Socio-Demographic Predictors of Earthquake Preparedness Among University Students: Evidence from a Public University in Bangladesh

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Abstract

Bangladesh is exceptionally prone to recurring hydrological and meteorological disasters, which have traditionally dominated the national policy and disaster management discourse. Consequently, seismic risk remains heavily underemphasized, leaving major urban centers like Dhaka highly vulnerable to catastrophic human and structural losses from potential earthquakes. While structural mitigation receives occasional attention, the public's behavioral resilience and practical preparedness remain significantly overlooked. This study aimed to evaluate the level of knowledge, attitudes, and practices (KAP) regarding earthquake preparedness among university students in Bangladesh and to identify the key socio-demographic factors influencing their readiness.

A cross-sectional quantitative survey was conducted among 840 undergraduate and graduate students in a highly rated public university in Dhaka. The structured, self-administered questionnaire demonstrated excellent internal consistency (Cronbach's alpha = .890).

The participants obtained relatively high mean scores for factual knowledge and favorable attitudes. However, their actual preparedness practice score was notably low, exposing a pronounced "knowledge-behavior gap". Multiple linear regression models revealed that overall earthquake preparedness was significantly predicted by several socio-demographic variables. Age, geographic location of growing up, housing type, family size, family type, house ownership, income level and maternal education levels were significant predictors of preparedness. Notably, only 1.7% of students relied on educational institutions as their primary information source, whereas those relying on family channels (40.8%) exhibited significantly better practice scores than those relying on social media (28%).

The study highlights a critical deficiency in practical earthquake readiness among Bangladeshi youth, heavily stratified along socio-demographic and economic lines. To bridge the gap between risk

awareness and physical readiness, a paradigm shift is needed in urban disaster management. Educational institutions must transition from passive public safety messaging toward mandatory, hands-on disaster training, evacuation drills, and targeted active support for socio-economically vulnerable student groups to cultivate community-wide seismic resilience.

Keywords: Earthquake Preparedness; KAP Framework; University Students; Knowledge-Behavior Gap; Socio-demographic Factors; Bangladesh.

1. Introduction

Bangladesh is widely recognized as one of the most disaster-prone countries in the world (Rahman et al., 2025) due to its unique geographic location, deltaic landscape, high population density, and increasing exposure to climate-induced hazards (Sikder et al., 2025; Ali et al., 2019; Bernzen et al., 2019). Bangladesh is ranked 9th in the World Risk Report 2022 (Rahman et al., 2023). National disaster management efforts have historically concentrated on recurrent hydrological and meteorological hazards such as floods, cyclones, riverbank erosion, waterlogging, and storm surges. Consequently, substantial institutional, financial, and policy attention has been directed toward climate adaptation and disaster risk reduction initiatives (Rahman et al., 2023). This focus is reflected in strategic national frameworks such as the Bangladesh Delta Plan 2100, which aims to enhance long-term resilience against climate-related risks, while contemporary urban planning initiatives increasingly incorporate climate change adaptation and sustainability considerations.

Despite these advancements, earthquake risk remains comparatively underemphasized within the national disaster preparedness discourse. Although Bangladesh is located in a seismically active region influenced by the interaction of the Indian, Eurasian, and Burmese tectonic plates (Rahman et al., 2023; Paul & Bhuiyan, 2010), earthquake preparedness has not received sustained policy and societal attention proportional to its potential consequences. Public concern typically intensifies only after the occurrence of mild tremors within the country or neighboring regions (Tan & Maharjan, 2018). However, such responses are often reactive and short-lived, resulting in a cyclical pattern of attention followed by institutional and public complacency.

The vulnerability of Bangladesh's major urban centers, particularly Dhaka, amplifies the severity of this risk. Dhaka is among the most densely populated cities in the world, characterized by rapid urbanization, inadequate land-use planning, aging infrastructure, narrow access roads, and widespread

construction practices that frequently deviate from established safety standards (Alam et al., 2025; Ferdous & Rahman, 2015; Rahaman et al., 2023). A moderate-to-large magnitude earthquake affecting the metropolitan area could result in catastrophic human casualties, extensive structural damage, disruption of essential services, and significant economic losses. The concentration of population and critical infrastructure within a highly congested urban environment further complicates emergency response and evacuation efforts (Wang et al., 2024).

While structural vulnerability has received some degree of attention, behavioral preparedness among the population remains largely overlooked. Earthquake resilience depends not only on the integrity of buildings and infrastructure but also on the capacity of individuals, households, and institutions to respond appropriately during and immediately after a seismic event (Alluqmani et al., 2026). In Bangladesh, earthquake-specific preparedness practices are generally absent from everyday life (Rahman et al., 2023). Institutions rarely conduct evacuation drills or earthquake safety training programs (Roy et al., 2025).

This lack of preparedness creates significant risks of preventable casualties during an earthquake. In the absence of adequate knowledge and training, individuals may engage in unsafe behaviors such as rushing toward exits simultaneously, causing crowd crushes and trampling incidents (Sieben & Seyfried, 2023); delaying evacuation to retrieve valuable possessions (Liu et al., 2026) etc. Furthermore, secondary hazards, including earthquake-induced fires and infrastructure failures, may exacerbate mortality and injury rates when residents are unprepared to respond effectively (Lu et al., 2025).

To contextually ground behavioral resilience, a growing body of international literature has examined the relationships between demographic factors and disaster preparedness. Several researchers have focused specifically on how individual characteristics dictate variations in risk perception, knowledge,

and behavior. For instance, Rahman (2019) demonstrated that disaster-related attitude, perception, and behavioral patterns vary significantly across variables such as education, age, and gender. Focusing on specialized cohorts, Hasan et al. (2022) examined nursing students' perceived readiness and preparedness relative to gender, age, and marital status, while Sözcü and Türker (2026) evaluated the foundational earthquake literacy levels of healthcare professionals. Regional demographics also play an essential role; Cisternas et al. (2024) investigated tsunami and earthquake preparedness among coastal residents and tourists, discovering that permanent residents consistently exhibit higher levels of preparation than transient visitors.

