Prevalence of and factors associated with depression, anxiety and stress among adolescents in Bangladesh during the COVID-19 pandemic: A population-based study [version 1; peer review: 1 approved with reservations]

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Abstract

Background: The COVID-19 pandemic has brought significant mental health challenges among adolescents in Bangladesh. This study aimed to investigate the prevalence of and associated factors of depression, anxiety and stress among adolescents of Bangladesh during the COVID-19 pandemic.

Methods: This cross-sectional study used a two-stage cluster sampling procedure for collecting the sample. A total of 2030 adolescents were enrolled from urban and rural areas of all eight administrative divisions of Bangladesh. The Depression, Anxiety, and Stress-21 (DASS-21) scale was used to assess depression, anxiety, and stress in adolescents. In addition, data on sociodemographics, parenting style, food insecurity, and anthropometric measures were also obtained. Linear regression was done to measure the risk factors.

Results: Depression, anxiety, and stress were identified in 18%, 14%, and 16% of adolescents, respectively. Sociodemographic characteristics such as female sex, higher age, urban resident, food insecurity, and poor parenting were significant risk factors for depression, anxiety, and stress during the COVID-19 pandemic. In addition, inconsistent parenting has been identified as a significant risk factor for depression only.

Conclusions: During the COVID-19 pandemic in Bangladesh, depression, anxiety, and stress are found quite common among...
adolescents. Therefore, necessary action is required to prevent the mental health epidemic from spreading.

**Keywords**
COVID-19, Depression, Anxiety, Stress, Adolescent, Rural, Urban, Bangladesh

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**Introduction**

Adolescence is a crucial phase of physical and psychological development, and adolescents are vulnerable to different mental health conditions that are often overlooked (Kieling et al., 2011). Mental health disorders in this population have been recognized as a significant public health challenge given that, according to the World Health Organization (WHO) data, 13% of adolescents worldwide suffer from psychological problems (WHO, 2021). Thus, given the disruption to their daily lives during the COVID-19 pandemic, which has resulted in severe mobility restrictions, including partial or complete lockdowns, it is not surprising that adolescents have experienced an upsurge in psychological problems (Racine et al. 2021). In adolescents already suffering from mental health conditions, sudden closure of academic institutions and extracurricular venues, unexpected bereavements, social isolation, increased screen time, and chronic stress may exacerbate the symptoms (Imran et al., 2020).

Depression, anxiety, and stress have been recognized as the three most common mental health issues among adolescents (Hicks and Heastie, 2008). Globally, depression and anxiety are ranked as the fourth and ninth leading cause of disease and disability in this age group (Reddy, 2010). However, the prevalence of depression and anxiety among adolescents is increasing around the globe (Zhang et al., 2021). In a survey conducted in 2019 in Bangladesh by Anjum et al. (2019) around 37% of participating adolescents reported being affected by depressive disorders. In another study conducted among 622 Bangladeshi adolescents, 30% and 16.4% of participants experienced depression and anxiety, respectively (Moonajilin et al., 2020). Since the COVID-19 outbreak in Bangladesh in March 2020, several preventive nationwide measures have been taken to limit the infection rate, including the closure of educational institutions, as well as episodic lockdowns and travel bans (Hossain et al., 2021). These measures have had an adverse effect on adolescents’ psychological well-being even though this age group was at the lowest risk of infection and fatal outcome.

As research on the mental health status of Bangladeshi people during the COVID-19 epidemic is limited, data pertaining specifically to adolescents is lacking (Das et al., 2021; Abir et al., 2021; Khatun et al., 2021; Islam et al., 2020). Thus, it is worth noting that through an online-based cross-sectional study involving 10,609 Bangladeshi participants conducted in 2021, Abir et al. (2021) found that 34% of the sample suffered from moderate depression during the COVID-19 pandemic, while in the same year, Das et al. (2021) found that 38% and 64% of 672 participants aged 15–65 years suffered from depression and anxiety, respectively, in Bangladesh. In another study conducted among Bangladeshi university students aged 18–29 years during the pandemic, 35.2%, 40.3%, and 37.7% prevalence of severe depression, anxiety, and stress, respectively, was noted (Islam et al., 2020). This is a marked increase compared to 2020, when Safa et al. (2021) reported 11.8% prevalence of severe anxiety among medical students, while 3.3% of the sample suffered from severe depression.

