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Original Article

Barriers to Accessing Dengue Healthcare: A Multicenter Survey from Dhaka, a Major Dengue Hotspot in Bangladesh

Nahid Hassan Nishan[1*], M Z E M Naser Uddin Ahmed[1], Sayeda Jahan Oishy[2], Aria Alam[3], Saidur Rahman Mashreky[1]

[1]Department of Public Health, North South University, Dhaka, Bangladesh.
[2]Department of Medicine, Dhaka National Medical College Hospital, Dhaka, Bangladesh.
[3]Department of Medicine, Comilla Medical College Hospital, Comilla, Bangladesh.

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ABSTRACT

Introduction: Dengue fever in Bangladesh, particularly in Dhaka, faces significant healthcare access barriers. Understanding these barriers is crucial for targeted interventions. Therefore, this study aims to analyze the barriers to accessing dengue healthcare through a multicenter survey in Dhaka, a major dengue hotspot in Bangladesh.

Methods: This cross-sectional study was employed throughout the study. The study was conducted in Dhaka City. This study used two-stage stratified sampling based on hospital type (public/private) and randomly selected 16 hospitals (7 public and 9 private), focusing on patients admitted with dengue. A total of 101 patients comprised the final sample. Data were collected using a structured questionnaire that focused on patient characteristics and challenges in accessing dengue treatment. The main outcomes measured included availability and accessibility access barriers, access barriers related to knowledge, attitudes, beliefs, or practices (KAP), and financial access barriers. Statistical analysis assessed the influence of demographic factors on these access barriers.

Results: The study reveals overall 96.04% of participants perceived dengue as a serious threat. Demographically, the patients mostly lived in urban (85.15%) and varied in education. MANOVA indicates that demographic variables significantly impact access barriers, highlighting age, and education status as influential factors (P-value <0.05).

Conclusion: This study highlights the importance of age and education as key determinants of access barriers in dengue healthcare. Addressing the unique needs of children and older adults, as well as enhancing educational opportunities, could be pivotal in mitigating these barriers.

Introduction

Dengue fever, transmitted by Aedes aegypti and Aedes albopictus mosquitoes, is a significant public health concern in many subtropical and tropical regions. The illness manifests with symptoms such as fever, headache, muscle and joint pain, and rash, and can escalate to

*.Corresponding Author: nissan0808@yahoo.com

severe complications like dengue hemorrhagic fever and dengue shock syndrome. These can be caused by four distinct viruses (DENV-1, DENV-2, DENV-3, and DENV-4) of the Flavivirus family.[1] These mosquitoes are referred to as "container breeders" as they lay eggs in artificial water containers like tires, buckets, flower pots, or tree holes.[2] In urban areas like Dhaka, poor sanitation and unmanaged waste create numerous breeding sites, such as stagnant water in discarded containers and clogged drains, exacerbating mosquito proliferation and increasing the risk of dengue transmission.[3] Additionally, inadequate waste management and poor drainage systems contribute to the formation of stagnant water bodies, which are ideal environments for Aedes mosquito breeding.[4] These mosquitoes thrive in urban settings due to the abundance of artificial containers and standing water, but they are also found in rural areas, where natural water bodies like tree holes and small ponds serve as breeding sites.[5] The adaptability of Aedes mosquitoes to both urban and rural environments underscore the widespread risk of dengue, though urban areas face heightened risks due to higher population density and concentrated breeding grounds.

Dengue fever is widespread in over 100 countries located in subtropical regions across Asia, Africa, the Americas, and the Pacific.[6] According to the World Health Organization (WHO), about half of the world's population is now at risk of dengue, with an estimated 100 to 400 million infections occurring annually.[1] Recent data show that the incidence of dengue has increased dramatically in recent decades, with over 6.5 million cases and more than 7,300 dengue-related deaths reported globally in 2023.[1] In Bangladesh, dengue outbreaks occur during the monsoon season from June to October. Dhaka's rapid urbanization, poor waste management, and high population density create ideal breeding conditions for Aedes mosquitoes, significantly increasing dengue transmission compared to less densely populated rural areas.[7,8] Significant outbreaks have been recorded since the 1960s, with a severe dengue hemorrhagic fever outbreak documented in 2002.[9] In 2019, the Ministry of Health and Family Welfare reported over 100,000 cases and 179 deaths. As of October 2023, the largest recorded outbreak resulted in 1,000 deaths.[7,8]

Dhaka, the capital city, is particularly affected, accounting for 70% of dengue cases in the country which labeled this district as a major dengue hotspot. This concentration of cases underscores the critical need for accessible and effective healthcare services in Dhaka.[10]

