive reframing	5.94±1.82	6.03±1.89	5.83±1.73	0.101	−0.055
Planning	5.78±1.89	5.80±2.02	5.75±1.73	0.646	−0.015
Acceptance	5.96±1.92	5.92±2.02	6.00±1.80	0.520	0.022
Religion	4.30±2.15	5.25±2.05	3.33±1.82	<0.001***	−0.445***
Humour	4.30±2.02	4.95±1.91	3.76±1.90	<0.001***	−0.297***
Self-distraction#	5.92±1.82	5.80±1.97	6.07±1.60	0.024*	0.076**
Denial#	3.73±2.12	3.32±1.95	4.21±2.20	<0.001***	0.209***
Substance use#	2.52±1.46	2.44±1.34	2.63±1.59	0.057	0.064
Behavioral disengagement	3.73±2.02	3.20±1.92	4.37±1.96	<0.001***	0.288***
Venting	4.34±2.05	3.80±1.98	4.99±1.96	<0.001***	0.286***

*Represent $P<0.05$, **Represent $P<0.01$, ***Represent $P<0.001$, #Represents the variables where Mann-Whitney U- test and Spearman correlation analysis was applied where Mean <2 SD. *r*: Correlation coefficient, SD: Standard deviation

Table 5: Hierarchical multiple regression analysis: Association between depression (depressed group versus nondepressed group) and coping mechanisms adjusted for sociodemographic factors and COVID-19-related experiences of the students

Serial number	Variables	*R*	R^2	▲R^2	▲*F* (df)	*P*	β
Model 1	Sociodemographic						
	Gender	0.087	0.008	0.002	1.353 (5878)	0.240	−0.067*
Model 2	COVID-19 related experiences						
	Any member with COVID-19	0.246	0.061	0.050	9.847 (10,873)	<0.001***	−0.090**
	Lagging behind in study						−0.189***
	Smoking status						0.093**
	Alcohol status						−0.089**
Model 3	Coping mechanisms						
	Active coping	0.620	0.385	0.378	34.842 (23,860)	<0.001***	0.143***
	Emotional support						−0.160***
	Positive reframing						−0.100**
	Religion						−0.396***
	Humor						−0.622***
	Denial						0.085**
	Substance use						−0.068**
	Behavioral disengagement						0.088***
	Venting						−0.499***

*Represent $P<0.05$, **Represent $P<0.01$, ***Represent $P<0.001$. R: Multiple correlation coefficient, R^2: Coefficient of determination; ▲R^2: Adjusted R^2, df: degree of freedom, β: Standardized coefficient

$P < 0.001$***), and lagging behind in study (β = −0.189, $P < 0.001$***) coefficients had more impact on depression than other variables having a value of standardized coefficient closer to zero.

Discussion

Subject of interest is the status of mental health of college students round the globe as they are undergoing a lot of mental challenges during the pandemic lockdown. Indeed, there was an imperative need to know the psychic health status of college students and to scrutinize its determining factors. This nationwide cross-sectional e-survey determined that nearly half of the college students have moderate-to-severe self-reported depressive symptoms along with several determinants related to pandemic contributing to depressive symptomatology and correlation between depression and coping mechanisms in students confined during COVID-19 lockdown of universities/colleges.

Prevalence of depression and association with determinants

The present study evaluated that three-fourths of college students presented with mild-to-severe depressive symptoms (PHQ >4) during COVID-19 pandemic, majority (24%) with moderate depressive symptoms (PHQ = 10–14). Around 45.5% students were afflicted with moderate-to-extremely severe (PHQ > 10) depressive symptoms, suggesting higher prevalence among college students and may require interventions. This higher prevalence of moderate-to-severe depressive symptoms was consistent with findings of a preliminary study done during the initial stages of the pandemic lockdown in Bangladeshi[18] students (53%), which is surely alarming. This could be ascribed to unprecedented level of stressful situations encountered during this drastic pandemic like feeling of being a burden on parents, decreased social connections and communications, and loss of autonomy among students. In contrast to the present study, lesser prevalence of depression (34%) was revealed in a study conducted by Odriozola-González *et al*. on mixed students' population of Spanish University.[14] A nation-wide large scale (n = 69,054) cross-sectional online survey in France during this confinement of students also reported lower prevalence of depression among students as compared to the present study.[19] Another multicountry study[20] during COVID-19 on 1057 participants using DASS, investigated the depressive symptomatology in about 60% of their sample population, much higher than the present study. The findings of the present survey might not be exactly comparable or consistent with the results assessed by other surveys around the globe because of nonidentical methodology and tools used, different sample sizes, and sociocultural dissimilarities.

