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Smartphone use and its association with academic performance among university students in Bangladesh

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ABSTRACT

Smartphone use has become integral to daily life, particularly among university students. While smartphones provide educational benefits, their overuse and addiction may negatively impact academic performance. This study investigates the prevalence of smartphone use, addiction levels, and their associations with academic performance among undergraduate students in Bangladesh. A cross-sectional survey was conducted on 615 undergraduate students from seven universities. The smartphone addiction scale-short version (SAS-SV) measured addiction levels, while academic performance was assessed via self-reported cumulative grade point average (CGPA). Descriptive statistics and logistic regression analyses were performed to explore associations. Among respondents, 29.1% were categorized as smartphone-addicted based on SAS-SV thresholds. Key predictors of higher academic performance (CGPA>3.0) included male gender (adjusted odds ratio (AOR): 3.71, 95% confidence interval (CI): 2.47–5.59, $p<0.01$), rural background (AOR: 1.64, 95% CI: 1.11–2.43, $p=0.01$), and attending private universities (AOR: 1.85, 95% CI: 1.28–2.74, $p<0.01$). Smartphone use for educational purposes was positively associated with better academic outcomes (AOR: 1.48, 95% CI: 0.95–2.30, $p<0.01$). Although smartphones are widely used for academic purposes, excessive use for stress relief or non-educational activities may harm academic outcomes. Interventions promoting responsible use and raising awareness about smartphone addiction are crucial for enhancing academic performance among university students.

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1. INTRODUCTION

The use and production of smartphones in our modern world have dramatically changed different aspects of our life, especially among the younger generation or more specifically among university students [1]. As of now, there are approximately 6.84 billion smartphone users worldwide, representing about 85% of the global population, and by 2028, the global count of smartphone users is expected to approach 7.21 billion [2]. While smartphones provide many benefits and can be highly productive devices, research has found that excessive or compulsive smartphone usage can lead to many negative consequences in daily life, work, and school, reflected in academic performance, behavioral disorders, and adverse effects on physical and mental

health [3]. Smartphone usage has been altering daily routines and impacting habits, social behaviors, family relations, social interactions, and norms and values.

The ubiquity of smartphones among university students no longer makes it difficult to access a wide range of information, communication tools, and various apps designed to improve productivity and learning outcomes. However, the benefits that come with smartphones are coupled with potential downsides, as the intrinsically addictive nature of these devices may lead to negative consequences on academic performance [4]. With increased usage of smartphones by students, there is heightened concern about the possible diversion from academic obligations and development of addictive behaviors that shall impede effective learning [5]. Symptoms of smartphone addiction include withdrawal, tolerance, and negative consequences at the social, academic, and personal levels [5].

The effects of excessive smartphone use on learners' educational outcomes are diverse and operate at multiple levels. Excessive dependence on smartphones might result in shorter periods of study, disturbed sleep patterns, and higher rates of procrastination contributing to lower academic achievement [6]. Moreover, permanent connectivity of the smartphone can increase levels of stress in students; this stress has been connected to poorer cognitive functioning and general well-being among people [7]. A complementary research program then designed and subsequently validated the adult user-targeted smartphone addiction assessment tool, presenting findings that identified multiple factors, including interruptions of daily activities, positive anticipation, withdrawal, and, specifically, internet-centered relationships, as significant predictors for smartphone addiction [8].

Despite the growing concern of global studies on the implications of smartphone addiction, there remains a significant gap in context-specific evidence from low- and middle-income countries, particularly Bangladesh. While several studies findings indicate that excessive smartphone use tends to correlate with poorer academic outcomes [7], much of the existing literature is constrained by limitations such as small sample sizes, restricted geographic coverage, and insufficient control for confounding factors like mental health and socioeconomic status. Consequently, the applicability of these results to the wider Bangladeshi university student population remains limited.

In response to the identified research gap, this study focuses on analyzing smartphone usage behaviors among Bangladeshi university students and determining how such use may affect their academic performance. Although smartphones are widely used by Bangladeshi students for educational and non-educational purposes, little is known about the specific usage behaviors and their academic consequences in this context. As far as we are aware, limited empirical research has thoroughly explored the association between cellphone usage and academic performance among university students in Bangladesh. Accordingly, this research intends to offer evidence-based insights that may inform institutional policies, promote healthier digital habits, and support academic success within higher education environments.