In these studies conducted in Bangladesh, different factors have been found to be associated with poor mental health during the COVID-19 pandemic, including female sex, unemployment, living without family, sharing the household with a greater number of family members, urban residence, sedentary lifestyle, greater screen time, and dissatisfaction with the system adopted for remote learning (Das et al., 2021; Islam et al., 2020). Apart from these factors, age, marital status, fear of humiliation, inability to pay attention to studies, and anxiety associated with the risk of being infected by the virus were also linked to the poor mental health status of physicians and medical students (Khatun et al., 2021; Safa et al., 2021). Therefore, the objective of this study was to determine the prevalence of depression, anxiety, and stress symptoms among adolescents during the COVID-19 pandemic in Bangladesh. Its further objective was to assess the factors potentially associated with depression, anxiety, and stress among the study participants.

**Methods**

**Study design and setting**

This cross-sectional population-based study was carried out among a representative sample of adolescents from rural and urban areas of Bangladesh. A multistage random sampling method was applied for this purpose. Bangladesh is divided into eight administrative divisions, each comprising four to thirteen districts. Within each district, there are several subdistricts known as upazilas, encompassing both rural and urban areas. To ensure representation, we utilized a lottery system to randomly select one district from each division, resulting in a total of eight districts. For urban representation, we specifically chose the Sadar upazilas from the following four districts: Magura, Gazipur, Cumilla, and Mymensingh. Similarly, for rural representation, we included four additional sub-districts: Kamalganj in Moulivibazar district, Sadullapur in Gaibandha district, Banaripara in Barisal district, and Boraigram in Natore district. The municipal territory of the Sadar upazila, which serves as the district headquarters, was designated as the urban area. This municipal area is further divided into several wards, from which we randomly selected one ward from each chosen Sadar upazila as an urban data enumeration area.
In Bangladesh, each upazila is composed of multiple unions. For the purpose of rural data enumeration areas, we randomly selected one union from each chosen upazila. Additionally, each union consists of several wards, from which we randomly selected one ward for data collection.

Recruitment and training of data collectors took place up to two weeks from 16 May 2021. Afterward, pretesting of the questionnaire was done in the non-sampling area to bring out any discrepancies in the questionnaire as well as the eligibility of the data collectors and based on the findings of that further steps were taken. Finally, data collection was conducted between 26 May 2021 and 6 June 2021. Household mapping was performed in the data enumeration areas before the commencement of the study, and a list of eligible households where adolescents aged 14–19 years lived was prepared. In this study adolescents who were aged 14-19 years and who were residents at the data collection areas were included in this study. The participants who were absent at the time of data collection or were unwilling to participate were excluded from the study.

Sample size
With the 13.6% prevalence of mental health disorders among adolescents (NIMH and WHO, 2019), design effect of 1.3, and 5% margin of error, at 95% confidence interval, the approximate sample size was 234. The final sample size was calculated as 257*8 = 2,056 after considering division as the strata and the non-response rate of 10%.

Data collection
Sixteen data collectors and eight field supervisors were recruited and trained on data collection through a two-week intensive training program. Prior to the field data collection, field testing was conducted in order to assess the efficacy of the data collectors and the study instruments. During the data collection, data collectors approached the listed households and invite the potential participant for interview. Face-to-face interviews were conducted in an isolated place at the respondent’s residence, using REDCap (Research Electronic Data Capture) software through Computer Assisted Personal Interviewing (CAPI). During these home visits, participants’ height, weight, and blood pressure (BP) were taken manually using measuring tape, NuLife Plus digital weight scale, and OMRON HEM-7121, respectively. During the height and weight measurements, the participant was asked to stand still, looking forward, having removed any heavy objects, such as a wristwatch. At every step, same-gender data collectors were made available for participants.

