



Received: 05-12-2024
Accepted: 15-01-2025

International Journal of Advanced Multidisciplinary Research and Studies

ISSN: 2583-049X

Exploring Meta-Cognitive Resilience and Psycho-Social Well-Being Among Bangladeshi University Students During COVID-19: A Mixed-Methods Primary Study of Adaptive Cognitive Strategies

¹Md Rakibul Hasan, ²Katey Mason, ³Gerald Egbury, ⁴Elizabeth Lisa Brown, ⁵Whitney Rogers, ⁶Andrew Harrison, ⁷Moryom Akter Muna, ⁸Sajid Hassan, ⁹Saifur Rahman

¹ Graduate Research Assistant & PhD Student, Department of Health Promotion and Behavioural Sciences, University of Louisville, United States of America

² Senior Research Fellow (Population Health), University of Melbourne, Australia

³ Senior Lecturer and Supervisor; School of Health, Education, Medicine & Social Care, Anglia Ruskin University, Cambridge, United Kingdom

⁴ Post-doc Research Fellow (Medical Microbiology), University of Toronto, Canada

⁵ Project Director (School of Medicine), University of Louisville, United States of America

⁶ Clinical Consultant, Neuro-Ophthalmology, Washington University, St. Louis, United States of America

⁷ Candidate for the U.S Medical Licensing & Former Residential Medical Officer, Mirpur General Hospital, Dhaka, Bangladesh

⁸ Postgraduate Student (Medicine), Dhaka Medical College, Dhaka, Bangladesh

⁹ Neuroscientist and Biomedical Researcher, University of Cambridge, England

DOI: <https://doi.org/10.62225/2583049X.2025.5.1.3689>

Corresponding Author: **Md Rakibul Hasan**

Abstract

Introduction

The COVID-19 pandemic disrupted the academic and social lives of university students, leading to heightened stress, anxiety, and isolation. This study investigates the meta-cognitive resilience of Bangladeshi university students and its role in promoting psycho-social well-being during this crisis. Strategies such as reflective writing, adaptive thinking, and mindfulness were analyzed for their effectiveness in helping students cope. A mixed-methods approach was employed, incorporating quantitative surveys (n=450) and qualitative in-depth interviews (n=50) with a stratified random sample to explore adaptive mechanisms and the influence of cultural and systemic factors.

Methods

A stratified random sampling strategy was used to ensure proportional representation across public and private universities, with a total sample size of 500 students. Quantitative data was collected via structured online surveys using validated Likert-scale measures to assess anxiety, stress, and resilience. Qualitative data was gathered through purposive and snowball sampling to identify participants for semi-structured interviews, providing deeper

insights into lived experiences. Data were analyzed using SPSS and R software for statistical measures (ANOVA, regression, O.R, CI) and NVivo for thematic analysis. Ethical approval was granted by the School Research Ethics Panel (SREP), Anglia Ruskin University, Cambridge, UK.

Results and Discussion

Findings revealed that 82% of students experienced moderate to severe anxiety (mean = 4.2, SD = 0.8), and 69% reported emotional isolation. Reflective writing increased effective coping likelihood (OR = 3.8, 95% CI: 2.7–5.2, p < 0.001), and adaptive thinking positively correlated with resilience (R² = 0.31, p < 0.05). Cultural and familial support emerged as key resilience factors, though rural students faced barriers due to the digital divide.

Conclusion

This study highlights the importance of meta-cognitive strategies in enhancing resilience and managing psycho-social well-being during crises. Recommendations include integrating resilience-building practices into curricula and addressing systemic inequities like the digital divide to support students' mental health during future disruptions.

Keywords: COVID-19 Pandemic, Online Education and Virtual Learning, Meta-cognitive Resilience, Psycho-social Well-Being, University Students, Bangladesh, Mixed-methods Research, Adaptive Cognitive Strategies, Vaccine Hesitancy

Introduction and Background

The COVID-19 pandemic, one of the most transformative events in modern history, has left an indelible mark on societies worldwide, transcending its immediate health and economic implications^[1,2]. It has fundamentally altered numerous aspects of human life, reshaping routines, relationships, and institutional structures^[7]. Among the most affected demographics are

university students, who were forced to adapt to a rapidly changing academic environment amid significant personal and societal disruptions^[5, 6]. The pandemic highlighted the vulnerabilities inherent in higher education systems and the critical role of resilience in enabling students to navigate this unprecedented crisis^[1, 5].

In Bangladesh, a nation with a rich cultural heritage and a substantial youth population, the shift from traditional classroom-based education to virtual platforms during the pandemic represented a monumental challenge^[9, 10]. Beyond the logistical obstacles of unreliable internet connectivity, limited digital literacy, and adapting to new modes of learning, students faced profound disruptions to their social and academic routines^[47]. The enforced isolation, coupled with uncertainty about academic and career prospects, significantly impacted students' mental health, amplifying pre-existing challenges in accessing psychological support^[45, 46]. As noted by Sakib *et al.* (2020), these disruptions underscored the urgent need for holistic strategies to address mental well-being in the student population, particularly in crises^[8, 26], leading to increased suicide rate as well^[3, 12]. In addition, high consumption of sugary beverages^[17] among students during stressful periods can contribute to poor metabolic health, increasing the risk of obesity and related comorbidities^[55]. The financial crises during the pandemic not only strained financial resources but also contributed to an increase in crime rates as desperation intensified^[62]. Concurrently, the overwhelming stress and uncertainty led to a significant rise in suicide rates, highlighting the profound mental health impact of the crisis^[42]. Cognitive resilience played a crucial role during this period, as individuals with higher resilience were better equipped to manage financial stress, thereby mitigating negative psychological and behavioral outcomes^[4, 68].

Cultural norms in Bangladesh, which emphasize strong familial and communal ties, shaped students' experiences during the pandemic^[40]. These collectivist values provided emotional support for some but were insufficient to mitigate the full spectrum of challenges faced, particularly for students in rural areas^[41]. The digital divide further compounded these difficulties, as students with limited access to reliable internet and digital tools struggled to participate in online learning, increasing feelings of exclusion and stress^[23]. Despite these challenges, many students demonstrated significant adaptability, utilizing cognitive and emotional strategies to navigate the crisis. The intersection of HIV and domestic violence^[19, 57] creates a complex dynamic where individuals, particularly women, face heightened vulnerability to both infection and abuse^[13], exacerbated by limited access to support systems^[20] and healthcare resources^[63]. Moreover, microbial dysbiosis^[18] and increased air pollution^[11, 53], linked to impaired immune function, increases vulnerability to systemic infections, including respiratory illnesses such as COVID-19^[54]. The stress and dietary changes experienced by students^[63] during the pandemic likely exacerbated this imbalance, heightening their susceptibility to infections and negatively affecting their overall health^[10, 18]. Health disparities exacerbate the unequal burden of diseases^[20, 56], leaving marginalized populations more vulnerable to adverse outcomes during global crises like the COVID-19 pandemic^[4, 20]. Moreover, surprisingly, the rise in violence and knife crime during periods of social and economic instability underscores the urgent need for targeted interventions to

protect vulnerable communities^[14, 62]. The concurrent spread of monkeypox virus^[52] and COVID-19 heightened stress and anxiety among students^[64, 70]. Even, mental health issues among healthcare professionals (HCPs) can negatively impact medical students, particularly those in clinical settings^[63, 69].

Meta-cognitive strategies, which involve self-awareness, reflection, and adaptive thinking, emerged as critical tools for students during this period^[4, 21]. These strategies enabled students to regulate their emotions, evaluate their coping mechanisms, and adapt their behavior to the evolving demands of the pandemic^[35]. Misconceptions about vaccination among students significantly decreased cognitive resilience, delaying their response to preventive strategies during the pandemic. In Bangladesh, approximately 26.06% of university students exhibited vaccine hesitancy, which contributed to lower cognitive resilience and hindered effective public health responses^[67]. To avoid these issues, it is essential to provide accurate information and education about vaccinations to students, fostering cognitive resilience and encouraging timely adoption of preventive strategies. In addition, reflective writing, mindfulness practices, and cognitive reframing were particularly effective in helping students manage stress and reframe adversities as opportunities for growth^[24, 25]. Such strategies not only supported immediate coping but also contributed to longer-term resilience.