2. METHOD

2.1. Study design and type

A cross-sectional survey was conducted to collect data from university-level participants across seven selected universities, comprising five public and two private institutions. Among the seven selected universities, six were selected from the capital city Dhaka, and one from outside Dhaka City.

2.2. Sample size estimation

The sample size was calculated using the standard formula:

$$n = z^2pq/d^2$$

where, z=1.96 (95% confidence level), p=0.532 (prevalence of problematic smartphone use among adolescents) [9], q=1−p, and d=0.04 (precision). The calculated sample size was 598. Accounting for a 5% non-response rate, the final target sample was 628. After data screening and quality checks, 615 respondents were included in the final analysis, out of the 628 initially sampled participants.

2.3. Sampling technique and selection criteria

A two-phase cluster sampling design was employed, with universities serving as primary clusters. In the first phase, seven universities were randomly selected from a comprehensive list. In the second phase, approximately 90 students were recruited from each selected university, based on predefined inclusion and exclusion criteria. Within each institution, participants were selected through convenience (quota) sampling by visiting campuses and residential halls. Participants were required to be enrolled students to meet the inclusion criteria who had completed at least one year of study and owned a smartphone, ensuring access to

academic performance data (e.g., grade point average or GPA). Students with irregular enrollment status or severe health conditions were excluded.

2.4. Data collection and processing

Field data collection was conducted during February and March 2023 using a structured questionnaire. Initially developed in English, the questionnaire was translated into Bangla, the native language, for field implementation. A pretest was conducted with 30 individuals not included in the main study to assess clarity, duration, and coherence. In response to the feedback, the content was revised accordingly, and the final version of the questionnaire was developed. Data was gathered through in-person interviews conducted by trained professionals. To ensure data quality and adherence to protocol, two experienced field supervisors oversaw the entire data collection process.

2.5. Data collection tools

The study gathered data on socio-demographic characteristics, patterns of smartphone use, academic performance, physical and mental health, and smartphone addiction. Socio-demographic data included variables such as gender, age, place of birth, current residence, type of university, year of study, housing conditions, and ownership of household assets. Smartphone use data encompasses daily usage duration (in hours), age at first use, and purpose of use. For the latter, respondents rated their usage (e.g., calls, entertainment, and browsing) on a 5-point Likert scale (1=never, 5=always). Academic performance was assessed through student-reported cumulative grade point average (CGPA).

Smartphone addiction was measured using the smartphone addiction scale–short version (SAS-SV), a validated 10-item instrument with responses on a 6-point Likert scale (1=strongly disagree, 6=strongly agree). The SAS-SV captures five dimensions: i) daily-life disturbance; ii) withdrawal; iii) cyberspace-oriented relationships; iv) overuse; and v) tolerance. Total scores range from 10 to 60, with higher scores indicating greater risk of addiction. Recommended cut-off scores are 31 for males and 33 for females [9]. The questionnaire was adapted from existing validated instruments to ensure content validity. Internal consistency of the SAS-SV was high, with Cronbach's alpha of 0.87, indicating excellent reliability.

2.6. Data analysis

Both descriptive and inferential statistical methods were applied. Descriptive analysis included frequency distributions, percentages, and mean±standard deviation for relevant variables. Smartphone addiction levels were assessed using the SAS-SV with established cut-off values.

Binary logistic regression was employed to examine associations, as the primary outcome variables were dichotomous. The findings are presented as odds ratios (ORs) accompanied by 95% confidence interval (CI), with statistical significance determined at the $p<0.05$ level. All analyses were conducted using SPSS version 25. Key potential confounders, including age, gender, academic year, socio-economic status, and study hours, were identified and incorporated into the questionnaire. To control confounding effects, multivariable regression analyses were performed, adjusting for variables that demonstrated significant bivariate associations with both smartphone addiction and academic performance.

3. RESULTS AND DISCUSSION

Table 1 shows respondents' socio-demographic characteristics and their association with CGPA. Among 615 respondents, males comprised 51.4% and females 48.9%. Gender was significantly associated with CGPA ($\chi^2=40.71$, $p<0.01$), with 41.3% of males and 28.0% of females achieving a CGPA above 3. Most respondents (61.8%) were aged 22–24 years (mean 22.7±1.8). Place of birth was significantly related to CGPA ($\chi^2=8.79$, $p<0.01$), with rural students (38.7%) outperforming urban peers (30.6%). Current living status also showed significance ($\chi^2=9.59$, $p<0.01$), as students living away from family (44.6%) had higher CGPAs than those living with family (24.6%). University type was significant ($\chi^2=10.67$, $p<0.01$), with public university students (51.2%) more likely to attain CGPA>3 than private university students (18.0%). Year of study (first–second vs. third year and above), extracurricular participation (54.5%), and regular exercise (20.0%) showed no significant CGPA differences. Smartphone addiction (29.1%) was not significantly associated with academic performance.