Outcome measure
A Bengali validated version of the Depression, Anxiety, Stress Scale-21 (DASS-21) was used to measure the level of depression, anxiety, and stress among adolescents (Lovibond and Lovibond, 1995; NIMH and WHO, 2019). It consists of 21 items divided into three self-reported subscales (each with seven items) to assess depression, anxiety, and stress. All items require a response on a 4-point Likert scale (0 = “Did not apply to me at all”, 1 = “Applied to me to some extent, or some of the time”, 2 = “Applied to me to a considerable extent, or a good part of the time”, and 3 = “Applied to me very much, or most of the time”), with participants instructed to consider how they felt during the previous week. Each subscale’s final score was multiplied by two and evaluated based on its severity rating index. The depression, anxiety, and stress scores were determined by summing the values for all items across the three subscales. The findings were interpreted in the manner outlined in Supplementary Table 1.

Other measures
Sociodemographic measures
Pertinent sociodemographic data was obtained from the respondents, including age, sex, residential area (urban or rural), parental educational qualifications, parental marital status (currently married vs. separated, widowed, divorced, which were classed under “other”), number of siblings, and number of family members. The number of family members and number of siblings were then further categorized according to the ideal household size and total fertility rate of women in Bangladesh (BBS, 2018).

Alabama Parenting Questionnaire
The Alabama Parenting Questionnaire (APQ-9) is a nine-item questionnaire that examines three dimensions of parenting behaviors—positive parenting, inconsistent discipline, and poor supervision—with three items related to each dimension (Essau et al., 2006). The responses are given on a 5-point Likert-type scale, anchored at 1 (never) and 5 (always). The three dimensions of this scale were validated in a previous study and were found highly reliable (Elgar et al., 2007). We adapted this questionnaire for use with adolescents. For example, “You threaten to punish your child and then do not actually punish him/her” (inconsistent discipline) was replaced by “Your parents threaten to punish you and then do not actually punish you.” The overall APQ-9 score was calculated by adding the scores from each subscale.
Food insecurity index

The United Nations Food and Agricultural Organization—Voices of the Hungry initiative (FAO-VoH) developed the Food Insecurity Experience Scale (FIES) in 2014. This scale probes into the self-reported experiences related to food access due to the lack of money or other resources throughout a 12-month recall period, with no regard for frequency of occurrence. As the scale contains eight questions with two response options (yes/no), the total score ranges from 0 to 8, which is subdivided into three categories: food secure (0–3), moderate food insecurity (4–6), and severe food insecurity (7–8). In this study, food security was further dichotomized into food secure (0–3) and food insecure (4–8).

BMI

Using participants’ weight and height measurements, BMI (kg/m²) was calculated and was categorized based on the ranges provided for south Asian adolescents: <18.5 kg/m² – underweight, 18.5–22.9 kg/m² – normal weight, 23–24.99 kg/m² – overweight and ≥25 kg/m² – obese (WHO Expert Consultation, 2004).

Hypertension

Hypertension was defined as having either a systolic BP of 140 mm of Hg or a diastolic BP of 90 mm of Hg, or both.

Statistical analysis

Descriptive analysis was performed on the sociodemographic data, as well as the anxiety, stress, and depression scores. Frequencies and percentages were calculated as summary measures for the qualitative variables, while arithmetic means and standard deviations (SDs) were used to summarize the quantitative variables. Pearson correlation, independent samples t-test, one-way ANOVA, and multilinear regression model were employed to evaluate the relationships between variables. Independent variables with a p-value ≤ .1 in the bivariate model were entered into the multivariate model. We included adolescents’ sex and age, parental marital status, number of siblings, residential area, food security, positive parenting, inconsistent parenting discipline, and poor parental supervision as independent variables. Three separate multivariate linear regression models were constructed to determine the extent to which the independent variables explained stress, anxiety, and depression, respectively. The associations are reported using unstandardized regression coefficient (B). The sample size was large enough for regression analysis and there was no evidence of multicollinearity among variables. Normal P-P plots of regression-standardized residuals of the dependent variables were acceptable. Data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 24 for Windows. The raw data can be found under Underlying data (Salwa and Haque, 2023).