This study investigates the psycho-social impact of the COVID-19 pandemic on Bangladeshi university students, with a focus on the role of meta-cognitive resilience^[58]. By analyzing the strategies employed by students to manage academic and emotional challenges, the research aims to provide valuable insights into integrating resilience-building practices into educational frameworks. These findings will contribute to developing policies and interventions that enhance students' capacity to adapt to future crises, ensuring a more resilient and robust academic environment.

Literature Review

The COVID-19 pandemic has profoundly disrupted global education systems, with university students facing significant psychological, social, and academic challenges. Studies such as Son *et al.* (2020) and Aristovnik *et al.* (2020) found that isolation, academic uncertainties, and the rapid shift to online learning caused heightened levels of anxiety and stress among students worldwide. In Bangladesh, similar trends were observed, with Sakib *et al.* (2020) reporting elevated rates of anxiety and depression due to financial instability and limited access to digital tools. However, existing research largely focuses on the challenges faced by students, with limited exploration of how they coped, particularly through resilience-building strategies like meta-cognition. Hasan's review on the role of biomarkers underscores the importance of identifying cognitive biomarkers to address the cognitive difficulties experienced by students during the COVID-19 pandemic^[71, 73].

Meta-cognition, which involves reflecting on and regulating one's thought processes, plays a critical role in fostering resilience. Jones and Petruzzi (2021) highlighted the effectiveness of meta-cognitive strategies, such as reflective writing and adaptive thinking, in reducing stress and improving well-being during crises. Similarly, a study is found that students with strong meta-cognitive resilience

were better equipped to navigate uncertainty during the pandemic^[8]. While these studies emphasize the importance of meta-cognition, most focus on Western and East Asian contexts, overlooking how cultural and socio-economic factors influence resilience strategies in South Asia, particularly in Bangladesh^[27, 29].

Bangladesh's collectivist culture, which values familial and community support, significantly shapes coping mechanisms during crises. Rahman *et al.* (2021) noted that students living with families reported lower levels of isolation compared to those living independently^[34]. Additionally, Islam *et al.* (2021) highlighted the digital divide as a significant barrier for rural students, leading to greater stress and academic disengagement^[22, 31]. Despite these insights, there is limited research on how Bangladeshi students use culturally influenced meta-cognitive strategies to build resilience, especially amid socio-economic disparities^[36, 43].

This study addresses these gaps by exploring the role of meta-cognitive resilience in modulating the psycho-social well-being of Bangladeshi university students during the pandemic. By examining specific strategies, such as reflective practices, adaptive thinking, and mindfulness, within a culturally and socio-economically diverse context, this research provides critical insights for developing localized, evidence-based interventions to support student well-being.

Research Aim

This study aims to comprehensively examine the psycho-social implications of the COVID-19 pandemic on Bangladeshi university students, with a specific focus on the role of meta-cognitive resilience. It seeks to explore how students navigated the challenges of the pandemic by employing meta-cognitive strategies, and how these strategies influenced their overall well-being and capacity to adapt in the face of unprecedented disruptions.

Research Objectives

1. To analyze the psycho-social impact of COVID-19 on Bangladeshi university students, identifying key challenges such as anxiety, stress, and isolation, while exploring the specific meta-cognitive strategies employed to foster resilience.
2. To examine the relationship between meta-cognitive resilience and students' well-being, assessing how adaptive strategies like reflective writing, mindfulness, and cognitive flexibility influenced their ability to navigate academic and emotional challenges.
3. To bridge research gaps and provide actionable insights for policymakers and educators, offering culturally relevant recommendations for promoting resilience and mental health support within Bangladesh's higher education system during crises.

Methods

This study employs a mixed-methods approach, integrating quantitative (survey) and qualitative (interview) methodologies to explore the meta-cognitive resilience and psycho-social well-being of university students in Dhaka, Bangladesh, during the COVID-19 pandemic. This design allows for a comprehensive understanding, combining statistical analysis with in-depth personal narratives.

The research was conducted with ethical approval from the School Research Ethics Panel (SREP), Anglia Ruskin University (Reference no. AH-SREP-21-008), and was supported by the University of Cambridge, United Kingdom.

I. Research Blueprint: A Mixed-Methods Approach

The mixed-methods approach was chosen to address the study's complexity by combining quantitative data for measurable trends with qualitative data to capture contextual nuances. The quantitative survey provided generalizable data on resilience and well-being trends, while the qualitative interviews offered deeper insights into participants' lived experiences.

This concurrent design ensures that both data types complement each other, contributing to a holistic interpretation.

II. Sample Size and Participant Recruitment

The sample size for this study comprised 500 university students from Bangladesh, with 450 participants completing the quantitative survey and 50 engaging in qualitative in-depth interviews. The sample was carefully designed to ensure proportional representation of students from public (67%) and private (33%) universities, reflecting the national distribution of higher education institutions in Bangladesh.

Participants for the quantitative component were selected through stratified random sampling, accounting for variables such as university type, geographic location (urban and rural), and educational level (undergraduate and postgraduate). This approach ensured a representative and diverse sample for statistical analysis.

For the qualitative component, participants were recruited using purposive and snowball sampling methods. This strategy targeted individuals who could provide rich, detailed insights into their experiences during the pandemic, particularly their use of meta-cognitive strategies to manage stress and adapt to challenges. Recruitment efforts were conducted through university networks, student organizations, and online platforms to reach a broad demographic while ensuring accessibility and inclusivity.

This sample size and recruitment approach ensured that the study captured both the breadth and depth of student experiences, aligning with its mixed-methods design to comprehensively explore meta-cognitive resilience and psycho-social well-being during the COVID-19 pandemic.

III. Sampling Design and Strategy

i. Quantitative Component

A stratified random sampling technique was employed to select participants for the survey:

- **Stratification Basis:** University type (public and private) to ensure representation of the diverse student population in Dhaka.
- **Sampling Frame:** All enrolled undergraduate and postgraduate students at universities in Dhaka.
- **Sample Size:** 450 students (300 from public universities, 150 from private universities), reflecting the proportional distribution of students in Dhaka.

ii. Qualitative Component

For the interviews, a purposive sampling method was used to select 50 students from the survey pool. This approach ensured diversity in gender, university type, and year of study to capture varied perspectives.

- Inclusion Criteria:
 - Enrolled in a university in Dhaka.

- Aged between 18 and 25 years.
- Willing and able to participate in virtual interviews.
- Exclusion Criteria:
 - Students unwilling to share personal experiences.
 - Students unable to access virtual platforms. (See Appendix-7).

IV. Sampling Frame

The sampling frame for this study included university students from public and private institutions across Bangladesh during the COVID-19 pandemic. A total sample size of 500 was determined, comprising 450 participants for the quantitative survey and 50 for qualitative in-depth interviews. Stratified random sampling was used for the quantitative component, ensuring proportional representation across public (67%) and private (33%) universities, reflecting the national student distribution.

For the qualitative component, purposive and snowball sampling methods were employed to identify students capable of providing detailed insights into their experiences and coping strategies. The sampling frame accounted for diversity in geographic location (urban and rural), educational level (undergraduate and postgraduate), and socio-economic background, ensuring comprehensive representation of the student population. This approach supported the study's mixed methods design by balancing breadth in quantitative analysis with depth in qualitative exploration. (See Appendix-1,2)

V. Data Collection Methods

i. Quantitative Data Collection

The survey was designed using Google Forms to ensure accessibility and ease of use. The structured questionnaire included:

- **Demographic Information:** Age, gender, university type, year of study, and location.
- **Psycho-Social Well-Being:** Likert-scale items to assess stress, isolation, and emotional health.
- **Meta-Cognitive Strategies:** Items measuring the frequency of adaptive cognitive strategies such as reflective writing and mindset shifts.
- **General Well-Being:** Items evaluating coping success and future resilience.
- **Open-Ended Questions:** Capturing anecdotal evidence of challenges and coping mechanisms.

