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Editorial

The Fading Efficacy of the Watch Group: A Crisis in Antibiotic Stewardship

Antibiotic resistance has emerged as one of the greatest public-health crises of the twenty-first century. The discovery of antibiotics once revolutionized modern medicine, making once-fatal infections curable. However, decades of overuse, misuse, and inadequate stewardship have pushed us to the brink of a post-antibiotic era. Current estimates suggest that antimicrobial resistance (AMR) could claim 10 million lives every year by 2050, surpassing cancer as a leading cause of death if urgent global action is not taken.[1]

The Role of the WHO AWaRe Classification

To address irrational prescribing, the World Health Organization (WHO) introduced the AWaRe classification—categorizing antibiotics into Access, Watch, and Reserve groups.[2,3]

- **Access group** antibiotics, such as amoxicillin, doxycycline, and gentamicin, are recommended as first-line choices with a lower potential for resistance.

- **Watch group** antibiotics—such as ceftriaxone, azithromycin, ciprofloxacin, and meropenem—are critically important for severe infections but have a higher potential for selecting resistant strains.

- **Reserve group** antibiotics, including colistin and linezolid, are considered last-resort options for multidrug-resistant pathogens.

The AWaRe framework helps countries and hospitals prioritize antibiotic stewardship, monitor usage trends, and guide procurement policies. Yet, despite these efforts, resistance within the Watch group is rising at an alarming pace, threatening the efficacy of our most relied-upon treatments for pneumonia, sepsis, urinary-tract infection, and typhoid fever.

Over the past decade, surveillance data have shown a worrying trend—bacteria that were once susceptible to Watch antibiotics are now exhibiting high resistance rates. Third-generation cephalosporins like ceftriaxone and ceftazidime, once considered lifesaving, are now frequently rendered ineffective by extended-spectrum β-lactamase (ESBL)-producing Enterobacteriaceae. Likewise, resistance to fluoroquinolones (e.g., ciprofloxacin) and macrolides (e.g., azithromycin, clarithromycin) is rising sharply. Multiple surveillance studies and hospital antibiograms demonstrate a strong association between prior exposure to Watch group antibiotics and the isolation of multidrug-resistant (MDR) bacteria.[3,4,5]

Why Resistance Emerges—A Clinical and Systemic Perspective

Several interconnected factors contribute to this growing threat:

1. **Overuse and Misuse** – Watch group antibiotics are often prescribed unnecessarily for viral infections or as "coverage" without diagnostic confirmation. Ceftriaxone and azithromycin, for instance, are frequently used empirically for fever or sore throat, even when not indicated.

2. **Empirical Shifts Due to Prior Resistance** – As resistance to older drugs like ampicillin or cotrimoxazole rises, clinicians shift empirically toward third-generation cephalosporins or carbapenems, accelerating the resistance cycle.

3. **Weak Antimicrobial Stewardship** – In many low- and middle-income countries (LMICs), antimicrobial-stewardship programs remain under-resourced. Lack of prescription audits, poor infection-control practices, and over-the-counter sales of antibiotics contribute significantly.

4. **Hospital and Community Transmission** – Resistant organisms spread rapidly between patients via healthcare workers, surfaces, and wastewater. Studies from China and India demonstrate that hospital wastewater often contains large reservoirs of resistant bacteria.[6]

5. **Pharmaceutical and Policy Gaps** – Limited enforcement of drug-control regulations and inadequate incentives for developing new antibiotics compound the crisis.

The Role of Surveillance in monitoring Resistance

Effective monitoring of resistance patterns is fundamental to combating antimicrobial resistance (AMR). Surveillance tools such as antibiograms provide localized insights into pathogen susceptibility, enabling clinicians to make evidence-based decisions and guiding hospitals in updating empirical therapy protocols. At a broader level, well-implemented National Action Plans (NAPs) can significantly reduce antibiotic consumption through coordinated policies and stewardship programs. Global surveillance systems like the World Health Organization's Global Antimicrobial Resistance and Use Surveillance System (GLASS) facilitate international data sharing and

trend analysis, helping countries track emerging resistance threats. Additionally, wastewater and environmental monitoring serve as crucial early-warning systems by identifying hidden reservoirs of resistant organisms within communities, allowing timely interventions to prevent wider outbreaks.

Consequences for Clinical Practice

The consequences of rising resistance among Watch-group antibiotics have serious clinical and economic implications. As first-line agents such as ceftriaxone or ciprofloxacin lose effectiveness, clinicians are forced to rely on more expensive or toxic alternatives like carbapenems or colistin, limiting treatment options and increasing the risk of adverse effects. Treatment failures necessitate prolonged hospitalization, escalating healthcare costs, patient morbidity, and mortality. Additionally, reliance on empirical therapy can delay definitive diagnosis, allowing resistant infections to persist and spread. Beyond the clinical impact, antimicrobial resistance imposes a heavy economic burden through longer illnesses, reduced productivity, and inefficient use of healthcare resources.

The Need for Clinician-Led Stewardship

Addressing resistance in the Watch group antibiotics requires frontline clinician ownership along with policies. Every clinician must view antibiotics as a shared resource—precious, finite, and requiring protection.

1. **Culture-Based Prescribing:** Whenever feasible, antibiotic therapy should be guided by culture and sensitivity testing.

2. Begin **empirical treatment** only when strongly indicated and review within 48–72 hours once laboratory results become available.

3. **Education and Accountability:** Continuous medical education on AWaRe categories should be mandatory, emphasizing the difference between "Access" and "Watch" choices.[8]

4. **Restriction Policies:** Hospitals should implement formulary restrictions for Watch and Reserve antibiotics—ensuring their use only under infectious-disease or microbiology consultation.

5. **Public Awareness:** Community education about the dangers of self-medication and incomplete antibiotic courses can reduce unnecessary demand.

In Bangladesh and other South-Asian nations, where antibiotics are often sold without prescription, these principles are urgently needed. Public-private collaboration could establish stewardship units within tertiary hospitals, supported by national surveillance networks and microbiology labs.

Global Responsibility and Future Directions

The fight against AMR requires global solidarity. Developed countries must support LMICs with funding, training, and laboratory infrastructure. Pharmaceutical industries should be incentivized to develop new molecules along with governments regulation regarding antibiotic marketing.

Innovations such as rapid diagnostic testing, AI-based surveillance, and phage therapy could aid in detecting and treating resistant infections. However, none of these will succeed without behavioral change among clinicians and patients alike.