Ethical considerations

Ethical clearance was obtained from the Institutional Review Board of BSMMU (Memo no: BSMMU/2021/4408). Prior to data collection, the data collector provided a comprehensive explanation of the study’s objectives, as well as the potential benefits and risks involved, to both the parents and the adolescents. Written assent from the adolescents and written consent from their parents were obtained, respectively, in the presence of at least one witness.

Results

The study sample comprised of 2,030 adolescents aged 14–19 years, 41.4% of whom reported having experienced mental health disorders (95% CI = 39.2–43.6%), with a statistically significant female predominance (female vs. male: 66.9% vs. 33.1%, p-value < .001) and no rural–urban difference (40.1% vs. 42.7%, p-value > .05) (Table 1).

Figure 1 shows that depressive symptoms were reported by 18% of participating adolescents, while extremely severe depression was noted by 0.4% of the sample. At 16% and 14%, respectively, stress symptoms and anxiety were slightly less prevalent, and reached extremely severe levels in 1.2% and 0.3% of the cases.

Table 3 demonstrates that age (B = 0.575, p-value < .001) and female sex (B = 1.404, p-value < .001) were found to have significant relationships with depressive symptoms in the participating adolescents. Adolescents whose parents were separated, widowed, or divorced (B = 1.664, p-value < .001), who lived in urban regions (B = 1.701, p-value < .001), and who experienced food insecurity (B = 2.437, p-value < .001) showed a higher propensity for depressive symptoms compared to their counterparts. Again, Table 2 and Table 3 exhibit that positive parenting exhibited a substantial negative association with depression (B = -0.247, p-value < .001), whereas poor parental supervision had a significant positive relationship with depression (B = 0.218, p-value < .001).
Table 1. Distribution of depression, anxiety and stress among the participants (n=2,030).