Table 2 shows that male students were more likely to achieve higher academic performance than females, as reflected by an adjusted odds ratio (AOR) of 3.71 (95% CI: 2.47–5.59; $p<0.01$). Students born in rural areas also had greater odds of better performance compared to urban counterparts, as indicated by an AOR of 1.64 (95% CI: 1.11–2.43; $p=0.01$). Those living with their families demonstrated higher academic success than those living apart, as reflected by an AOR of 1.44 (95% CI: 0.92–2.27; $p<0.01$). Contrary to earlier findings, private university students were significantly more likely to perform better than public

university students, as shown by an AOR of 1.85 (95% CI: 1.28–2.74; p<0.01). Additionally, students who started using smartphones before age 15 were more likely to have higher academic achievement, as reflected by an AOR of1.65 (95% CI: 1.02–2.67; p=0.03).

Table 1. Socio-demographic characteristics of the respondents

Characteristics	n (%)	CGPA <3	CGPA >3	χ^2 value	p-value
Gender					
Male	314 (51.4)	60 (9.8)	254 (41.3)	40.71	<0.01
Female	301 (48.9)	129 (21.0)	172 (28.0)		
Age					
19-21	149 (24.2)	49 (8.0)	99 (16.1)	0.59	1.04
22-24	380 (61.8)	116 (18.9)	264 (43.0)		
25+	86 (14.0)	23 (3.7)	63 (10.3)		
Mean ±SD		22.7±1.8			
Place of birth					
Urban	271 (44.1)	83 (13.5)	188 (30.6)	8.79	<0.01
Rural	344 (55.9)	106 (17.2)	238 (38.7)		
Current living status					
With family	243 (39.6)	92 (15.0)	151 (24.6)	9.59	<0.01
Without family	372 (60.4)	97 (15.8)	275 (44.6)		
University type					
Public	430 (69.9)	115 (18.7)	315 (51.2)	10.67	<0.01
Private	185 (30.1)	74 (12.0)	111 (18.0)		
Current year of study					
First to second year	181 (29.4)	51 (8.3)	130 (21.1)	0.78	0.37
Third year to masters	434 (70.6)	138 (22.5)	296 (48.1)		
Participation in extracurricular activities					
Yes	335 (54.5)	91 (14.8)	244 (39.7)	4.39	0.30
No	280 (45.5)	98 (15.9)	182 (29.6)		
Regular physical exercise					
Yes	123 (20.0)	39 (6.3)	84 (13.7)	0.06	0.79
No	592 (80.0)	150 (24.4)	342 (55.6)		
Smartphone addiction					
Yes	179 (29.1)	48 (7.8)	131 (21.3)	1.81	0.17
No	436 (70.9)	141 (22.9)	295 (48.0)		

Table 2. Association between sociodemographic factors and academic performance

Variables		Unadjusted model			Adjusted model		
		COR	95% CI	p-value	AOR	95% CI	p-value
Gender	Male	3.90	2.57–5.92	<0.01	3.71	2.47–5.59	<0.01
	Female		Ref.				
Age	19-24	1.16	0.67–2.01	0.58	1.10	0.65–1.95	0.65
	25+		Ref.				
Place of birth	Rural	1.60	1.10–2.43	0.01	1.64	1.11–2.43	0.01
	Urban		Ref.				
Current living status	With family	1.36	0.90–2.06	0.01	1.44	0.92–2.27	<0.01
	Without family		Ref.				
University type	Private	1.77	1.15–2.71	<0.01	1.85	1.28–2.74	<0.01
	Public		Ref.				
Current year of study	First to second year	0.97	0.63–1.49	0.89	0.87	0.58–1.31	0.52
	Third year and above		Ref.				
Age at the onset of smartphone use	<15 years	1.56	0.96–2.53	0.07	1.65	1.02–2.67	0.03
	>15 years		Ref.				