Conclusion

The rising resistance among Watch group antibiotics represents a critical warning. This crisis transcends borders—it affects every clinician, pharmacist, policymaker, and patient. The solution lies not only in new drugs but in responsible use of the available antibiotics. Clinicians should prescribe wisely, support stewardship programs, and educate our communities. If we fail to act, infections that are easily treatable today may once again become deadly tomorrow.

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Original article

Osteometric Analysis of Mid-Shaft Dimensions of Fully Ossified Dry Adult Human Fibulae in a Bangladeshi Population

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Abstract:

Background: The fibular shaft provides extensive surface area for muscle attachment that supports ankle and foot movements. *Objectives:* To measure the mid-shaft circumference, anterior–posterior, and transverse diameters of fully ossified dry adult human fibulae in a Bangladeshi population. *Methodology:* A total of 300 fibulae (152 right and 148 left) were examined in a descriptive cross-sectional study conducted in the Department of Anatomy, Mymensingh Medical College, Bangladesh (January–December 2023). Samples with deformity, fractures, or incomplete ossification were excluded. Measurements were taken using flexible measuring tapes and sliding calipers, and analyzed with SPSS software. *Results:* The mean (±SD) mid-shaft circumference was 4.22 ± 0.49 cm (right) and 4.21 ± 0.53 cm (left). The mean anterior–posterior diameters were 13.77 ± 1.73 mm (right) and 13.71 ± 1.67 mm (left), while transverse diameters were 10.34 ± 1.58 mm (right) and 10.60 ± 1.70 mm (left). *Conclusion:* The fibular shaft, being thin and vascular, is suitable for bone grafting procedures, particularly in reconstructive surgeries.

Keywords: Fibula, Osteometry, Mid-shaft, Circumference, Diameter, Bone graft

Introduction:

The fibula is a long bone and consists of three parts: upper end, lower end, and intervening shaft [1]. The fibula (Latin clasp/pin) is the lateral and smaller bone of the leg. It is very thin as compared to the tibia. It is homologous with the ulna of the upper limb. It forms a mortice of the ankle joint [5]. It gives the calf its structure and helps to forms a stable ankle joint. Its shape is like a three- sided prism. The shaft has three borders and surfaces, each associated with a particular group of muscles[3]. The shaft is described to have anterior, interosseous, and posterior borders; and medial, lateral, and posterior surfaces. The shaft of the fibula provides surface area for the attachment of most of the extensor, flexor and

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peroneal muscles[4]. Shaft of fibula is triangular in cross-section[6]. The shaft of the fibula is also important for tendons and ligaments attachment. The shaft forms the outer part of the calf contribute to the overall structural support of the lower leg. The interosseous membrane of the leg is a tough fibrous sheet of connective tissue that spans the distance between facing interosseous borders of the tibial and fibular shafts. Middle tibiofibular joint is formed by the interosseous membrane which is a fibrous connective tissue that connects the shaft of the tibia and fibula. The interosseous membrane not only links the tibia and fibula together, but also provides an increased surface area for muscle attachment [7]. The cortical bone of the shaft of the fibula is a valuable source of bone grafting. Fracture of the shaft of the fibula can be associated with instability of the ankle joint, especially if the distal tibiofibular syndesmosis is also disrupted. Despite several osteometric studies conducted in other populations, data on fibular shaft dimensions in the Bangladeshi population remain limited. Understanding these measurements is crucial for orthopedic and reconstructive surgical applications. Therefore, this study aimed to evaluate the mid-shaft circumference and diameters of fully ossified dry human fibulae in a Bangladeshi sample.

Materials & Methods:

This cross-sectional descriptive study was conducted on 300 fully ossified dry human fibulae collected from the Department of Anatomy, Mymensingh Medical College (MMC), Mymensingh, Bangladesh. Among the samples, 152 were from the right side and 148 from the left. The study was carried out over a one-year period, from January to December 2023. Samples were selected using a non-random purposive sampling technique. Ethical approval was obtained from the Institutional Review Board (IRB) of MMC (Memo No. MMC/IRB/2023/575, dated 24 June 2023).

Only fully ossified, intact fibulae without deformity, fracture, or pathology were included. Three osteometric parameters were measured: mid-shaft circumference, mid-shaft anterior–posterior diameter, and mid-shaft transverse diameter.

To measure the mid-shaft circumference, the midpoint of the total length of each fibula was marked with a pencil, and the circumference at that point was measured using a flexible measuring tape and recorded in centimeters (cm). The mid-shaft anterior–posterior diameter was measured at the same midpoint using sliding calipers, by placing the fixed jaw on the anterior border and the movable jaw on the posterior border of the bone; the value was expressed in millimeters (mm). The mid-shaft transverse diameter was also measured with sliding calipers, by placing the fixed jaw on the medial border and the movable jaw on the lateral surface at the midpoint of the bone; the distance was recorded in millimeters (mm).

Figure 1: Procedure for measuring mid-shaft circumference using a flexible measuring tape.
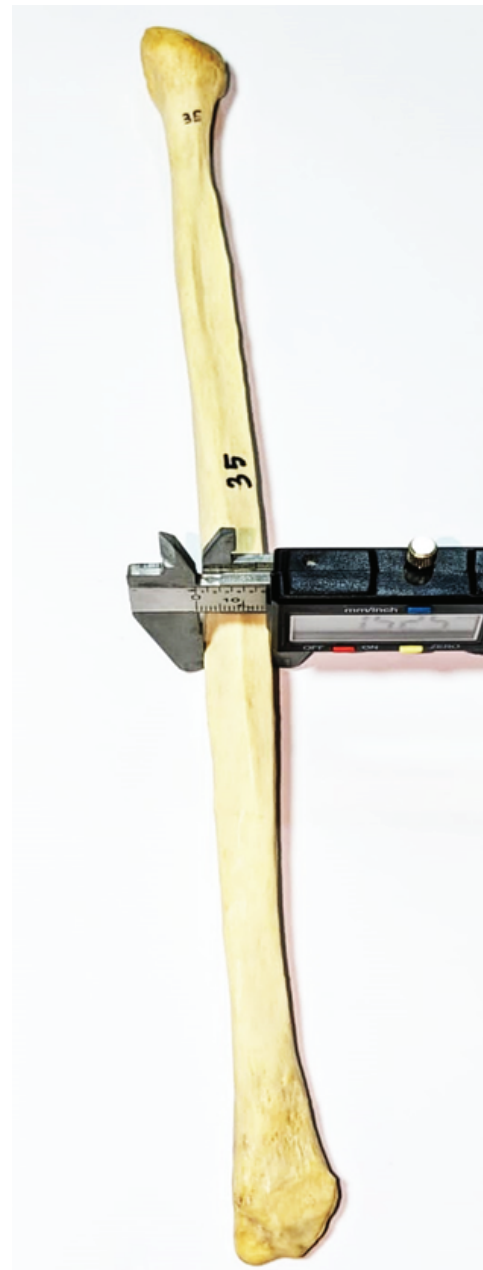
Figure 2: Procedure for measuring mid-shaft anterior–posterior diameter using sliding calipers.