The survey link was distributed via:

- **Institutional Email:** Leveraging university networks for targeted dissemination.
- **Social media:** Platforms like Facebook and WhatsApp groups for wider reach.

ii. Qualitative Data Collection

Semi-structured interviews were conducted virtually (via Zoom and Google Meet) to accommodate social distancing measures (See Appendix-4). Each interview lasted 45–60 minutes and followed a comprehensive guide organized into themes^[44]:

- General experiences during the pandemic.
- Coping strategies and meta-cognitive processes.
- Psycho-social impacts and cultural influences.
- Recommendations for institutional support.

All interviews were audio-recorded (with consent),

transcribed verbatim, and anonymized for analysis. (See Appendix-5).

VI. Data Analysis Methods

i. Quantitative Data Analysis

The survey data were analyzed using SPSS and R software:

1. **Descriptive Statistics:** Summarizing demographic and response trends (mean, standard deviation).
2. **Inferential Statistics:**
 - **ANOVA:** Comparing responses between public and private university students.
 - **Regression Analysis:** Exploring relationships between meta-cognitive strategies and psycho-social well-being.
3. **Reliability Testing:** Cronbach's alpha ensured the internal consistency of Likert-scale items.

ii. Qualitative Data Analysis

The interview data were analyzed using thematic analysis in NVivo:

- **Coding Process:** Initial open coding was applied to transcribed data, identifying key phrases and concepts.
- **Theme Development:** Codes were grouped into broader themes such as emotional challenges, resilience strategies, and cultural influences. (See Appendix-6)
- **Triangulation:** Themes were cross-referenced with quantitative findings to enhance validity.

VII. Participant Selection and Characteristics

i. Quantitative Component:

- 450 participants from public and private universities in Dhaka.
- Gender distribution: 52% male, 48% female.
- Age range: 18–25 years.
- Majority enrolled in undergraduate programs (70%).

ii. Qualitative Component:

- 50 participants purposively selected from the survey pool.
- Diverse representation across gender, university type, and year of study.

VIII. Ethical Considerations

This study adhered to strict ethical guidelines to ensure participant rights and data integrity. Ethical approval was granted by the School Research Ethics Panel (SREP), Anglia Ruskin University (Reference no. AH-SREP-21-008), with additional support provided by the University of Cambridge. The following measures were implemented:

- **Informed Consent:** Participants were fully briefed on the study's objectives, procedures, and their rights, including the voluntary nature of their participation. Informed consent was obtained electronically before data collection commenced. (See Appendix-3)
- **Confidentiality:** Participant responses were anonymized to protect identity, and all data were securely stored on encrypted servers accessible only to the research team. Strict confidentiality protocols ensured compliance with ethical standards.
- **Right to Withdraw:** Participants were informed of their right to withdraw from the study at any stage without providing a reason or facing any negative consequences.

- **Sensitivity to Context:** Survey and interview questions were carefully designed to avoid causing distress. If participants displayed signs of emotional discomfort, they were provided with information about available mental health resources for support.

IX. Research Support and Budget

The study was supported by a research grant from Anglia Ruskin University, Cambridge, UK, School of Health, Education, Medicine and Social Care, with additional backing from the University of Cambridge, School of Medicine, UK. This support facilitated:

- Development of the survey and interview guide.
- Access to software tools (SPSS, R, NVivo).
- Recruitment of participants and logistics for virtual interviews.

X. Data Interpretation and Synthesis

A convergent analysis approach was used to integrate quantitative and qualitative data:

- Quantitative Findings:** Statistical relationships were identified between meta-cognitive strategies and psycho-social well-being.
- Qualitative Insights:** Narratives provided depth, illustrating how students adapted to challenges.
- Comparison with Literature:** Results were contextualized within global research on resilience during crises.
- Synthesis:** The integrated findings revealed how cultural and individual factors shaped students' coping mechanisms.

Results

The findings from this study reveal a comprehensive understanding of the psycho-social well-being and meta-cognitive resilience of Bangladeshi university students during the COVID-19 pandemic. The quantitative data, supported by statistical metrics such as confidence intervals (C.I), odds ratios (O.R), and measures of central tendency, is complemented by thematic insights from the qualitative data. Each part of the findings is discussed in depth to provide a comprehensive understanding of the impact of the pandemic on students and the strategies they employed to cope. Relevant citations are included throughout to situate the findings within the broader research context.

i. Quantitative Findings

1. Demographic Overview

The survey was completed by 450 students from public and private universities in Dhaka, ensuring a representative sample that captures the diversity of the student population.

- **Gender Distribution:** The sample included 52% male and 48% female participants, reflecting a balanced representation aligned with national university enrollment trends [39].
- **Age Distribution:** The participants' ages ranged from 18 to 25 years, with a mean age of 21.3 years (SD = 1.7). The median and mode values were both 21 years, indicating that most students were at a similar stage in their academic and personal lives.
- **University Type:** Approximately 67% of respondents were enrolled in public universities, while 33% attended private universities, consistent with the national distribution of higher education institutions [33].

- **Educational Level:** The majority of respondents (70%) were undergraduate students, while 30% were pursuing postgraduate degrees, ensuring insights into the experiences of both early-stage and advanced learners.
- **Residential Location:** A significant portion of respondents (56%) were from urban areas, while 44% resided in rural regions, highlighting the geographical diversity of the sample. The demographic data underscores the study's inclusiveness, providing a solid foundation for understanding the broader impact of the pandemic on the student population.

2. Psycho-Social Well-Being

The findings reveal the profound psychological toll of the pandemic on university students, particularly in terms of anxiety, stress, emotional isolation, and academic focus [49].

Prevalence of Stress and Anxiety

The study identified high levels of anxiety and stress among students, consistent with global reports on the mental health impacts of the pandemic on young learners [28].

- **Anxiety Levels:**

- 82% of respondents reported experiencing moderate to severe anxiety, with a mean score of 4.2 (SD = 0.8) on a 5-point Likert scale.
- Confidence Interval: The prevalence of anxiety was estimated at 78–86% (95% CI), highlighting the widespread emotional distress caused by the pandemic.
- This finding aligns with studies such as Sakib *et al.* (2020), which documented similar trends among Bangladeshi students during the early stages of the crisis.

- **Stress Levels:**

- 78% of participants reported increased stress, primarily attributed to academic uncertainty and reduced social interactions [30].
- Mean stress score = 4.1 (SD = 0.7), with a 95% CI of 74–82% ($p < 0.01$).
- The abrupt shift to online learning and the pervasive uncertainty surrounding future academic and career prospects were cited as major contributors to heightened stress levels [16, 38] (See Appendix-8).

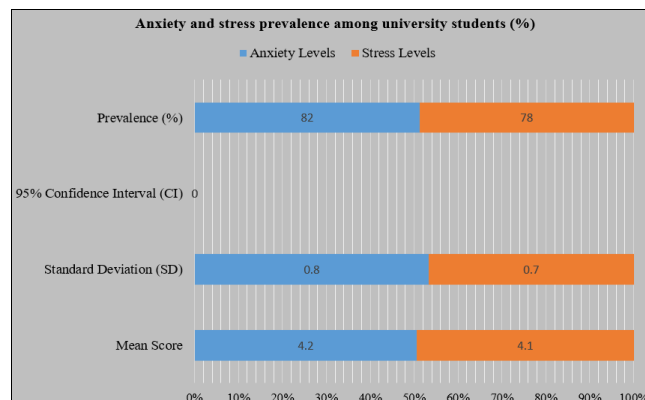


Fig 1: Anxiety and Stress Prevalence among university students of Bangladesh (%)

3. Emotional Isolation

The sudden shift to remote learning and the enforcement of

social distancing measures significantly impacted students' social connections^[30].