Other scholars have concentrated on vulnerable or culturally diverse cohorts using varied statistical and qualitative frameworks. Liao and Hu (2025) utilized hierarchical regression to determine disaster preparedness factors among older adults in Taiwan. Similarly, a cross-cultural study by Grozdanić et al. (2024) across multiple Southeastern European nations highlighted that socio-economic characteristics—predominantly age, gender, and education—serve as significant predictors of resilience. In the immediate aftermath of a crisis, Arunratanothai et al. (2026) conducted a post-disaster study following a major earthquake in Thailand, detailing the complex interplay between post-traumatic stress, awareness, and preparedness among Thai dental students.

Scholars have increasingly adopted advanced spatial and behavioral models to decipher preparedness pathways. Spatial Analysis was introduced by Hajilo et al. (2024), who investigated earthquake preparedness by evaluating location-based hazard proneness. In terms of behavioral theory, Demir and Aydemir (2025) tracked preparedness behaviors through the different stages of the Precaution Adoption Process Model (PAPM). To understand structural dependencies, Sözen and Genç (2025) modeled university students' earthquake knowledge using Structural Equation Modeling (SEM) involving six latent variables. This structural modeling approach was also utilized by Fatehpanah et al. (2025), who integrated diverse socio-demographic factors, such as gender, education, and geographic

location, into an SEM framework. To complement these quantitative approaches, Atando and Sugawara (2024) conducted a qualitative, comparative study across two countries to understand how underlying resource differences influence earthquake preparedness.

Within the specific geographic and socio-cultural context of Bangladesh, empirical studies have begun evaluating localized behavioral preparedness. M. M. Rahman et al. (2023) studied urban earthquake preparedness in Dhaka, establishing significant associations between individual preparedness and variables such as education, occupation, and housing type. More recently, Islam et al. (2026) conducted a mixed-method study in Bangladesh mapping perceived earthquake knowledge, attitudes, and preparedness, confirming the statistical significance of family income, age, and education.

A few foundational international and regional papers bear the closest structural resemblance to our current inquiry. A highly comparable baseline study was conducted in Israel by Soffer et al. (2011), which evaluated baseline earthquake-related knowledge and perceptions. Crucially, the closest work to our current study was executed by Khan et al. (2025); however, their work was unable to specify or isolate the precise influence of various socio-demographic factors among young people—a critical empirical gap that our study directly addresses.

Addressing this gap is essential for developing comprehensive disaster risk reduction strategies that move beyond structural mitigation and incorporate behavioral resilience, public awareness, institutional preparedness, and community-level capacity building. Without sustained efforts to improve earthquake preparedness at individual, household, and organizational levels, populations will remain highly vulnerable to this low-frequency but potentially catastrophic hazard.

2. Methods

2.1. Study Design and Setting

This study employed a cross-sectional quantitative design to assess the level of knowledge, attitudes, and practices (KAP) regarding earthquake preparedness among university students and to identify associated demographic factors. The study was conducted at Jahangirnagar University, a residential public university located in Savar, Dhaka, Bangladesh. Data collection was carried out using a structured self-administered questionnaire between 3rd June, 2025 to 2nd July, 2025.

2.2. Study Participants and Sampling

The target population comprised undergraduate and graduate students enrolled at Jahangirnagar University. A total of 1,000 printed questionnaires were distributed using a convenience sampling method. Convenience sampling was chosen due to its feasibility in accessing a large number of students within a limited timeframe. Of these, 840 completed questionnaires were retained for final analysis, yielding a response rate of 84%. The remaining 160 questionnaires were excluded due to incomplete responses or missing data. The male and female ratio (53.1:46.5) of sampled participants reflects the institution's actual ratio as it is known for enrolling the same number of male and female students each year. In addition, the distribution of students from different majors closely follows the university's actual distribution where most (43%) of the students are enrolled in science and technology related disciplines and only a small fraction (7%) of students are pursuing business and management related degrees.

There were some specific eligibility and exclusion criteria for participants of this study. Eligibility criteria included: (i) being an enrolled student at Jahangirnagar University during the survey period, (ii) willing to participate voluntarily. Exclusion criteria encompassed: (i) incomplete responses, (ii) illogical/irrational responses.

2.3. Data Collection Instrument and Procedure

A structured questionnaire was developed in English, which consisted of four structured sections: demographic information (Section A), earthquake-related knowledge (Section B), attitudes (Section C), and practices (Section D). The instrument was developed based on existing literature and expert consultation and was pretested among a subset of students to ensure clarity and contextual relevance. The pretesting of the data collection tool involved face-to-face interviews in assessing respondents' perceptions of the questions, overall questionnaire comprehensiveness, and the appropriateness of question-wording, length, and sensitivity.

The variables and items utilized in the development of scales to access the level of KAP were derived from earlier studies. A combination of these items was tailored and adapted to align with the particular socio-cultural context of university students of Bangladesh.

Before data collection, the questionnaire was translated independently from English to Bangla by a bilingual expert. Afterwards, a different expert who is fluent in both languages translated it from Bangla to English. A comparison of item meanings between the original English version and the back translated Bangla version showed no significant differences. Ten enumerators participated in the pretesting, final printed questionnaire dissemination and collection of the questionnaire. After collection they inputted the data into excel sheets for the preparation of analysis. All the exclusion and inclusion criteria were considered rigorously while inputting the data from the printed questionnaire to the digital database file (.xlsx).

To assess the internal consistency of the research tool, a reliability analysis was conducted across all 38 items of the combined Knowledge, Attitude, and Practice scales. The overall instrument demonstrated excellent internal consistency, yielding a Cronbach's alpha coefficient of .890 (Standardized $\alpha = .877$), significantly exceeding the widely accepted academic threshold of .70. This confirms that the composite KAP survey serves as a highly reliable tool for evaluating overall earthquake preparedness among the target student population.