Figure 3: Procedure for measuring mid-shaft transverse diameter using sliding calipers.

Results:

The mid-shaft circumference of the right-sided fibulae (n = 152) ranged from 3.0 cm to 5.5 cm, with more than 83% of the samples measuring between 3.5 cm and 4.5 cm. The left-sided fibulae (n = 148) also showed a range of 3.0 cm to 5.5 cm, with more than 78% falling within the 3.5–4.5 cm range.

The mid-shaft anterior–posterior diameter of the right-sided fibulae varied between 9.62 mm and 18.32 mm, with over 82% of the samples measuring within 11–16 mm. For the left-sided fibulae, the range was 9.78 mm to 17.76 mm, and more than 77% of the samples were within 11–15 mm.
The mid-shaft transverse diameter of the right-sided fibulae ranged from 4.53 mm to 14.45 mm, with over 83% of the bones measuring between 8.75 mm and 11.25 mm. The left-sided fibulae showed a range of 6.8 mm to 16.17 mm, and more than 76% were within 8.75–12.50 mm.

The mean (±SD) mid-shaft circumference was 4.22 ± 0.49 cm on the right side and 4.21 ± 0.53 cm on the left side. The mean (±SD) mid-shaft anterior–posterior diameters were 13.77 ± 1.73 mm (right) and 13.71 ± 1.67 mm (left). The mean (±SD) mid-shaft transverse diameters were 10.34 ± 1.58 mm (right) and 10.60 ± 1.70 mm (left).

Table 1. Mean and Range of Fibular Mid-Shaft Measurements (n = 300)

Parameter	Side	Range	Mean ± SD
Mid-shaft circumference (cm)	Right	3.0–5.5	4.22 ± 0.49
	Left	3.0–5.5	4.21 ± 0.53
Mid-shaft anterior–posterior diameter (mm)	Right	9.62–18.32	13.77 ± 1.73
	Left	9.78–17.76	13.71 ± 1.67
Mid-shaft transverse diameter (mm)	Right	4.53–14.45	10.34 ± 1.58
	Left	6.80–16.17	10.60 ± 1.70
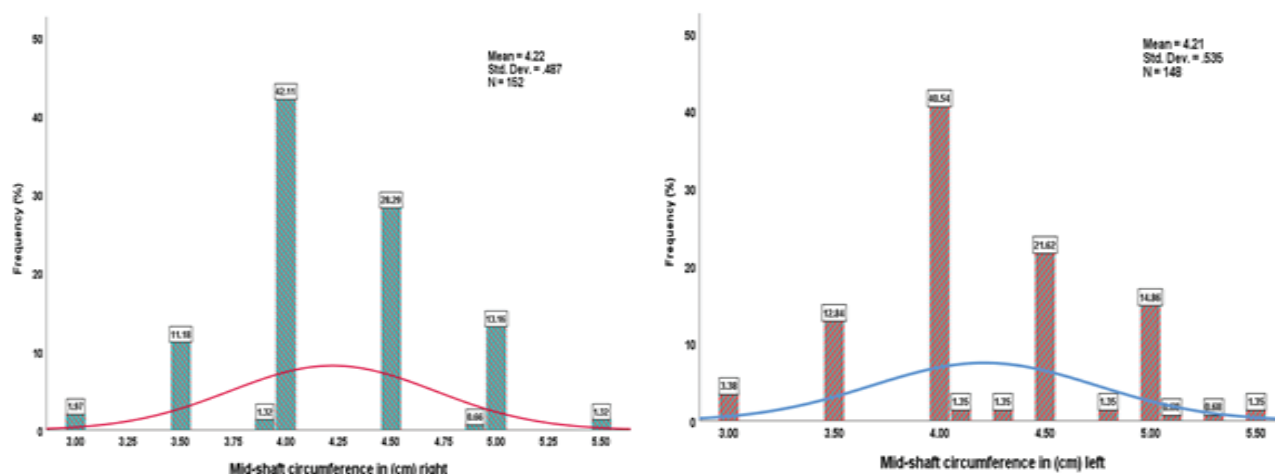
Figure 4: Histogram showing frequency distribution of mid-shaft circumference of both right and left fibulae.
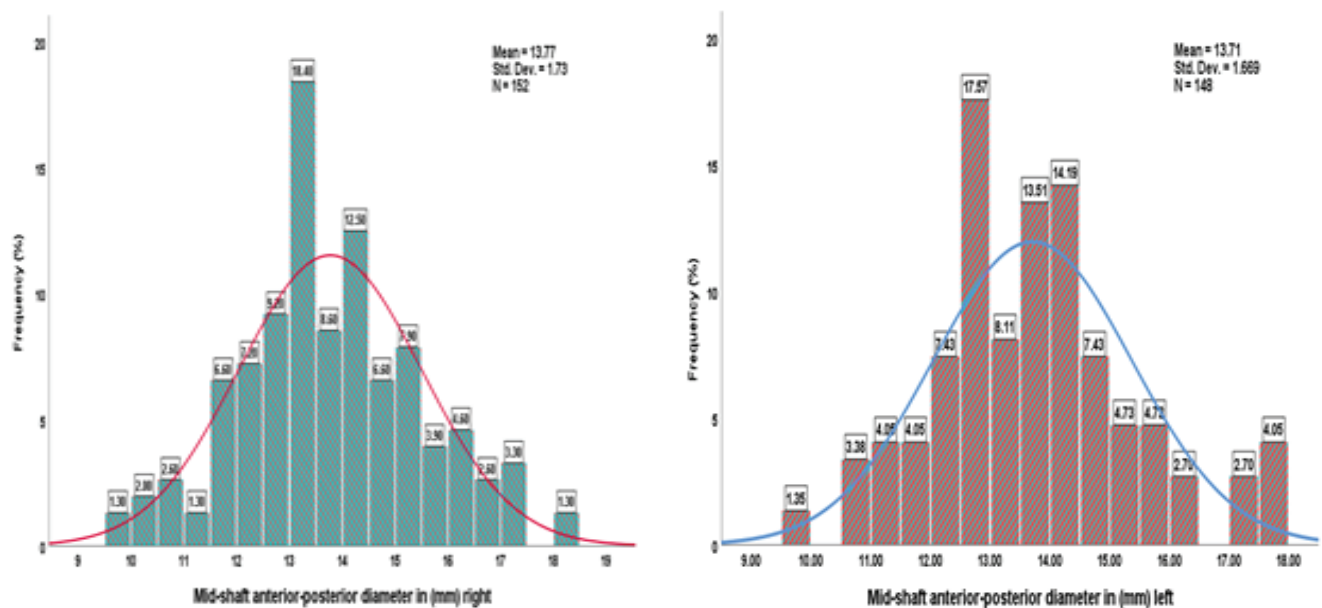
Figure 5: Histogram showing frequency distribution of mid-shaft anterior–posterior diameter of both right and left fibulae.
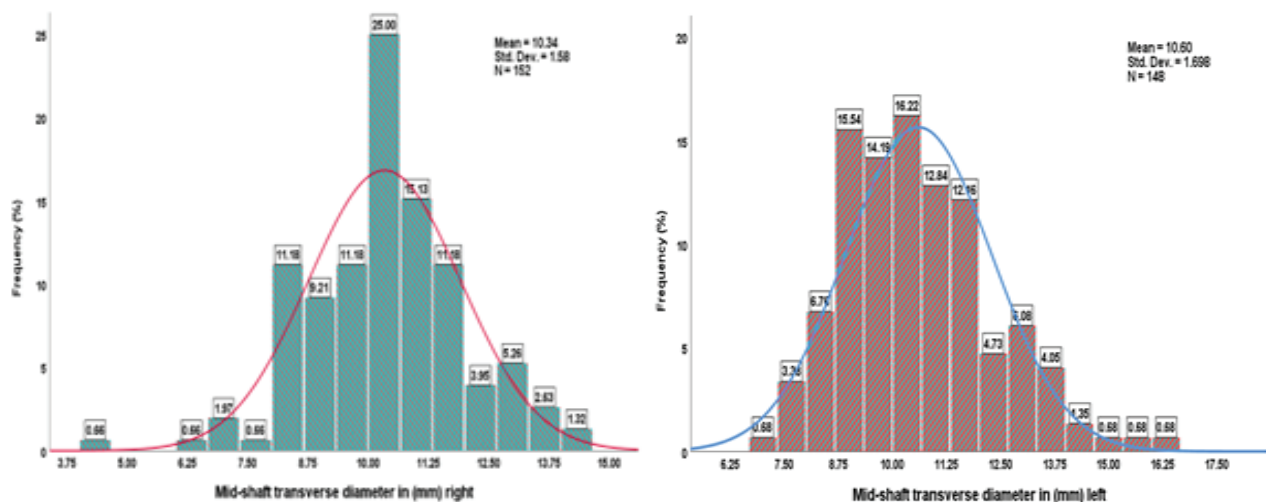
Figure 6: Histogram showing frequency distribution of mid-shaft transverse diameter of both right and left fibulae.