The higher levels of depressive symptoms in the present study population were not influenced by sociodemographics (gender, place of residence, region of living, and stream), similar to a study done by Saraswathi *et al*.[21] in Indian context and Tayefi *et al*. in Iranian students.[22] This result indicates that students of every stream throughout the country, either male or female, might have faced similar negative emotions and problems related to pandemic during the lockdown. On the contrary, the cross-sectional survey in the context of the COVID-19 pandemic by Sartorao Filhao *et al*.[23] pointed out that depressive symptoms were significantly influenced by a few sociodemographics such as gender and place of residence. Among the sociodemographics, only age group factor was significantly associated with depressive symptoms in students

which is precisely similar to a study done by Islam *et al*.[18] The proportion of depressive symptoms was significantly higher among the participants aged 21–24 years (63.7%). Students of this age group were in their final academic sessions or going to complete their graduation and were more worried about future employment which might be the reason for being in depressed group in a higher proportion.[24]

This study identified significant association regarding COVID-19-related experiences' factors such as any family members/relatives/friends diagnosed with COVID-19 and lagging behind in study, with depression, also supported by other studies done in China[7] and Bangladesh.[18] Cao *et al*.[7] established that knowing the diagnosed COVID-19 patients leads to impairment in psychological functioning of students. Being at risk of acquiring dreadful infection increases the level of depression among college students during this confinement whose family members/relatives/friends are diagnosed with COVID-19.[25] There is documentation from studies by Cao *et al*.[7] and Islam *et al*.[18] investigating the mental health status of students which assessed that lagging behind in studies was significantly associated with depressive symptoms in students, in line with the results of the present study. Due to sustained closure of colleges/universities, students might have thought that online classes could not accomplish their prerequisites.[26] The present study revealed that higher proportions (85.3%) of participants who thought that they might be lagging behind in studies were significantly getting depressive symptoms. Lagging behind in studies lead to loss of satisfaction and failure to achieve academic goals which eventually produces depressive symptoms in students.[26]

Coping mechanisms and correlation with depression

On the basis of mean scores, it was revealed that a larger number of students used various adaptive coping mechanisms at the same time to cope with stressful situations generated by the COVID-19 pandemic. In the present study, acceptance was the most common coping mechanism used by college students followed by positive reframing and self-distraction which were related with healthier mental status as suggested previously by Elfström *et al*.[27] It indicates that students accepted the reality of COVID-19 and distracted themselves with other activities by setting a positive path cognitively. These results were consistent with findings of a survey done in Greece during COVID-19 where acceptance and positive reframing were used by a larger number of participants.[28] Remarkable inconsistencies from the present study were reported in a survey by Liang *et al*.,[29] in which planning and active coping were the main coping mechanisms adopted by students. Substance use to overcome the effects of COVID-19 was the least used coping mechanism followed by propensity of students to deny the situations created by this dreadful pandemic (denial). Similar presentation of least used coping mechanisms was also shown by Skapinakis *et al*.[28]