COR=Crude odds ratio

3.1. Daily use and purpose of smartphone

Figure 1 indicates that 78.9% of respondents primarily used their smartphones for social networking purposes on a daily basis. This was followed by entertainment (63.7%) and email or internet communication (61.1%), reflecting use for leisure and professional purposes. Educational use was reported by 55.1% of participants. Additionally, 53% used smartphones for calls, and 52.4% to pass time. Other frequent uses included web browsing (43%), coping with loneliness (37.9%), and stress relief (36.7%). Gaming was least common, with 23.5% engaging regularly.

Table 3 examines the relationship between academic performance and variables related to smartphone use. Smartphone use for educational purposes was significantly associated with better academic performance, as reflected by an AOR of 1.48 (95% CI: 0.95–2.30; p<0.01). Additionally, respondents who

did not use smartphones as a means of reducing mental stress were 61% more likely to exhibit improved academic outcomes, as indicated by an AOR of 1.61 (95% CI: 1.04–2.48; p=0.03). Furthermore, smartphone use to cope with loneliness demonstrated a statistically significant, though comparatively weaker, association with academic performance, with an AOR of 1.15 (95% CI: 0.78–1.69; p=0.03).

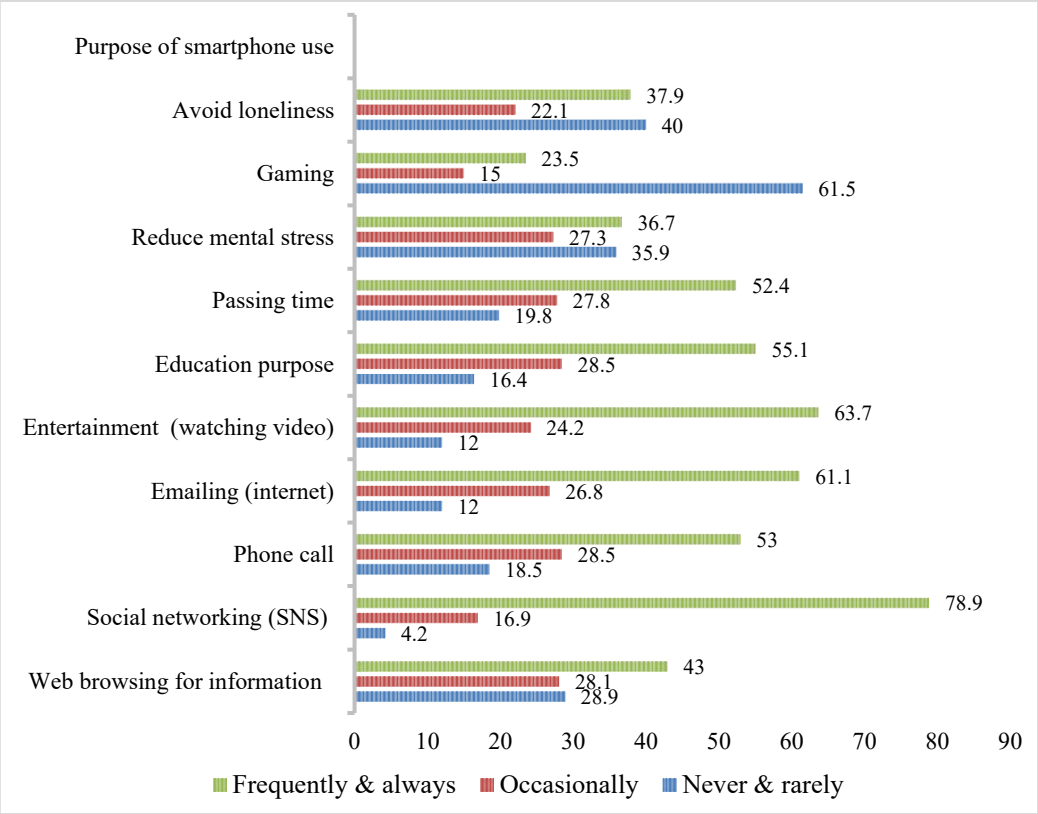

Figure 1. Distribution of the level of purpose of smartphone use

Table 3. Association between smartphone use behaviors and academic performance

Variables		Unadjusted model			Adjusted model		
		COR	95% CI	p-value	AOR	95% CI	p-value
Smartphone addiction	No	1.26	0.84–1.89	0.24	1.30	0.88–1.92	0.17
	Yes		Ref.				
Duration of smartphone use/day (in hours)	<3 hour	1.35	0.91–1.99	0.12	1.37	0.93–2.01	0.10
	>3 hour		Ref.				
Purpose of smartphone use							
Education	No	0.74	0.47–1.80	<0.01	1.48	0.95–2.30	<0.01
	Yes		Ref.				
Phone call	No	0.93	0.64–1.35	0.73	0.89	0.62–1.26	0.52
	Yes		Ref.				
Web series	No	0.77	0.53–1.13	0.19	0.87	0.61–1.23	0.44
	Yes		Ref.				
Gaming	No	0.77	0.50–1.19	0.25	0.71	0.46–1.09	0.12
	Yes		Ref.				
Music	No	0.74	0.50–1.08	0.12	0.72	0.50–1.05	0.09
	Yes		Ref.				
Social media	No	1.02	0.70–1.50	0.88	1.07	0.73–1.57	0.70
	Yes		Ref.				
Passing time	No	1.06	0.71–1.59	0.75	1.16	0.81–1.66	0.40
	Yes		Ref.				
Reduce mental stress	No	1.55	1.00–2.40	0.04	1.61	1.04–2.48	0.03
	Yes		Ref.				
Avoid loneliness	No	0.59	0.38–0.93	0.02	1.15	0.78–1.69	0.03
	Yes		Ref.				

4. DISCUSSION

The current study sets out to look into the academic performance of university students, particularly concerning smartphone use. The findings revealed that gender, place of birth, living arrangements, and university type significantly influenced CGPA, while variables such as smartphone addiction and extracurricular activities had no discernible effect. The analysis showed that a higher percentage of male students (41.3%) attained a CGPA of above 3 compared to their female counterparts (28.0%). This is in line with previous research, which has ascertained that male students tend to perform better academically, especially in subjects requiring analytical minds [10]. Another study has observed males are more actively engaged in mobile learning environments than their female classmates [11]. This finding, however, diverges from previous research suggesting that women usually perform better academically than their male counterparts [12]. The gender difference that materialized in this study can be attributed to the difference in study habits, social norms, or other responsibilities like childcare, which fall more on female students [13].