Discussion

In the present study, the mean (±SD) mid-shaft circumference of the fibula was 4.22 ± 0.49 cm on the right side and 4.21 ± 0.53 cm on the left. The mean (±SD) mid-shaft anterior–posterior diameter was 13.77 ± 1.73 mm on the right and 13.71 ± 1.67 mm on the left. The mean (±SD) mid-shaft transverse diameter was 10.34 ± 1.58 mm on the right and 10.60 ± 1.70 mm on the left. These findings indicate minimal side-to-side variation, suggesting bilateral symmetry of fibular dimensions in the Bangladeshi population.

The present results are comparable to those reported by Lingamdenne (2019) [2], who observed a mean mid-shaft circumference of 3.94 ± 0.50 cm, a mean anterior–posterior diameter of 13.67 ± 2.07 mm, and a mean transverse diameter of 10.86 ± 1.63 mm in a population from Telangana,

India. The small discrepancies between populations may reflect differences in genetics, nutrition, and habitual physical activity influencing bone morphology.

Osteometric analyses of long bones are valuable for both clinical and anthropological purposes. In orthopedics and reconstructive surgery, the fibular shaft is widely recognized as a reliable donor site for cortical bone grafts due to its favorable shape, adequate length, and limited functional loss after harvest [3,6]. According to Standring (2016) [3] and Moore et al. (2018) [6], the fibula provides an excellent source of vascularized cortical bone, suitable for reconstructive procedures such as mandibular or long-bone defect repair.

The findings of this study are consistent with established anatomical data demonstrating that fibular shaft dimensions are relatively stable across populations, with minor regional

variations [2–4,6]. Such consistency enhances its applicability in forensic identification and reconstructive planning. Furthermore, the osteometric data obtained in this study may serve as a reference for anthropological research and educational purposes, as well as for developing population-specific morphometric standards.

Overall, this study provides important baseline data on the morphometry of the fibular shaft in the Bangladeshi population. These findings contribute to the existing anatomical database and have potential implications in forensic anthropology, orthopedic surgery, and academic anatomy.

Conclusion

The fibular shaft serves as an important source of cortical bone for grafting in various reconstructive surgical procedures, particularly for mandibular and long bone defects. The findings of this osteometric study demonstrate that the mid-shaft circumference and diameters of the fibula are bilaterally symmetrical, with minimal variation between the right and left sides in the Bangladeshi population.

Its thin cortical structure, adequate vascularity, and limited functional compromise after harvest make the fibula one of the most reliable donor bone for reconstructive applications.[3,6] The osteometric data presented in this study enrich the anatomical database for the Bangladeshi population and can serve as a reference for anthropological research, orthopedic surgery, and forensic identification. Future studies with larger sample sizes and comparative analyses across diverse populations are recommended to validate these findings.