2.4. Demographic Information

This section contained 14 items collecting information on participants' age, gender, area of upbringing (urban/rural), housing type (kacha, semi-pucca, pucca), family type (nuclear or joint), number of family members, housing tenure (owned/rented), monthly family income (categorized), parental education levels, number of years spent at university, broad academic discipline, membership in any disaster-related organization or club, prior earthquake experience, and sources of information about earthquakes.

2.5. Knowledge of Earthquake

This section included 14 statements assessing participants' factual knowledge about earthquake causes, risks, and safety protocols. Each item had three response options: True, False, and Don't Know. Correct responses received a score of 1, while incorrect or "Don't know" responses were scored 0. For most of the 14 statements, the correct answer was True. However, for three deliberately designed and reversely coded questions (K3, K6, and K14), "False" was considered the correct response. The total knowledge score ranged from 0 to 14, with higher scores indicating greater earthquake-related knowledge.

2.6. Attitude toward Earthquake

This section assessed students' attitudes about earthquake preparedness using 10 statements. Each statement was rated using three options: Agree, Disagree, and Don't Know. Responses were dichotomized for analysis, where 'Agree' was scored as 1, indicating a favorable attitude, and 'Disagree' or 'Don't Know' were scored as 0. No reverse coding was applied. Scores ranged from 0 to 10, with higher scores representing more favorable attitudes towards earthquake preparedness.

2.7. Practices before, during and after Earthquake

Practices were assessed with 14 items rated on a 5-point frequency scale: 1 = Never, 2 = Occasionally, 3 = Sometimes, 4 = Often, and 5 = Always. Among them the first seven items assessed pre-earthquake practices, the next three items assessed during earthquake practices and the last 4 items assessed practices immediately after an earthquake event. Scores were summed to produce a total practice score ranging from 14 to 70, with higher scores indicating more frequent engagement in preparedness behaviors.

2.8. Composite KAP Score

An overall KAP score was calculated by summing the individual scores from the knowledge, attitude, and practice sections. This composite variable served as a proxy indicator for the participants' total level of earthquake preparedness, with higher scores representing greater awareness and preparation. This score represented overall earthquake preparedness, ranging from a minimum of 14 to a maximum of 94.

2.9. Ethical Considerations

The study adhered to the principles outlined in the 1975 Declaration of Helsinki, specifically its 6th version from 2008. Participation was voluntary, and written informed consent was obtained from all respondents. Data was anonymized and stored securely to ensure confidentiality. No incentives were offered to participants.

2.10. Statistical Analysis

Data were analyzed using RStudio (Version 2025.05.0 Build 496) with R packages including dplyr, car, tidyr, and rlang. Descriptive statistics such as means, standard deviations, and percentages were computed for all relevant variables.

The digital database file (.xlsx) was imported into the RStudio environment using the readxl package. Then to examine differences in KAP (Knowledge, Attitude, Practice) scores across demographic subgroups, independent samples t-tests or one-way ANOVA were conducted depending on the number of groups per independent variable. Prior to these analyses, the assumption of homogeneity of variances were assessed using the Levene's test (via the car package).

When Levene's test indicated violation of the homogeneity assumption ($p < 0.05$), either Welch's t-test or Welch's ANOVA (using base R functions t.test() and oneway.test()) was applied to ensure robustness. Otherwise, standard parametric tests assuming equal variances were used. For variables with statistically significant group differences, post-hoc analyses were conducted using Tukey's HSD for standard ANOVA or Games-Howell for Welch's ANOVA.

To identify significant predictors of the four outcome variables (earthquake-related knowledge, attitudes, practices, and overall KAP scores), four separate multiple linear regression models were performed. Each model included all demographic variables from Section A as predictors. Regression diagnostics confirmed that key assumptions — including linearity, homoscedasticity, and multicollinearity— were satisfied. Results were reported using standardized regression coefficients (β), standard errors (SE), and p-values, with significance determined at $p < 0.05$.

3. Results

3.1. Characteristics of the Study Participants

Table 1 summarizes the demographic, socioeconomic, earthquake and education related characteristics of the study participants (N=840). The mean age of participants was 22.74 ± 1.48 years where males comprised 53.1% of the sample. 50.7% of the participants were brought up in rural areas and 63.6% belonged to families living in reinforced concrete (pucca) housing and 77.5% belonged to nuclear families. The mean number of family members were 5.20 ± 1.83. 72.5% of the participants' families dwelt in their own housing. 60.2% and 31.4% of the participants belonged to middle income and higher income families respectively. Regarding parental education, 47.6% of fathers had attained a bachelor's degree, while 26.1% of mothers had completed secondary education. In terms of participants' university major, 43% were enrolled in Science and Technology related programs and on average participants had 2.92 ± 1.47 years of tertiary education. Only 14.9% of the participants were engaged with environment related clubs/organizations. 91% of the participants experienced earthquake at least once in their lifetime. 40.8% participants reported that their main source of earthquake related information was family members.

The mean scores for earthquake preparedness related knowledge, attitude and practice were 10.62 ± 1.93 (range 0-14), 8.57 ± 1.89 (range 0-10) and 40.05 ± 13.51 (range 14-70) respectively. The mean overall earthquake preparedness score was 59.62 ± 14.99 (range 14-94).

Table 1

Participant Characteristics of the Study.