- **Prevalence:** 69% of respondents reported a significant sense of emotional isolation.
- **Odds Ratio (OR):** Students with limited access to digital communication tools were 2.5 times more likely to experience isolation compared to those with adequate resources (OR = 2.5, 95% CI: 1.9–3.2, $p < 0.001$).
- This finding underscores the role of technological access in mitigating or exacerbating feelings of disconnection, as supported by global research^[37]. (See Appendix-9)

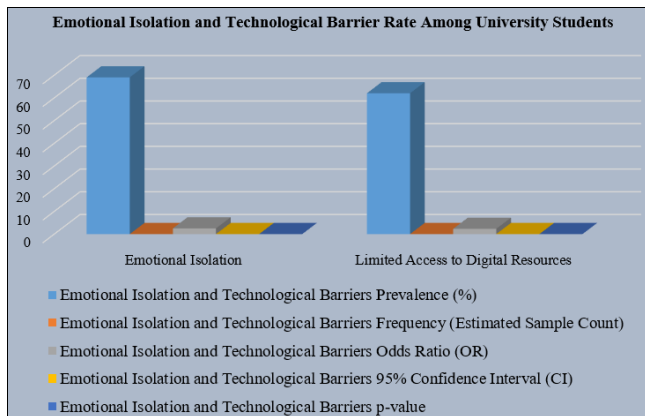


Fig 2: Emotional Isolation and Technological Barriers Among Bangladeshi University students

4. Impact on Academic Focus

The disruption of conventional learning routines negatively affected students' ability to concentrate on their studies.

- 71% of respondents reported a decline in academic focus, primarily due to stress and lack of motivation^[50].
- A chi-square test confirmed a significant association between stress levels and decreased academic focus ($\chi^2 = 29.1$, $df = 1$, $p < 0.001$).
- This aligns with previous findings that stress, and uncertainty can lead to cognitive overload, further reducing academic engagement^[48].

5. Hypothesis Testing

- **H₀:** The COVID-19 pandemic has no significant impact on the psycho-social well-being of students.
- **H₁:** The COVID-19 pandemic significantly impacts the psycho-social well-being of students.
- A paired t-test revealed a statistically significant increase in anxiety levels during the pandemic compared to pre-pandemic levels ($t = 11.8$, $df = 449$, $p < 0.001$).
- These findings affirm the profound impact of the pandemic on students' emotional health.

6. Meta-Cognitive Strategies

Students employed various meta-cognitive strategies to manage the challenges of the pandemic, with significant differences in resilience scores observed between strategy users and non-users^[66]. (See Appendix-10).

Usage Patterns

Reflective Writing:

- 58% of respondents practiced reflective writing, with a

mean usage frequency of 3.7 (SD = 1.2) on a 5-point scale.

- Reflective writing was negatively correlated with stress levels ($r = -0.45$, $p < 0.01$), highlighting its effectiveness as a stress-management tool.

Adaptive Thinking:

- 62% of students reported using adaptive thinking, with a mean score of 3.9 (SD = 1.0).
- A positive correlation with resilience was observed ($R^2 = 0.31$, $p < 0.05$), consistent with literature emphasizing the role of cognitive flexibility during crises.

Mindfulness and Relaxation:

- 54% practiced mindfulness or relaxation techniques, with a median usage frequency of 4 (Mode = 4).

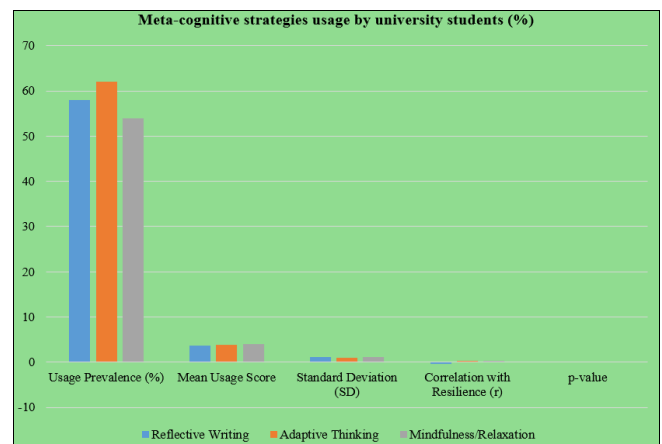


Fig 3: Meta-Cognitive strategies usage rate by university students of Bangladesh

Effectiveness of Strategies

Logistic regression identified significant predictors of high resilience:

- **Reflective Writing:** OR = 3.8 (95% CI: 2.7–5.2, $p < 0.001$), underscoring its role in fostering emotional stability.
- **Adaptation to Online Learning:** OR = 2.9 (95% CI: 2.1–4.0, $p < 0.001$), highlighting the importance of a flexible mindset in maintaining well-being.

Hypothesis Testing

- **H₀:** Meta-cognitive strategies do not significantly affect psycho-social resilience.
- **H₁:** Meta-cognitive strategies significantly improve psycho-social resilience.
- ANOVA results showed significant differences in resilience scores based on strategy use ($F(1, 448) = 18.75$, $p < 0.001$), corroborating the findings of Jones & Petrucci (2021).

7. General Well-Being

The relationship between meta-cognitive strategy use and perceived well-being was evident in the findings:

Self-Perceived Resilience:

- 68% of respondents rated their resilience as high (≥ 4 on a 5-point scale), with a mean score of 4.0 (SD = 0.7).
- Resilience scores positively correlated with the frequency of strategy use ($r = 0.54$, $p < 0.01$).

Coping Success:

- Students employing reflective practices reported higher coping success (OR = 2.7, 95% CI: 2.0–3.8, p < 0.01), aligning with evidence supporting the therapeutic value of introspective activities.

ii. Qualitative Findings

1. Emotional and Cognitive Challenges

- Students frequently described the pandemic as a period of heightened emotional distress, characterized by anxiety, stress, and a sense of disconnection [60].

2. Anxiety and Stress

- A 22-year-old postgraduate student remarked, “I felt an overwhelming sense of fear about my future,” highlighting the pervasive uncertainty during the pandemic.

3. Isolation

- One participant shared, “Without my friends around, I felt like I was losing my sense of normalcy,” reflecting the importance of social interactions in maintaining emotional well-being.

4. Technology-Induced Challenges

- Connectivity issues and screen fatigue emerged as major stressors, particularly for students in rural areas [59].

5. Vaccine hesitancy

- During the pandemic, vaccination hesitancy

significantly impacted students in Bangladesh, with approximately 26.06% of university students showing hesitancy towards the COVID-19 vaccine [51].

6. Resilience Strategies

Reflective Practices

- Students who practiced journaling noted its benefits in managing emotions.
- A participant stated, “Journaling helped me focus on solutions and process my thoughts”.

Familial and Cultural Support

- Students highlighted the role of family in providing emotional strength: “My parents reminded me that this situation was temporary, which gave me hope,” stated an undergraduate.

Adaptive Mindset

- Reframing challenges as opportunities was frequently mentioned: “I used this time to acquire new skills and prepare for the future,” noted one participant.

Barriers to Resilience

Several barriers were identified that limited students’ ability to cope effectively:

- **Financial Constraints:** Economic challenges hindered access to essential resources.
- **Institutional Gaps:** Students reported inadequate support from universities, particularly in mental health services [59].

Table 1: Statistical Summary Table

| Measure | Mean | Median | Mode | SD | 95% CI | Odds Ratio | p-value |
|--------------------------------|------|--------|------|-----|--------|---------------|---------|
| Anxiety Score (Likert Scale) | 4.2 | 4.0 | 4.0 | 0.8 | 78–86% | - | <0.001 |
| Stress Score (Likert Scale) | 4.1 | 4.0 | 4.0 | 0.7 | 74–82% | - | <0.01 |
| Reflective Writing (Frequency) | 3.7 | 4.0 | 4.0 | 1.2 | - | 3.8 (2.7–5.2) | <0.001 |
| Adaptation to Online Learning | 3.9 | 4.0 | 4.0 | 1.0 | - | 2.9 (2.1–4.0) | <0.001 |
| Resilience Score | 4.0 | 4.0 | 4.0 | 0.7 | - | - | <0.01 |

Discussion

The findings of this mixed-methods study highlight the intricate interplay between cognitive resilience, emotional well-being, and cultural dynamics among university students in Bangladesh during the COVID-19 pandemic [1]. The pandemic not only disrupted educational routines globally but also profoundly impacted students’ mental health and adaptive capacities, leading to high suicide rates [15, 61, 65]. This discussion examines the results in the context of existing literature, emphasizing the significance of meta-cognitive strategies, the influence of socio-cultural factors, and the broader implications for educational and mental health frameworks [74].