In this study, depression was correlated with a few of both adaptive and maladaptive coping mechanisms. Depression was negatively correlated with adaptive coping mechanisms (emotional support, religion, and humor) meaning that students with higher levels of depressive symptoms endorsed lower levels of these coping mechanisms. These results are echoed in previous reports on relation between coping mechanisms and responses to pandemic in Israel[30] and Spain.[31] Few inconsistencies from the findings of the present study were reported in a survey by Babore *et al*.[32] It could be suggested that adaptive coping mechanisms empower the participants to reinterpret negative emotions in a positive way and help in buffering the depressive symptoms in students.[33] Depression was positively correlated with maladaptive coping mechanisms (self-distraction, denial, behavioral disengagement, and venting) meaning that students with higher levels of depressive symptoms endorsed higher levels of these coping mechanisms. Students might have developed poor problem-solving skills and tending to have the inclination to avoid the situation using the maladaptive coping strategies during the pandemic. The results of Babore *et al*.,[32] a cross-sectional survey using COPE-NVI-25, also showed that adoption of maladaptive coping mechanisms increased the vulnerability of depressive symptoms in their study population. Previously, in literature, it was argued that maladaptive coping mechanisms could alleviate the stress by releasing pessimistic emotions and provisionally drift their focus away from stressors and were finally viewed as problem-solving mechanisms.[34]

In adjusted (sociodemographic characteristics and COVID-19-related experiences) multiple regression analysis, it was found that several coping mechanisms (active coping, emotional support, positive reframing, humor, religion, denial, substance use, behavioral disengagement, and venting) were significantly associated with depression among college students. It was revealed that participants who had lower ratings on adaptive (emotional support, positive reframing, humor, and religion) coping mechanisms and higher ratings on maladaptive (denial and behavioral disengagement) coping mechanisms, presented with higher levels of depressive symptoms. These findings were consistent with a preliminary study done by Lo Buono *et al*.,[35] in which seldom use of adaptive strategies and persistent use of maladaptive strategies were associated with negative mental health outcomes. Contrary to expectations, in the present study, it was observed that higher ratings on adaptive (active coping) coping mechanism and lower ratings on maladaptive (substance use and venting) coping mechanisms were associated with higher levels of depressive symptoms. Similar to the present survey, a study on Italian population during the COVID-19 pandemic also found that active coping was positively related to depression.[33] Active coping (excessive guidance/seeking support) might have resulted in more criticism and interpersonal rejection, even after revealing their fears/emotions, which in turn creates a lot of stress and could magnify depressive symptoms.[36] Venting, in short term, acts as a useful mechanism in relieving the stress by letting out the strong negative emotions. Similarly,

substance use helps in deviating the focus from perception of the stressful situations or negative experiences.

The strengths of this survey can be explained on the basis of several points. This online survey followed the WHO norms of "social distancing." The sampling technique used in the study was quite effective which helped in collecting the large sample data within a short time period. The survey also helped in finding the vulnerable groups of students during COVID-19 lockdown using standardized validated tools with very good internal reliability. The findings of the present study added new evidences concerning psychological impacts of the COVID-19 pandemic, adopted coping mechanisms and their relations among college students.

This study has several limitations. First, it is an online survey and no face-to-face interaction due to which chances of recall, selection, response, and social desirability bias cannot be ruled out. Second, impact of the COVID-19 on psychology of students might be long term or changeable, which is not possible to investigate with a cross-sectional design study. Thus, longitudinal studies are required in future, using tools especially developed for COVID-19 to get in-depth information about the mental health of students even after the opening of the universities/colleges. Due to the stigma prevalent regarding COVID-19 and mental illnesses in India, students having mental illness/having suffered from COVID-19 infection might not have participated in the study, and it would result in underreporting of psychological morbidities.

Conclusion and Future Suggestions

This study concluded that a high proportion of students expressed depressive symptoms while confined during COVID-19 lockdown. It conveys that special attention must be paid to students who are in their early twenties and lagging behind in studies, as well as whose family member/friends/relatives are diagnosed with COVID-19. It also provides empirical evidence that students coped with this pandemic using adaptive mechanisms (negatively correlated) rather than maladaptive mechanisms (positively correlated). The government should support and encourage families/parents to provide positive surroundings without pressuring the students about their future academic pursuits. Psychological support provided by colleges should be fully oriented to the problems related to pandemic situations. Furthermore, future research should be conducted to explore the other societal factors influencing the mental health of students and relation between coping mechanisms and psychological impacts of COVID-19 on students.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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