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## Prevalence and factors associated with depression and anxiety among the Bangladeshi university entrance test-taking students using GIS technology

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This study focuses on Bangladeshi university entrance test-taking students mental health problems and explores the geographical distribution of these problems using GIS technique. A cross-sectional survey was conducted among 1523 university entrance test-taking students. Data were collected on participants' socio-demographic characteristics, COVID-19-related factors, admission tests, depression, and anxiety. Chi-square tests and logistic regression were performed using SPSS software. GIS mapping was used to visualize the distribution of mental health problems across districts using ArcGIS. The study found that the prevalence rates of depression and anxiety among university entrance examinees were 53.8% and 33.2%, respectively. Males exhibited higher rates of depression and anxiety compared to females, while repeat test-taking students were more susceptible to these mental health issues compared to first-time test-takers. Factors such as urban residence, personal/familial COVID-19 infections, and COVID-19 deaths in close relationships were associated with increased mental health problems. District-based distribution showed no significant variation in depression, but anxiety varied significantly. Post-hoc GIS analysis revealed variations in the distribution of depression and anxiety among males, as well as variations in anxiety distribution based on student status across districts. This study emphasizes the high prevalence of depression and anxiety among university entrance examinees, emphasizing the importance of addressing mental health risks in this population. It also suggests the need for reforms in the university entrance test-taking system to reduce psychological problems and advocates for a more inclusive approach to student admissions to alleviate mental health burdens.

**Keywords** Academic achievement, Depression, Anxiety, Prevalence and risk factors, University admission test, Bangladeshi students

Mental health problems have become a growing concern worldwide, impacting the quality of life and work productivity. According to the World Health Organization, approximately 970 million people globally live with at least one mental disorder, with depression and anxiety being the most reported conditions<sup>1</sup>. Adolescents aged 10–19 are particularly affected, with an estimated 14% experiencing unrecognized and untreated mental health problems<sup>2</sup>. This period of transition from childhood to adulthood can exacerbate mental health issues due to the physiological changes that occur<sup>3</sup>.

The COVID-19 pandemic has significantly impacted mental health, particularly among adolescent students. Research has shown that rates of depression and anxiety have significantly increased during the pandemic, with 27.6% and 25.6% increments in depression and anxiety disorders reported<sup>4</sup>. In Bangladesh, a recent meta-analysis

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of the studies conducted during the pandemic found that 47% of the population experienced both depression and anxiety during the pandemic, with students being more affected than the general population<sup>5</sup>. Before the pandemic, the rate was 30.5% and 16.4% for depression and anxiety in Bangladeshi adolescents<sup>6</sup>, and it appeared to be as high as 59.16% and 53.99% among university students<sup>7</sup>. In another Bangladeshi systematic review of mental health problems among students in general, 46.92% to 82.4% and 26.6% to 96.82% rates of mild to severe symptoms of depression and anxiety, respectively, were reported by Al Mamun et al.<sup>8</sup>. Similar findings were reported in other countries; for instance, a Chinese study found that the prevalence of depression and anxiety symptoms was 43.7% and 37.4% among high school students during the COVID-19 outbreak<sup>9</sup>. Overall, a meta-analysis suggested that the prevalence of depression and anxiety in adolescents aged 13–18 during the COVID-19 pandemic was significantly higher compared to other age groups, with 34.4% and 29.1% vs children aged ≤ 12 years 11.8% and 15.7% respectively<sup>10</sup>. Therefore, mental health problems are anticipated to be higher after the post-pandemic era than before the COVID-19 pandemic among students in Bangladesh.

On 8 March 2020, Bangladesh recorded its first COVID-19 case<sup>11</sup> leading to the closure of educational institutions due to the virus's rapid spread. This forced the implementation of a new schooling method, which posed significant challenges for many students, including difficulty comprehending study materials, technical issues, lack of interest in attending classes, and limited access to online educational resources<sup>11,12</sup>. Consequently, several studies have been conducted to measure the impact of the COVID-19 pandemic on students' mental health<sup>8</sup>. For example, a previous study among 874 university students reported that 40% had moderate to severe anxiety, and 72% had depressive symptoms<sup>13</sup>. Another study among 601 high school, medical college, and university students reported that 43.3% suffered from depression, and 32.6% had anxiety problems<sup>14</sup>. In addition, lower monthly family income, urban residence, family size, being smokers, not performing physical exercise, dissatisfaction with sleep, and dissatisfaction with academic studies were identified as the escalators of mental health problems among students<sup>8</sup>.

However, in Bangladesh, students must pass the Higher Secondary School Certificate (HSC) or equivalent exams before being eligible to take the university entrance test. Since the university entrance test is a highly competitive exam and is a pathway to higher study, students might suffer from psychological problems. Notably, academic performance, pressure to succeed, and post-graduation plans increased the risk of depression and anxiety among students<sup>15</sup>. Considering the situation, a previous study before the COVID-19 pandemic was conducted by Mamun and colleagues and found that nearly half of the university admission test-takers experienced depression (47.9%), while 28.9% experienced anxiety<sup>16</sup>. However, as the pandemic has brought about significant changes in the education system, resulting in increased mental health problems and uncertainty for students, it is anticipated that there will be an increased prevalence of mental health problems among university entrance test takers. Therefore, the present study aimed to examine the prevalence of depression and anxiety among these students after the COVID-19 pandemic's impact. In addition, the spatial distribution of mental health problems was also presented using Geographical Information System (GIS) techniques, which adds new dimensions in visualizing the data. By investigating the pandemic's impact on these students' mental health, interventions can be designed to address the mental health needs of university entrance test takers in Bangladesh, which could ultimately improve their academic performance and overall well-being.

## Methods

### Study participants and procedure

This cross-sectional study was undertaken within a specific time frame between September 4th and 11th, 2022. The participants of this study were university students who were undergoing the process of taking an entrance exam at Jahangirnagar University in Dhaka, Bangladesh. Those who expressed an interest in participating in the study and were present in the university residence halls during the admission test period were included in the research. To collect the data, a self-administered survey was utilized, with a non-probability sampling technique being employed. Before the data collection process, all participants were thoroughly briefed about the terminology used within the survey questionnaire. The study included 1574 students, and upon the removal of incomplete questionnaires, 1523 data were deemed suitable for analysis. Notably, the survey was conducted using an English version questionnaire, and since all the participants were prospective university students, they did not have any difficulty understanding the English questionnaire.

### Measures

#### *Sociodemographic factors*

The survey collected socio-demographic information from the participants, including but not limited to gender, permanent residence (distinguishing between urban and rural areas), family type, monthly family income, religion, smoking status, and substance use status. The participant's socioeconomic status (Poor = income was less than 15,000 Bangladeshi Taka [BDT]; middle-class = income ranged between 15,000 and 30,000 BDT; and high class = income was more than 30,000 BDT) was determined based on their monthly family income.

#### *COVID-19-related variables*

Participants were asked to divulge whether they had previously been contacted with the COVID-19 virus. Subsequently, information related to their family members or friends infected or died due to COVID-19 infection was also collected. All the questions were responded to in a yes/no manner.

#### *Admission-related variables*

Data about the test-taking status of the participants, namely whether they were first-time or repeat test takers, as well as their previous educational background in high school and the various dimensions thereof, alongside

their public exams GPA (Grade Point Average), was gathered. Additionally, the participants were inquired about their preparation for the examination, including whether they sought the aid of tutors or coaching facilities and their performance on practice exams. In addition, they were also asked about their monthly expenditure during the admission test preparation and their preferred institution of admission.

#### *Patient Health Questionnaire*

The depression status of participants in this study was assessed utilizing the Patient Health Questionnaire (PHQ-9)<sup>17</sup>. The PHQ-9 is composed of 9 items, and participants were asked to respond to them using a four-point Likert scale (0 = not at all, 1 = several days, 2 = more than half of the days, and 3 = nearly every day), reflecting their experiences over the past two weeks. The scores range from 0 to 27, with higher scores indicating greater severity of depression. A cut-off score of  $\geq 10$  was employed to identify the presence of depression among participants<sup>17</sup>. The internal consistency of the PHQ-9 was measured by Cronbach's alpha ( $\alpha = 0.76$ ) in the present study.

#### *Generalized Anxiety Disorder*

This study employed the Generalized Anxiety Disorder (GAD-7) scale to assess anxiety<sup>18</sup>. The GAD-7 consists of 7 items that are responded to using a four-point Likert scale (0 = not at all, 1 = several days, 2 = more than half of the days, and 3 = nearly every day), reflecting the participant's experiences over the past two weeks. The scores range from 0 to 21, with higher scores indicating greater severity of anxiety. A cut-off score of  $\geq 10$  was utilized to identify the presence of anxiety among participants<sup>18</sup>. The internal consistency of the GAD-7 was measured by Cronbach's alpha ( $\alpha = 0.83$ ) in the present study.

#### **Ethical considerations**

The Helsinki Declaration of 2013 was conscientiously adhered to ensure that the human participants were treated with the utmost care and respect. Additionally, the research protocol was thoroughly scrutinized and approved by the CHINTA Research Bangladesh review board. Before requesting the participants to enroll in the study, a comprehensive briefing session was held to inform them about the study's objectives, and the right to participate or withdraw at any point, among other relevant matters. Finally, a written informed consent form was obtained from each participant to affirm their willingness to participate in the survey.

#### **Statistical analysis**

Microsoft Excel 2019 was utilized to input and cleanse the data, while the Statistical Package for Social Science (SPSS) version 25 was employed for statistical analysis. The study used descriptive (i.e., frequency and percentages) and inferential statistics (i.e., chi-square and logistic regression). The chi-square test was conducted to ascertain the association between depression and anxiety and the variables under study. Binary logistic regression was performed to extract the associated factors of depression and anxiety. The results from binary logistic regression were presented as the odds ratio with a 95% confidence interval. ArcGIS 10.8 was used for spatial analysis across districts in terms of depression and anxiety. The shape file for the GIS data is available at <http://diva-gis.org/>. All statistical tests were considered significant at  $p < 0.05$ , with a 95% confidence interval.

## **Results**

### **Description of the study participants**

The study involved 1523 participants, predominantly male (76.8%,  $n = 1169$ ) and living in rural areas (74.9%). Religion-wise, most participants were Muslim (87.1%) and belonged to nuclear families (76.2%). The percentage of participants who reported smoking was 10%, while the rate of those who reported drug use was 4%. Regarding COVID-19-related information, 8.4% of participants reported being infected with the virus, while 18.3% and 9.6% reported their family members or friends being infected and dying due to the virus, respectively. Additionally, 71.5% of the participants were first-time test takers, and 73.1% took professional help to prepare for their tests (Table 1).

The overall prevalence of depression and anxiety among the participants was 53.8% and 33.2%, respectively. In terms of gender-based mental health suffering, 57.1% and 35.2% of males significantly suffered from depression and anxiety, respectively, whereas it was 42.9% and 26.3% of females. With respect to student status, repeat test-taking students were significantly more likely to suffer from depression (59.0% vs. 51.7%) and anxiety (40.3% vs. 30.3%) (Table 1).

### **Association between depression and the study variables**

In terms of the total sample, the female gender showed a significantly higher rate of depression suffering ( $\chi^2 = 21.79$ ,  $p < 0.001$ ) than males. Participants' permanent residence ( $\chi^2 = 20.809$ ,  $p < 0.001$ ), monthly family income ( $\chi^2 = 5.701$ ,  $p < 0.05$ ), personal COVID-19 infection ( $\chi^2 = 11.403$ ,  $p < 0.001$ ), family/friends COVID-19 infection ( $\chi^2 = 21.219$ ,  $p < 0.001$ ), family/friends COVID-19 death ( $\chi^2 = 21.775$ ,  $p < 0.001$ ) were significantly associated with depression status. In addition, their desired institute for admission ( $\chi^2 = 17.042$ ,  $p < 0.001$ ), average monthly expenditure during the admission test preparation time ( $\chi^2 = 6.927$ ,  $p < 0.05$ ), satisfied with previous mock tests ( $\chi^2 = 12.778$ ,  $p < 0.001$ ), educational background ( $\chi^2 = 14.164$ ,  $p < 0.001$ ), and anxiety ( $\chi^2 = 318.338$ ,  $p < 0.001$ ) significantly differed in terms of their depression status (Table 2).