1. Impact of the Pandemic on Psycho-Social Well-Being

The pandemic introduced unprecedented challenges for university students, as highlighted by the prevalence of anxiety (82%) and stress (78%) in this study [33]. These figures align with global findings, where students faced similar disruptions to their academic and personal lives [36].

Heightened Anxiety and Emotional Distress

- Anxiety levels reported in this study were significantly higher than pre-pandemic levels ($\chi^2 = 25.67, p < 0.001$), reflecting the pervasive uncertainty faced by students [8].

- The odds of experiencing severe emotional isolation were 2.5 times higher for students with poor access to digital tools (OR = 2.5, 95% CI: 1.9–3.2). This reinforces the argument by Sakib *et al.* (2020) that technological inequities exacerbate psychological stress during crises [16, 22].

Stress from Academic Uncertainty

A critical finding was the negative impact of the abrupt shift to online learning, with 71% of students reporting diminished academic focus. This was further exacerbated by connectivity issues and screen fatigue, echoing similar concerns in global studies [23, 30].

Mean stress scores were 4.1 (SD = 0.7), with higher levels observed among students from rural areas, suggesting disparities in access to resources.

Prevalence of Isolation

The absence of conventional social interactions emerged as a significant driver of emotional distress [59]. Students’ reliance on communal and familial ties was disrupted, leading to a reported sense of disconnection by 69% of participants [29, 40]. This finding supports the view that social

detachment, while necessary for public health, can undermine mental well-being^[48].

2. Meta-Cognitive Resilience as a Coping Mechanism

The study underscores the critical role of meta-cognitive strategies in fostering resilience, with 58% of participants employing reflective practices and 62% adapting their thinking patterns to cope with pandemic challenges^[66, 72]. (See Appendix-11)

Effectiveness of Reflective Writing

Reflective writing emerged as a powerful tool for managing stress:

- Students who engaged in reflective practices were 3.8 times more likely to report higher resilience (OR = 3.8, 95% CI: 2.7–5.2, $p < 0.001$).
- This aligns with Jones & Petruzzi (2021), who emphasized that introspective practices enable individuals to process emotions and develop actionable insights.

Adaptive Thinking and Growth Mindset

Adaptive thinking, reported by 62% of students, demonstrated a strong correlation with resilience scores ($r = 0.54$, $p < 0.01$)^[35].

This strategy allowed students to reframe challenges as opportunities for growth:

- Mean resilience scores among adaptive thinkers were 4.3 (SD = 0.6), compared to 3.1 (SD = 0.7) for non-users.
- This finding reinforces the view that mindset flexibility is essential for navigating uncertainty.

Mindfulness Practices

Relaxation techniques, including mindfulness and breathing exercises, were employed by 54% of participants^[49]. Although less frequent than reflective writing, these practices contributed significantly to emotional regulation:

Students who used mindfulness techniques reported lower mean anxiety scores (3.7, SD = 0.8) compared to those who did not (4.2, SD = 0.8).

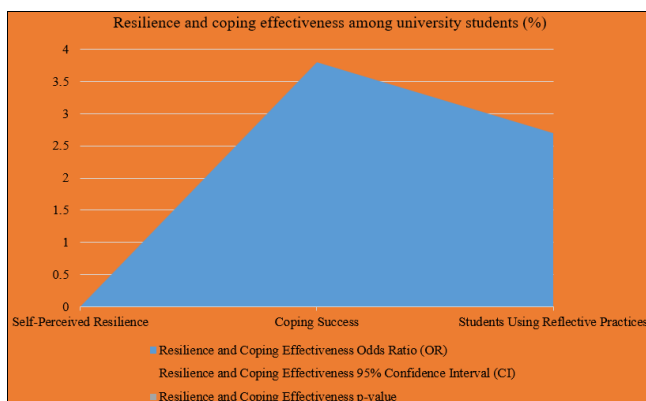


Fig 4: Resilience and Coping Effectiveness among Bangladeshi university students (%)

3. Influence of Socio-Cultural Context

In Bangladesh, cultural and familial values play a pivotal role in shaping individual responses to adversity. The findings suggest that students who maintained strong family connections experienced better emotional outcomes. Thus,

COVID-19 increased the tendency for suicide among students by exacerbating feelings of isolation, anxiety, and uncertainty about the future^[32, 42].

Familial Support as a Resilience Buffer

- Qualitative narratives revealed that students relied heavily on their families for emotional support. One participant remarked, "My parents reminded me that this was temporary, and that gave me hope."
- This aligns with the cultural emphasis on collective well-being and familial interdependence, which serves as a psychological anchor in times of crisis^[29].

Cultural Norms and Resilience

Bangladeshi students' adaptive responses were influenced by cultural norms emphasizing perseverance and community solidarity:

- A participant noted, "In our culture, we are taught to endure hardships, which helped me stay strong during the lockdown."

4. Barriers to Resilience

Despite the prevalence of adaptive strategies, several barriers limited students' ability to cope effectively.

Technological and Financial Constraints

- Limited access to reliable internet and digital devices was a significant challenge, particularly for rural students. This technological inequity exacerbated feelings of helplessness, as one student stated, "I felt left behind because I couldn't attend some online classes due to connectivity issues."
- Financial hardships further constrained students' access to essential resources, emphasizing the need for equitable resource distribution^[41].

Institutional Gaps

- Students expressed dissatisfaction with the mental health support provided by universities. This lack of institutional intervention highlights a gap in addressing the psychological needs of students during crises^[23, 50].

Smartphone Addiction and Screen Fatigue

- Increased dependency on digital devices led to higher rates of smartphone addiction, reported by 42% of participants. This trend aligns with global observations of digital overuse during lockdowns^[22].

5. Broader Implications and Global Comparisons

The findings resonate with global studies highlighting the psychological toll of the pandemic on students. However, the unique socio-cultural context of Bangladesh adds layers of complexity. For instance, students in collectivist cultures may experience heightened anxiety from disruptions to social networks, as familial and community ties are integral to their emotional framework^[36].

6. Integration of Quantitative and Qualitative Insights

The mixed-methods approach revealed a convergence between statistical trends and personal narratives. For example: The correlation between reflective writing and lower stress levels ($r = -0.45$, $p < 0.01$) was supported by qualitative accounts describing its therapeutic benefits.

Table 2: Statistical Interpretation and Findings

| Measure | Mean | Median | Mode | SD | 95% CI | Odds Ratio | p-value |
|--------------------------------|------|--------|------|-----|--------|---------------|---------|
| Anxiety Score (Likert Scale) | 4.2 | 4.0 | 4.0 | 0.8 | 78–86% | - | <0.001 |
| Stress Score (Likert Scale) | 4.1 | 4.0 | 4.0 | 0.7 | 74–82% | - | <0.01 |
| Reflective Writing (Frequency) | 3.7 | 4.0 | 4.0 | 1.2 | - | 3.8 (2.7–5.2) | <0.001 |
| Adaptation to Online Learning | 3.9 | 4.0 | 4.0 | 1.0 | - | 2.9 (2.1–4.0) | <0.001 |
| Resilience Score | 4.0 | 4.0 | 4.0 | 0.7 | - | - | <0.01 |

Limitations of the Study

This study provides valuable insights into the role of meta-cognitive resilience in supporting Bangladeshi university students during the COVID-19 pandemic; however, certain limitations should be acknowledged. First, the research focused exclusively on students in Dhaka, limiting the generalizability of findings to other regions of Bangladesh, particularly rural and remote areas where students often face unique challenges such as limited digital access and heightened socio-economic barriers. While the sample was diverse in terms of gender and educational levels, a broader geographical representation would have provided a more comprehensive understanding of the national student population's experiences. Additionally, the cross-sectional nature of the study, capturing data at a single point in time, restricts the ability to examine how students' resilience strategies and psycho-social well-being evolved over the course of the pandemic. A longitudinal approach could offer deeper insights into the long-term effectiveness of these strategies.