Acknowledgement

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Original article

Unraveling the Resistance: A Study on Urinary Tract Infections and Antibiotic Susceptibility in a specialized hospital in Dhaka

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Abstract:

Background: Urinary tract infections (UTIs) are among the most common infections worldwide, affecting individuals of all ages and both sexes. The increasing prevalence of UTIs, coupled with rising antibiotic resistance, underscores the need to evaluate UTI pathogens and their antibiotic susceptibility. ***Objectives:*** This study was conducted at Rushmono Specialized Hospital to assess the microbiological profile and resistance patterns of UTI pathogens in hospitalized patients. ***Methodology:*** A total of 147 UTI patients (55 males and 92 females) were included in the study. Urine samples were analyzed for microbial growth, and pathogens were identified using standard microbiological techniques, including Gram staining and biochemical testing. Antibiotic susceptibility testing was performed using the disk diffusion method to determine resistance and sensitivity patterns against commonly prescribed antibiotics. ***Result:*** Of the 147 patients, 59 (40.14%) had positive microbial growth, while 88 (59.86%) had negative cultures. Among the 55 male patients, 17 (23.61%) had positive cultures, whereas 42 of the 92 female patients (56.00%) showed bacterial growth, reflecting the higher prevalence of UTIs in females. Gram-positive organisms accounted for 9.52% of the isolates, while Gram-negative organisms made up 31.97%. The most common Gram-positive pathogens were Staphylococcus aureus (4.76%) and Enterococci (4.08%), whereas Escherichia coli (19.73%) and Enterobacter (10.20%) were the predominant Gram-negative organisms. Antibiotic susceptibility testing revealed high resistance in Gram-positive organisms to Penicillin G (17.01%) and Erythromycin (25.85%), while Vancomycin, Linezolid, and Imipenem remained effective. Among Gram-negative isolates, E. coli exhibited significant resistance to Ceftazidime (78.13%), Nalidixic acid (66.67%), and Amoxiclav (64.29%), but showed high sensitivity to Ciprofloxacin (73.91%) and Meropenem (93.55%). ***Conclusion:*** This study highlights the increasing antibiotic resistance among UTI pathogens, both Gram-positive and Gram-negative. High resistance rates to common antibiotics emphasize the need for continuous local surveillance of resistance patterns.

Keywords: UTI, Antibiotic susceptibility, Multidrug-resistant strain, Antibiotic.

Introduction:

Globally, Urinary Tract Infections (UTIs) represent a major public health burden, affecting individuals across all demographics. In healthcare environments, UTIs are a leading cause of morbidity and increased costs. Urinary tract infec-

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tions (UTIs) are one of the most prevalent infectious diseases worldwide, significantly affecting individuals of all ages and sexes.[1] UTIs are particularly common in healthcare settings, contributing to both morbidity and healthcare costs.[2] The urinary tract is susceptible to infections due to its direct contact with the external environment, and factors such as poor hygiene, sexual activity, catheter use, and underlying medical conditions (such as diabetes and immune suppression) increase the risk of infection.[1]According to global health reports, UTIs are the second most common type of infection in primary care settings and one of the most frequent reasons for hospitalization, particularly among older adults and individuals with chronic conditions. The most common pathogens responsible for UTIs are bacteria, with Escherichia coli (E. coli) being the leading culprit in 70-90% of cases.[1] Antibiotic resistance is a major public health concern & overuse and misuse of antibiotics & inadequate infection control practices in healthcare settings are considered as the major cause.[3,4] This resistance not only diminishes the effectiveness of commonly used antibiotics but also limits the available treatment options, thereby necessitating regular surveillance of bacterial resistance patterns in specific populations.[5] As UTIs are among the most frequent reasons for antibiotic prescriptions in hospital settings, understanding the local patterns of microbial resistance is crucial for guiding empirical therapy and improving patient outcomes.[6] In light of this, our study aimed to investigate the microbiological profile and antibiotic resistance patterns of UTI pathogens in patients admitted to Rushmono Specialized Hospital. This hospital, a key healthcare facility in the region, provides a wide range of medical services and treats a substantial number of UTI cases annually. The purpose of the study was to determine the prevalence of bacterial pathogens in UTI samples, identify the antibiotic susceptibility profiles of these pathogens, and assess trends in resistance that could guide treatment strategies in this healthcare setting. By analyzing a comprehensive sample of patients, including both male and female individuals, we sought to provide valuable insights into the current state of UTI management at Rushmono Specialized Hospital and contribute to broader efforts to combat antibiotic resistance in the region. Our study specifically focused on identifying the microorganisms responsible for UTIs, with a particular emphasis on understanding their Gram reaction (Gram-positive or Gram-negative) and determining their resistance or susceptibility to a variety of commonly used antibiotics. In doing so, we aimed to not only characterize the local resistance patterns but also highlight potential therapeutic challenges and the need for tailored antibiotic regimens. Given the rising incidence of multi-drug-resistant organisms, this research holds important implications for hospital infection control measures and antibiotic stewardship programs.[7] The importance of this study lies in its potential to inform clinical decision-making and optimize UTI treatment in the hospi-

tal. The identification of resistant pathogens can help clinicians adjust their treatment strategies to ensure better patient outcomes and reduce the emergence and spread of resistant strains. Furthermore, the data generated from this research could serve as a basis for developing more effective infection control practices within the hospital and could contribute to national and global efforts to monitor and combat antibiotic resistance.[8]

Materials and Methods

This retrospective study was conducted at Rushmono Specialized Hospital, focusing on the microbiological profile and antibiotic susceptibility patterns of urinary tract infection (UTI) pathogens. The study analyzed 147 urine samples collected from 147 patients, comprising 59 males and 88 females, who were diagnosed with UTI and admitted to the hospital. The study was conducted over a period from 15/07/2023 to 15/01/2025.

Sample Collection and Processing

Clean-catch midstream urine (MSU) samples of approximately 4-5 ml were collected using sterile disposable containers from UTI patients. The samples were transported to the microbiology laboratory promptly for analysis.9 The presence of microorganisms was determined using semi-quantitative culture methods on three different agar media: MacConkey agar, 5% blood agar, and cystine lactose electrolyte deficient medium (CLED) agar (Oxoid Ltd, Basingstoke, Hampshire, UK). The samples were incubated at 37°C for 24–48 hours in aerobic conditions.[10] Routine urine microscopy was performed to count white blood cells (WBCs) and compare findings with culture results for the diagnosis of UTI.[11] If no growth was observed after 24 hours, the cultures were further incubated for an additional 24 hours before concluding that no growth was present.[12] Organisms were identified using standard microbiological and biochemical tests, such as Gram staining, colony morphology, lactose fermentation, indole, citrate utilization, catalase, coagulase, oxidase, and urease tests, following WHO guidelines.