In terms of the gender-based analysis, permanent residence was significantly associated with the depression status of males ( $\chi^2 = 9.056$ ,  $p < 0.001$ ) and female samples ( $\chi^2 = 12.031$ ,  $p < 0.001$ ). In addition, cigarette smoking status ( $\chi^2 = 6.580$ ,  $p < 0.05$ ), drug usage status ( $\chi^2 = 4.256$ ,  $p < 0.05$ ), personal COVID-19 infection ( $\chi^2 = 12.114$ ,  $p < 0.001$ ), family/friends COVID-19 infection ( $\chi^2 = 16.209$ ,  $p < 0.001$ ), family/friends COVID-19

Variables	Total sample	Gender		p-value	Student status		p-value
	n; (%)	Male; n (%)	Female, n (%)		Fresher test-taker; n (%)	Repeat test-taker; n (%)	
Socio-demographic variables							
Gender							
Female	354; 23.2%	–	–	–	263; 24.2%	91; 21%	0.184
Male	1169; 76.8%	–	–		826; 75.8%	343; 79%	
Permanent residence							
Rural	1127; 74.9%	843; 72.9%	284; 81.6%	0.001	824; 76.7%	303; 70.5%	0.011
Urban	377; 25.1%	313; 27.1%	64; 18.4%		250; 23.3%	127; 29.5%	
Religion							
Muslim	1298; 87.1%	1005; 86.9%	293; 87.7%	0.705	937; 88%	361; 84.9%	0.114
Others	192; 12.9%	151; 13.1%	41; 12.3%		128; 12%	64; 15.1%	
Family type							
Nuclear	1115; 76.2%	860; 75.4%	255; 78.9%	0.191	808; 77.5%	307; 72.9%	0.060
Joint	348; 23.8%	280; 24.6%	68; 21.1%		234; 22.5%	114; 27.1%	
Monthly income (BDT)							
< 15,000	375; 36.5%	307; 35%	68; 45.3%	0.041	266; 37.8%	109; 33.5%	0.214
15,000–30,000	383; 37.3%	332; 37.8%	51; 34%		263; 37.4%	120; 36.9%	
> 30,000	270; 26.3%	239; 27.2%	31; 20.7%		174; 24.8%	96; 29.5%	
Cigarette smoking status							
Yes	152; 10.3%	101; 8.7%	51; 15.9%	< 0.001	97; 9.2%	55; 12.9%	0.037
No	1328; 89.7%	1059; 91.3%	269; 84.1%		955; 90.8%	373; 87.1%	
Drug usage status							
Yes	59; 4%	49; 4.2%	10; 3.1%	0.369	40; 3.8%	19; 4.5%	0.535
No	1422; 96%	1111; 95.8%	311; 96.9%		1017; 96.2%	405; 95.5%	
COVID-19 related information							
Personal COVID-19 infection							
Yes	126; 8.4%	104; 9%	22; 6.5%	0.153	88; 8.2%	38; 8.9%	0.651
No	1373; 91.6%	1057; 91%	316; 93.5%		985; 91.8%	388; 91.1%	
Family members/friend's COVID-19 infection							
Yes	275; 18.3%	244; 21%	31; 9.2%	< 0.001	193; 18%	82; 19.2%	0.569
No	1224; 81.7%	917; 79%	307; 90.8%		880; 82%	344; 80.8%	
Family members/friend's COVID-19 death							
Yes	144; 9.6%	114; 9.8%	30; 8.7%	0.546	92; 8.5%	52; 12.1%	0.033
No	1362; 90.4%	1048; 90.2%	314; 91.3%		985; 91.5%	377; 87.9%	
Admission-related variables							
Appearance in the admission test							
First timer	1089; 71.5%	826; 70.7%	263; 74.3%	0.184	–	–	–
Repeat test-takers	434; 28.5%	343; 29.3%	91; 25.7%		–	–	
Secondary School Certificate (SSC) grade point average							
Poor (< 4.5)	300; 22.7%	258; 23.1%	42; 20.5%	0.660	219; 23.7%	81; 20.5%	0.017
Moderate	481; 36.4%	402; 36.1%	79; 38.5%		351; 38%	130; 32.8%	
High (5)	539; 40.8%	455; 40.8%	84; 41%		354; 38.3%	185; 46.7%	
Higher Secondary Certificate (HSC) grade point average							
Poor (< 4.5)	146; 11.1%	125; 11.2%	21; 10.3%	0.678	91; 9.9%	55; 13.9%	0.014
Moderate	383; 29.1%	328; 29.5%	55; 27.1%		257; 27.9%	126; 31.9%	
High (5)	786; 59.8%	659; 59.3%	127; 62.6%		572; 62.2%	214; 54.2%	
Coached by professional coaching centers							
No	381; 26.9%	304; 27%	77; 26.4%	0.823	195; 19.4%	186; 45.4%	< 0.001
Yes	1036; 73.1%	821; 73%	215; 73.6%		812; 80.6%	224; 54.6%	
Desired institute/department for admission							
Varsity	1100; 76.4%	860; 75.2%	240; 81.1%	0.063	801; 78.3%	299; 71.9%	< 0.001
Medical	217; 15.1%	179; 15.7%	38; 12.8%		146; 14.3%	71; 17.1%	
Engineering	89; 6.2%	79; 6.9%	10; 3.4%		64; 6.3%	25; 6%	
Agriculture	33; 2.3%	25; 2.2%	8; 2.7%		12; 1.2%	21; 5%	
Satisfied with previous mock tests							
Continued							

Variables	Total sample	Gender		p-value	Student status		
	n; (%)	Male; n (%)	Female, n (%)		Fresher test-taker; n (%)	Repeat test-taker; n (%)	p-value
Yes	508; 37.5%	406; 37.2%	102; 38.6%	0.661	365; 37.6%	143; 37.2%	0.915
No	848; 62.5%	686; 62.8%	162; 61.4%		607; 62.4%	241; 62.8%	
Average monthly expenditure (BDT)							
< 5000	203; 19.9%	165; 19.2%	38; 23.8%	0.261	135; 18.9%	68; 22.3%	0.270
5000–10,000	601; 58.9%	507; 58.9%	94; 58.8%		421; 58.8%	180; 59%	
> 10,000	217; 21.3%	189; 22%	28; 17.5%		160; 22.3%	57; 18.7%	
Educational background							
Science	886; 58.6%	698; 60%	188; 54.3%	0.179	601; 55.6%	285; 66.3%	< 0.001
Arts	516; 34.1%	385; 33%	131; 37.9%		405; 37.5%	111; 25.8%	
Commerce	109; 7.2%	82; 7%	27; 7.8%		75; 6.9%	34; 7.9%	
Mental health problems							
Depression							
No	704; 46.2%	502; 42.9%	202; 57.1%	< 0.001	526; 48.3%	178; 41%	0.010
Yes	819; 53.8%	667; 57.1%	152; 42.9%		563; 51.7%	256; 59%	
Anxiety							
No	1018; 66.8%	757; 64.8%	261; 73.7%	0.002	759; 69.7%	259; 59.7%	< 0.001
Yes	505; 33.2%	412; 35.2%	93; 26.3%		330; 30.3%	175; 40.3%	

**Table 1.** Distribution of the study variables by gender and test-taking student status.

death ( $\chi^2 = 19.622, p < 0.001$ ), HSC GPA ( $\chi^2 = 8.319, p < 0.05$ ), desired institute for admission ( $\chi^2 = 17.787, p < 0.001$ ), satisfaction with their previous mock tests ( $\chi^2 = 11.823, p < 0.001$ ), average monthly expenditure ( $\chi^2 = 7.901, p < 0.05$ ), educational background ( $\chi^2 = 12.372, p < 0.001$ ) had a significant association with male depression status. In addition, anxiety ( $\chi^2 = 246.43, p < 0.001$ ) significantly differed in terms of male depression status. However, female depressive symptoms were significantly associated with appearance with admission test ( $\chi^2 = 7.207, p < 0.001$ ), HSC GPA ( $\chi^2 = 11.061, p < 0.001$ ), and anxiety ( $\chi^2 = 65.05, p < 0.001$ ) (Table 2).

In terms of the student-status-based analysis, first-time test-taker's depression was associated with personal COVID-19 infection ( $\chi^2 = 5.533, p < 0.05$ ), family/friends COVID-19 infection ( $\chi^2 = 9.128, p < 0.001$ ), family/friends COVID-19 death ( $\chi^2 = 14.443, p < 0.001$ ), SSC GPA ( $\chi^2 = 6.521, p < 0.05$ ), desired institute/department for admission ( $\chi^2 = 10.355, p < 0.001$ ), satisfaction with previous mock tests ( $\chi^2 = 10.659, p < 0.001$ ), average monthly expenditure ( $\chi^2 = 10.438, p < 0.001$ ), and educational background ( $\chi^2 = 11.564, p < 0.001$ ). In addition, a significant association was also reported between first-time test-taker's depressive symptoms and anxiety ( $\chi^2 = 212.19, p < 0.001$ ). However, COVID-19-related information such as personal COVID-19 infection ( $\chi^2 = 6.471, p < 0.05$ ), family/friends COVID-19 infection ( $\chi^2 = 14.319, p < 0.001$ ), family/friends COVID-19 death ( $\chi^2 = 6.281, p < 0.05$ ); admission test related variables such as HSC GPA ( $\chi^2 = 8.401, p < 0.05$ ), coached by professional coaching centers ( $\chi^2 = 5.020, p < 0.05$ ) had a profound association with repeat test-takers depression. In addition, anxiety ( $\chi^2 = 102.03, p < 0.001$ ) was significantly associated with repeat test-taker's depression (Table 2).

### Association between anxiety and the study variables

In terms of the total sample, gender showed a significant difference with anxiety ( $\chi^2 = 9.870, p < 0.001$ ). Participants' permanent residence ( $\chi^2 = 18.080, p < 0.001$ ), monthly family income ( $\chi^2 = 11.357, p < 0.001$ ), cigarette smoking ( $\chi^2 = 6.618, p < 0.05$ ), drug usage ( $\chi^2 = 11.434, p < 0.001$ ), personal COVID-19 infection ( $\chi^2 = 15.402, p < 0.001$ ), family/friends COVID-19 infection ( $\chi^2 = 10.646, p < 0.001$ ), family/friends COVID-19 death ( $\chi^2 = 15.548, p < 0.001$ ) were significantly associated with anxiety. In addition, appearance in admission test ( $\chi^2 = 14.056, p < 0.001$ ), SSC GPA ( $\chi^2 = 15.215, p < 0.001$ ), HSC GPA ( $\chi^2 = 7.063, p < 0.05$ ), their desired institute for admission ( $\chi^2 = 17.739, p < 0.001$ ), satisfied with previous mock tests ( $\chi^2 = 29.891, p < 0.001$ ), educational background ( $\chi^2 = 14.234, p < 0.001$ ), and depression ( $\chi^2 = 318.338, p < 0.001$ ) significantly differed in terms of their anxiety status (Table 3).

In terms of the gender-based analysis, permanent residence was significantly associated with the anxiety status of males ( $\chi^2 = 10.115, p < 0.001$ ) and female samples ( $\chi^2 = 7.127, p < 0.001$ ). In addition, monthly family income ( $\chi^2 = 6.502, p < 0.05$ ), cigarette smoking status ( $\chi^2 = 9.579, p < 0.001$ ), drug usage status ( $\chi^2 = 10.638, p < 0.001$ ), personal COVID-19 infection ( $\chi^2 = 17.534, p < 0.001$ ), family/friends COVID-19 infection ( $\chi^2 = 9.338, p < 0.001$ ), family/friends COVID-19 death ( $\chi^2 = 15.543, p < 0.001$ ), appearance in the admission test ( $\chi^2 = 7.314, p < 0.001$ ), SSC GPA ( $\chi^2 = 15.366, p < 0.001$ ), HSC GPA ( $\chi^2 = 10.903, p < 0.001$ ), desired institute for admission ( $\chi^2 = 14.054, p < 0.001$ ), satisfaction with their previous mock tests ( $\chi^2 = 20.051, p < 0.001$ ), educational background ( $\chi^2 = 18.463, p < 0.001$ ) had a significant association with male anxiety status. In addition, depression ( $\chi^2 = 246.43, p < 0.001$ ) significantly differed in terms of male anxiety status. However, female anxiety symptoms were significantly associated with permanent residence ( $\chi^2 = 7.127, p < 0.001$ ), monthly family income ( $\chi^2 = 7.004, p < 0.05$ ), appearance with admission test ( $\chi^2 = 7.779, p < 0.001$ ), Satisfaction with previous mock tests ( $\chi^2 = 4.732, p < 0.05$ ), and depression ( $\chi^2 = 65.05, p < 0.001$ ) (Table 3).