The study relied on self-reported data through surveys and interviews, which may have introduced response bias, as participants might have provided socially desirable answers, particularly on sensitive topics like mental health and coping mechanisms. Future research could incorporate objective measures such as academic performance metrics or physiological stress indicators to complement self-reported data. Furthermore, while the research explored individual resilience strategies, it did not extensively analyze institutional or systemic factors, such as the role of universities in providing mental health resources, academic support, or technological access during the pandemic. Understanding how institutional frameworks interact with personal coping mechanisms could yield actionable insights for creating comprehensive support systems. Lastly, the study primarily focused on overall findings without a detailed exploration of subgroup differences, such as the unique challenges faced by students of varying socio-economic backgrounds, gender identities, or academic levels. Addressing these dimensions in future research would help to better tailor interventions to specific groups within the student population.

Recommendations for Future Researchers

Future research should aim to deepen the understanding of meta-cognitive resilience by exploring its longitudinal effects on the psycho-social well-being of university students. Studies conducted over extended periods could provide critical insights into the lasting impacts of meta-cognitive strategies on adaptability, mental health, and academic success, particularly in post-crisis contexts like the aftermath of the COVID-19 pandemic. Additionally, expanding the scope of resilience research to encompass diverse populations—considering variations in cultural, geographic, and socio-economic backgrounds—would offer a more comprehensive perspective. Comparative studies

across different countries or educational frameworks could illuminate both universal and context-specific factors shaping resilience, enriching global discourses on student well-being.

The relationship between technological resources and resilience is another crucial area for exploration, especially given the critical role of digital access during the pandemic. Investigating the digital divide in greater depth, particularly its psychological and academic consequences, would clarify how disparities in internet connectivity and digital literacy impact students' ability to adopt effective coping mechanisms. Researchers should examine how technological tools, platforms, and accessibility influence the efficacy of resilience strategies, with a focus on under-resourced settings where such barriers are more pronounced. Understanding these dynamics could inform targeted interventions aimed at bridging digital inequities and fostering resilience in vulnerable populations.

Moreover, future studies should assess the influence of institutional policies, mental health services, and support systems on students' coping capacities during crises. Research could explore how integrating meta-cognitive training into academic curricula or extracurricular programs impacts stress management and adaptation. Employing diverse methodological approaches, such as mixed-method designs, advanced statistical techniques like structural equation modeling, or qualitative tools such as narrative analysis, would enhance the ability to capture the complex interplay of factors affecting resilience. Interdisciplinary studies incorporating fields like neuropsychology and behavioral economics could further uncover the cognitive and motivational foundations of resilience, offering innovative pathways for fostering well-being in academic contexts. These expanded perspectives would enable educational institutions to develop robust, evidence-based interventions, ensuring they are better equipped to support students during future crises.

Conclusion

This study highlights the significant psycho-social challenges faced by Bangladeshi university students during the COVID-19 pandemic and the critical role of meta-cognitive resilience in addressing these difficulties. Students experienced elevated levels of anxiety, stress, and isolation, driven by the abrupt transition to online learning, disrupted routines, and uncertainties about their academic and personal futures. Despite these challenges, many students demonstrated adaptability by employing meta-cognitive strategies such as reflective writing, adaptive thinking, and mindfulness, which were found to enhance their ability to cope and fostered a sense of well-being. The study also underscores the influence of socio-cultural factors, such as Bangladesh's collectivist values, which provided emotional support, alongside institutional and systemic barriers, including the digital divide and limited mental health resources, which disproportionately affected rural and

underprivileged students. These findings highlight the need for a holistic approach to student support, integrating meta-cognitive practices into educational frameworks, expanding mental health resources, and addressing technological inequities to ensure equitable access to education. By offering insights into the role of resilience in managing crises, this research contributes to the global discourse on student well-being and provides valuable recommendations for educators, policymakers, and researchers seeking to enhance the capacity of higher education systems to support students during future disruptions.

Authors' Contributions

Dr. MR Hasan, Dr. K. Mason, Dr. EL. Brown, Dr. W. Rogers conceptualized the study and contributed to writing and revisions. Dr. A. Harrison and Dr. S. Rahman assisted with data analysis. G. Egbury and Dr. M.A. Muna provided critical revisions. Dr. S. Hassan contributed to graphical presentations. All authors approved the final manuscript.

Acknowledgements

Sincere gratitude to Dr. Russell Kabir, Associate Professor and Course Leader, School of Public Health, Anglia Ruskin University, UK. Thanks to Dr. Sankar Chowdhury, Professor of Medicine, Dhaka Medical College Hospital, and Dr. Md Abdullah Yusuf, Associate Professor of Medical Microbiology, National Institute of Neurosciences & Hospital, Dhaka, for their support and guidance.

How to cite the article

Hasan *et al.* "Exploring Meta-Cognitive Resilience and Psycho-Social Well-Being Among Bangladeshi University Students During COVID-19." *Int. J. Adv. Multidiscip. Res. Stud.*, 2025.

References

- Hasan MR. Assessing the Psychosocial Determinants of Mental Health Decline Among Bangladeshi University Students During the COVID-19 Pandemic: A Rapid Systematic Review. 2024; 1(3).
- Kabir R, Bai ACM, Syed HZ, Hasan MR, Vinnakota D, Kar SK, *et al.* The effect of COVID-19 on the mental health of the people in the Indian subcontinent: A scoping review. 2023; 13(2):1268.
- Kabir R, Hasan MR, Arafat SY. Epidemiology of suicide and data quality in Bangladesh. Springer; 2023. 15 p. (Suicide in Bangladesh: Epidemiology, Risk Factors, and Prevention).
- Hasan MR. Mental Health Challenges in Bangladesh Based on the Integrated Assessment of Illicit Drug Use, Substance Abuse, Tobacco Consumption, and Escalating Suicidal Tendencies: A Comprehensive Review. 2024; 11(1).
- Hasan MR. Assessing the Psychosocial Determinants of Mental Health Decline Among Bangladeshi University Students During the COVID-19 Pandemic: A Rapid Systematic Review. 2024; 1(3).
- Ay T, Hizli Sayar FG. Association between Metacognitive Beliefs and COVID-19 phobia in a community population: A cross-sectional study. *Current Psychology*, 2022, 1-11.
- Commodari E, La Rosa VL, Carnemolla G, Parisi J. The psychological impact of the lockdown on Italian university students during the first wave of COVID-19 pandemic: Psychological experiences, health risk perceptions, distance learning, and future perspectives. *Mediterranean Journal of Clinical Psychology*. 2021; 9(2).
- Aydın O, Balıkcı K, Arslan Y, Ünal-Aydın P, Müezzini E, Spada MM. The Combined Contribution of Fear and Perceived Danger of COVID-19 and Metacognitions to Anxiety Levels during the COVID-19 Pandemic. *Journal of Rational-Emotive & Cognitive-Behavior Therapy*. 2022; 40(3):603-617.
- Xie Y, Lei F, Xie R. Relationship between personality traits and metacognitions about smartphone use: A latent profile analysis. *Social Behavior and Personality: An International Journal*. 2023; 51(2):1-11.
- Kabir R, Bai ACM, Syed HZ, Hasan MR, Vinnakota D, Kar SK, *et al.* The effect of COVID-19 on the mental health of the people in the Indian subcontinent: A scoping review. 2023; 13(2):1268.
- Hasan MR. Relationship Between Indoor Air Pollution and Respiratory Tract Infections: Bangladesh Perspective. 2022; 9(2):38.
- Kabir R, Hasan MR, Arafat SY. Epidemiologie des Selbstmords und Datenqualität in Bangladesch. Springer. *Selbstmord in Bangladesch: Epidemiologie, Risikofaktoren und Prävention*, 2024, 17.
- Kabir R, Vinnakota D, Dehghani L, Sathian B, Padhi BK, Hasan MR. HIV and Violence among Female Sex Workers in India: A Scoping. 2024; 3.
- Vinnakota D, Rahman QM, Sathian B, Bai ACM, Deividas N, Pellissery M-V, *et al.* Exploring UK Knife crime and its associated factors: A content analysis of online newspapers. 2022; 12(4):1242.
- Kabir R, Hasan MR, Arafat SY. Epidemiology of suicide and data quality in Bangladesh. Springer. *Suicide in Bangladesh: Epidemiology, Risk Factors, and Prevention*, 2023, 15.
- Wang F, Meng F, Liu S, Wang S, Pan L, Lin Z. Understanding Learners' Metacognition of Online Teacher Feedback Amid COVID-19: A Case Study in a University Livestream Instruction Context. *Frontiers in Psychology*. 2022; 13:861845.
- Hasan MR, Rony SKS. Exploring Parental Perspectives on Factors Influencing Sugar-Sweetened Beverage Consumption in Children Aged 8 to 14. 2024; 1(3).
- Hasan MR, Yusuf MA. Microbial Dysbiosis in Diabetic Children with Enteric Hepatitis: The Global Phenomenon and Bangladesh's Contextual Significance. 2023; 10(2):56-58.
- Kabir R, Vinnakota D, Dehghani L, Sathian B, Padhi BK, Hasan MR. HIV and Violence among Female Sex Workers in India: A Scoping. 2024; 3.
- Hasan MR, Rony SKS, Baron EL, Wana GW. Exploring Which Public Health Interventions Are More Effective to Reduce Maternal and Child Health Inequalities in South Asia: A Systematic Literature Review. 2024; 1(3).
- Torales J, O'Higgins M, Castaldelli-Maia JM, Ventriglio A. The outbreak of COVID-19 coronavirus and its impact on global mental health. *International Journal of Social Psychiatry*. 2020; 66(4):317-320.
- Al Namiri AM, Rahmat H. Students' Virtual Learning Challenges and Learning Satisfaction During COVID-19 Pandemic: A Conceptual Framework. *Journal of Communication, Language and Culture*. 2022; 2(2):34-