Variables	Frequency	Percentages	Mean ± SD
Age			22.74 ± 1.48
Gender			
Male	446	53.1	
Female	391	46.5	
Grew Up in			
Village	426	50.7	
City	412	49	
Housing Type			
Kacha (made of non-durable materials)	144	17.1	
Semi-pucca (re-inforced concrete with tin roof)	157	18.7	
Pucca (re-inforced concrete)	534	63.6	
Family Type			
Nuclear	651	77.5	
Joint	185	22	
Number of Family Members			5.2 ± 1.83
Housing Tenure			
Own	607	72.3	
Rented	224	26.7	

Income Class			
Lower Income	66	7.9	
Middle Income	506	60.2	
Higher Income	264	31.4	
Father's Education Level			
No Formal Education	58	6.9	
Primary Education	38	4.5	
Secondary Education	114	13.6	
Higher Secondary Education	226	26.9	
Tertiary Education	400	47.6	
Mother's Education Level			
No Formal Education	83	9.9	
Primary Education	135	16.1	
Secondary Education	219	26.1	
Higher Secondary Education	195	23.2	
Tertiary Education	208	24.8	
Major enrolled in			
Science and Technology	361	43	
Arts and Humanities	192	22.9	
Social Sciences	221	26.3	
Business and Management	59	7	
Years of Tertiary Education			2.92 ± 1.47
Environment related Club Membership			

No	714	85
Yes	125	14.9
Experience of Earthquake		
No	75	8.9
Yes	764	91
Primary Source of Earthquake related Information		
Family Members	343	40.8
Relatives	18	2.1
Neighbors	28	3.3
Educational Institutions	14	1.7
Television	139	16.5
Social media	235	28
Friends	32	3.8
Other	21	2.5
Knowledge Score		10.62 ± 1.93
Attitude Score		8.57 ± 1.89
Practice Score		40.05 ± 13.51
Total KAP Score		59.62 ± 14.99

(Source: Data presented in Table 1 is compiled from a cross-sectional quantitative questionnaire survey administered to university students at Jahangirnagar University, Savar, Dhaka, Bangladesh between June 3, 2025, and July 2, 2025 (N=840).)

3.2. Associations between the study variables and Knowledge, Attitude, Practice and Total Score

Table 2 presents the associations between Knowledge, Attitude, Practice and Total earthquake preparedness scores across various study variables. Male participants had significantly higher attitude score than females (8.75 ± 1.69 vs. 8.35 ± 2.08, p = 0.0026). Participants who grew up in urban areas had significantly higher practice score (41.19 ± 13.88 vs. 38.95 ± 13.10, p = 0.0197) and total score (61.11 ± 15.52 vs. 58.23 ± 14.39, p = 0.0098) than those brought up in rural areas. Participants' housing type was significantly associated with knowledge score (F = 5.52, p = 0.0045), practice score (F = 7.04, p < 0.001) and total score (F = 6.31, p = 0.0019), where post-hoc analysis revealed that participants from reinforced concrete housing had higher knowledge (p = 0.002), practice (p < 0.001) and total (p = 0.003) scores. Participants belonging to nuclear families had significantly higher knowledge (10.84 ± 1.71 vs. 9.82 ± 2.38, p < 0.001), attitude (8.75 ± 1.74 vs. 7.92 ± 2.23, p < 0.001), practice (41.15 ± 13.12 vs. 36.34 ± 14.14, p < 0.001) and total score (60.95 ± 14.46 vs. 55.11 ± 15.82, p < 0.001) than participants coming from joint families. Participants who were house owners had significantly higher attitude score (8.73 ± 1.73 vs. 8.18 ± 2.22, p = 0.001) than that of renters. The income class of participants was significantly associated with practice score (F = 6.66, p = 0.0017) and total score (F = 6.6, p 0.0018), where post-hoc analysis revealed that participants belonging to lower income families had significantly higher practice (p < 0.001) and total (p < 0.001) scores compared to their high-income counterparts. Participants' maternal education was significantly associated with knowledge (F = 6.83, p < 0.001), attitude (F = 4.25, p = 0.0023), practice (F = 5.62, p < 0.001) and total score (F = 6.94, p < 0.001), where post-hoc analysis showed that participants with tertiary education of mothers had higher overall preparedness scores than that with higher secondary education of mothers (p < 0.001), secondary education of mothers (p < 0.001) and primary education of mothers (p < 0.012). Participants who were not engaged with any environment related clubs or organizations had significantly higher

knowledge score (10.73 ± 1.82 vs. 9.94 ± 2.34, $p < 0.001$) than participants engaged with such clubs or organizations. Primary source of earthquake related information source was significantly associated with knowledge ($F = 2.37$, $p = 0.021$), practice ($F = 2.29$, $p = 0.0256$) and total score ($F = 2.82$, $p = 0.0066$), where post-hoc analysis revealed that participants having family as main source had higher practice ($p = 0.023$) and overall scores ($p = 0.007$) than those having social media as main source.

Table 2

Associations of the variables with Earthquake preparedness Knowledge, Attitude, Practice and Total score

	Knowledge Score			Attitude Score			Practice Score			Total Score		
Variables	Mean ± SD	t/F Value	p value	Mean ± SD	t/F Value	p value	Mean ± SD	t/F Value	p value	Mean ± SD	t/F Value	p value
Gender		0.46	0.6446		-3.02	0.0026		1.69	0.0921		0.999	0.3183
Female	10.65 ± 2.09			8.35 ± 2.08			40.92 ± 11.63			60.24 ± 13.01		
Male	10.59 ± 1.78			8.75 ± 1.69			39.33 ± 14.80			59.15 ± 16.33		
Grew Up		1.14	0.2557		1.09	0.2781		2.34	0.0197		2.59	0.0098
City	10.71 ± 1.84			8.65 ± 1.88			41.19 ± 13.88			61.11 ± 15.52		
Village	10.55 ± 1.98			8.50 ± 1.87			38.95 ± 13.10			58.23 ± 14.39		
Housing type		5.52	0.0045		1.19	0.305		7.04	< 0.001		6.31	0.0019
Kacha	10.14 ± 2.06			8.49 ± 1.72			36.71 ± 14.11			56.21 ± 15.55		
Semi-pucca	10.52 ± 2.22			8.39 ± 2.24			39.01 ± 12.68			58.15 ± 14.41		
Pucca	10.77 ± 1.77			8.64 ± 1.82			41.32 ± 13.43			61.10 ± 14.86		
Family type		-5.18	< 0.001		-4.63	< 0.001		-4.21	< 0.001		-4.19	< 0.001
Joint	9.82 ± 2.38			7.92 ± 2.23			36.34 ± 14.14			55.11 ± 15.82		
Nuclear	10.84 ± 1.71			8.75 ± 1.74			41.15 ± 13.12			60.95 ± 14.46		
Housing tenure status		1.12	0.2624		3.32	0.001		-0.32	0.7526		0.38	0.7071
Own house	10.67 ± 1.85			8.73 ± 1.73			40.05 ± 12.93			59.90 ± 14.08		
Rented house	10.50 ± 2.12			8.18 ± 2.22			40.42 ± 14.93			59.39 ± 17.09		