Access to quality healthcare is a crucial determinant of health outcomes for dengue patients, as timely diagnosis and treatment can significantly reduce the severity and fatality of the disease. However, several factors pose significant barriers to accessing healthcare for dengue patients in Bangladesh.[11,12] For instance, the inability to access healthcare in a timely manner, particularly due to geographic distance and transportation limitations, can significantly hinder patients' ability to receive early treatment, especially for those living in remote or underserved areas. These delays in accessing care can exacerbate the severity of dengue, leading to worse health outcomes.[13,14] Moreover, Financial constraints, including high costs of medical care and lack of health insurance, further exacerbate these barriers. In Bangladesh, less than 1% of the population has health coverage, and around 3.8% (6 million people) are pushed into poverty each year due to out-of-pocket healthcare costs. These financial obstacles are particularly burdensome for low-income families, further limiting their access to timely care.[15] Patients may struggle with fees, charges, and co-payments, as well as indirect costs such as lost income due to illness.[16,17]

The availability and acceptability of healthcare services also play a crucial role. Inadequate healthcare infrastructure, long wait times, and supply shortages can impede timely and effective treatment for dengue patients. In some cases, patients may resort to seeking care from unregulated and potentially unreliable sources.[14,18–20] Additionally, knowledge and attitudes towards dengue can influence healthcare-seeking behavior. Individuals with limited health literacy or indifferent attitudes toward the disease may delay seeking care, increasing the risk of severe outcomes.[21,22] While dengue fever often presents as a mild illness with flu-like symptoms, it can progress to more severe forms, such as dengue hemorrhagic fever (DHF) or dengue shock syndrome (DSS). These severe forms are characterized by internal bleeding, plasma leakage, and organ damage, leading to higher fatality rates if not treated promptly. Patients who hold indifferent attitudes toward dengue fever may neglect seeking healthcare, while those engaging in risky practices may unknowingly increase their vulnerability to mosquito bites and subsequent infection.[23,24]

Understanding these barriers is vital for developing targeted interventions and policies to improve healthcare access for dengue patients. Therefore, this study aims to identify and analyze the barriers to accessing dengue healthcare through a multicenter survey in Dhaka, a major dengue hotspot in Bangladesh. Unlike previous studies, our research incorporates data from both public and private hospitals, providing the most recent and comprehensive understanding of healthcare access barriers of dengue patients.

Methods

Study Description

This study utilized a cross-sectional survey to gather quantitative data from a sample group of people affected by dengue using a structured questionnaire. Additionally, information was collected from healthcare providers to understand access and barriers to dengue healthcare.

Study area, Population, and Sampling process

The study was conducted at selected hospitals across Dhaka City using a two-stage stratified sampling method. Hospitals were first stratified into public and private categories using a comprehensive list from the Directorate General of Health Services (DGHS), which included all hospitals that receive and treat dengue patients. According to a study, 61% of dengue patients in Bangladesh are treated in public hospitals, while 39% are treated in private hospitals.[25] The initial sampling frame consisted of 12 public hospitals and 22 private hospitals. Hospitals were selected proportionally to the number of dengue cases they handled. Specifically, 61% of the public hospitals (61% of 12) are approximately 7 hospitals, and 39% of the private hospitals (39% of 22) are approximately 9 hospitals.

Therefore, using a random sampling method, seven public hospitals and nine private hospitals were selected using an online tool called Research Randomizer software.

The selected public hospitals were: Bangabandhu Sheikh Mujib Medical University, Dhaka Medical College Hospital, Mugda Medical College Hospital, Kurmitola General Hospital, Shaheed Suhrawardy Medical College Hospital, Sir Salimullah Medical College & Mitford Hospital, and the Institute of Epidemiology Disease Control and Research.

The selected private hospitals were Evergreen Hospital, BRB Hospital, Ad-din Women's Medical College Hospital, Square Hospitals Ltd., United Hospital Ltd., Evercare Hospital (formerly Apollo Hospital), Labaid Specialized Hospital, Popular Diagnostic Centre & Hospital, and Anwer Khan Modern Medical College Hospital.

The entire list of hospitals of the sampling frame is given below in Table 1.

In the second stage, the study recruited a total of 130 patients. Based on the proportion of dengue cases treated, 79 patients were initially recruited from public hospitals and 51 from private hospitals. Dengue patients were randomly selected from each hospital, ensuring each patient had an equal chance of being included in the study to avoid selection bias.