<table>
<thead>
<tr>
<th>Variables</th>
<th>%</th>
<th>Depression</th>
<th></th>
<th>Anxiety</th>
<th></th>
<th>Stress</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean (min, max)</td>
<td>SD</td>
<td>t-value</td>
<td>p-value</td>
<td>Mean (min, max)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mean (min, max)</td>
<td>SD</td>
<td>t-value</td>
<td>p-value</td>
<td>Mean (min, max)</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>39.3</td>
<td>3.97 (0, 34)</td>
<td>4.81</td>
<td>-6.883</td>
<td>.000†</td>
<td>1.71 (0, 24)</td>
</tr>
<tr>
<td>Female</td>
<td>60.7</td>
<td>5.59 (0, 34)</td>
<td>5.74</td>
<td></td>
<td></td>
<td>3.71 (0, 38)</td>
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<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14–16 years</td>
<td>76.4</td>
<td>4.52 (0, 34)</td>
<td>5.01</td>
<td>-5.707</td>
<td>.000†</td>
<td>2.63 (0, 32)</td>
</tr>
<tr>
<td>17–19 years</td>
<td>23.6</td>
<td>6.36 (0, 34)</td>
<td>6.48</td>
<td></td>
<td></td>
<td>3.88 (0, 38)</td>
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<tr>
<td>Father’s education</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than higher secondary</td>
<td>84.1</td>
<td>5.03 (0, 34)</td>
<td>5.47</td>
<td>1.379</td>
<td>.039</td>
<td>2.94 (0, 38)</td>
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<tr>
<td>Higher secondary and above</td>
<td>15.9</td>
<td>4.58 (0, 34)</td>
<td>5.32</td>
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<td></td>
<td>2.81 (0, 32)</td>
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<td></td>
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<td></td>
<td></td>
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<tr>
<td>Less than higher secondary</td>
<td>90.3</td>
<td>5.02 (0, 34)</td>
<td>5.42</td>
<td>1.482</td>
<td>.432</td>
<td>2.97 (0, 38)</td>
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<tr>
<td>Higher secondary and above</td>
<td>9.7</td>
<td>4.38 (0, 34)</td>
<td>5.77</td>
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<td></td>
<td>2.52 (0, 32)</td>
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<tr>
<td>Parental marital status</td>
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<td></td>
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<tr>
<td>Currently married</td>
<td>90.2</td>
<td>4.72 (0, 34)</td>
<td>5.25</td>
<td>-4.886</td>
<td>.000†</td>
<td>2.84 (0, 38)</td>
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<td>Other (separated, widowed, divorced)</td>
<td>9.8</td>
<td>7.11 (0, 34)</td>
<td>6.66</td>
<td></td>
<td></td>
<td>3.68 (0, 28)</td>
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<td>Number of siblings</td>
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<td></td>
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<tr>
<td>≤2 siblings</td>
<td>44.1</td>
<td>4.57 (0, 34)</td>
<td>5.36</td>
<td>5.215</td>
<td>.006†</td>
<td>2.61 (0, 32)</td>
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<td>3–6 siblings</td>
<td>54.8</td>
<td>5.30 (0, 34)</td>
<td>5.51</td>
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<td></td>
<td>3.19 (0, 38)</td>
</tr>
<tr>
<td>&gt;6 siblings</td>
<td>1.1</td>
<td>3.55 (0, 20)</td>
<td>5.20</td>
<td></td>
<td></td>
<td>2.27 (0, 18)</td>
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<tr>
<td>Number of family members</td>
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<td>1–4 members</td>
<td>42.3</td>
<td>4.83 (0, 34)</td>
<td>5.54</td>
<td>2.780</td>
<td>.062</td>
<td>2.67 (0, 32)</td>
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<td>5–8 members</td>
<td>54.7</td>
<td>5.13 (0, 34)</td>
<td>5.41</td>
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<td>3.14 (0, 38)</td>
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<td>&gt;8 members</td>
<td>3.1</td>
<td>3.98 (0, 22)</td>
<td>4.74</td>
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<td></td>
<td>2.61 (0, 16)</td>
</tr>
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<td>Urban</td>
<td>50.4</td>
<td>5.96 (0, 34)</td>
<td>5.90</td>
<td>8.502</td>
<td>.000†</td>
<td>3.38 (0, 38)</td>
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<td>Rural</td>
<td>49.6</td>
<td>3.94 (0, 30)</td>
<td>4.74</td>
<td></td>
<td></td>
<td>2.46 (0, 32)</td>
</tr>
</tbody>
</table>
Table 1. Continued

<table>
<thead>
<tr>
<th>Variables</th>
<th>%</th>
<th>Depression</th>
<th>Anxiety</th>
<th>Stress</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean (min, max)</td>
<td>SD</td>
<td>t-value/F-value</td>
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<td>Food insecurity</td>
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<tr>
<td>Food secure</td>
<td>77.8</td>
<td>4.21 (0, 34)</td>
<td>4.91</td>
<td>71.873</td>
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<td>Moderately food insecure</td>
<td>14.5</td>
<td>7.31 (0, 28)</td>
<td>6.08</td>
<td>4.11 (0, 28)</td>
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<td>Severely food insecure</td>
<td>7.7</td>
<td>8.04 (0, 34)</td>
<td>6.91</td>
<td>5.12 (0, 28)</td>
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<td>Hypertension</td>
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<td></td>
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<tr>
<td>No</td>
<td>94.8</td>
<td>4.96 (0, 34)</td>
<td>5.43</td>
<td>0.121</td>
</tr>
<tr>
<td>Yes</td>
<td>5.2</td>
<td>4.89 (0, 34)</td>
<td>5.94</td>
<td>3.02 (0, 32)</td>
</tr>
</tbody>
</table>