The study also found that students from rural areas outperformed those from urban environments. This outcome supports previous research that indicates that rural students often have fewer distractions and a stronger work ethic, which can be explained by the fewer number of activities available for leisure and a generally more disciplined environment [14]. Additionally, students living independently from their families demonstrated higher academic performance, possibly due to the development of greater autonomy and responsibility. Living away from family may encourage time management and self-regulation, factors linked to improved academic outcomes [15].

Public university students (51.2%) were more likely to attain higher CGPAs than those in private institutions (18.0%), possibly due to differences in curriculum strength, teaching resources, or institutional rigor [16]. No significant performance difference was observed across academic years, supporting earlier findings that psychological and socio-environmental factors—like self-esteem, sleep, and family support—may outweigh the influence of academic seniority [17], [18]. When used effectively, smartphones can enhance learning by providing access to digital materials, supporting group tasks, and allowing flexible study schedules [19]. Contrary to the common belief that heavy smartphone use negatively affects academics, many students use their devices for productive tasks like accessing course content or engaging in academic discussions. The multidimensional nature of smartphone use may explain the weak correlation with academic performance, consistent with earlier studies that found no direct relationship [20], [21]. These findings highlight that usage quality and intent matter more than time spent. Students with higher smartphone self-efficacy—those confident in using devices for academic tasks—tend to achieve better results [22]. Accessing course material, educational videos, and tools for time management helps students understand content more efficiently than traditional methods [23]. Thus, smartphones, when used constructively, serve as valuable academic aids.

A study demonstrated that the association between cellphone usage and students' academic performance is complex and depends on multiple factors, such as the purpose of use and levels of self-regulation [24]. Another body of research examined the effectiveness of virtual learning environments and showed that when used effectively within educational settings, smartphones can positively influence student motivation, satisfaction, and learning performance [25]. This substantiates the assertion of encouraging productive and educational applications of smartphones, which may lead to positive academic outcomes. This found a connection between different factors of smartphone use and CGPA, with increased hours spent on smartphones associated with an elevated CGPA [26]. The use of cellphones for academic-related purposes, and entertainment through playing games sharpens certain cognitive skills that ultimately improve academic performance [27]. As a result, college students who rely more heavily on smartphones for learning may be more inclined to view them as having a positive effect on their academic performance [28]. These results suggest that promoting responsible and productive smartphone use could be a more effective strategy than discouraging its use altogether.