Inclusion & Exclusion criteria

The study included only hospitalized dengue patients who were able and willing to give interviews. If a patient could not provide an interview, their attendant was interviewed. No outdoor patients were included. Incomplete

Table 1. List of Selected Public and Private Hospitals in Dhaka for Dengue Patient Treatment

Public Hospitals	Private Hospitals
Bangabandhu Sheikh Mujib Medical University	Evergreen Hospital
Dhaka Medical College Hospital	BRB Hospital
Mugda Medical College Hospital	Ad-din Women's Medical College Hospital
Kurmitola General Hospital	Square Hospitals Ltd.
Shaheed Suhrawardy Medical College Hospital	United Hospital Ltd.
Sir Salimullah Medical College & Mitford Hospital	Evercare Hospital (formerly Apollo Hospital)
Institute of Epidemiology Disease Control and Research	Labaid Specialized Hospital
National Institute of Cardiovascular Diseases	Popular Diagnostic Centre & Hospital
National Institute of Traumatology and Orthopedic Rehabilitation	Anwer Khan Modern Medical College Hospital
National Institute of Cancer Research & Hospital	Bangladesh Medical College & Hospital
Institute of Child and Mother Health	Central Hospital Ltd.
Dhaka Shishu (Children) Hospital	Ibn Sina Hospital
	Holy Family Red Crescent Medical College Hospital
	Islami Bank Central Hospital
	Green Life Medical College Hospital
	Enam Medical College & Hospital
	BIRDEM General Hospital
	Dhaka Community Medical College & Hospital
	Medinova Medical Services Ltd.
	Bashundhara Ad-din Medical College Hospital
	Asgar Ali Hospital
	Bangladesh Specialized Hospital

surveys and those who refused to participate were excluded.

Sample size

Initially, data were collected from 130 individuals. The required sample size was calculated using an online calculator called Stats Kingdom for MANOVA analysis.[26] With 2 strata, an effect size set at medium (0.25), 3 dependent variables, a significance level of 0.05, and a high power of 0.90, the calculated total sample required was 62. Each MANOVA test (Wilks' Lambda, Pillai's Trace, Hotelling's Trace) was checked for sample size adequacy, confirming that 62 was sufficient. The effect type was set to η^2 (eta-squared), a commonly used measure for effect size in MANOVA.

After data cleaning and applying inclusion and exclusion criteria, 22 participants were excluded due to incomplete surveys, and 7 participants were excluded as they refused to fully participate after the initial data collection, resulting in a large amount of missing data. This left a final sample size of 101 patients, which was more than adequate for conducting our MANOVA analysis. The final sample size ensured that the dataset remained sufficiently balanced for robust statistical analysis.

Variable of interest

All necessary variables for the analysis were identified to find the actual access barriers to dengue healthcare in Bangladesh. Demographics included age groups categorized into three groups: Children (5-18 years), Adults (19-49 years), and Older Adults (50-81 years). Gender (male and female), residency (urban and rural), occupation (working [individuals engaged in formal employment, such as salaried jobs, and informal employment, such as day labor, street vending, or self-employment] and not working [includes unemployed individuals, homemakers, students, and retired persons]), and education (no education, primary, secondary including SSC and HSC, and higher education) were also categorized.

Other variables included the distance to healthcare services (walking distance, less than two hours, more than two hours), challenges faced (Yes, No, Don't know), the first healthcare facility visited (This hospital or Another hospital), availability of dengue healthcare inpatient areas (Yes or No), issues faced during admission and while getting medication (Yes or No), and the availability of funds for dengue treatment from the local government or private community (Yes, No, Don't know).

In barriers to knowledge, attitudes, beliefs, and practices, variables included the decision-maker for dengue treatment (Own, Partner, Other family members, Healthcare provider), barriers to making decisions (Negligence [referring to behaviors such as delaying the decision to seek medical care, underestimating the severity of dengue symptoms, or failing to follow preventive measures], Distance, Cost, Unavailability of the healthcare facility), issues faced during admission (Not applicable, long waiting time, Less bed availability), facing the same issue in dengue care for another family member (Yes or No), and feeling dengue as a serious threat (Yes or No). Financial access barriers included bearing costs through Savings, Family support, Borrowing, and the impact of transport costs (Yes, No, Don't know). Total cost and total treatment cost variables remained continuous.

Dependent variable

To address the complexity in our analysis and to ensure a robust MANOVA (Multivariate Analysis of Variance), three composite outcome group variables were created: Availability and Accessibility Access Barrier, Access-barrier of (Knowledge, Attitudes, and Practices), and Financial Access Barrier. These composite variables were created by grouping their respective component variables using the "Egen group" function in Stata. The "Egen group" function in Stata is used to create composite variables by grouping together related categories or variables into a single identifier. This function combines distinct variables under one umbrella to simplify the analysis, ensuring that all related components are analyzed as part of the same composite outcome. After grouping the variables, the data standardization process was applied using the "Egen std" function. This function transforms each composite variable into a continuous scale with a mean of 0 and a standard deviation of 1, ensuring that the different components, which may have varying scales, are comparable. This process ensures that each composite variable remains continuous. This approach was chosen to simplify the model and to capture all potential interactions between the variables, which might be lost if analyzed separately. This aligns with practical guidance on multivariate analysis techniques and ensures that the relationships between the groups and the dependent variables could be thoroughly examined.[27]

Statistical Analysis

After applying all the inclusion and exclusion criteria, all the data were cleaned, identified the necessary variables for the analysis, and coded accordingly. For the visualization of univariate, bivariate, and multivariate analyses, tables and graphs were used. In univariate analysis, frequencies and percentages were displayed to provide a basic overview. For bivariate analysis, frequencies, percentages, and significance values were included. The χ^2 test was used to assess associations between categorical variables, and ANOVA was used for associations between categorical and continuous variables.