†Significant at 0.05 level (independent samples t-test).
‡Significant at 0.05 level (one-way ANOVA).
Anxiety was found to be significantly associated with female sex ($B = 1.881$, $p$-value $\leq .001$), age ($B = 0.477$, $p$-value $< .001$), urban residence ($B = 0.795$, $p$-value $\leq .001$) and food insecurity ($B = 1.357$, $p$-value $< .001$). Positive parenting had a significant negative relation ($B = -0.210$, $p$-value $<.001$) whereas poor supervision had a significant positive relation ($B = 0.093$, $p$-value $= .007$) with anxiety (Table 3).

Stress symptoms among adolescents exhibited a significant relationship with female sex ($B = 1.876$, $p$-value $\leq .001$), age ($B = 0.627$, $p$-value $< .001$), having separated, widowed, or divorced parents ($B = 1.318$, $p$-value $= .004$), urban residence ($B = 2.601$, $p$-value $< .001$) as well as food insecurity ($B = 2.290$, $p$-value $< .001$). Both positive parenting ($B = -0.166$, $p$-value $= .008$) and inconsistent parental discipline ($B = -0.141$, $p$-value $= .002$) had a significant negative link with stress (Table 3).

Discussion

The findings obtained in this study indicate 18%, 14%, and 16% prevalence of depression, anxiety, and stress symptoms, respectively, among urban and rural adolescents living in Bangladesh. These percentages exceed those yielded by the 2018–19 Bangladesh's National Mental Health Survey conducted in the pre-pandemic period (National Institute of Mental Health and WHO, 2019), suggesting that the social isolation and worries about contracting COVID-19 have exacerbated these mental health issues. However, a systematic review of the available research on the impact of COVID-19 on the adult population of Bangladesh indicated a much higher prevalence of depression and anxiety in adults (Hossain et al., 2021), likely due to methodological differences, as well as those related to sample characteristics. As no prior research has been conducted on Bangladeshi adolescents’ mental health during the pandemic, it is worth noting that, according to a recent poll in the Latin America and Caribbean region conducted by the United Nations Children's Fund (UNICEF), 27% of the respondents aged 13–29 years experienced anxiety and 15% experienced depression during the COVID-19 pandemic (UNICEF, 2021). Similarly, children and adolescents from European countries have been found to experience a wide range of psychological and behavioral problems during the early stages of the pandemic (Racine et al., 2021). Data yielded by an Australian survey involving 760 adolescents aged 12–18 indicated that about three-quarters reported mental health problems during the COVID-19 pandemic (Li et al., 2021).
Table 3. Multiple linear regression analysis of factors associated with depression, anxiety and stress (n = 2,030).

<table>
<thead>
<tr>
<th>Variables*</th>
<th>Depression</th>
<th>Anxiety</th>
<th>Stress</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B (SE B)</td>
<td>95% CI of B</td>
<td>p-value</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male (ref)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Female</td>
<td>1.40 (0.24)</td>
<td>0.94-1.86</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Age (years)</td>
<td>0.58 (0.09)</td>
<td>0.41-0.74</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Parental marital status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Currently married (ref)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Other (separated, widowed, divorced)</td>
<td>1.66 (0.38)</td>
<td>0.92-2.41</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Number of siblings</td>
<td>0.01 (0.09)</td>
<td>-0.19-0.2</td>
<td>.942</td>
</tr>
<tr>
<td>Residential area</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rural area (ref)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Urban area</td>
<td>1.70 (0.20)</td>
<td>1.25-2.15</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Food security</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food secure (ref)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Food insecure</td>
<td>2.44 (0.28)</td>
<td>1.88-2.99</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Positive parenting</td>
<td>-0.25 (0.05)</td>
<td>-0.35-0.14</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Inconsistent parenting discipline</td>
<td>-0.05 (0.04)</td>
<td>-0.12-0.03</td>
<td>.213</td>
</tr>
<tr>
<td>Poor parental supervision</td>
<td>0.22 (0.04)</td>
<td>0.14-0.30</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Adjusted R²</td>
<td>.148</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

B = unstandardized regression coefficient; SE B = standard error for the unstandardized regression coefficient. Adolescents’ sex and age, their parental marital status, number of siblings, residential area, food insecurity, positive parenting, inconsistent parenting discipline, and poor parental supervision.