Income Class		0.83	0.4346		0.81	0.4459		6.66	0.0017		6.6	0.0018
Low Income	10.86 ± 2.15			8.77 ± 1.51			40.63 ± 13.57			61.38 ± 14.30		
Middle Income	10.64 ± 1.95			8.60 ± 1.91			41.44 ± 12.59			61.11 ± 14.04		
High Income	10.51 ± 1.84			8.46 ± 1.94			37.45 ± 14.71			56.6 ± 16.33		
Father's Education		1.23	0.2966		0.79	0.535		2.36	0.0558		1.75	0.1427
No Formal	10.65 ± 2.02			8.54 ± 2.04			39.73 ± 11.81			58.75 ± 13.17		
Primary	11.14 ± 1.68			8.24 ± 1.50			42.86 ± 12.83			62.71 ± 13.36		
Secondary	10.72 ± 1.72			8.82 ± 1.53			38.79 ± 12.57			58.66 ± 13.49		
HSC	10.43 ± 2.12			8.56 ± 1.92			38.29 ± 12.27			57.90 ± 13.89		
Tertiary	10.63 ± 1.89			8.54 ± 1.98			41.22 ± 14.59			60.74 ± 16.32		
Mother's Education		6.83	< 0.001		4.25	0.0023		5.62	< 0.001		6.94	< 0.001
No Formal	10.54 ± 1.83			8.54 ± 1.74			40.14 ± 12.93			59.93 ± 14.27		
Primary	10.98 ± 1.67			8.57 ± 1.68			39.28 ± 11.32			59.07 ± 12.49		
Secondary	10.42 ± 2.09			8.57 ± 1.79			37.56 ± 13.19			56.98 ± 14.49		
HSC	10.16 ± 2.04			8.15 ± 2.32			39.26 ± 13.82			57.59 ± 15.88		
Tertiary	11.03 ± 1.71			8.97 ± 1.64			43.96 ± 14.40			64.67 ± 15.43		
Major enrolled in		0.14	0.9356		1.36	0.2539		0.64	0.5893		0.79	0.4972
Business	10.50 ± 2.03			8.95 ± 1.76			38.5 ± 13.25			57.90 ± 15.49		
Social Sci	10.60 ± 1.91			8.64 ± 1.86			40.88 ± 14.03			60.73 ± 15.38		
Science & Tech	10.66 ± 1.96			8.46 ± 1.93			39.70 ± 13.45			59.11 ± 14.84		
Arts	10.65 ± 1.80			8.65 ± 1.76			40.43 ± 12.98			60.30 ± 14.20		

Environment related club participation		3.5	< 0.001		1.51	0.1324		-0.43	0.6705		-0.5	0.6192
No	10.73 ± 1.82			8.61 ± 1.90			39.94 ± 12.97			59.48 ± 14.37		
Yes	9.94 ± 2.34			8.33 ± 1.81			40.61 ± 16.30			60.39 ± 18.15		
Prior Earthquake experience		-1.5	0.1331		-0.71	0.4777		0.25	0.8006		-0.1	0.92
No	10.29 ± 2.20			8.42 ± 2.43			40.33 ± 9.20			59.48 ± 10.32		
Yes	10.65 ± 1.90			8.58 ± 1.83			40.02 ± 13.86			59.63 ± 15.37		
Primary Information source		2.37	0.021		1.97	0.0559		2.29	0.0256		2.82	0.0066
Family	10.72 ± 1.81			8.77 ± 1.71			41.39 ± 13.54			61.52 ± 14.53		
Relatives	9.88 ± 2.50			8.62 ± 1.63			42.41 ± 16.08			65.00 ± 18.6		
Neighbors	10.54 ± 1.48			8.29 ± 2.52			38.32 ± 15.72			57.62 ± 17.18		
Institutions	9.79 ± 1.89			7.86 ± 1.88			38.62 ± 13.14			56.08 ± 14		
TV	10.59 ± 1.57			8.73 ± 1.64			41.69 ± 12.28			60.75 ± 13.48		
Social Media	10.57 ± 2.16			8.27 ± 2.16			37.50 ± 13.50			56.58 ± 15.64		
Friends	11.32 ± 2.04			8.77 ± 1.82			40.63 ± 15.15			61.36 ± 16.7		
Others	9.57 ± 2.38			8.35 ± 1.93			36.05 ± 10.02			54.30 ± 11.36		

(Source: Data presented in Table 2 is derived from statistical bivariate analysis (independent samples t-tests and one-way ANOVA) of the primary data collected through the structured self-administered Knowledge, Attitude, and Practice (KAP) questionnaire survey.)

3.3. Linear regression analysis of Earthquake Preparedness related Knowledge, Attitude, Practice and Total Score

A multiple linear regression analysis was conducted to identify the factors associated with earthquake preparedness-related knowledge. The model was statistically significant (R^2 = 0.114, adjusted R^2 = 0.094, $F(15, 676) = 5.795$, $p < 0.001$), indicating that the independent variables explained 11.4% of the variance in knowledge scores. Among the predictors, several variables were found to be statistically significant. Participants who grew up in urban areas demonstrated higher knowledge scores compared to those from rural areas ($\beta = 0.081$, $p = 0.0365$). The type of housing that participants' families belonged to also significantly influenced knowledge scores ($\beta = 0.117$, $p = 0.0053$). Additionally, family type emerged as a strong predictor, with participants from nuclear families showing higher knowledge scores than those from joint families ($\beta = -0.225$, $p < 0.001$). Other significant predictors included the housing tenure status of participants' families ($\beta = -0.096$, $p = 0.0142$), participants' engagement with environment-related clubs or organizations ($\beta = -0.121$, $p = 0.0013$), and prior experience of an earthquake ($\beta = 0.094$, $p = 0.0141$).