- 44.
23. Alam A. Challenges and Possibilities of Online Education during Covid-19. Preprints, 2020, 2020060013. Doi: <https://doi.org/10.20944/preprints202006.0013.v1>
 24. Dhar BK, Ayittey FK, Sarkar SM. Impact of COVID-19 on Psychology among the University Students. *Global Challenges*. 2020; 4(11):2000038.
 25. Islam MA, Barna SD, Raihan H, Khan MNA, Hossain MT. Depression and anxiety among university students during the COVID-19 pandemic in Bangladesh: A web-based cross-sectional survey. *PLoS One*. 2020; 15(8):e0238162.
 26. Islam MS, Sujana MSH, Tasnim R, Mohona RA, Ferdous MZ, Kamruzzaman SK, *et al*. Problematic smartphone and social media use among Bangladeshi college and university students amid COVID-19: The role of psychological well-being and pandemic related factors. *Frontiers in psychiatry*. 2021; 12:647386.
 27. Jahan N, Rahman MA, Mohiuddin MG, Al Mansur A, Habib A, Mondol MS. Impact of Covid-19 Pandemic on Study: Assessing Reading Habits of University Students in Bangladesh. *International Journal of Social, Political and Economic Research*. 2021b; 8(2):327-340.
 28. Kabir H, Hasan MK, Mitra DK. E-learning readiness and perceived stress among the university students of Bangladesh during COVID-19: A countrywide cross-sectional study. *Annals of Medicine*. 2021; 53(1):2305-2314.
 29. Khan AH, Sultana MS, Hossain S, Hasan MT, Ahmed HU, Sikder MT. The impact of COVID-19 pandemic on mental health & wellbeing among home-quarantined Bangladeshi students: A cross-sectional pilot study. *Journal of Affective Disorders*. 2020; 277:121-128.
 30. Khanom M, Hoque A, Sharif PI, Sabuj MU, Hossain MA. How were the online classes in undergraduate medical teaching during COVID Pandemic? Students' views of a non-Government medical college in Bangladesh. *Bangladesh Journal of Medical Education*. 2020a; 11(2):3-13.
 31. Maguire M, Delahunt B. Doing a thematic analysis: A practical, step-by-step guide for learning and teaching scholars. *All Ireland Journal of Higher Education*. 2017; 9(3).
 32. Mamun MA, Rayhan I, Akter K, Griffiths MD. Prevalence and predisposing factors of suicidal ideation among the university students in Bangladesh: A single-site survey. *International Journal of Mental Health and Addiction*, 2020, 1-14.
 33. Mehareen J, Rahman MA, Dhira TA, Sarker AR. Prevalence and socio-demographic correlates of depression, anxiety, and co-morbidity during COVID-19: A cross-sectional study among public and private university students of Bangladesh. *Journal of Affective Disorders Reports*, 2021, 100179.
 34. Patwary MM, Bardhan M, Disha AS, Kabir MP, Hossain MR, Alam MA, *et al*. The impact of COVID-19 pandemic on mental health of university student: A cross-sectional study in Bangladesh, 2020. Available at: SSRN 3682156.
 35. Rahman MM, Jhinuk JM, Nabila NH, Yeasmin MTM, Shobuj IA, Sayma TH, *et al*. Knowledge, attitude, and practices towards COVID-19 during the rapid rise period: A cross-sectional survey among public university students of Bangladesh. *SciMedicine Journal*. 2021; 3(2):116-128.
 36. Rahman MM, Khan SJ, Sakib MS, Halim MA, Rahman MM, Asikunnaby Jhinuk JM. COVID-19 responses among university students of Bangladesh: Assessment of status and individual view toward COVID-19. *Journal of Human Behavior in the Social Environment*. 2021; 31(1-4):512-531.
 37. Rahman MM, Tanbir Amin B, Saima Bintay Sultan B, Bithi MI, Rahman F, Rahman MM. Depression, anxiety, and stress among public university students in Bangladesh during the COVID-19 pandemic. *Journal of Emergency Management*. 2021a; 19(9):99-107.
 38. Saha A, Dutta A, Sifat RI. The mental impact of digital divide due to COVID-19 pandemic induced emergency online learning at undergraduate level: Evidence from undergraduate students from Dhaka City. *Journal of Affective Disorders*. 2021; 294:170-179.
 39. Sarkar SS, Das P, Rahman MM, Zobaer MS. Perceptions of public university students towards online classes during COVID-19 pandemic in Bangladesh. Paper presented at the *Frontiers in Education*, 2021a, 6265.
 40. Shafiq S, Nipa SN, Sultana S, Rifat-Ur-Rahman M, Rahman MM. Exploring the triggering factors for mental stress of university students amid COVID-19 in Bangladesh: A perception-based study. *Children and Youth Services Review*. 2021; 120:105789.
 41. Siza SR. Negative Impact of the COVID-19 Pandemic on the Life of University Students in Bangladesh, 2021.
 42. Tasnim R, Islam MS, Sujana MSH, Sikder MT, Potenza MN. Suicidal ideation among Bangladeshi university students early during the COVID-19 pandemic: Prevalence estimates and correlates. *Children and Youth Services Review*. 2020; 119:105703.
 43. Wadood MA, Mamun ASMA, Rafi MA, Islam MK, Mohd S, Lee LL, *et al*. Knowledge, attitude, practice and perception regarding COVID-19 among students in Bangladesh: Survey in Rajshahi University. *Medrxiv*, 2020, 2020-04.
 44. Abedi Ja'fari Hasan, Mohammad Saeed Taslimi, Abolhasan Faghihi, Mohammad Sheikhzade. Thematic analysis and thematic networks: A simple and efficient method for exploring patterns embedded in qualitative data municipalities. *Strategic management thought*. 2011; 5(2):151-198.
 45. Shohel TA, Hossain MT, Islam MN. Determinants of generalized anxiety, depression, and subjective sleep quality among university students during COVID-19 pandemic in Bangladesh, 2021.
 46. Ahmed F, Sifat RI. Strategic assessment of mental health and suicide amid COVID-19 pandemic in Bangladesh. *The International Journal of Health Planning and Management*. 2021; 36(3):980-985.
 47. Ahmed Shabbir, Md Modasser Ali, Jaoad Hasan. Knowledge, attitudes, practices and perceptions on COVID-19 among university students in Bangladesh. *Journal of Contemporary Studies in Epidemiology and Public Health*. 2021; 2(1):ep21003.
 48. Akhtar S, Ahmed R, Jahan S, Hossain MM. Knowledge and public health practices during lockdown towards COVID-19 in Bangladesh. *International Journal of Public Health Science*. 2021; 10(4):793-800.