Variables	Total sample		Gender				Student status			
			Male		Female		Fresher test-taker		Repeat test-taker	
	Yes (n; %)	$\chi^2$ test value	Yes (n; %)	$\chi^2$ test value	Yes (n; %)	$\chi^2$ test value	Yes (n; %)	$\chi^2$ test value	Yes (n; %)	$\chi^2$ test value
Socio-demographic variables										
Gender										
Male	152; 42.9%	21.792**	–	–	–	–	102; 38.8%	23.163**	206; 60.1%	0.777
Female	354; 57.1%		–	–	–	–	461; 55.8%		50; 54.9%	
Permanent residence										
Urban	571; 50.7%	20.809**	461; 54.7%	9.056**	110; 38.7%	12.031**	401; 48.7%	17.145**	170; 56.1%	3.161
Rural	242; 64.2%		202; 64.5%		40; 62.5%		159; 63.6%		83; 65.4%	
Religion										
Muslim	697; 53.7%	0.870	567; 56.4%	1.433	130; 44.4%	0.123	483; 51.5%	1.357	214; 59.3%	0.048
Others	110; 57.3%		93; 60.6%		17; 39.4%		73; 57%		37; 57.8%	
Family type										
Nuclear	594; 53.3%	2.150	487; 56.6%	0.610	107; 42%	1.971	411; 50.9%	2.978	183; 59.6%	0.024
Joint	201; 57.8%		166; 59.3%		35; 51.5%		134; 57.3%		67; 58.8%	
Monthly income (BDT)										
< 15,000	207; 55.2%	5.701*	175; 57%	3.307	32; 47.1%	3.076	138; 51.9%	4.923	69; 63.3%	0.884
15,000–30,000	237; 61.9%		205; 61.7%		32; 62.7%		154; 58.6%		83; 69.2%	
> 30,000	172; 63.7%		154; 64.4%		18; 58.1%		108; 62.1%		64; 66.7%	
Cigarette smoking status										
Yes	94; 61.8%	3.267	70; 69.3%	6.580*	24; 47.1%	0.006	60; 61.9%	3.333	34; 61.8%	0.131
No	719; 54.1%		594; 56.1%		125; 46.5%		498; 52.1%		221; 59.2%	
Drug usage status										
Yes	38; 64.4%	2.340	35; 71.4%	4.256*	3; 30%	1.037	27; 67.5%	3.701	11; 57.9%	0.033
No	772; 54.3%		628; 56.6%		144; 46.3%		529; 52%		243; 60%	
COVID-19 related information										
Personal COVID-19 infection										
Yes	86; 68.3%	11.403**	76; 73.1%	12.114**	10; 45.5%	0.037	56; 63.6%	5.533*	30; 78.9%	6.471*
No	722; 52.6%		585; 55.3%		137; 43.4%		498; 50.6%		224; 57.7%	
Family/friend's COVID-19 infection										
Yes	183; 66.5%	21.219**	167; 68.4%	16.209**	16; 51.6%	0.916	119; 61.7%	9.128**	64; 78%	14.319**
No	627; 51.2%		496; 54.1%		131; 42.7%		437; 49.7%		190; 55.2%	
Family/friend's COVID-19 death										
Yes	104; 72.2%	21.775**	87; 76.3%	19.622**	17; 56.7%	2.280	65; 70.7%	14.443**	39; 75%	6.281*
No	706; 51.8%		573; 54.7%		133; 42.4%		492; 49.9%		214; 56.8%	
Admission-related variables										
Appearance in the admission test										
Fresher	563; 51.7%	6.630	461; 55.8%	1.784	102; 38.8%	7.207**	–	–	–	–
Repeat	256; 59%		206; 60.1%		50; 54.9%		–	–	–	
Secondary School Certificate (SSC) grade point average										
Poor (< 4.5)	178; 59.3%	4.866	150; 58.1%	5.241	28; 66.7%	3.870	131; 59.8%	6.521*	47; 58%	0.421
Moderate	260; 54.1%		221; 55%		39; 49.4%		180; 51.3%		80; 61.5%	
High (5)	327; 60.7%		285; 62.6%		42; 50%		212; 59.9%		115; 62.2%	
Higher Secondary Certificate (HSC) grade point average										
Poor (< 4.5)	83; 56.8%	1.949	67; 53.6%	8.319*	16; 76.2%	11.061**	59; 64.8%	5.661	24; 43.6%	8.401*
Moderate	212; 55.4%		177; 54%		35; 63.6%		132; 51.4%		80; 63.5%	
High (5)	468; 59.5%		412; 62.5%		56; 44.1%		330; 57.7%		138; 64.5%	
Coached by professional coaching centers										
No	198; 52%	3.138	161; 53%	3.256	37; 48.1%	0.159	97; 49.7%	1.782	101; 54.3%	5.020*
Yes	593; 57.2%		484; 59%		109; 50.7%		447; 55%		146; 65.2%	
Desired institute/department for admission										
Varsity	578; 52.5%	17.042**	464; 54%	17.787**	114; 47.5%	6.671	411; 51.3%	10.355*	167; 55.9%	6.215
Medical	143; 65.9%		118; 65.9%		25; 65.8%		95; 65.1%		48; 67.6%	
Engineering	54; 60.7%		50; 63.3%		4; 40%		38; 59.4%		16; 64%	
Agriculture	23; 69.7%		21; 84%		2; 25%		7; 58.3%		16; 76.2%	
Satisfied with previous mock tests										
Continued										

Variables	Total sample		Gender				Student status			
			Male		Female		Fresher test-taker		Repeat test-taker	
	Yes (n; %)	$\chi^2$ test value	Yes (n; %)	$\chi^2$ test value	Yes (n; %)	$\chi^2$ test value	Yes (n; %)	$\chi^2$ test value	Yes (n; %)	$\chi^2$ test value
No	255; 50.2%	12.778**	209; 51.5%	11.823**	46; 45.1%	1.142	176; 48.2%	10.659**	79; 55.2%	2.293
Yes	510; 60.1%		426; 62.1%		84; 51.9%		358; 59%		152; 63.1%	
Average monthly expenditure (BDT)										
< 5000	111; 54.7%	6.927*	89; 53.9%	7.901*	22; 57.9%	0.177	69; 51.1%	10.438**	42; 61.8%	0.616
5000–10,000	353; 58.7%		302; 59.6%		51; 54.3%		233; 55.3%		120; 66.7%	
> 10,000	145; 66.8%		129; 68.3%		16; 57.1		109; 68.1%		36; 63.2%	
Educational background										
Science	511; 57.7%	14.164**	425; 60.9%	12.372**	86; 45.7%	1.217	337; 56.1%	11.564**	174; 61.1%	1.384
Arts	244; 47.3%		192; 49.9%		52; 39.7%		183; 45.2%		61; 55%	
Commerce	59; 54.1%		48; 58.8%		11; 40.7%		40; 53.3%		19; 55.9%	
Mental health problems										
Anxiety										
Yes	384; 37.7%	318.338**	305; 40.3%	246.43**	79; 30.3%	65.05**	282; 37.2%	212.19**	102; 39.4%	102.03**
No	435; 86.1%		362; 87.9%		73; 78.5%		281; 85.2%		154; 88%	

**Table 2.** Association between depression and the study variables with respect to gender and student status. \*Significant at 0.05 level; \*\*Significant at 0.01 level.

In terms of the student-status-based analysis, first-time test-takers anxiety was associated with permanent residence ( $\chi^2 = 12.609$ ,  $p < 0.001$ ), monthly family income ( $\chi^2 = 10.933$ ,  $p < 0.001$ ), cigarette smoking status ( $\chi^2 = 3.967$ ,  $p < 0.05$ ), drug usage status ( $\chi^2 = 7.071$ ,  $p < 0.001$ ), personal COVID-19 infection ( $\chi^2 = 4.925$ ,  $p < 0.05$ ), family/friends COVID-19 infection ( $\chi^2 = 9.004$ ,  $p < 0.001$ ), family/friends COVID-19 death ( $\chi^2 = 9.740$ ,  $p < 0.001$ ), SSC GPA ( $\chi^2 = 12.666$ ,  $p < 0.001$ ), HSC GPA ( $\chi^2 = 9.688$ ,  $p < 0.001$ ), satisfaction with previous mock tests ( $\chi^2 = 35.539$ ,  $p < 0.001$ ), and educational background ( $\chi^2 = 11.836$ ,  $p < 0.001$ ). In addition, a significant association was also reported between first-time test-takers anxiety symptoms and depression ( $\chi^2 = 212.19$ ,  $p < 0.001$ ). However, permanent residence ( $\chi^2 = 3.941$ ,  $p < 0.05$ ), drug usage status ( $\chi^2 = 4.022$ ,  $p < 0.05$ ), COVID-19-related information such as personal COVID-19 infection ( $\chi^2 = 13.131$ ,  $p < 0.001$ ), family/friends COVID-19 death ( $\chi^2 = 4.333$ ,  $p < 0.05$ ); admission tests related variables such as HSC GPA ( $\chi^2 = 6.571$ ,  $p < 0.05$ ), desired institute/department for admission ( $\chi^2 = 18.309$ ,  $p < 0.001$ ), and depression ( $\chi^2 = 102.03$ ,  $p < 0.001$ ) was significantly associated with repeat test takers anxiety (Table 3).

### Factors associated with depression

In terms of the total sample, males were more likely to suffer from depression than females (OR = 1.76, 95% CI = 1.38–2.24,  $p < 0.001$ ). Participants from the urban area were at 1.74 times higher risk of suffering from depression than the rural participants (OR = 1.74, 95% CI = 1.37–2.22,  $p < 0.001$ ). Personal COVID-19 infection (OR = 1.93, 95% CI = 1.31–2.86,  $p = 0.001$ ), family/friends COVID-19 infection (OR = 1.89, 95% CI = 1.43–2.49,  $p < 0.001$ ), family/friends COVID-19 death (OR = 2.41, 95% CI = 1.65–3.53,  $p < 0.001$ ), not satisfied with previous mock tests (OR = 1.49, 95% CI = 1.19–1.86,  $p < 0.001$ ), and suffering from anxiety (OR = 10.26, 95% CI = 7.73–13.60,  $p < 0.001$ ) increased the risk of depression among participants (Table 4).

In terms of gender-based analysis, urban males were at higher risk of depression than rural males (OR = 1.50, 95% CI = 1.15–1.97,  $p = 0.003$ ). Male cigarette smokers (OR = 1.76, 95% CI = 1.13–2.74,  $p = 0.011$ ), drug users (OR = 1.92, 95% CI = 1.02–3.61,  $p = 0.042$ ), self-infected with COVID-19 (OR = 2.19, 95% CI = 1.39–3.43,  $p = 0.001$ ), family/friends infected with COVID-19 (OR = 1.84, 95% CI = 1.36–2.48,  $p < 0.001$ ), family/friends died due to COVID-19 (OR = 2.67, 95% CI = 1.70–4.18,  $p < 0.001$ ), not satisfied with previous mock tests (OR = 1.54, 95% CI = 1.20–1.98,  $p = 0.001$ ), and suffering from anxiety (OR = 10.72, 95% CI = 7.71–14.91,  $p < 0.001$ ), increased the risk of depression. However, female depressive symptoms increased in terms of urban residence (OR = 2.63, 95% CI = 1.50–4.61,  $p = 0.001$ ), HSC GPA (OR = 4.05, 95% CI = 1.40–11.75, for poor and OR = 2.21, 95% CI = 1.15–4.25, for moderate;  $p = 0.005$ ), and anxiety (OR = 8.40, 95% CI = 4.80–14.73,  $p < 0.001$ ) (Table 4).

In terms of student status-based analysis, urban residence (OR = 1.84, 95% CI = 1.37–2.46,  $p < 0.001$ ), family/friends COVID-19 infection (OR = 1.63, 95% CI = 1.18–2.24,  $p = 0.003$ ), family/friends COVID-19 death (OR = 2.41, 95% CI = 1.51–3.84,  $p < 0.001$ ), not satisfied with previous mock tests (OR = 1.54, 95% CI = 1.18–2.00,  $p = 0.001$ ), and suffering from anxiety (OR = 9.70, 95% CI = 6.92–13.59,  $p < 0.001$ ), increased the risk of depression among first-time test-takers. Repeat test-takers risk of depression was increased by 2.74 times (OR = 2.74; 95% CI = 1.22–6.14,  $p = 0.014$ ), 2.88 times (OR = 2.88; 95% CI = 1.63–5.06,  $p < 0.001$ ), and 2.28 times (OR = 2.28; 95% CI = 1.18–4.42,  $p = 0.014$ ) due to personal COVID-19 infection, family/friends COVID-19 infection, and family/friends COVID-19 death, respectively (Table 4).