For multivariate analysis, a Multivariate Analysis of Variance (MANOVA) was performed to investigate relationships between the dependent variables and the demographic variables of the patients. MANOVA is used to understand how multiple dependent variables are influenced by one or more independent variables, extending ANOVA by considering multiple dependent variables simultaneously for a comprehensive understanding of the data. When there are multiple continuous dependent variables and the independent variables are categorical MANOVA analysis would be suitable for such study. MANOVA assumes multivariate normality, meaning the dependent variables are normally distributed within each group and homogeneity of covariance matrices. Robustness was ensured by examining the distribution for approximate normality of the dependent variables. Additionally, a Box's M test was conducted to examine the homogeneity of covariance matrices. The test indicated that the covariance matrix is not diagonal (P-value < 0.001), confirming that the dependent variables are correlated, justifying the use of MANOVA.

Multicollinearity among the demographic

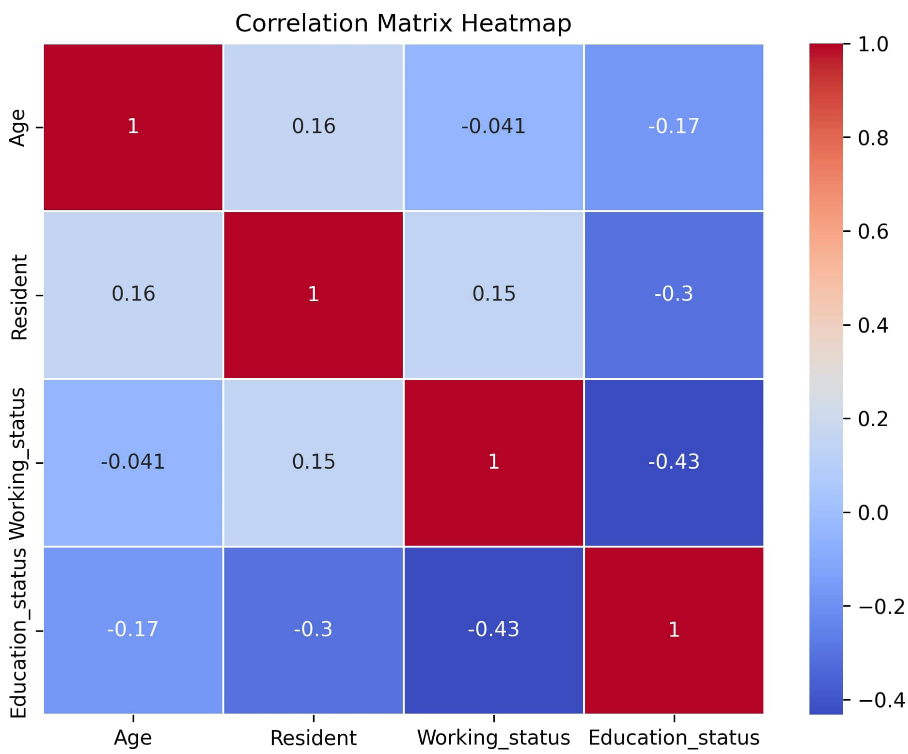

Figure 1. Correlation Matrix Heatmap
Figure 1 shows the correlation matrix of the demographic variables used in the study: Age, Resident, Working Status, and Education Status. The color intensity represents the strength and direction of the correlations, with red indicating positive correlations and blue indicating negative correlations. The values within the cells show the correlation coefficients. The matrix demonstrates that the strongest negative correlation is between Working Status and Education Status (r = -0.43), while the strongest positive correlation is between Age and Resident (r = 0.16).

variables was checked using the correlation matrix, finding no significant issues as all values were below the typical threshold (0.8 or 0.9).[28] The correlation matrix heatmap was given below in Figure 1. Finally, all necessary variables were analyzed, and the results were displayed in tables. For statistical analysis, Stata 17 software was used.

Ethical Approval

Ethical approval for this study was obtained from the Institutional Review Board (IRB) of North South University. The IRB approval number is 2024/OR-NSU/IRB/0109. All procedures performed in this study involving human participants were by the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study.

Results

Demographic Characteristics

In Table 2, the study reveals that among the respondents, 94.44% of females (51 out of 54) and 97.87% of males (46 out of 47) perceive dengue as a threat, resulting in an overall perception rate of 96.04% (97 out of 101). However, the study explored the demographic characteristics of 101 dengue fever patients, finding that the majority of the participants were adults (60.40%). Among the participants, 85.15% resided in urban areas, and 70.30% were not actively employed. Educational backgrounds varied, but most of the participants (33.66%) had primary education.