*At the 10% significance level.
High prevalence of depression and anxiety was also noted among young adults aged 18–30 years living in the U.S. (Liu et al., 2020). These alarming findings point to the urgent need to provide adequate support to this population to prevent a mental health pandemic that could have devastating long-term repercussions.

In the cohort analyzed in this study, female sex emerged as a risk factor for depression, anxiety, and stress during the COVID-19 pandemic, concurring with the findings reported by other authors (Qu et al., 2020; Wang et al., 2020; Alamri et al., 2020). While it is too early to draw any conclusions regarding the causality of this association, it is likely that fluctuations in estrogen and progesterone levels during the menstrual cycle, as well as environmental and hereditary variables, and a variety of physiological, social, and mental health factors play a role (Pigott, 2003; Tambs et al., 2012).

Although the present study focused on adolescents, there were still some age-related differences in the prevalence of depression, anxiety, and stress among urban and rural adolescents, with somewhat higher figures noted for those aged 17–19 relative to participants in the 14–16 age group. This finding is supported by a previous comparison of 14–20 vs. 21–35 age cohorts, whereby the former group was found to be more likely to suffer from psychological problems during the pandemic (Liang et al., 2020). However, other authors have noted that depressive and anxiety symptoms are more likely to be observed among older compared to younger adolescents (Xie et al., 2020; Zhou et al., 2020; Chen et al., 2020). Although the relationship between age and depression, anxiety, and stress among adolescents during the pandemic is still unclear, sociodemographic factors and parental mental health have been found to profoundly impact adolescents, and these issues are likely to be exacerbated by the pandemic (Schmidt et al., 2021).

Parental marital status was found to have an impact on the mental health of the adolescents that took part in our study, as depression and stress were less prevalent among adolescents whose parents were currently married. In their meta-analysis conducted in 2020, Wahyuningsih et al. (2020) similarly found that parental marital quality could affect the psychological wellbeing of adolescents (Shek, 2010). Available evidence further suggests that adjustment, academic, and behavioral problems, as well as depressed mood, are more likely to be experienced by adolescents whose parents are divorced or separated (Lee and McLanahan, 2015). As the pandemic also posed a risk to physical health, and even survival, it is also noteworthy that the death of one of both parents often leads to mental ill-health and related disorders among adolescents (Bergman et al., 2017). Thus, all these factors combined would likely worsen the mental health of adolescents, especially those living with only one parent.

According to our analyses, depression, anxiety, and stress symptoms were more pronounced among adolescents living in urban areas relative to those living in rural areas. These findings are contrasted by the results yielded by the study conducted in China by Zhou et al. in 2020. On the other hand, they concur with the view put forth by Menculini et al. that the urban environment, air pollution, complex social context, and other factors adversely affect the mental health of urban residents (Menculini et al., 2021). These issues are amplified during lockdowns, as urban adolescents would feel the social isolation during lockdowns more acutely than their rural counterparts (Pizarro-Ruiz and Ordóñez-Camblor, 2021).

As expected, adolescents that had experienced food insecurity throughout the pandemic period were more likely to report depression, anxiety, and stress compared to those who did not have such existential problems. Given that Bangladesh ranks 84th out of 113 countries in the Global Food Security Index 2020, it is evident that food security plays a major role in the mental health status of its residents, and thus adolescents (Shibli, 2021). Similar observations were made by other authors in relation to developed countries, as food insecurity is on the rise across the world and contributes to mental health problems (Rahman et al., 2021; Mishra and Rampal, 2020).