A multiple linear regression analysis was conducted to identify the factors associated with earthquake preparedness-related attitude. The model was statistically significant (R^2 = 0.105, adjusted R^2 = 0.086, $F(15, 701) = 5.467$, $p < 0.001$), indicating that the independent variables explained 10.5% of the variance in attitude scores. Among the predictors, gender was a significant factor ($\beta = -0.146$, $p < 0.001$), with males reporting higher attitude scores than females. Family type also emerged as a strong predictor ($\beta = -0.208$, $p < 0.001$), where participants from nuclear families had higher attitude scores compared to those from joint families. Additionally, the housing tenure status of participants' families was a significant predictor of earthquake preparedness-related attitude ($\beta = -0.215$, $p < 0.001$).

A multiple linear regression analysis was conducted to identify the factors influencing participants' earthquake preparedness-related practice scores. The model was statistically significant ($R^2 = 0.124$, adjusted $R^2 = 0.105$, $F(15, 683) = 6.445$, $p < 0.001$), indicating that the predictors explained 12.4% of the variance in practice scores. Several variables were found to be significant predictors. Age was positively associated with practice scores ($\beta = 0.099$, $p = 0.0099$), with senior students demonstrating higher levels of preparedness-related practices. Participants' location of growing up influenced practice scores ($\beta = 0.083$, $p = 0.0277$) and participants who were brought up in urban areas scored higher on practice measures compared to those from rural areas. Similarly, participants' family type was another significant predictor ($\beta = -0.255$, $p < 0.001$) and participants from nuclear families reported significantly higher practice scores than those from joint families. The type of housing participants belonged to also influenced preparedness practices ($\beta = 0.101$, $p = 0.0141$), as did the number of family members, which was positively associated with higher practice scores ($\beta = 0.179$, $p < 0.001$). Family income class was another strong predictor, with participants from lower income classes reporting lower practice scores ($\beta = -0.178$, $p < 0.001$). Additionally, maternal education was significantly associated with practice scores ($\beta = 0.169$, $p = 0.0012$), suggesting that higher maternal education levels are linked to better preparedness-related practices.

A multiple linear regression analysis was conducted to examine the relationship between various predictor variables and participants' total scores on earthquake preparedness. The model was statistically significant ($F(15, 623) = 6.900$, $p < 0.001$), explaining 14.2% of the variance in total scores ($R^2 = 0.142$, adjusted $R^2 = 0.122$). Several variables emerged as significant predictors. Age was positively associated with total preparedness scores ($\beta = 0.114$, $p = 0.0038$), with senior students demonstrating higher levels of overall earthquake preparedness. Participants location of growing up is a significant predictor of overall earthquake preparedness ($\beta = 0.111$, $p = 0.005$). Housing type also showed a significant

positive influence on overall preparedness (β = 0.115, p = 0.0068). Family type had a significant negative association with total preparedness scores (β = -0.251, p < 0.001), indicating that participants from nuclear families were more likely to have higher levels of earthquake preparedness. The number of family members was also a significant positive predictor (β = 0.151, p = 0.0013), suggesting that larger families may be more prepared. Housing tenure status showed a significant negative association (β = -0.097, p = 0.0161), implying that those from non-owned housing situations tended to have lower preparedness scores. Income class was another strong negative predictor (β = -0.21, p < 0.001), with lower income levels associated with reduced preparedness. Lastly, maternal education had a significant positive influence on total preparedness scores (β = 0.161, p = 0.0033), indicating that higher maternal education is linked to better earthquake preparedness.

Table 3

Predictive models for Knowledge Score, Attitude Score, Practice Score and Total KAP Score

Variables	Knowledge Score				Attitude Score				Practice Score				Total KAP Score			
	B	β	Std Error	*p* value	B	β	Std Error	*p* value	B	β	Std Error	*p* value	B	β	Std Error	*p* value
	Model Fit: F(15, 676) = 5.795, p = < 0.001, R^2 = 0.114				Model Fit: F(15, 701) = 5.467, p = < 0.001, R^2 = 0.105				Model Fit: F(15, 683) = 6.445, p = < 0.001, R^2 = 0.124				Model Fit: F(15, 623) = 6.900, p = < 0.001, R^2 = 0.142			
(Constant)	10.463		1.126	< 0.001	9.117		1.107	< 0.001	24.197		8.447	0.0043	41.864		9.576	< 0.001
Age	0.032	0.027	0.046	0.4906	0.071	0.059	0.045	0.1201	0.892	0.099	0.345	0.0099	1.129	0.114	0.389	0.0038
Gender	-0.003	-0.001	0.145	0.9814	-0.521	-0.146	0.143	< 0.001	0.309	0.011	1.084	0.7756	0.038	0.001	1.232	0.9752
Grew Up in	0.284	0.081	0.135	0.0365	0.218	0.061	0.134	0.104	2.225	0.083	1.009	0.0277	3.232	0.111	1.149	0.005
Housing type	0.264	0.117	0.094	0.0053	0.145	0.063	0.093	0.1207	1.726	0.101	0.701	0.0141	2.154	0.115	0.794	0.0068
Family type	-0.998	-0.225	0.203	< 0.001	-0.922	-0.208	0.2	< 0.001	-8.481	-0.255	1.499	< 0.001	-9.169	-0.251	1.707	< 0.001