In Table 3, a higher percentage of males (46.81%) could access healthcare by walking compared to females (22.22%), which was statistically significant (P-value<0.05). Another statistically significant difference (P-value<0.01) was observed in the first healthcare institution visited, with more males (76.60%) seeking early treatment compared to females (51.85%).

Regarding knowledge, attitudes, and practices, 72.22% of females viewed the institute as their last choice for healthcare, compared to 57.45% of males. Females (66.67%) often relied on family members for decision-making, highlighting sociocultural dynamics. Both genders faced similar challenges in accessing dengue care, with the unavailability of healthcare facilities being a common concern (37.04% females, 36.17% males).

Financially, 51.85% of females used savings, while 38.30% of males did the same. Borrowing funds was chosen by 27.78% of females and 36.17% of males. Transport costs impacted 48.15% of females and 42.55% of males. The average total cost for treatment was BDT 30833.3±2505.4 for females and BDT 25074.4±6054.2 for males, with no significant difference (P=0.860). The average total treatment cost was BDT 27842.6±6544.5

Table 2. Demographic Characteristics, and Perception of Dengue Threat by Gender

Characteristics	Female	Male	Total
Age	N (%)	N (%)	N (%)
Children	9 (16.67)	14 (29.79)	23 (22.77)
Adults	36 (66.67)	225 (53.19)	61 (60.40)
Older adults	9 (16.67)	8 (17.02)	17 (16.83)
Resident			
Urban	43 (79.63)	43 (91.49)	86 (85.15)
Rural	11 (20.37)	4 (8.51)	15 (14.85)
Occupation			
Working	6 (11.11)	24 (51.06)	30 (29.70)
Not working	48 (88.89)	23 (48.94)	71 (70.30)
Education			
No education	14 (25.93)	3 (6.38)	17 (16.83)
Primary	17 (31.48)	17 (36.17)	34 (33.66)
Secondary	15 (27.78)	16 (34.04)	31 (30.69)
Higher	8 (14.81)	11 (23.40)	19 (18.81)
Dengue Threat Perception			
Yes	51 (94.44)	46 (97.87)	97 (96.04)
No	3 (5.56)	1 (2.13)	4 (3.96)

This table summarizes the demographic characteristics, and perception of dengue threat among participants, categorized by gender. Age is presented as the mean with standard deviation. Residency is categorized as urban or rural. Occupation is divided into working and not working, based on the participant's current working condition. Education is recoded into no education, primary, secondary, and higher education, with SSC and HSC labeled as secondary and any education above HSC labeled as higher. The table also includes participants' perception of dengue as a serious threat (yes or no) for females and BDT 22170.2±6786.6 for males, also showing no significant difference (P=0.496).

Table 3. Healthcare Accessibility Barriers, Barriers of Knowledge, Attitudes, Practices (KAP), and Financial Barriers among Dengue Patients by Gender

Characteristics	Female N%	Male N%	P-value (95% CI level)
Availability and Accessibility access barrier			
Distance of Healthcare from Home			0.031$^{\Psi}$
Can go by walk	12(22.22)	22(46.81)	0.25-0.43
Take less than 2 hours	24(44.44)	13(27.66)	0.27-0.46
Takes more than 2 hours	18(33.33)	12(25.53)	0.21-0.39
Felt Challenge for Distance			0.529
Yes	18(33.33)	19(40.43)	0.27-0.46
No	31(57.41)	27(55.32)	0.46-0.65
Don't know	5(9.26)	2(4.26)	0.03-0.13
First Taken in Health Care			0.010$^{\Psi\Psi}$
This institute	28(51.85)	36(76.60)	0.53-0.72
Other	26(48.15)	11(23.40)	0.27-0.46
Availability of dengue health care in living area			0.115
Yes	25(46.30)	27(57.45)	0.41-0.61
No	22(40.74)	19(40.43)	0.31-0.51
Don't know	7(12.96)	1(2.13)	0.03-0.15
Faced problems during admission			0.572
Yes	20(37.04)	20(42.55)	0.30-0.49
No	34(62.96)	27(57.45)	0.50-0.69
Faced issues while getting medicine			0.571
Yes	6(11.11)	7(14.89)	0.07-0.21
No	48(88.89)	40(85.11)	0.78-0.92
Assistance of the institution during dengue in the living area			0.354
Yes	5(9.26)	5(10.64)	0.05-0.17
No	14(25.93)	18(38.30)	0.23-0.41
Don't know	35(64.81)	24(51.06)	0.48-0.67
Access-barrier of Knowledge, attitudes, or practices			
Opinion on receiving health care in case of illness			0.120
didn't give importance	15(27.78)	20(42.55)	0.25-0.44
went on the institute is the last choice	39(72.22)	27(57.45)	0.55-0.74
Decision to take dengue care			0.085
own	6(11.11)	13(27.66)	0.12-0.27
husband/wife	8(14.81)	2(4.26)	0.05-0.17
other family members	36(66.67)	29(61.70)	0.54-0.73
healthcare provider	4(7.41)	3(6.38)	0.03-0.13
A barrier to taking dengue care			0.814
neglect	9(16.67)	11(23.40)	0.13-0.28
distance	8(14.81)	5(10.64)	0.06-0.18
cost	17(31.48)	14(29.79)	0.22-0.40
unavailability of healthcare facilities	20(37.04)	17(36.17)	0.22-0.44
Faced issues during healthcare			0.777
not applicable	36(66.67)	29(61.70)	0.54-0.73
longtime waiting	15(27.78)	16(34.04)	0.22-0.40
less healthcare provider	3(5.56)	2(4.26)	0.02-0.11