In the present study, positive parenting style was also found to significantly reduce the level of depression, anxiety, and stress among Bangladeshi adolescents, concurring with the previously reported findings (Kingsbury et al., 2020). Conversely, inconsistent parenting discipline was found to be inversely related to stress, which is counterintuitive and should be examined further. Moreover, according to Tifèneh and Srahbu (2020), parental neglect or poor supervision strongly impacts adolescent negative affective emotions.

**Limitations of the study**

As this is the first population-based study to identify the prevalence and risk factors associated with depression, anxiety, and stress among adolescents in Bangladesh, its findings are certainly beneficial, but should be interpreted in light of some limitations. Specifically, owing to the cross-sectional nature of the study, it was not possible to determine causal relationships between any of the examined risk factors and depression, anxiety, and stress among adolescents. Moreover, as all data was self-reported and relied on respondents’ recollection, there is a risk of recall bias. Although the survey was conducted in person and participants could ask for interpretation of unfamiliar terms, there is also a risk of response bias.
Finally, type-1 error inflation could have been caused by the use of multiple statistical tests without performing statistical correction of p-values.

**Strengths of the study**

We employed random sampling to collect data from all administrative divisions of Bangladesh, ensuring representation from both urban and rural areas. As a result, the findings from this study can be generalized to the entire population of Bangladesh.

**Conclusions**

According to this cross-sectional study, a significant percentage of urban and rural adolescents in Bangladesh experienced depression, anxiety, and stress during the COVID-19 pandemic. Age, sex, food insecurity, parenting style, and place of residence emerged as significant risk factors for adolescent mental health. Given that mental health problems during adolescence increase the risk of adult mental distress, responsible authorities must take immediate action if we are to avert a mental health epidemic in the post-COVID era.

**Data availability**

**Underlying data**

Mendeley data: Mental Health of Adolescents in Bangladesh. DOI:10.17632/fycfkms359.1. (Salwa and Haque, 2023).

This project contains the following underlying data:

- Adolescent_Mental health.sav

Data are available under the terms of the Creative Commons Attribution 4.0 International license (CC-BY 4.0).

**Acknowledgements**

We would like to express our heartfelt gratitude to the study participants and their parents for their willingness to partake in this investigation and provide thoughtful and responsible responses. We also wish to convey our appreciation towards all the people responsible for field implementation, management, and supervision of this study. We are also grateful for the financial and practical support offered by relevant authorities, especially for the monitoring and supervision of the study.

**References**


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Department of Development Studies, University of Dhaka, Dhaka, Dhaka Division, Bangladesh

Thank you so much for writing an excellent paper. I believe that this paper will bring an additional insight regarding the issue discussed in paper. Despite all the things, this needs some corrections are stated as follows:

**Major:**
1. Though authors cited recent literature, authors should also cite papers from 2022 & 2023. There have been published several papers on adolescent mental health & COVID-19 in 2022 & 2023.

2. The conclusion part seems not reflect the result part of the paper. The authors should revise the conclusion part again.

3. Authors added the food insecurity index in the methodology part. In the result analysis, the authors added an analysis of food insecurity issues but the authors did not make any relation to food insecurity index to mental health impact, as I think. The authors should revise this part.

**Minor revision:**
1. Authors should revise the abstract part again

2. In acknowledgment, authors should add funding sources/organizations or sources of data.

3. Authors should revise the introduction part for checking grammatical errors and sentences.

**Is the work clearly and accurately presented and does it cite the current literature?**
Partly

**Is the study design appropriate and is the work technically sound?**
Yes

**Are sufficient details of methods and analysis provided to allow replication by others?**
Yes

**If applicable, is the statistical analysis and its interpretation appropriate?**
Yes

**Are all the source data underlying the results available to ensure full reproducibility?**
Yes

**Are the conclusions drawn adequately supported by the results?**
Partly

*Competing Interests:* No competing interests were disclosed.

*Reviewer Expertise:* Public health, Public policy, Social protection, & Politics

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

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