### Factors associated with anxiety

In terms of the total sample, males were more likely to suffer from anxiety than females (OR = 1.52, 95% CI = 1.17–1.99,  $p = 0.002$ ). Participants from the urban area were at a 1.68 times higher risk of suffering from depression than the rural participants (OR = 1.68, 95% CI = 1.32–2.13,  $p < 0.001$ ). Cigarette smoking (OR = 1.55,

Variables	Total sample		Gender				Student status			
			Male		Female		Fresher test-taker		Repeat test-taker	
	Yes (n; %)	$\chi^2$ test value	Yes (n; %)	$\chi^2$ test value	Yes (n; %)	$\chi^2$ test value	Yes (n; %)	$\chi^2$ test value	Yes (n; %)	$\chi^2$ test value
Socio-demographic variables										
Gender										
Male	93;26.3%	9.870**	–	–	–	–	59; 22.4%	10.167**	34; 37.4%	0.419
Female	412;35.2%		–	–	–	–	271; 32.8%		141; 41.1%	
Permanent residence										
Urban	341;30.3%	18.080**	276; 32.7%	10.115**	65; 22.9%	7.127**	229; 27.8%	12.609**	112; 37%	3.941*
Rural	159; 42.2%		134; 42.8%		25; 39.1%		99; 39.6%		60; 47.2%	
Religion										
Muslim	413; 33.2%	0.560	350; 34.8%	0.739	81; 27.6%	0.012	284; 30.3%	1.239	147; 40.7%	0.234
Others	69; 35.9%		58; 38.4%		11; 26.8%		45; 35.2%		24; 37.5%	
Family type										
Nuclear	372; 33.4%	0.465	306; 35.6%	0.005	66; 25.9%	2.366	244; 30.2%	1.348	128; 41.7%	0.544
Joint	123; 35.3%		99; 35.4%		24; 35.3%		80; 34.2%		43; 37.7%	
Monthly income (BDT)										
< 15,000	114; 30.4%	11.357**	99; 32.2%	6.502*	15; 22.1%	7.004*	70; 26.3%	10.933**	44; 40.4%	1.469
15,000–30,000	152; 39.7%		135; 40.7%		17; 33.3%		94; 35.7%		58; 48.3%	
> 30,000	114; 42.2%		99; 41.4%		15; 48.4%		71; 40.8%		43; 44.8%	
Cigarette smoking status										
Yes	66; 43.4%	6.618*	50; 49.5%	9.579**	16; 31.4%	0.157	39; 40.2%	3.967*	27; 49.1%	1.757
No	438; 33%		361; 34.1%		77; 28.6%		290; 30.4%		148; 39.7%	
Yes	32; 54.2%	11.434**	28; 57.1%	10.638**	4; 40%	0.690	20; 50%	7.071**	12; 63.2%	4.022*
No	469; 33%		382; 34.4%		87; 28%		307; 30.2%		162; 40%	
COVID-19 related information										
Personal COVID-19 infection										
Yes	62; 49.2%	15.402**	56; 53.8%	17.534**	6; 27.3%	0.001	36; 40.9%	4.925*	26; 68.4%	13.131**
No	439; 32%		352; 33.3%		87; 27.5%		291; 29.5%		148; 38.1%	
Family/friend's COVID-19 infection										
Yes	114; 41.5%	10.646**	106; 43.4%	9.338**	8; 25.8%	0.001	76; 39.4%	9.004**	38; 46.3%	1.754
No	382; 31.2%		302; 32.9%		80; 26.1%		250; 28.4%		132; 38.4%	
Family/friend's COVID-19 death										
Yes	69; 47.9%	15.548**	59; 51.8%	15.543**	10; 33.3%	0.661	41; 44.6%	9.740**	28; 53.8%	4.333*
No	413; 31.6%		348; 33.2%		83; 26.4%		285; 28.9%		146; 38.7%	
Admission-related variables										
Appearance in the admission test										
Fresher	330; 30.3%	14.056**	271; 32.8%	7.314**	59; 22.4%	7.779**	–	–	–	–
Repeat	175; 40.3%		141; 41.1%		34; 37.4%		–	–	–	
Secondary School Certificate (SSC) grade point average										
Poor (< 4.5)	111; 37%	15.215**	97; 37.6%	15.366**	14; 33.3%	0.695	79; 36.1%	12.666**	32; 39.5%	2.417
Moderate	139;28.9%		118; 29.4%		21; 26.6%		91; 25.9%		48; 36.9%	
High (5)	218; 40.4%		192; 42.2%		26; 31%		134; 37.9%		84; 45.4%	
Higher Secondary Certificate (HSC) grade point average										
Poor (< 4.5)	47; 32.2%	7.063*	42; 33.6%	10.903**	5; 23.8%	1.801	33; 36.3%	9.688**	14; 25.5%	6.571*
Moderate	118; 30.8%		98; 29.9%		20; 36.4%		65; 25.3%		53; 42.1%	
High (5)	301; 38.3%		266; 40.4%		35; 27.6%		206; 36%		95; 44.4%	
Coached by professional coaching centers										
No	129; 33.9%	0.120	107; 35.2%	0.036	22; 28.6%	0.180	57; 29.2%	0.669	72; 38.7%	1.258
Yes	361; 34.8%		294; 35.8%		67; 31.2%		262; 32.3%		99; 44.2%	
Desired institute/department for admission										
Varsity	349; 31.7%	17.739**	283; 32.9%	14.054**	66; 27.5%	5.225	241; 30.1%	4.177	108; 36.1%	18.309**
Medical	99; 45.6%		82; 45.8%		17; 44.7%		56; 38.4%		43; 60.6%	
Engineering	28; 31.5%		26; 32.9%		2; 20%		22; 34.4%		6; 24%	
Agriculture	15; 45.5%		13; 52%		2; 25%		4; 33.3%		11; 52.4%	
Satisfied with previous mock tests										
Continued										



Variables	Total sample		Gender				Student status			
			Male		Female		Fresher test-taker		Repeat test-taker	
	Yes (n; %)	$\chi^2$ test value	Yes (n; %)	$\chi^2$ test value	Yes (n; %)	$\chi^2$ test value	Yes (n; %)	$\chi^2$ test value	Yes (n; %)	$\chi^2$ test value
No	129; 25.4%	29.891**	106; 26.1%	25.051**	23; 22.5%	4.732*	76; 20.8%	33.539**	53; 37.1%	1.377
Yes	339; 40%		282; 41.1%		57; 35.2%		235; 38.7%		104; 43.2%	
Average monthly expenditure (BDT)										
< 5,000	62; 30.5%	4.088	52; 31.5%	3.557	10; 26.3%	1.590	36; 26.7%	5.874	26; 38.2%	4.501
5000–10,000	228; 37.9%		195; 38.5%		33; 35.1%		140; 33.3%		88; 48.9%	
> 10,000	84; 38.7%		77; 40.7%		7; 25%		64; 40%		20; 35.1%	
Educational background										
Science	324; 36.6%	14.234**	274; 39.3%	18.463**	50; 26.6%	0.317	201; 33.4%	11.836**	123; 43.2%	2.690
Arts	139; 26.9%		103; 26.8%		36; 27.5%		99; 24.4%		40; 36%	
Commerce	40; 36.7%		34; 41.5%		6; 22.2%		29; 38.7%		11; 32.4%	
Mental health problems										
Depression										
Yes	70; 9.9%	318.338**	50; 10%	246.43**	20; 9.9%	65.05**	49; 9.3%	212.19**	21; 11.8%	102.03**
No	436; 53.1%		362; 54.3%		73; 48%		281; 49.9%		154; 60.2%	

**Table 3.** Association between anxiety and the study variables with respect to gender and student status. \*Significant at 0.05 level; \*\*Significant at 0.01 level.

95% CI = 1.10–2.19,  $p = 0.011$ ), drug usage (OR = 2.40, 95% CI = 1.42–4.06,  $p = 0.001$ ), personal COVID-19 infection (OR = 2.06, 95% CI = 1.42–2.97,  $p < 0.001$ ), family/friends COVID-19 infection (OR = 1.56, 95% CI = 1.19–2.04,  $p = 0.001$ ), family/friends COVID-19 death (OR = 1.98, 95% CI = 1.40–2.81,  $p < 0.001$ ), not satisfied with previous mock tests (OR = 1.95, 95% CI = 1.53–2.49,  $p < 0.001$ ), and suffering from depression (OR = 10.26, 95% CI = 7.73–13.60,  $p < 0.001$ ) increased the risk of anxiety among participants (Table 5).

In terms of gender-based analysis, urban males were at higher risk of anxiety than rural males (OR = 1.53, 95% CI = 1.17–2.00,  $p = 0.002$ ). Male cigarette smokers (OR = 1.89, 95% CI = 1.25–2.85,  $p = 0.002$ ), drug users (OR = 2.54, 95% CI = 1.42–4.54,  $p = 0.002$ ), self-infected with COVID-19 (OR = 2.33, 95% CI = 1.55–3.50,  $p < 0.001$ ), family/friends infected with COVID-19 (OR = 1.56, 95% CI = 1.17–2.08,  $p < 0.001$ ), family/friends died due to COVID-19 (OR = 2.15, 95% CI = 1.46–3.18,  $p < 0.001$ ), not satisfied with previous mock tests (OR = 1.97, 95% CI = 1.51–2.58,  $p < 0.001$ ), and suffering from depression (OR = 10.72, 95% CI = 7.71–14.91,  $p < 0.001$ ), increased the risk of depression. However, female anxiety symptoms increased in terms of urban residence (OR = 2.16, 95% CI = 1.21–3.83,  $p = 0.008$ ), not satisfied with previous mock tests (OR = 1.86, 95% CI = 1.05–3.28,  $p = 0.031$ ), and depression (OR = 8.40, 95% CI = 4.80–14.73,  $p < 0.001$ ) (Table 5).

In terms of student's status-based analysis, urban residence (OR = 1.70, 95% CI = 1.26–2.29,  $p < 0.001$ ), drug user (OR = 2.31, 95% CI = 1.22–4.36,  $p = 0.010$ ), family/friends COVID-19 infection (OR = 1.63, 95% CI = 1.18–2.26,  $p = 0.003$ ), family/friends COVID-19 death (OR = 1.97, 95% CI = 1.28–3.04,  $p = 0.002$ ), not satisfied with previous mock tests (OR = 2.40, 95% CI = 1.77–3.24,  $p < 0.001$ ), and suffering from depression (OR = 9.70, 95% CI = 6.92–13.59,  $p < 0.001$ ), increased the risk of depression among first-time test-takers. Repeat test-taker's risk of anxiety was increased by 3.51 times (OR = 3.51; 95% CI = 1.72–7.17,  $p = 0.001$ ), 1.84 times (OR = 1.84; 95% CI = 1.03–3.30,  $p = 0.039$ ), and 11.28 times (OR = 11.28; 95% CI = 6.71–18.97,  $p < 0.001$ ), due to personal COVID-19 infection, family/friends COVID-19 death, and depression, respectively (Table 5).

### GIS-based distribution of depression across districts

Results suggested no significant association between the district and depression ( $\chi^2 = 65.226$ ,  $p = 0.332$ ). The prevalence of depression was high in some northern districts, such as Thakurgaon, Nilphamari, and Lalmonirhat, and in some western districts, such as Pabna, Rajbari, Magura, Chuadanga, Jashore, and Khulna. However, low prevalence was reported in Tangail, Sylhet, Khagrachari, and Sherpur (Fig. 1). Depression was not significantly differed in terms of gender ( $\chi^2 = 63.615$ ,  $p = 0.211$ , for males, and  $\chi^2 = 8.316$ ,  $p = 0.628$ , for females) and student status ( $\chi^2 = 51.237$ ,  $p = 0.833$ , for first-time test-takers; and  $\chi^2 = 61.747$ ,  $p = 0.098$  for repeat test-takers). However, the rate of gender-based depression was high in Lalmonirhat, Rajshahi, and Hobiganj (Fig. 2). Regarding student status, Lalmonirhat, Thakurgaon, Borgona, Sunamganj, and Narayanganj showed a high prevalence of depression (Fig. 3).

### GIS-based distribution of anxiety across districts

Results suggested a significant association between the districts and anxiety ( $\chi^2 = 111.966$ ,  $p < 0.001$ ). The prevalence rate of anxiety was high in Netrakona, Pabna, Manikganj, Jashore, Khulna, Barisal, and Chittagong (Fig. 4). Gender-based anxiety was only significant for males ( $\chi^2 = 112.191$ ,  $p < 0.001$ ). The gender-based anxiety was high in Rajshahi and Lalmonirhat districts (Fig. 5). In terms of student status, the prevalence rate significantly differed for first-time test takers ( $\chi^2 = 79.403$ ,  $p = 0.026$ ) and repeat test-takers ( $\chi^2 = 80.060$ ,  $p < 0.001$ ). The student status-based anxiety was high in Jashore, Barisal, Netrakona, and Borgona (Fig. 6).