Table 3. Continue

Characteristics	Female N%	Male N%	P-value (95% CI level)
Faced the same issue with another family member			0.222
Yes	9(16.67)	4(8.51)	0.07-0.21
No	45(83.33)	43(91.49)	0.78-0.92
Financial access barrier			
Bearing cost through			0.393
savings	28(51.85)	18(38.30)	0.36-0.55
family support	11(20.37)	12(25.53)	0.15-0.32
borrow	15(27.78)	17(36.17)	0.23-0.41
Transport costs created an impact			0.312
Yes	26(48.15)	20(42.55)	0.36-0.55
No	26(48.15)	27(57.45)	0.42-0.62
Don›t Know	2(3.70)	0(0.00)	0.01-0.07
	Female Mean (SD)	Male Mean (SD)	
Total cost			0.860
	30833.3±2505.4	25074.4±6054.2	19820.6-3486.3
Total treatment cost			0.496
	27842.6±6544.5	22170.2±6786.6	15774.7-3631.2

This table presents the frequency and percentage distributions of various barriers faced by dengue patients, categorized by gender. The chi-square (χ^2) test was used to assess associations between categorical variables, while ANOVA was used to assess associations in continuous variables such as total cost and total treatment cost. The strength of the associations is indicated using Ψ, with different P-values reflecting the strength of these associations: P<0.05=Ψ, P<0.01=ΨΨ, P<0.001=ΨΨΨ

MANOVA analysis

In Table 4, the MANOVA analysis revealed a significant overall effect of demographic variables on access barriers. The model showed significant results across various tests, with Wilks' lambda (W = 0.65, P-value = 0.007), Pillai's trace (P = 0.38, P-value = 0.009), Lawley-Hotelling trace (L = 0.47, P-value = 0.005), and Roy's largest root (R = 0.32, P-value < 0.001). The model had 7 degrees of freedom (DF), indicating a robust capability to explain the variability in access barriers.

Specifically, age showed a trend towards significance in affecting access barriers, with P-values close to the threshold across most tests (W = 0.88, P-value = 0.071; P = 0.12, P-value = 0.073; L = 0.13, P-value = 0.070). However, it was significant in Roy's largest root test (R = 0.11, P-value = 0.018). Education status had a significant impact in Roy's largest root test (R = 0.11, P-value = 0.014), while other tests showed marginal significance (W = 0.84, P-value = 0.085; P = 0.15, P-value = 0.086; L = 0.17, P-value = 0.085). These results highlight that both age and education are important factors influencing access barriers.

Table 4. MANOVA Analysis of Access Barriers with Demographic Variables

Source	Statistic	Df	Prob > F
Model		7	
	W = 0.65		0.007**
	P = 0.38		0.009**
	L = 0.47		0.005**
	R = 0.32		<0.001***
Age		2	
	W = 0.88		0.071
	P = 0.12		0.073
	L = 0.13		0.070
	R = 0.11		0.018*
Resident		1	
	W = 0.95		0.256
	P = 0.04		0.256
	L = 0.04		0.256
	R = 0.04		0.256

Education status	3	
W = 0.84		0.085
P = 0.15		0.086
L = 0.17		0.085
R = 0.11		0.014*
Working status	1	
W = 0.93		0.089
P = 0.06		0.089
L = 0.07		0.089
R = 0.07		0.089
Residual	93	
Total	100	

This table presents the results of the MANOVA analysis examining the relationship between access barriers and demographic variables. The access barriers analyzed include Availability and Accessibility Access Barriers, Access-barrier of Knowledge, Attitudes, Beliefs, or Practices (KAP), and Financial Access Barriers. The statistical tests used include Wilks' Lambda (W), Pillai's Trace (P), Lawley-Hotelling Trace (L), and Roy's Largest Root (R). Degrees of freedom (df) are provided for each test. The F values and their corresponding probabilities (Prob > F) indicate the significance of each test. Significance levels are denoted as follows: * p < 0.05, ** p < 0.01, *** p < 0.001. The analysis includes the overall model and individual demographic variables such as age, working status, and education status. "Residual" represents the degrees of freedom remaining after accounting for the model, and "Total" indicates the total degrees of freedom for the dataset.