Family member number	0.045	0.046	0.044	0.3108	0.037	0.038	0.044	0.3996	1.33	0.179	0.334	< 0.001	1.211	0.151	0.374	0.0013
Housing tenure status	-0.375	-0.096	0.153	0.0142	-0.846	-0.215	0.152	< 0.001	-1.52	-0.051	1.148	0.186	-3.131	-0.097	1.297	0.0161
Income Class	-0.074	-0.024	0.128	0.5643	-0.165	-0.054	0.124	0.1862	-4.129	-0.178	0.95	< 0.001	-5.357	-0.21	1.094	< 0.001
Father's Education level	-0.135	-0.092	0.077	0.0797	-0.019	-0.013	0.077	0.808	-0.466	-0.042	0.575	0.4175	-0.269	-0.022	0.649	0.6791
Mother's Education level	0.042	0.031	0.072	0.5596	0.112	0.082	0.071	0.1156	1.746	0.169	0.539	0.0012	1.812	0.161	0.615	0.0033
Years spent in university	0.068	0.057	0.046	0.142	0.014	0.011	0.046	0.7686	-0.407	-0.045	0.35	0.2446	-0.449	-0.045	0.394	0.2556

Type of major enrolled in	-0.088	-0.049	0.066	0.1808	0.078	0.043	0.065	0.235	-0.141	-0.01	0.489	0.773	-0.21	-0.014	0.56	0.7078
Environment related club participation	-0.583	-0.121	0.181	0.0013	-0.145	-0.03	0.18	0.4193	2.316	0.064	1.349	0.0865	2.597	0.066	1.513	0.0866
Prior Earthquake experience	0.581	0.094	0.236	0.0141	0.024	0.004	0.232	0.9161	0.65	0.014	1.806	0.719	1.166	0.022	2.044	0.5687
Primary Information source	0.000243	0.00033	0.027	0.9929	-0.029	-0.039	0.027	0.2902	-0.254	-0.046	0.205	0.216	-0.363	-0.06	0.231	0.1166

Categorical predictors are coded as: Gender (1=Male, 2=Female); Grew Up in (1=Village, 2=City); Housing type (1=Kacha, 2=Semi-pucca, 3=Pucca); Family type (1=Nuclear, 2=Joint); Housing tenure status (1=Own house, 2=Rented house); Income Class (1=Low Income, 2=Middle Income, 3=High Income); Father's Education level & Mother's Education level (1=No Formal Education, 2=Primary, 3=Secondary, 4=Higher

Secondary, 5=Tertiary); Type of major enrolled in (1=Science & Technology, 2=Arts & Humanities, 3=Social Sciences, 4=Business & Management); Environment related club participation & prior earthquake experience (0=No, 1=Yes); primary Information source (1=Family members, 2=Relatives, 3=Neighbors, 4=Educational institution, 5=Television, 6=Social Media, 7=Friends, 8=Others); while Age, Family member number, and years spent in university are continuous scale metrics

(Source: Data presented in Table 3 is generated from multiple linear regression models utilizing the primary data collected via the structured self-administered questionnaire survey (N=840); categorical and continuous scale metrics are derived from demographic, socioeconomic, and earthquake experience variables collected during the survey period.)

4. Discussion

The results of this study show how much university students in Bangladesh know about earthquakes, their attitude towards earthquake preparedness, and their practices before, during and immediately after an earthquake. The average scores for knowledge (10.62 ± 1.93) and attitude (8.57 ± 1.89) are quite high. This means students understand the facts well and have a positive attitude toward reducing casualties. However, the average practice score is much lower (40.05 ± 13.51). This shows a clear gap between what students know and what they actually do to protect themselves.

This gap between knowledge and behavior matches modern disaster frameworks. Often, a general "knowledge-behavior gap" stops people from turning their awareness of risks into practical actions, like preparing emergency survival kits or planning escape routes (Sözcü & Türker, 2026). This issue is common in developing countries where earthquakes are a threat; people understand the danger but do very little physical preparation at home (Ristiani, 2026). This finding also agrees with previous studies, such as Hasan et al. (2022a), who found that university students in Dhaka had good disaster knowledge but low practical preparedness. This disconnect is worrying because it shows that simply raising awareness is not enough to make students take real protective actions. In Bangladesh, this situation is made worse by a history of ignoring earthquake risks. This is because local disaster plans have traditionally focused on frequent, highly visible climate events like cyclones and severe floods rather than rare seismic threats (M. I. Hasan et al., 2026).

Gender was another important factor in our study. Male participants had significantly higher attitude scores than females (8.75 ± 1.69 vs. 8.35 ± 2.08). However, there were no significant gender differences in knowledge and practice scores, which means differences in attitude do not always lead to differences in real behavior. This matches the findings of Rahman et al.

(2023), who noted that males showed more capacity to adapt during crises. Soffer et al. (2011) also found higher earthquake knowledge among males. These differences might come from traditional cultural roles where men are expected to act as the main protectors during disasters (Usta et al., 2024). Knowing these differences is important for creating targeted disaster campaigns that can reach both male and female students effectively. On the other hand, Hasan et al. (2022b) studied nursing students in Bangladesh and found that female students had higher readiness levels than males. This could be because the nursing field in this part of the world has mostly female students. Other studies, like Turan Bayraktar et al. (2024), found that total earthquake knowledge scores did not differ significantly by gender among university students in Turkey.

Another useful comparison can be made with Torpuş and Işık Demirarslan (2025), who looked at disaster preparedness among nursing students. They reported a high Disaster Risk Perception Scale (DRPS) score of 97.69 ± 15.19 out of 125 points. Their study looked at a small group focused on specific career outcomes, whereas our study includes a wider range of university students from different majors to give a broader view. However, their finding that age is positively related to risk perception matches our study, where age is also positively and significantly correlated with practice scores and total KAP scores.

A study by Serondo et al. (2024) on college students in the Philippines found that disaster awareness was high, and practical preparedness was positively linked to it. However, their sample size was only 236 students, which is very small compared to our study. While their data showed that awareness is the strongest predictor of preparedness, our study goes further by looking at a wider range of specific socio-demographic factors that influence preparedness behaviors.