Variables	Total sample		Gender				Student status			
			Male		Female		Fresher test-taker		Repeat test-taker	
	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value
Socio-demographic variables										
Gender										
Male	1.76 (1.38–2.24)	<0.001	–	–	–	–	1.99 (1.50–2.64)	<0.001	1.23 (0.77–1.96)	0.378
Female	Reference		–	–	–	Reference	Reference			
Permanent residence										
Urban	1.74 (1.37–2.22)	<0.001	1.50 (1.15–1.97)	0.003	2.63 (1.50–4.61)	0.001	1.84 (1.37–2.46)	<0.001	1.47 (0.96–2.26)	0.076
Rural	Reference		Reference		Reference		Reference			
Religion										
Muslim	0.35 (0.63–1.17)	0.351	0.80 (0.56–1.14)	0.232	1.12 (0.58–2.18)	0.726	0.80 (0.55–1.16)	0.245	1.06 (0.62–1.82)	0.826
Others	Reference		Reference		Reference		Reference			
Family type										
Nuclear	0.83 (0.65–1.06)	0.143	0.897 (0.68–1.17)	0.435	0.68 (0.39–1.16)	0.162	0.77 (0.57–1.03)	0.085	1.03 (0.66–1.60)	0.876
Joint	Reference		Reference		Reference		Reference			
Monthly income (BDT)										
< 15,000	0.70 (0.50–0.96)	0.058	0.73 (0.51–1.03)	0.192	0.64 (0.27–1.51)	0.218	0.65 (0.44–0.97)	0.086	0.86 (0.48–1.53)	0.643
15,000–30,000	0.92 (0.67–1.27)		0.89 (0.63–1.25)		1.21 (0.48–3.02)		0.86 (0.58–1.27)			
> 30,000	Reference		Reference		Reference		Reference			
Cigarette smoking status										
Yes	1.37 (0.97–1.93)	0.072	1.76 (1.13–2.74)	0.011	1.02 (0.56–1.86)	0.938	1.48 (0.96–2.28)	0.069	1.11 (0.62–1.99)	0.717
No	Reference		Reference		Reference		Reference			
Drug usage status										
Yes	1.52 (0.88–2.62)	0.129	1.92 (1.02–3.61)	0.042	0.49 (0.12–1.95)	0.317	1.91 (0.97–3.75)	0.058	0.91 (0.36–2.32)	0.855
No	Reference		Reference		Reference		Reference			
COVID-19 related information										
Personal COVID-19 infection										
Yes	1.93 (1.31–2.86)	0.001	2.19 (1.39–3.43)	0.001	1.08 (0.45–2.59)	0.848	1.71 (1.08–2.68)	0.020	2.74 (1.22–6.14)	0.014
No	Reference		Reference		Reference		Reference			
Family/friend's COVID-19 infection										
Yes	1.89 (1.43–2.49)	<0.001	1.84 (1.36–2.48)	<0.001	1.43 (0.68–3.03)	0.340	1.63 (1.18–2.24)	0.003	2.88 (1.63–5.06)	<0.001
No	Reference		Reference		Reference		Reference			
Family/friend's COVID-19 death										
Yes	2.41 (1.65–3.53)	<0.001	2.67 (1.70–4.18)	<0.001	1.78 (0.83–3.79)	0.135	2.41 (1.51–3.84)	<0.001	2.28 (1.18–4.42)	0.014
No	Reference		Reference		Reference		Reference			
Admission-related variables										
Appearance in the admission test										
Fresher	0.74 (0.59–0.93)	0.010	0.84 (0.65–1.08)	0.182	0.52 (0.32–0.84)	0.008	–	–	–	–
Repeat	Reference		Reference		Reference		–	–	–	
Secondary School Certificate (SSC) grade point average										
Poor (< 4.5)	0.94 (0.70–1.26)	0.088	0.82 (0.60–1.13)	0.073	2.00 (0.92–4.32)	0.151	0.99 (0.70–1.40)	0.039	0.84 (0.49–1.43)	0.811
Moderate	0.76 (0.59–0.97)		0.72 (0.55–0.95)		0.97 (0.52–4.32)		0.70 (0.52–0.95)			
High (5)	Reference		Reference		Reference		Reference			
Higher Secondary Certificate (HSC) grade point average										
Poor (< 4.5)	0.89 (0.62–1.27)	0.378	0.69 (0.47–1.01)	0.016	4.05 (1.40–11.75)	0.005	1.35 (0.85–2.14)	0.060	0.42 (0.23–0.77)	0.017
Moderate	0.84 (0.65–1.07)		0.70 (0.53–0.91)		2.21 (1.15–4.25)		0.77 (0.57–1.04)			
High (5)	Reference		Reference		Reference		Reference			
Coached by professional coaching centers										
No	1.23 (0.97–1.56)	0.077	0.78 (0.60–1.02)	0.071	0.90 (0.53–1.51)	0.690	0.80 (0.59–1.10)	0.182	0.63 (0.42–0.94)	0.025
Yes	Reference		Reference		Reference		Reference			
Desired institute/department for admission										
Varsity	0.48 (0.22–1.02)	0.001	0.22 (0.07–0.65)	0.001	2.71 (0.53–13.71)	0.096	0.75 (0.23–2.39)	0.017	0.39 (0.14–1.10)	0.109
Medical	0.84 (0.38–1.85)		0.36 (0.12–1.12)		5.76 (1.01–32.70)		1.33 (0.40–4.40)			
Engineering	0.67 (0.28–1.57)		0.32 (0.10–1.05)		2.00 (0.26–15.38)		1.04 (0.29–3.64)			
Agriculture	Reference		Reference		Reference		Reference			
Satisfied with previous mock tests										
Continued										

Variables	Total sample		Gender				Student status			
			Male		Female		Fresher test-taker		Repeat test-taker	
	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value
No	1.49 (1.19–1.86)	<0.001	1.54 (1.20–1.98)	0.001	1.31 (0.79–2.15)	0.286	1.54 (1.18–2.00)	0.001	1.38 (0.90–2.10)	0.130
Yes	Reference		Reference		Reference		Reference			
Average monthly expenditure (BDT)										
< 5000	0.59 (0.40–0.89)	0.032	0.54 (0.35–0.84)	0.020	1.03 (0.38–2.76)	0.915	0.48 (0.30–0.78)	0.006	0.94 (0.45–1.95)	0.735
5000–10,000	0.70 (0.51–0.97)		0.68 (0.48–0.97)		0.89 (0.38–2.08)		0.58 (0.39–0.85)		1.16 (0.62–2.17)	
> 10,000	Reference		Reference		Reference		Reference			
Educational background										
Science	1.15 (0.77–1.72)	0.001	1.10 (0.69–1.75)	0.002	1.22 (0.54–2.78)	0.545	1.11 (0.69–1.80)	0.003	1.23 (0.60–2.53)	0.501
Arts	0.76 (0.50–1.15)		0.70 (0.43–1.14)		0.95 (0.41–2.22)		0.72 (0.44–1.18)		0.96 (0.44–2.08)	
Commerce	Reference		Reference		Reference		Reference			
Mental health problems										
Anxiety										
Yes	10.26 (7.73–13.60)	<0.001	10.72 (7.71–14.91)	<0.001	8.40 (4.80–14.73)	<0.001	9.70 (6.92–13.59)	<0.001	11.28 (6.71–18.97)	<0.001
No	Reference		Reference		Reference		Reference			

**Table 4.** Binary logistic regression analysis concerning depression and the study variables with respect to gender and student status. OR, odds ratio; CI, confidence interval.

## Discussion

This study represents the first examination of the prevalence of mental health conditions, specifically depression and anxiety, among Bangladeshi university entrance examinees following the COVID-19 outbreak, utilizing GIS distribution. The findings reveal a significant increase in the rates of depression and anxiety compared to a previous study conducted among a similar population. This study reports that 53.8% of the participants are depressed, while 33.3% are anxious, showing a dramatic rise from the previous figures of 47.9% and 28.9%, respectively<sup>16</sup>. This increase is not surprising, as COVID-19 has had a profound impact on student mental health. Furthermore, the university entrance phase is a critical transitional period in students' educational lives, and the disruption caused by the pandemic, including the extended academic year and the challenges faced during exam preparation, may have contributed to the heightened mental health problems observed. Notably, the present study also revealed higher mental health problems among repeat test-takers.

The study also highlights the influence of COVID-19-related factors on the student's mental health. Previous studies have indicated that COVID-19 patients tend to experience high levels of depression<sup>19</sup>, and this study echoes those findings, suggesting that factors such as the fear of infection, fear of assault or humiliation, financial difficulties, and inadequate food supply significantly contribute to mental health problems among students<sup>8</sup>. Additionally, the fear of social isolation and loneliness may exacerbate psychological suffering<sup>20</sup>. These COVID-19-related factors are important to consider when examining the mental health status of university entrance examinees. The pandemic has created a unique set of stressors and challenges that impact individuals' mental well-being. The fear and uncertainty surrounding COVID-19, coupled with the disruptions in daily life and potential health risks, can significantly contribute to the development or exacerbation of mental health illness as well as extreme conditions like suicide<sup>21</sup>. The findings of this study emphasize the need for targeted interventions and support systems to address the specific concerns arising from the pandemic and its impact on the mental health of university entrance examinees.

This study also highlights the influence of participants' residential areas on their mental health status, particularly among university entrance examinees. While this finding emphasized the higher prevalence of mental health issues among urban students, it's essential to recognize the challenges faced by students in rural areas as well. Previous studies conducted during the COVID-19 pandemic consistently reported that individuals residing in urban areas are more susceptible to experiencing psychological problems<sup>8</sup>. Consistent with these findings, the present study revealed that urban students were 1.74 times more likely to suffer from depression and 1.68 times more likely to experience anxiety compared to rural students. Several factors may contribute to the higher prevalence of psychological problems among urban students. Firstly, the lack of close-knit community ties in urban areas can lead to feelings of isolation and a reduced support system, which in turn can negatively impact mental well-being<sup>22,23</sup>. Additionally, easy access to substances and the associated risks of substance abuse may be more prevalent in urban environments<sup>24</sup>, further contributing to mental health issues<sup>25</sup>. Moreover, the widespread availability and excessive use of the Internet among urban students can lead to addictive behaviors and social media-related stress, which have been linked to mental health problems<sup>26</sup>. Finally, parents in urban areas may have higher academic expectations for their children, creating additional pressure and stress that may increase the risk of depression and anxiety among students<sup>27</sup>. However, understanding the relationship between residential areas and mental health status is crucial for developing targeted interventions and support systems. Recognizing the unique challenges faced by both urban and rural students and addressing the underlying factors that contribute to their mental health problems can help mitigate the impact of these issues. Effective strategies may involve fostering community connections, promoting healthy coping mechanisms, providing mental health support services, and engaging parents in open and supportive communication regarding academic expectations.