Post Hoc Test Findings

After conducting the MANOVA analysis, it's necessary to perform post hoc tests to identify which specific groups differ from each other when significant results are found. While MANOVA can determine that there are overall differences among the groups, it does not indicate which specific pairs of groups are significantly different. Post hoc tests help to pinpoint these differences, providing more detailed insights into the data. The results from the ANOVA analysis indicated that there were significant differences in access barriers based on age group and education status, specifically for the dependent variable "Access-barrier of Knowledge, attitudes, or practices."

In Table 5, For the age group, the ANOVA results (F = 6.51, P-value = 0.0022) suggest significant differences in access barriers. Post hoc comparisons using Tukey's HSD test revealed that adults have significantly lower access barriers compared to children, with a mean difference (Tukey contrast) of -0.70 (95% CI: -0.14 to -1.25). There were no significant differences between older adults and children, as indicated by the Tukey contrast of -0.00 (95% CI: -0.72 to 0.72). However, older adults have significantly higher access barriers compared to adults, with a mean difference of 0.70 (95% CI: 0.08 to 1.32).

For education status, the ANOVA results (F = 3.16, P-value = 0.0280) also indicate significant differences in access barriers. Post hoc comparisons using Tukey's HSD test demonstrated that individuals with secondary education have significantly lower access barriers compared to those with no education, with a mean difference of -0.87 (95% CI: -1.63 to -0.10). No significant differences were found between individuals with primary education and those with no education (Tukey contrast = -0.38, 95% CI: -1.13 to 0.37), between individuals with higher education and those with no education (Tukey contrast = -0.50, 95% CI: -1.34 to 0.35), between individuals with secondary education and those with primary education (Tukey contrast = -0.49, 95% CI: -1.12 to 0.14), between individuals with higher education and those with primary education (Tukey contrast = -0.12, 95% CI: -0.84 to 0.61), and between individuals with higher education and those with secondary education (Tukey contrast = 0.37, 95% CI: -0.37 to 1.11).

Table 5. ANOVA and Post Hoc Analysis of Access Barriers with Significant Demographic Variables

Factor	F-value	p-value	Significant Comparisons	Tukey Contrast	95% CI (Lower - Upper)
Availability and Accessibility access barrier					
Age	1.92	0.1518			
Education Status	1.82	0.1492			
Access-barrier of Knowledge, attitudes, or practices					
Age	6.51	0.0022**	Adult vs Children	-0.70	(-0.14 - 1.25)
			Older Adults vs Children	-0.00	(-0.72 - 0.72)
			Older Adults vs Adults	0.70	(0.08 - 1.32)
Education Status	3.16	0.0280*	Primary vs No education	-0.38	(-1.13 - 0.37)
			Secondary vs No education	-0.87	(-1.63 - -0.10)
			Higher vs No education	-0.50	(-1.34 - 0.35)
			Secondary vs Primary	-0.49	(-1.12 - 0.14)
			Higher vs Primary	-0.12	(-0.84 - 0.61)
			Higher vs Secondary	0.37	(-0.37 - 1.11)
Financial access barrier					
Age	2.05	0.1344			
Education Status	1.07	0.3670			

Only significant p-values are marked (*$p < 0.05$, **$p < 0.01$). F-values represent the ratio of variance explained by the factor to the variance within groups. Tukey contrasts and 95% confidence intervals (CI) indicate the mean differences and their range, respectively, between the groups compared.

Discussion

This study highlights the demographic factors influencing healthcare access among dengue fever patients. The age distribution indicates the broad impact of dengue across all age groups, with a significant portion of participants residing in urban areas and many being unemployed, which likely influences their healthcare access due to financial and time constraints.[29,30] The diversity in educational backgrounds underscores the need for tailored health literacy programs.[31]

Accessibility challenges were evident, with significant gender differences in the ability to access healthcare by walking and the initial healthcare institution visited. Males were more likely to seek early treatment compared to females. These gender differences may be attributed to cultural and social norms in Bangladesh, where men often have more autonomy in healthcare decision-making, while women may rely on family members or partners. The finding that women often depend on family members for healthcare decisions (66.67%) reflects traditional gender roles in Bangladesh, where women's healthcare-seeking behavior is influenced by family or partner decision-making. Policy implications include promoting women's autonomy in healthcare decisions through public health education campaigns and increasing gender-sensitive healthcare access by providing targeted outreach for women.[32,33] We observe consistent patterns when comparing our findings with similar studies in South Asia. For example, research from India has shown that women delay seeking healthcare due to cultural norms that prioritize men's health.[34] Studies from Thailand also report that women rely on family members to make healthcare decisions, which can delay timely treatment.[35]

These similarities emphasize the importance of addressing gendered barriers in healthcare access across the region.