However, it was confirmed by several studies that high addiction or excessive use of smartphones and technology particularly for non-educational purposes did have a negative impact on overall academic performance [26], [29]. Studies have shown that students with higher smartphone dependency often demonstrate lower academic performance [30]. However, students who used smartphones to reduce mental stress or avoid loneliness were less likely to perform well academically. This notable finding aligns with existing literature suggesting that reliance on smartphones to cope with stress or social isolation may contribute to increased distraction and reduced academic engagement [31].

Although smartphones are widely used, no significant correlation was found between academic performance and either smartphone addiction or daily usage duration. The purpose of smartphone use may moderate its impact on academic achievement. Nonetheless, this study has its limitations, as cross-sectional design prevents any conclusions about cause and effect, and self-reported smartphone use may introduce bias. Moreover, these unexpected findings suggest that simply measuring frequency of use or extracurricular participation may not fully capture their effects on academic performance. To better understand long-term

effects, future research should consider using longitudinal study designs, emphasize the quality and type of smartphone use, and explore additional factors such as personality traits and cognitive abilities.

5. CONCLUSION

This study contributes meaningful understanding of smartphone usage patterns, addiction prevalence, and their academic implications among undergraduate students in Bangladesh. Several factors were significantly associated with academic outcomes. Findings have important implications for students, parents, educators, administrators, and healthcare professionals aiming to improve university students' academic success. On average, students spend about 5 hours daily on smartphones, primarily for web browsing, social networking, entertainment, and passing time. The moderately high prevalence of smartphone addiction signals an emerging public health concern. Effective interventions—including mass media campaigns and counseling—are needed to raise awareness about the risks of smartphone addiction and its adverse effects on academics. Public health practitioners should consider these findings in clinical settings, while higher education policymakers must develop targeted strategies to support students vulnerable to smartphone addiction and poor academic performance.

Although this study adds value to the existing body of research, certain limitations should be acknowledged, including its reliance on a cross-sectional approach, self-reported responses, and the possibility of sampling bias, all of which should be considered when interpreting the results. Future research should adopt longitudinal methods and objective measures to strengthen evidence. This study contributes preliminary insights that can support further exploration of the complex relationship between smartphone engagement and academic performance, notably in emerging country contexts. Addressing smartphone addiction is vital to safeguard students' academic success and overall well-being. Collaborative efforts among educators, policymakers, and healthcare providers are essential to promote responsible use of smartphone and enhance academic outcomes.

From the findings of the study, several recommendations are advanced to reduce smartphone addiction and its negative effects on academic performance. Universities should establish guidelines on responsible smartphone use and integrate digital health education into curriculums. Creating awareness of the risks of excessive use of smartphones among students, parents, and educators will be very important, together with counseling services that may offer support for behavioral modification. The use of smartphones and promotion of physical activity should be delayed until at least 17 years in order to improve academic outcomes. Besides, the adoption of smartphone apps to limit screen time and further study to monitor long-term impact will help alleviate this modern scourge. Concerted efforts from policymakers, teachers, and health professionals will be needed to ensure proper smartphone usage for better scholastic achievement.

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AUTHOR CONTRIBUTIONS STATEMENT

This journal uses the Contributor Roles Taxonomy (CRediT) to recognize individual author contributions, reduce authorship disputes, and facilitate collaboration.

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C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

CONFLICT OF INTEREST STATEMENT

The authors declare no competing interests related to this study.

INFORMED CONSENT

Before enrolling in the study, all participants gave informed consent. They were clearly briefed on the study's purpose, procedures, any potential risks, and their right to withdraw at any time without consequences. Participant confidentiality and anonymity were rigorously protected throughout the research. The study adhered to established ethical standards and received approval from the Institutional Review Board (IRB) of the Bangladesh Medical Research Council (BMRC).

ETHICAL APPROVAL

The study was approved by the Institutional Review Board (IRB) of the Bangladesh Medical Research Council (BMRC) with Reference: BMRC/HPNSP-Research Grant/2022-2023/613(1-18), dated January 15th, 2023, and by the Department of Public Health at Daffodil International University. The study was carried out in accordance with the principles of the 1975 Helsinki Declaration, as revised in 2000.

DATA AVAILABILITY

The raw dataset used in this study is available from the corresponding author [FAI], upon justified request.

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