Inclusion and Exclusion Criteria

Inclusion criteria for the study included patients presenting with UTI symptoms and a requisition for urine culture and sensitivity tests from both indoor and outdoor departments.[3] Exclusion criteria included patients who had incomplete data or who were treated with antibiotics prior to sample collection.[14]

Antimicrobial Susceptibility Testing

Antimicrobial susceptibility testing was carried out using the Kirby-Bauer disk diffusion method on Mueller-Hinton agar.[15] Antibiotic discs from Oxoid Ltd, Basingstoke, Hampshire, UK, were used, and the testing was performed according to Clinical and Laboratory Standards Institute (CLSI) guidelines. Antibiotics tested for both Gram-positive and Gram-negative isolates included:

- **For Gram-positive organisms:** Ampicillin (Amp), Cephradine (Ceph), Cotrimoxazole (Cot), Ciprofloxacin (Cip), Nitrofurantoin (Nit), Levofloxacin (Lev), Nalidixic acid (NA), Cefotaxime (CTX), Ceftriaxone (CTR), Amoxiclav (AMC), Gentamicin (Gen), Ceftazidime (CAZ), Amikacin (AK), Meropenem (Mero), Vancomycin (Van), Linezolid (Lz), Oxacillin (Ox), Cloxacillin (Clox), Erythromycin (Ery), Doxycycline (Do).[15]

- **For Gram-negative organisms:** Ampicillin (Amp), Cephradine (Ceph), Cotrimoxazole (Cot), Ciprofloxacin (Cip), Nitrofurantoin (Nit), Levofloxacin (Lev), Nalidixic acid (NA), Cefotaxime (CTX), Ceftriaxone (CTR), Amoxiclav (AMC), Gentamicin (Gen), Ceftazidime (CAZ), Amikacin (AK), Meropenem (Mero), Cefixime (CXM), Piperacillin-tazobactam (PIT), Colistin (Col).[15]

The diameter of inhibition zones was measured and interpreted based on CLSI guidelines to determine whether the isolates were resistant or sensitive to each antibiotic.[16]

Antibiotic Susceptibility Patterns

The results of antibiotic susceptibility testing for the Gram-positive and Gram-negative organisms isolated are summarized below:

Gram-Positive Organisms

The antibiotic susceptibility pattern for Gram-positive organisms (Staphylococcus aureus, Coagulase-negative staphylococci (CONS), and Enterococci) is presented in Table 3.

- Staphylococcus aureus (7 isolates) showed significant resistance to Penicillin G (17.01%) and Erythromycin (25.85%). However, it was highly sensitive to Vancomycin, Linezolid, and Imipenem, which demonstrated no resistance.

- Enterococci (6 isolates) also showed resistance to common antibiotics, but were sensitive to Vancomycin and Linezolid.

- Overall, Gram-positive bacteria exhibited high resistance rates to Penicillin G and Erythromycin, while remaining largely sensitive to Vancomycin, Linezolid, and Imipenem.[17]

Gram-Negative Organisms

The antibiotic susceptibility pattern for Gram-negative organisms (Escherichia coli, Enterobacter, Pseudomonas, Klebsiella, and Acinetobacter) is presented in Table 4.

- Escherichia coli (29 isolates) was highly resistant to Ceftazidime (78.13%), Nalidixic acid (66.67%), and Amoxiclav (64.29%). However, it exhibited high sensitivity to Ciprofloxacin (73.91%) and Meropenem (93.55%).

- Enterobacter (15 isolates) showed moderate resistance to multiple antibiotics, with notable resistance to Ceftriaxone and Cefepime.

- Other Gram-negative organisms, such as Klebsiella and Acinetobacter, showed varied resistance profiles with significant resistance to Amoxiclav and Cefepime.[18]

Results:

Distribution of Samples Received

The total number of samples received from UTI patients was 147, split equally between males and females. A breakdown of growth positivity and negativity is as follows:

Table 1: Percentage Distribution of Growth Positive and Growth Negative Cases by Sex

Sex	Growth Positive	Growth Negative	Total	% Positive	% Negative
Male	17	55		23.61%	76.39%
Female	42	33	147	56.00%	44.00%
Total	59	88		40.14%	59.86%

Overall, 59 samples (40.14%) tested positive for microbial growth, while 88 samples (59.86%) were negative. The growth positivity rate was higher among females (56.00%) compared to males (23.61%).
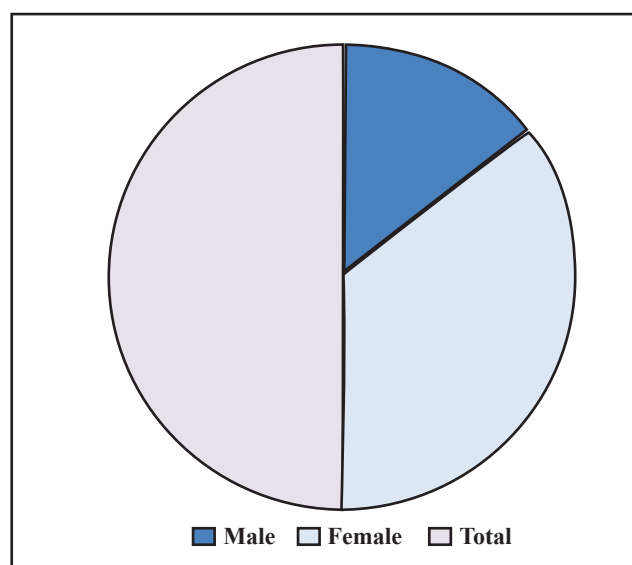
Figure 1 : Distribution of Growth Positive and Growth Negative Cases by Sex

Table 2: Distribution of Bacterial Isolates by Gram Reaction

Gram Reaction	Organism	Count	Percentage
Gram Positive	*S. aureus*	7	4.76%
	CONS	1	0.68%
	Enterococci	6	4.08%
Total gram positive		**14**	**9.52%**
Gram negative	*E. coli*	29	19.73%
	Enterobacter	15	10.20%
	Pseudomonas	1	0.68%
	Klebsiella	1	0.68%
	Acinatobacteer	1	0.68%
Total Gram Negative		**47**	**31.97%**
Total		**147**	**100.00%**

Gram-negative organisms, particularly E. coli, are the leading contributors to UTI infections in this sample population.