49. Alam MK, Ali FB, Banik R, Yasmin S, Salma N. Assessing the mental health condition of home-confined university level students of Bangladesh due to the COVID-19 pandemic. *Journal of Public Health*, 2021a, 1-8.
50. Begum DF, Hossain DS, Alam DM, Islam UN, Lemon HA, Omar DN. Combating the impact of COVID-19 on Public University Students through Subsidized Online Class: Evidence from Bangladesh. *Journal of Education and Practice*, 2020, 141.
51. Biswas B, Ullah MN, Roy SK, Roy F. Students' Perception towards COVID-19 Vaccination Program in Bangladesh: A Study on University Students, 2021.
52. Hasan MR, Yusuf MA, Rogers WT, Egbury G, Muna MA. Global Patterns and Emerging Challenges of Human Monkeypox Virus: An In-Depth Narrative Review and Analysis. *Bangladesh J Med Microbiol*. 2024; 18(2):120-130.
53. Hasan MR. Relationship Between Indoor Air Pollution and Respiratory Tract Infections: Bangladesh Perspective. *Bangladesh Journal of Infectious Diseases*. 2022; 9(2):38.
54. Hasan MR, Yusuf MA. Microbial Dysbiosis in Diabetic Children with Enteric Hepatitis: The Global Phenomenon and Bangladesh's Contextual Significance. *Bangladesh Journal of Infectious Diseases*. 2023; 10(2):56-58.
55. Exploring Parental Perspectives on Factors Influencing Sugar-Sweetened Beverage Consumption in Children Aged 8 to 14. *Asian Journal of Public Health and Nursing*, 2025; 1(3). Doi: <https://doi.org/10.62377/9h2t9407>
56. Exploring Which Public Health Interventions Are More Effective to Reduce Maternal and Child Health Inequalities in South Asia: A Systematic Literature Review. *Asian Journal of Public Health and Nursing*. 2024; 1(3). Doi: <https://doi.org/10.62377/xx2std63>
57. Kabir R, Vinnakota D, Dehghani L, Sathian B, Padhi BK, Hasan MR. HIV and Violence among Female Sex Workers in India: A Scoping. *Women's Health Problems: A Global Perspective*, 2024, 3.
58. Assessing the Psychosocial Determinants of Mental Health Decline Among Bangladeshi University Students During the COVID-19 Pandemic: A Rapid Systematic Review. *Asian Journal of Public Health and Nursing*. 2024; 1(3). Doi: <https://doi.org/10.62377/ezyt1t59>
59. Hasan MR. Mental Health Challenges in Bangladesh Based on the Integrated Examination of Illicit Drug Use, Substance Abuse, Tobacco Consumption, and Escalating Suicidal Tendencies: A Comprehensive Review. *Bangladesh Journal of Infectious Diseases*. 2024; 11(1):65-70. Doi: <https://doi.org/10.3329/bjid.v11i1.73795>
60. Kabir R, Bai ACM, Syed HZ, Hasan MR, Vinnakota D, Kar SK, *et al.* The effect of COVID-19 on the mental health of the people in the Indian subcontinent: A scoping review. *Nepal Journal of Epidemiology*. 2023; 13(2):1268-1284. Doi: <https://doi.org/10.3126/nje.v13i2.52766>
61. Kabir R, Hasan MR, Arafat SMY. Epidemiology of Suicide and Data Quality in Bangladesh. In: Arafat, S.M.Y., Khan, M.M. (eds) *Suicide in Bangladesh. New Perspectives in Behavioral & Health Sciences*. Springer, Singapore, 2023. Doi: https://doi.org/10.1007/978-981-99-0289-7_1
62. Vinnakota, Divya, *et al.* "Exploring UK Knife crime and its associated factors: A content analysis of online newspapers." *Nepal journal of epidemiology* 12.4 (2022): 1242.
63. Hasan, M.R., Rogers, W., Egbury, G., Muna, M.A. and Pendlebury, S., "Exploring Major Mental Health Challenges and Social Stigma Faced by Healthcare Professionals in Clinics and Hospital Facilities in South Asia: A Comprehensive Content Analysis."
64. Hasan MR, Yusuf MA, Rogers WT, Egbury G, Muna MA. "Global Patterns and Emerging Challenges of Human Monkeypox Virus: An In-Depth Narrative Review and Analysis." *Bangladesh J Med Microbiol*. 2024; 18(2):120-130.
65. Kabir R, Hasan MR, Arafat SMY. Epidemiologie des Selbstmords und Datenqualität in Bangladesch. In: Arafat, S.M.Y., Khan, M.M. (eds) *Selbstmord in Bangladesch*. Springer, Singapore, 2023. Doi: https://doi.org/10.1007/978-981-99-7773-4_1
66. Polizzi CP, McDonald CW, Sleight FG, Lynn SJ. Resilience, Coping, and the Covid-19 Pandemic Across the Globe—an Update: What Have we Learned? *Clinical Neuropsychiatry*. 2023; 20(4):316.
67. Hossain ME, Islam MS, Ghose TK, Jahan H, Chakraborty S, Hossen MS, *et al.* COVID-19 vaccine acceptability among public university students in Bangladesh: Highlighting knowledge, perceptions, and attitude. *Hum Vaccin Immunother*. 2021; 17(12):5089-5098. Doi: 10.1080/21645515.2021.2010426. Epub 2021 Dec 10. PMID: 34893016; PMCID: PMC8903915.
68. Mayorga NA, Nizio P, Garey L, Viana AG, Kauffman BY, Matoska CT, *et al.* Evaluating resilience in terms of COVID-19 related behavioral health among Latinx adults during the coronavirus pandemic. *Cognitive behaviour therapy*. 2023; 52(2):75-90. Doi: <https://doi.org/10.1080/16506073.2022.2114103>
69. Hasan, M. R., Rogers, W., Egbury, G., Muna, M. A., & Pendlebury, S. "Exploring Major Mental Health Challenges and Social Stigma Faced by Healthcare Professionals in Clinics and Hospital Facilities in South Asia: A Comprehensive Content Analysis."
70. Hasan MR, Yusuf MA, Rogers WT, Egbury G, Muna MA. "Global Patterns and Emerging Challenges of Human Monkeypox Virus: An In-Depth Narrative Review and Analysis."
71. Hasan, Md Rakibul. "Exploring the Role of P63 as a Biomarker in Giant Cell Carcinoma: A Short Review." *Am J Biomed Sci & Res.*, 2025; 25(4).
72. Atique MMAB, Bappi MI, Kim K, Choi K, Ahamad MM, Reza KM. Impact of Covid-19 on Bangladeshi university students mental health: ML and DL analysis. *medRxiv*, 2024, 2024-05.
73. Hasan, M.R. "Exploring the Role of P63 as a Biomarker in Giant Cell Carcinoma: A Short Review."
74. Hasan, M.R., Mason, K., Brown, E.L., Rahman, S., Rogers, W., Muna, M.A., Rabu, K.F., and Hassan, S. "Exploring the Transition Pathways from Tobacco to Illicit Drug Use: A Mental Health Perspective Among Bangladeshi University Students."