Variables	Total sample		Gender				Student status			
			Male		Female		Fresher test-taker		Repeat test-taker	
	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value
Socio-demographic variables										
Gender										
Male	1.52 (1.17–1.99)	0.002	–	–	–	–	1.68 (1.22–2.33)	0.002	1.17 (0.72–1.88)	0.518
Female	Reference		–	–	–	–	Reference		Reference	
Permanent residence										
Urban	1.68 (1.32–2.13)	<0.001	1.53 (1.17–2.00)	0.002	2.16 (1.21–3.83)	0.008	1.70 (1.26–2.29)	<0.001	1.52 (1.00–2.32)	0.048
Rural	Reference		Reference		Reference		Reference			
Religion										
Muslim	0.88 (0.64–1.21)	0.454	0.85 (0.60–1.21)	0.390	1.04 (0.49–2.17)	0.913	0.80 (0.54–1.18)	0.266	1.14 (0.66–1.98)	0.628
Others	Reference		Reference		Reference		Reference			
Family type										
Nuclear	0.91 (0.71–1.17)	0.495	1.01 (0.76–1.33)	0.946	0.64 (0.36–1.13)	0.126	0.83 (0.61–1.13)	0.246	1.18 (0.75–1.83)	0.461
Joint	Reference		Reference		Reference		Reference			
Monthly income (BDT)										
< 15,000	0.59 (0.43–0.82)	0.004	0.67 (0.47–1.35)	0.039	0.30 (0.12–0.74)	0.034	0.51 (0.34–0.77)	0.004	0.83 (0.47–1.45)	0.481
15,000–30,000	0.90 (0.65–1.23)		0.96 (0.69–1.35)		0.53 (0.21–1.33)		0.80 (0.54–1.19)			
> 30,000	Reference		Reference		Reference		Reference			
Cigarette smoking status										
Yes	1.55 (1.10–2.19)	0.011	1.89 (1.25–2.85)	0.002	1.14 (0.59–2.17)	0.692	1.54 (1.00–2.36)	0.048	1.46 (0.83–2.58)	0.187
No	Reference		Reference		Reference		Reference			
Drug usage status										
Yes	2.40 (1.42–4.06)	0.001	2.54 (1.42–4.54)	0.002	1.71 (0.47–6.23)	0.411	2.31 (1.22–4.36)	0.010	2.57 (0.99–6.67)	0.052
No	Reference		Reference		Reference		Reference			
COVID-19 related information										
Personal COVID-19 infection										
Yes	2.06 (1.42–2.97)	<0.001	2.33 (1.55–3.50)	<0.001	0.98 (0.37–2.60)	0.979	1.65 (1.05–2.58)	0.028	3.51 (1.72–7.17)	0.001
No	Reference		Reference		Reference		Reference			
Family/friend's COVID-19 infection										
Yes	1.56 (1.19–2.04)	0.001	1.56 (1.17–2.08)	<0.001	0.98 (0.42–2.29)	0.976	1.63 (1.18–2.26)	0.003	1.38 (0.85–2.25)	0.186
No	Reference		Reference		Reference		Reference			
Family/friend's COVID-19 death										
Yes	1.98 (1.40–2.81)	<0.001	2.15 (1.46–3.18)	<0.001	1.39 (0.62–3.09)	0.418	1.97 (1.28–3.04)	0.002	1.84 (1.03–3.30)	0.039
No	Reference		Reference		Reference		Reference			
Admission-related variables										
Appearance in the admission test										
Fresher	0.64 (0.51–0.81)	<0.001	0.70 (0.54–0.90)	0.007	0.48 (0.29–0.81)	0.006	–	–	–	–
Repeat	Reference		Reference		Reference		–	–	–	
Secondary School Certificate (SSC) grade point average										
Poor (< 4.5)	0.86 (0.64–1.15)	0.001	0.82 (0.60–1.12)	<0.001	1.11 (0.50–2.46)	0.707	0.92 (0.65–1.31)	0.002	0.78 (0.46–1.33)	0.300
Moderate	0.59 (0.46–0.77)		0.56 (0.42–0.75)		0.80 (0.40–1.59)		0.57 (0.41–0.79)			
High (5)	Reference		Reference		Reference		Reference			
Higher Secondary Certificate (HSC) grade point average										
Poor (< 4.5)	0.76 (0.52–1.11)	0.030	0.74 (0.50–1.11)	0.004	0.82 (0.28–2.41)	0.409	1.01 (0.63–1.60)	0.008	0.42 (0.22–0.83)	0.042
Moderate	0.71 (0.55–0.93)		0.63 (0.47–0.83)		1.50 (0.76–2.94)		0.60 (0.43–0.83)			
High (5)	Reference		Reference		Reference		Reference			
Coached by professional coaching centers										
No	0.95 (0.74–1.22)	0.729	0.97 (0.73–1.28)	0.849	0.88 (0.49–1.56)	0.672	0.86 (0.61–1.22)	0.414	0.79 (0.53–1.18)	0.262
Yes	Reference		Reference		Reference		Reference			
Desired institute/department for admission										
Varsity	0.55 (0.27–1.11)	0.001	0.45 (0.20–1.00)	0.003	1.13 (0.22–5.78)	0.168	0.86 (0.25–2.88)	0.246	0.51 (0.21–1.25)	0.001
Medical	1.00 (0.48–2.10)		0.78 (0.33–1.80)		2.42 (0.43–13.60)		1.24 (0.35–4.32)			
Engineering	0.55 (0.24–1.24)		0.45 (0.18–1.13)		0.75 (0.08–6.95)		1.04 (0.28–3.86)			
Agriculture	Reference		Reference		Reference		Reference			
Satisfied with previous mock tests										
Continued										

Variables	Total sample		Gender				Student status			
			Male		Female		Fresher test-taker		Repeat test-taker	
	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value
No	1.95 (1.53–2.49)	<0.001	1.97 (1.51–2.58)	<0.001	1.86 (1.05–3.28)	0.031	2.40 (1.77–3.24)	<0.001	1.28 (0.84–1.97)	0.241
Yes	Reference		Reference		Reference		Reference			
Average monthly expenditure (BDT)										
< 5000	0.69 (0.46–1.04)	0.131	0.66 (0.43–1.03)	0.170	1.07 (0.35–3.28)	0.454	0.54 (0.33–0.89)	0.054	1.14 (0.55–2.38)	0.107
5000–10,000	0.96 (0.70–1.33)		0.90 (0.64–1.27)		1.62 (0.62–4.21)		0.74 (0.51–1.08)			
> 10,000	Reference		Reference		Reference		Reference			
Educational background										
Science	0.99 (0.65–1.50)	0.001	0.91 (0.57–1.45)	<0.001	1.26 (0.48–3.32)	0.854	0.79 (0.48–1.30)	0.003	1.58 (0.74–3.38)	0.262
Arts	0.63 (0.41–0.98)		0.51 (0.31–0.84)		1.32 (0.49–3.55)		0.51 (0.30–0.86)			
Commerce	Reference		Reference		Reference		Reference			
Mental health problems										
Anxiety										
Yes	10.26 (7.73–13.60)	<0.001	10.72 (7.71–14.91)	<0.001	8.40 (4.80–14.73)	<0.001	9.70 (6.92–13.59)	<0.001	11.28 (6.71–18.97)	<0.001
No	Reference		Reference		Reference		Reference			

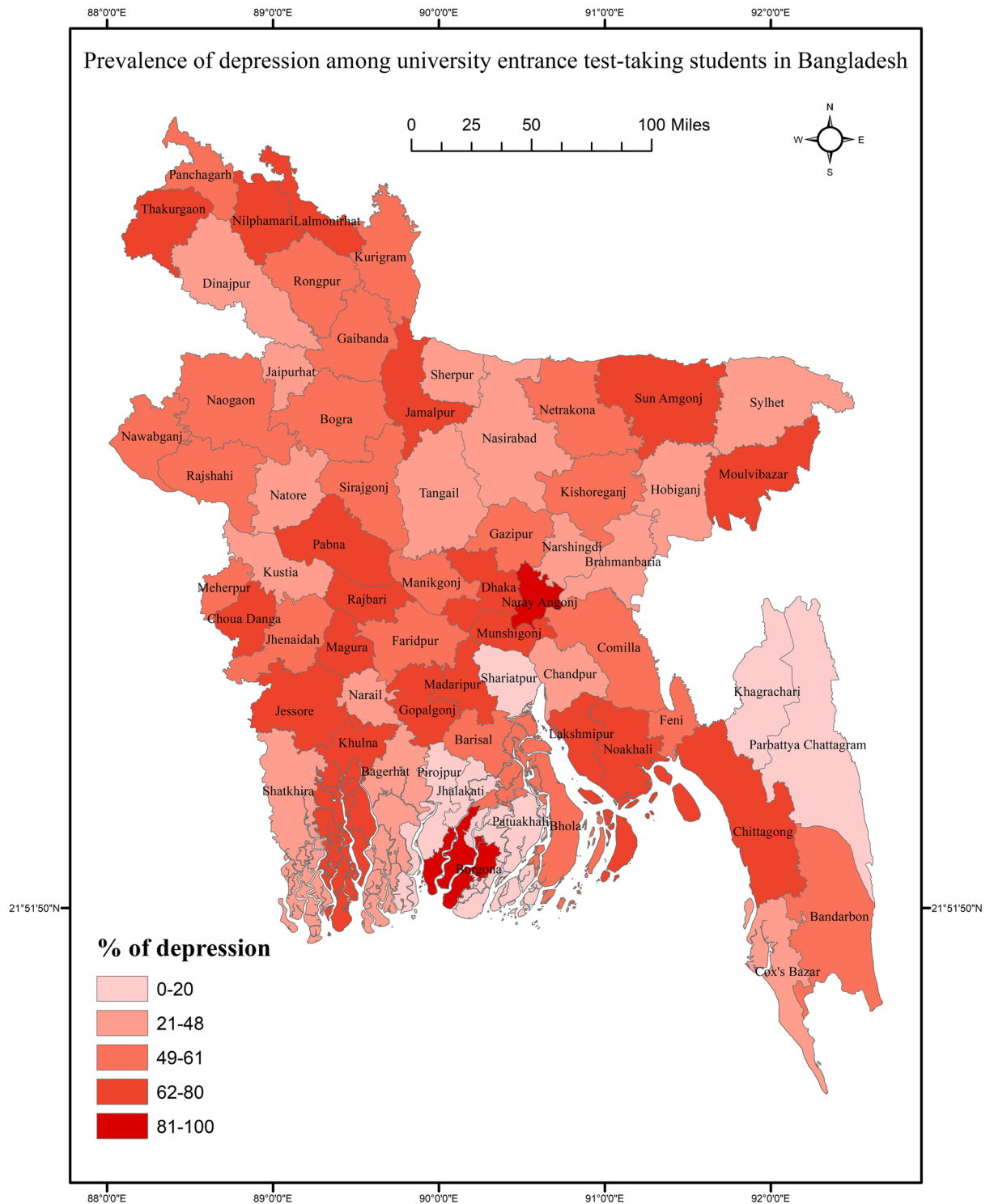
**Table 5.** Binary logistic regression analysis concerning anxiety and the study variables with respect to gender and student status. OR, odds ratio; CI, confidence interval.

By tailoring interventions to the specific needs of students from diverse geographical backgrounds, it is possible to improve their mental well-being and ultimately enhance their overall academic performance and quality of life.

The gender-based comparison in this study revealed a surprising finding, that is, male students exhibited higher levels of depression and anxiety compared to females, which contradicts the results of previous studies that reported higher rates of depression among females conducted in different student cohorts<sup>28,29</sup>. But it is worthy of note that the female entrance test appearing students reported having a higher risk of suicidality<sup>16</sup> as well as burnout symptoms<sup>30</sup>, as reported in the previous studies from the same project. However, the causes of depression among males may stem from various factors. Firstly, male students often face high levels of stress and pressure to excel academically, which can contribute to the development of depressive symptoms<sup>15</sup>. Additionally, societal and cultural expectations of masculinity may further exacerbate the risk of depression and anxiety among male students<sup>31</sup>. Traditional notions of masculinity often discourage the expression of emotions and vulnerability, leading to suppressed feelings that can manifest as mental health issues<sup>32</sup>. These unique stressors and societal pressures faced by male students may explain the higher rates of depression and anxiety observed in this study.

Furthermore, this study found that depression and anxiety rates were significantly higher among repeat test-takers compared to first-time test-takers. This finding is not surprising considering that repeat test-takers have already experienced academic failure and the loss of an entire academic year. These circumstances can induce significant psychological pressure and act as triggering factors for burnout. Previously, it has been indicated that repeat test-takers are at a higher risk of suffering from burnout symptoms compared to first-time test-takers, with burnout itself being significantly associated with depression and anxiety among students<sup>30</sup>. The added stress of repeating the exam, coupled with the disappointment and frustration from previous academic setbacks<sup>33</sup>, likely contributes to the elevated rates of depression and anxiety among repeat test-takers. Additionally, the present study highlighted that dissatisfaction with previous mock test results further increases the risk of mental health problems. Negative experiences and perceived inadequacy in performance can contribute to a cycle of self-doubt and psychological distress<sup>34</sup>. Thus, academic institutions and mental health professionals can implement strategies to address the academic pressures faced by test-taking students and provide them with resources to cope effectively. In addition, support programs can be designed to assist repeat test-takers in managing the psychological burden associated with their academic setbacks and help them build resilience.

The GIS distribution analysis in this study revealed interesting patterns related to the prevalence of depression and anxiety across different districts. While districts like Thakurgaon, Nilphamari, and Lalmonirhat, as well as other western districts, showed a higher prevalence of depression, the differences observed were not statistically significant. This indicates that there may be some geographic variability in the rates of depression, but further investigation is needed to determine the underlying factors contributing to these differences. Similarly, the GIS-based analysis did not find any significant association between any gender and districts in terms of depression prevalence. However, when considering the student status of repeat test-takers, a significant difference in depression distribution across the districts was observed. This suggests that the geographic distribution of depression among repeat test-takers varies significantly, indicating potential contextual factors influencing mental health outcomes in specific districts, for instance, districts near the capital and northwest districts. In contrast to depression, anxiety was found to be significantly associated with districts. This finding suggests that the geographic location of participants plays a role in the prevalence of anxiety symptoms. In Bangladesh, students are often required to travel from one institution to another to attend university entrance tests. This traveling requirement can create added stress and logistical challenges for students, such as managing accommodations and completing the journey. These factors may contribute to the development of anxiety symptoms among students, particularly those from different districts who have to adapt to new environments and navigate unfamiliar circumstances.