Exploring barriers to knowledge, attitudes, beliefs, and practices among patients reveals that more than half of the patients viewed healthcare as a last resort, emphasizing the importance of public health campaigns. Females often relied on family members for decision-making, highlighting sociocultural dynamics.[36] Both genders faced similar challenges in accessing dengue care, with the unavailability of healthcare facilities being a common concern.

Although financial barriers did not show statistical significance, differences in how females and males managed treatment costs were observed. Females relied more on savings, while males leaned towards borrowing. The mean total cost was BDT 30,833.3 ± 2,505.4 for females and BDT 25,074.4 ± 6,054.2 for males. The mean total treatment cost was similarly high at BDT 27,842.6 ± 6,544.5 for females and BDT 22,170.2 ± 6,786.6 for males, posing a significant financial burden for many households. The distribution of these costs revealed that some families faced even higher expenses, stressing the need for financial support mechanisms like subsidies or insurance to alleviate the burden and ensure timely access to care.[37]

The MANOVA analysis revealed a significant overall effect of demographic variables on access barriers, indicating that demographic characteristics collectively influence access to healthcare. The model showed significant results across various tests, confirming the robustness of the findings.

Specifically, age showed a significant effect on access barriers, particularly in Roy's largest root test. This underscores the influence of age on healthcare access. Education status also had a significant impact, especially in Roy's largest root test, indicating its role in shaping healthcare access and attitudes towards dengue treatment.

Post hoc tests were performed to identify specific group differences following significant ANOVA results for age group and education status. For the Access-barrier of Knowledge, Attitudes, or Practices, post hoc comparisons using Tukey's HSD test revealed that adults have significantly lower access barriers compared to children. This suggests that children face greater challenges in accessing healthcare, particularly in areas related to knowledge and attitudes about dengue treatment. Their reliance on caregivers for decision-making and transportation further exacerbates these barriers, as caregivers may lack sufficient understanding or urgency regarding dengue symptoms. Additionally, children may encounter structural barriers, such as the limited availability of pediatric-specific healthcare services.[11] For older adults, post hoc tests indicated that they face significantly higher similar access barriers compared to adults. These barriers likely stem from age-related health issues, such as mobility restrictions, which hinder their ability to access healthcare services promptly.[38]

Based on the ANOVA post hoc findings, secondary education showed a significant reduction in access barriers compared to those with no education, but higher education did not show a further significant reduction. This could be explained by the fact that secondary education equips individuals with essential health literacy, enabling them to navigate the healthcare system and access necessary services. Beyond secondary education, additional formal education may not further reduce barriers as the basic literacy and decision-making skills gained in secondary education already suffice for accessing care. This diminishing return could reflect that primary healthcare services might not differentiate between secondary and higher education individuals in terms of accessibility.

Limitations

This study has several limitations that should be acknowledged. Firstly, this study is based on self-reported data, it may introduce potential biases and limit the information available for analysis. The focus on urban-rural differences does not account for variations within these areas, such as differences between metropolitan and smaller urban settings or among rural communities, potentially oversimplifying access barriers. Additionally, the study did not consider seasonal variations in dengue incidence, which could influence healthcare access patterns. Although not statistically significant, financial barriers showed notable differences in how females and males managed treatment costs, indicating potential underlying issues that were not fully explored. The exclusion of outdoor patients limits the generalizability to hospitalized cases, potentially missing dengue patients treated outside hospitals. The focus on hospitalized patients was due to logistical constraints and the need for consistent data collection in a controlled setting. Furthermore, the study did not account for potential confounding variables, such as socioeconomic status, pre-existing health conditions, or other individual-level factors that could influence access barriers. These confounders were not included due to limitations in the available data and challenges during data collection. Additionally, sensitivity analyses were not conducted, which would have helped assess the robustness of the findings by evaluating potential alternative explanations for the observed associations. Future research should include larger sample sizes to enhance representativeness and statistical power to capture a more comprehensive picture of healthcare access barriers. It should also address seasonal and intra-urban/rural differences to offer more nuanced insights for policy recommendations.

Conclusion

The findings highlight the importance of age and education as key determinants of access barriers in dengue healthcare. The significant differences identified between specific age groups and education levels underscore the need for targeted interventions to address these disparities. The multifaceted nature of access barriers requires comprehensive, patient-centered interventions and policies to ensure equitable access and improved health outcomes for all patients. Addressing the unique needs of children and older adults, as well as enhancing educational opportunities, could be pivotal in mitigating access barriers in dengue healthcare.

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Conflict of Interest

No conflict of interest.

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