Table 3 : Gram-Positive Bacterial Antibiotic Sensitivity and Resistance Pattern

Antibiotic	Sensitive (S)	Resistant (R)	Total %	Sensitive %	Resistant %
Penicillin G	1	25	26	0.68%	17,01%
Vancomycin	9	-	9	6.12%	-
Linezolid	13	-	13	8.84%	-
Erythromycin	3	38	41	2.04%	25.85%
Cefuroxime	4	28	32	2.72%	19.05%
Meropenem	3	-	3	2.04%	-
Imipenem	9	-	9	6.12%	-
Nitroglycerin	12	1	13	8.16%	0.68%
Tetracycline	12	3	15	8.16%	2.04%
Doxycycline	1	3	4	0.68%	2.04%
Amoxiclav	4	1	5	2.72%	O.68%
Ceftriaxone	1	4	5	0.68%	2.72%
Cefepime	2	2	4	1.36%	1.36%
Co-trimoxazole	6	4	10	4.08%	2.72%
Levofloxacin	7	2	9	4.76%	1.36%
Netilmicin	6	-	6	4.08%	-

- **Highly Resistant Antibiotics:** Erythromycin (25.21% resistant), Cefuroxime (18.37% resistant), and Penicillin G (16.99% resistant) showed high resistance rates.

- **Most Effective Antibiotics (100% Sensitivity):** Vancomycin, Linezolid, Meropenem, Imipenem, and Netilmicin showed no resistance.

- **Moderate Effectiveness:** Tetracycline, Co-trimoxazole, Levofloxacin, and Amoxiclav had mixed sensitivity and resistance.

- **Least Effective Antibiotics:** Erythromycin, Cefuroxime, and Penicillin G had the highest resistance percentages
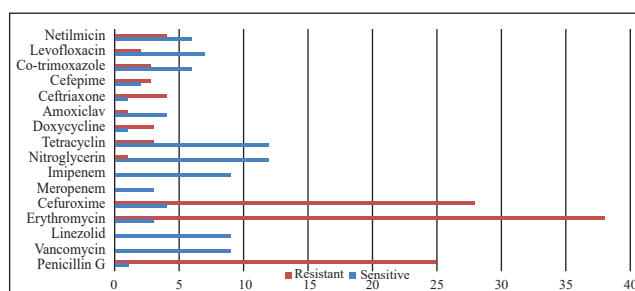
Figure 2 : Gram-Positive Bacterial Antibiotic Sensitivity and Resistance Pattern

- **Highly Effective Antibiotics (≥80% Sensitivity):** Imipenem (100% S), Co-trimoxazole (100% S), Meropenem (93.55% S), and Gentamicin (88.24% S) showed the highest sensitivity rates, indicating their strong efficacy.

- **Moderately Effective Antibiotics (50–79% Sensitivity):** Ciprofloxacin (73.91% S), Nitroglycerin (80% S), Tetracycline (62.50% S), Netilmicin (66.67% S), Levofloxacin (54.55% S), and Doxycycline (53.33% S) displayed moderate effectiveness, suggesting their potential use depending on the clinical scenario.

- **Poorly Effective Antibiotics (<50% Sensitivity):** Ceftazidime (21.88% S), Nalidixic Acid (33.33% S), Collistin (40% S), Amoxiclav (35.71% S), Cefepime (33.33% S), and Ceftriaxone (50% S) exhibited high resistance, indicating limited therapeutic use.

- **Complete Resistance Data Not Available:** Some antibiotics, including Meropenem, Imipenem, and Co-trimoxazole, had no recorded resistant cases, suggesting strong activity but requiring further confirmation.

Overall, carbapenems (Meropenem, Imipenem) and Co-trimoxazole demonstrated the highest effectiveness, while Ceftazidime, Amoxiclav, and Cefepime had significant resistance. The findings emphasize the importance of antibiotic susceptibility testing to guide appropriate treatment decisions.

Table 4:: Antibiotic Sensitivity and Resistance Profiles of Isolated Gram-negative Organisms

Antibiotic	Sensitive (S)	Resistant (R)	Total %	Sensitive %	Resistant %
Ceftazidime	7	25	32	21.88%	78.13%
Ciprofloxacin	34	12	46	73.91%	26.09%
Nalidixic acide	1	2	3	33.33%	66.67%
Collistin	2	3	5	40.00%	60.00%
Gentamicin	15	2	17	88.24%	11.76%
Meropenem	31	-	31	93.55%	-
Imipenem	11	-	11	100.00%	-
Nitroglycerin	8	2	10	80.00%	20.00%
Tetracycline	10	6	16	62.50%	37.50%
Doxycycline	8	7	15	53.33%	46.67%
Amoxiclav	5	9	14	35.71%	64.29%
Ceftriaxone	9	9	18	50.00%	50.00%
Cefepime	2	4	6	33.33%	66.67%
Co-trimoxazole	7	-	7	100.00%	-
Levofloxacin	6	5	11	54.55%	45.45%
Netilmicin	6	3	9	66.67%	33.33%
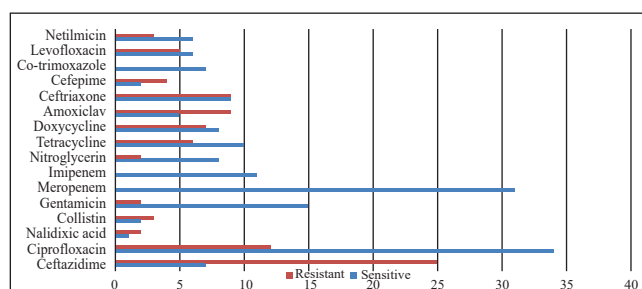
Figure 3 : Antibiotic Sensitivity and Resistance Profiles of Isolated Gram-negative Organisms

5. Gender-Based Analysis

Based on the data in Table 1, the growth positivity rate was significantly higher in females (56.00%) compared to males (23.61%). Among males, 23.61% had growth-positive cultures, while 76.39% were growth-negative. In contrast, females had a 56.00% growth-positive rate and a 44.00% growth-negative rate. The overall growth positivity rate was 40.14%, with 59.86% of the cultures being growth-negative. These findings suggest that females are more prone to urinary tract infections, possibly due to anatomical differences, which may require gender-specific management and prevention strategies.