**Fig. 1.** Prevalence of depression among university entrance test-taking students in Bangladesh.

Additionally, the lack of confidence in performing well on the exam, financial burdens associated with traveling and food expenses, and social and cultural factors may also influence anxiety levels among the participants from different districts. However, understanding the geographic distribution of mental health problems, such as depression and anxiety, can help inform targeted interventions and support services. By identifying areas with higher prevalence rates, resources can be allocated to provide adequate mental health support and interventions tailored to the specific needs of those districts. Besides, addressing the unique challenges faced by students traveling for university entrance tests, such as improving accessibility and reducing logistical burdens, can help alleviate anxiety symptoms and promote better mental well-being among these individuals.

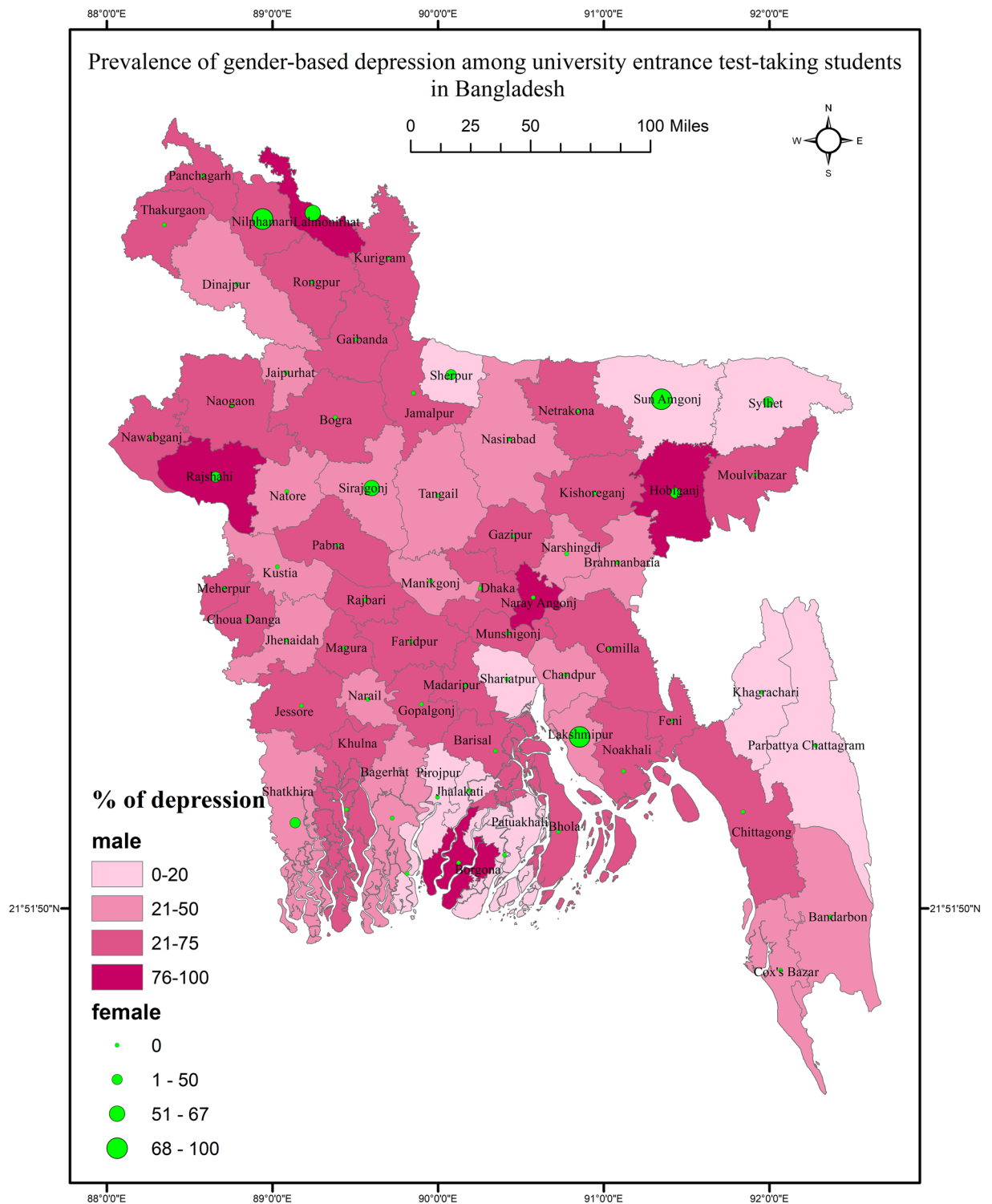
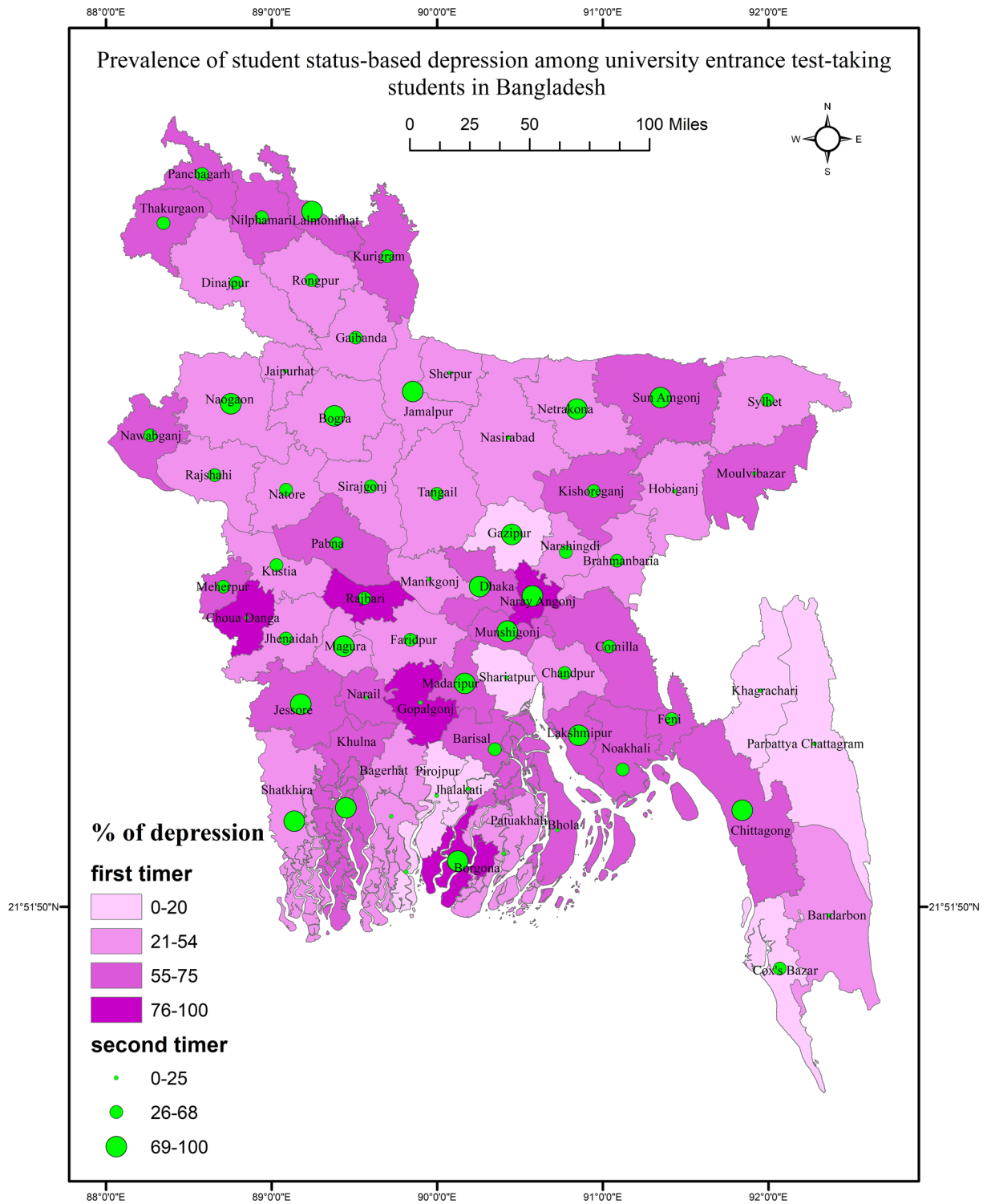


Fig. 2. Prevalence of gender-based depression among university entrance test-taking students in Bangladesh.

### Stigma reduction and promoting mental health literacy

For reducing stigma and improving mental health literacy among university entrance test-taking students, several strategies can be suggested. By implementing these strategies, academic institutions can create a supportive and inclusive environment that promotes mental health awareness, reduces stigma, and empowers university entrance test-takers to prioritize their well-being.

- **Education and awareness campaigns:** Implementing educational initiatives aimed at increasing awareness and understanding of mental health issues among university entrance test-takers can help combat stigma.

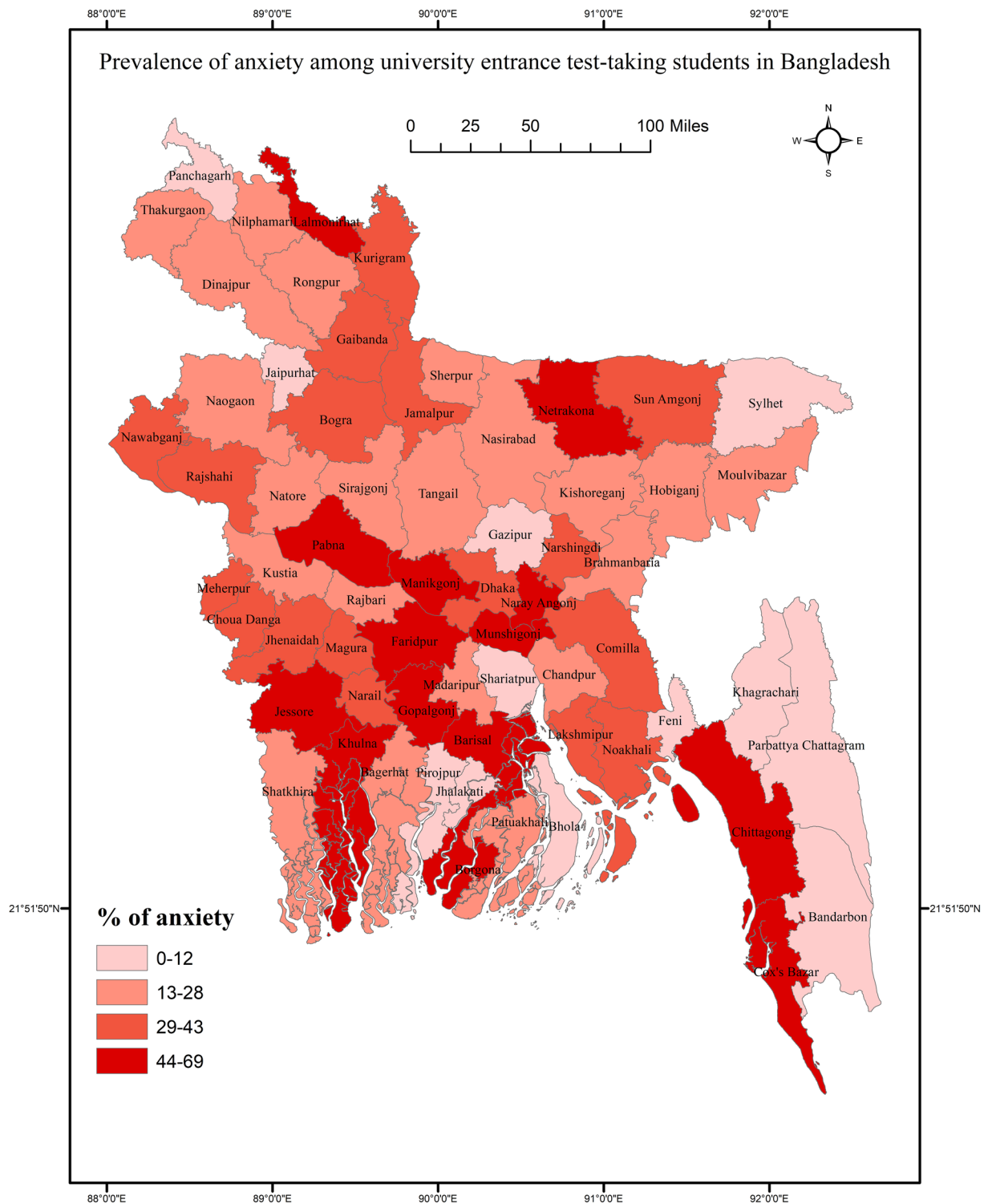


**Fig. 3.** Prevalence of student status-based depression among university entrance test-taking students in Bangladesh.

These campaigns can include workshops, seminars, and informational sessions that provide accurate information about mental health disorders, symptoms, and available support services.