Our multiple linear regression models highlight several socio-demographic factors that shape student behavior, with family structure and income being the main predictors. We found a significant negative link between joint family households and total preparedness levels ($\beta = -0.251$, $p < 0.001$). This suggests that students living in nuclear families are in a much better position to understand, coordinate, and carry out disaster plans. The regression model also shows that students from low-income classes have much weaker practice scores ($\beta = -0.178$, $p < 0.001$). Recent studies confirm that having a high knowledge score is often not enough to overcome economic difficulties. Lower-income families lack the extra money and resources needed to secure furniture, buy emergency equipment, or make physical changes to their homes (Sungur, 2026; Tabatabaei et al., 2025).

The types of housing and home ownership also play a role in preparedness, pointing out institutional challenges. Students living in permanent reinforced concrete buildings (*pucca*) showed significantly better knowledge ($\beta = 0.117$, $p = 0.0053$) and practical actions ($\beta = 0.101$, $p = 0.0141$) compared to those living in temporary (*kacha*) or semi-permanent (*semi-pucca*) housing. The structural quality of a home directly affects survival chances during an earthquake, and families with better homes might be more aware of earthquake risks and preparedness. This matches Mandal et al. (2023), who found that people living in resilient buildings feel safer and are more likely to prepare. Similarly, families who do not own their homes reported lower attitude and total preparedness scores ($\beta = -0.097$, $p = 0.0161$). This mirrors recent evidence from South Asia showing that home ownership and institutional support are necessary to turn risk awareness into community action (Lin & Lee, 2025; Aksa et al., 2024).

Furthermore, the strong link between maternal education and both practical and overall preparedness is one of our most important findings. It shows that a mother's education and

guidance act as a key pathway for building real emergency habits at home (Sungur, 2026). This pattern highlights how educational benefits are passed down through generations and shows how mothers shape risk awareness and habits. Mothers with higher education may communicate risks better, make better decisions about investing in safety, and place a greater focus on safe behaviors at home. This finding is completely new for this specific context. Because mothers typically spend the most time with their children, their education naturally influences their child's learning. Although not phrased exactly the same way, children of educated mothers spend significantly more time on educational activities at home compared to children of uneducated mothers, showing that maternal education improves general home learning (Andrabi et al., 2012). This benefit likely extends to disaster preparedness education as well.

An important institutional finding involves how universities share information. Even though all participants were university students, only 1.7% said educational institutions were their main source of earthquake-related knowledge. Instead, the vast majority relied on immediate family members (40.8%) or social media (28%). Crucially, a post-hoc analysis confirmed that students who relied on family channels had significantly better practice and total scores than those who relied on social media. This suggests that personal communication with family is more effective at promoting preparedness than digital media.

Although Torpuş and Işık Demirarslan (2025) focused on nursing students rather than a general youth population, we included it because it highlights the knowledge-practice gap in health education. Their study found that even though nursing students had a strong background in disaster knowledge, they still lacked practical preparedness behaviors. Their results showed that 74.5% of participants had never received disaster training, while 90.9% wanted to receive it. This is a relevant comparison because it shows that even with specialized education, students

across different fields face challenges turning knowledge into action. While the study by Khan et al. (2025) focused on youth populations similar to our sample, the studies by Sinha et al. (2008) and Torpuş and Işık Demirarslan (2025) focused on medical and nursing students. These were included to show that even students with specialized healthcare training struggle to take practical steps, just like general university students do. This comparison broadens our understanding of the KAP model, showing that preparedness requires more than just raw knowledge.

City planning in crowded urban centers like Dhaka is starting to move away from simply reacting to disasters after they happen. Instead, it is moving toward active readiness and complex medical care or injury rehabilitation (Hasan, 2026). Because of this shift, university students are a valuable resource. To empower this group, we must move away from abstract public safety announcements and move toward specific, community-tested institutional plans and hands-on emergency training (Lin & Lee, 2025).

The results of this study offer several practical recommendations for improving earthquake preparedness among university students. First, it is clear that awareness programs alone are not enough. Educational programs must include hands-on activities, such as securing furniture, making emergency kits, and practicing evacuation drills. Given the socio-demographic factors found in this study, these efforts should specifically target students from joint families, lower-income families, and those living in non-reinforced housing, as these groups showed much lower levels of preparedness.

The biggest limitation of this study is that the sample came from only one university, which limits how well the findings apply to the whole country. Relying on self-reported data might also introduce response biases. Furthermore, the low score for the statistical model fit is another

weakness that future studies can look into. Future research could use longitudinal designs to track changes in preparedness over time and across different regions of Bangladesh.

Future research should also test how well targeted preparedness programs improve actual behaviors among university students. Longitudinal studies could track preparedness actions over time, especially after students experience a disaster or complete a training program. Finally, expanding the study to include multiple universities from different areas of Bangladesh would give a much more complete and national picture of the factors that influence earthquake preparedness.

5. Conclusion

This study highlights a critical "knowledge-behavior gap" regarding earthquake preparedness among university students. While students demonstrate high levels of factual knowledge and favorable attitudes toward seismic risks, their practical, actionable preparedness behaviors remain alarmingly low. Crucially, this readiness is heavily divided along socio-demographic lines; students from joint families, lower-income households, and temporary housing structures face significantly higher vulnerabilities and lower preparedness scores. Furthermore, maternal education and source of earthquake related information were found to be crucial for better practical earthquake preparedness.

To bridge the gap between risk awareness and physical readiness, a paradigm shift is required in urban disaster management. Educational institutions must move away from passive, abstract public safety messaging and instead implement mandatory, hands-on disaster training, structural evacuation drills, and targeted support for socio-economically vulnerable student groups. Ultimately, empowering the youth population through proactive, institutionalized

readiness plans is essential to building a resilient, disaster-prepared community in earthquake-prone urban centers like Dhaka.

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