- **Peer support programs:** Establishing peer support programs within academic settings can create safe spaces for students to discuss their mental health concerns openly. Peer support groups, led by trained facilitators or mental health professionals, can offer emotional support, validation, and practical coping strategies to help students navigate their mental health challenges.





**Fig. 4.** Prevalence of anxiety among university entrance test-taking students in Bangladesh.

- **Integration of mental health education into curriculum:** Incorporating mental health education into the curriculum of university entrance test preparation programs can promote mental health literacy among students. By integrating topics related to stress management, self-care, and seeking help for mental health concerns, students can develop the skills and knowledge needed to maintain their well-being.
- **Destigmatizing language and attitudes:** Promoting language that is inclusive, respectful, and non-stigmatizing when discussing mental health can help create a more supportive academic environment. Encouraging faculty, staff, and students to use person-first language and avoid derogatory terms can contribute to reducing the stigma surrounding mental health.

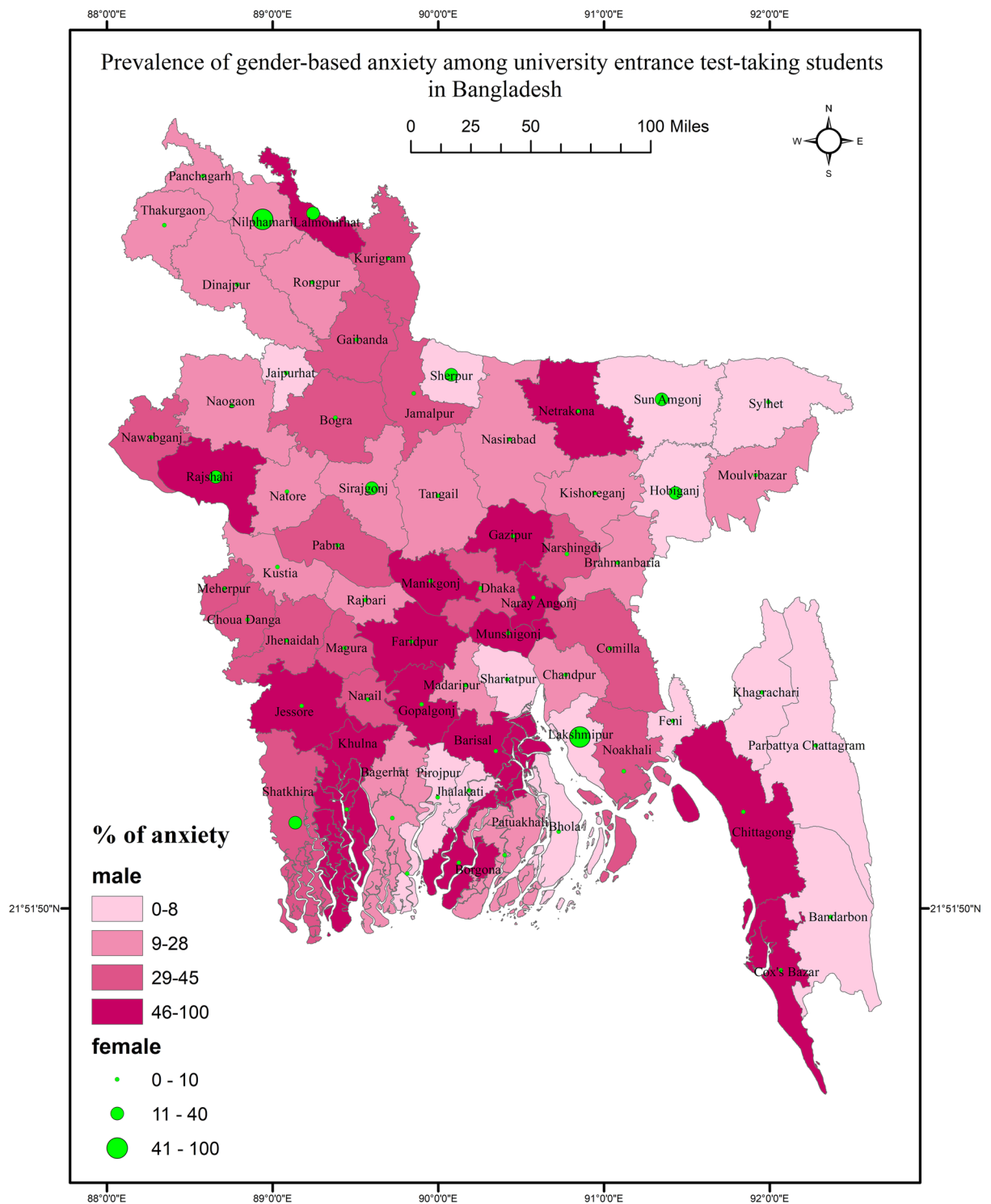
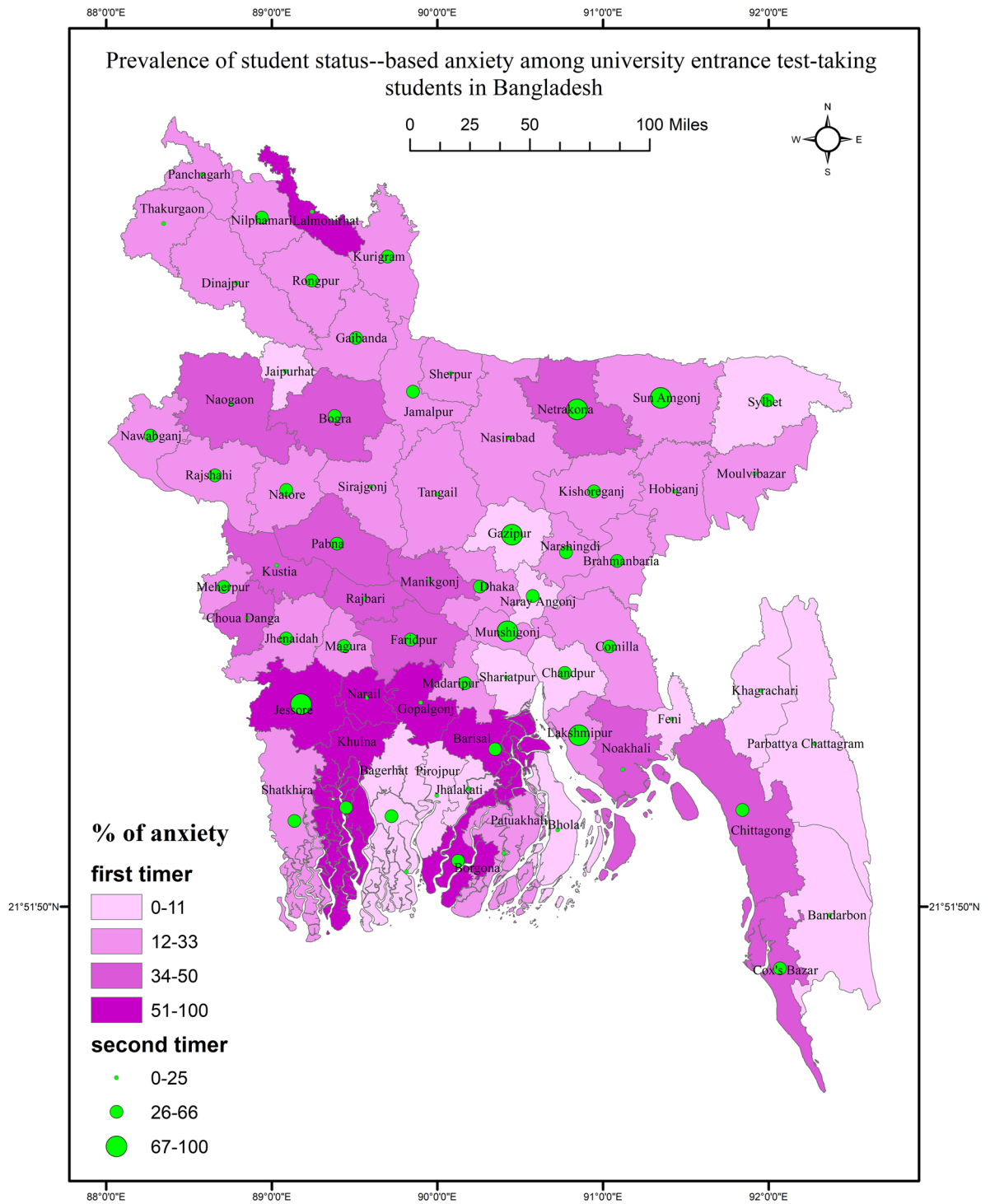


Fig. 5. Prevalence of gender-based anxiety among university entrance test-taking students in Bangladesh.

- **Accessible mental health resources:** Ensuring access to mental health resources and support services for university entrance test-takers is essential for reducing stigma and promoting help-seeking behaviors. This can include establishing counseling centers, helplines, and online resources that provide confidential support and information about available mental health resources.
- **Training for faculty and staff:** Providing training for faculty and staff on recognizing signs of mental distress, responding effectively to students in crisis, and referring them to appropriate support services can facilitate early intervention and support for students struggling with mental health issues.



**Fig. 6.** Prevalence of student status-based anxiety among university entrance test-taking students in Bangladesh.

- **Collaboration with mental health organizations:** Partnering with mental health organizations and advocacy groups can enhance efforts to reduce stigma and promote mental health literacy among university entrance test-takers. Collaborative initiatives can include organizing events, campaigns, and outreach activities aimed at raising awareness and destigmatizing mental health issues within academic settings.
- **Evaluation and feedback mechanisms:** Establishing mechanisms for collecting feedback and evaluating the effectiveness of stigma reduction and mental health literacy initiatives is crucial for continuous improvement. Regular assessments can help identify areas for improvement and ensure that interventions are meeting the needs of university entrance test-takers effectively.

## Limitations

It is important to acknowledge the limitations of this study. Firstly, the study's cross-sectional design restricts the ability to establish causal relationships between mental health problems and the studied variables. The findings provide a snapshot of the participants' mental health at a specific point in time, but long-term effects and causality cannot be determined. Secondly, the sampling technique employed in this study, which relied on convenience sampling, introduces potential biases. The study's exclusive focus on a single center restricts the generalizability of the findings, as center-specific factors may impact the results. Furthermore, the unequal distribution of participants across gender, student status, and districts is another limitation. Although attempts were made to address this issue through statistical analysis, there is still a possibility of unequal representation, potentially affecting the study's findings. In particular, we recognize the need for a more inclusive gender analysis to explore the experiences of non-binary and transgender students. Moreover, the reliance on quantitative methods may not fully capture the depth of students' experiences with anxiety and depression. While our research question primarily focused on quantitative analysis, we acknowledge the value of incorporating qualitative methods to provide richer insights into mental health issues among students. Lastly, reliance on self-reported data introduces inherent limitations, such as subjectivity and recall biases. Thus, acknowledging these limitations is crucial while interpreting the findings appropriately and understanding the scope and generalizability of the study's conclusions. Future research should address these limitations through longitudinal designs, more representative sampling techniques, and objective measures to strengthen the validity and reliability of the findings.

## Conclusions

The COVID-19 pandemic has had a profound impact on the mental health of university entrance test-takers, as evidenced by the higher prevalence of depression and anxiety found in this study compared to previous research. These findings emphasize the urgent need for targeted interventions to support the mental well-being of students facing academic stressors. Following are some specific recommendations that could mitigate the burden of mental health problems among university entrance students. The recommendations provide a comprehensive plan to address the pressing issue of mental health among university entrance test-takers. Reforms in the test-taking system, such as flexible formats and scheduling options, can alleviate stress. Besides, enhancing campus mental health support through counseling, peer programs, and staff training is crucial. Collaboration among stakeholders, including academic institutions and families, is essential for developing effective support programs. Conducting follow-up studies can offer insights into long-term mental health outcomes. Overall, implementing these recommendations can create a supportive environment for students, reducing the burden of mental health issues during the university entrance process.

## Data availability

Data are available upon reasonable request from the corresponding author.

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## Author contributions

FAM and MM: conceptualization, methodology, investigation, data curation. FAM, AMA, MMA, MM and MAM: writing—original draft preparation, writing—reviewing and editing, visualization, validation supervision, software. All authors reviewed the final version and agreed for publication.

## Competing interests

The authors declare no competing interests.

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