Discussion

Urinary Tract Infections (UTIs) continue to be one of the most common bacterial infections globally, and their prevalence and resistance patterns have significant public health implications.[19] This study aimed to investigate the microbial etiology of UTIs, the differences in infection rates based on sex, and the patterns of antibiotic resistance. The results showed a higher growth positivity rate in females (56.00%) compared to males (23.61%), that indicate a sex-based disparity in UTI prevalence.[20] Females are generally more prone to UTIs than males due to anatomical differences, such as a shorter urethra, which facilitates easier bacterial entry, particularly fecal bacteria such as Escherichia coli.[21] These anatomical factors, combined with hormonal influences and sexual activity, put females at a higher risk of developing UTIs.[22] This study's findings are consistent with the literature, which has repeatedly shown that females are at greater risk for recurrent infections due to these factors.[23] The male UTI population, though smaller in number, tends to present with more complicated infections. This has been documented in various studies, including Schappert, who noted that UTIs in males are often more severe and are frequently linked to underlying conditions such as prostate issues or urinary tract obstructions.[24] This study found a much lower growth positivity rate among males (23.61%) than females (56.00%), which is reflective of these differences in severity and frequency.[25] Furthermore, males with UTIs often present with more complicated or healthcare-associated infections, which are less frequent but potentially more resistant to antibiotics.[26] The distribution of microbial organisms in this study showed that Gram-negative bacteria, particularly E. coli, were the predominant pathogens, responsible for 19.73% of all UTI cases.[27] This is in agreement with previous studies, such as those by Foxman, which found that E. coli is the leading cause of UTI infections worldwide, accounting for up to 80% of cases.[28] The high prevalence of Gram-negative organisms, including Enterobacter (10.20%) and other less common pathogens such as Klebsiella and Pseudomonas, is also consistent with reports from global surveillance studies.[29] Gram-negative bacteria are known to be more adept at acquiring resistance to antibiotics, which is a growing concern in the management of UTIs. E. coli, in particular, is often resistant to several classes of antibiotics, and the increasing resistance in these organisms complicates the treatment and management of UTIs.[30] In this study, Gram-positive organisms accounted for a smaller proportion of infections, with Staphylococcus aureus and Enterococci being the most commonly isolated species. This is in line with studies by Nicolle,[31] who found that while Gram-positive bacteria are less common in community-acquired UTIs, they are frequently involved in hospital-acquired or complicated UTIs. S. aureus, especially methicillin-resistant S. aureus (MRSA), poses a significant

threat due to its resistance to multiple antibiotics.[32] This study's findings of high resistance to common antibiotics such as Penicillin G (96.15%) and Erythromycin (92.68%) highlight the growing concern of multidrug-resistant (MDR) pathogens, which has been a consistent issue in healthcare settings.[33] MRSA, for example, is a significant cause of both community-acquired and healthcare-associated UTIs, and its increasing prevalence complicates treatment strategie.[34] The presence of Enterococci in this study further supports previous findings, as Enterococcus faecalis is often linked to complicated or hospital-acquired UTIs.[31] The antibiotic resistance patterns observed in this study are troubling, as they reflect the broader global trend of rising resistance in UTI pathogens.[35] These antibiotics are first-line treatments for many bacterial infections, and the increasing resistance to them is a direct reflection of overuse and misuse of antibiotics, while some antibiotics, such as Vancomycin, Linezolid, and Meropenem, showed no resistance, the overall picture of resistance is concerning.[36] This study found that Penicillin G, Erythromycin, and Cefuroxime had the highest resistance rates, which is consistent with global concerns about the rise of resistance in both Gram-positive and Gram-negative organisms.[37] Notably, E. coli isolates in this study exhibited high resistance to Ceftazidime (78.13%), which is commonly used to treat Gram-negative infections. The resistance to third-generation Cephalosporins, such as Ceftazidime, points to the increasing prevalence of extended-spectrum beta-lactamase (ESBL)-producing E. coli strains, which are resistant to many beta-lactam antibiotics. This trend has been observed in numerous studies worldwide, and the rise of ESBL-producing bacteria presents a significant challenge in UTI management. However, this study also found that antibiotics such as Gentamicin (88.24%) and Meropenem (93.55%) still had good efficacy against E. coli, although the latter is a last-resort antibiotic that should be used judiciously to avoid the development of carbapenem-resistant organisms.[38] The results of this study are in line with research by Bush & Jacoby, which highlighted the growing problem of antibiotic resistance in E. coli and other Gram-negative bacteria. The high resistance rates observed in this study emphasize the importance of using targeted antibiotics based on culture and sensitivity testing rather than relying on empirical treatment, which could contribute to further resistance development. Ciprofloxacin, for example, showed moderate resistance (26.09%), and its continued use as a first-line treatment may need to be reconsidered given the rising rates of resistance.[39] Additionally, the use of antibiotics like Ceftriaxone and Cefepime, which showed moderate resistance in this study, calls for caution in their application, particularly in the face of rising multidrug resistance.[40] While carbapenems such as Imipenem and Meropenem showed excellent effectiveness, their potential overuse is a concern.[41] Carbapenems are considered last-resort antibiotics for treating resistant

infections, but their widespread use could lead to the emergence of carbapenem-resistant organisms.[38] This is a significant challenge, as these bacteria are resistant to nearly all available antibiotics, leaving few treatment options.[36] The need for careful stewardship of these antibiotics is critical to prevent their overuse and preserve their effectiveness in treating resistant infections.[42] The findings of this study underscore the growing issue of antibiotic resistance in UTIs and highlight the need for continued surveillance of antimicrobial resistance patterns.[8] The high rates of resistance observed in both Gram-positive and Gram-negative organisms align with concerns raised in previous studies about the increasing prevalence of multidrug-resistant pathogens.[35] The findings also emphasize the importance of implementing antimicrobial stewardship programs, particularly in healthcare settings, to reduce the misuse of antibiotics and slow the spread of resistance.[7] Furthermore, these results reinforce the need for public health initiatives that promote proper hygiene, hydration, and the responsible use of antibiotics to prevent UTIs and reduce the development of resistance.[8]

Conclusion

This study highlights significant findings regarding the prevalence, microbial etiology, and antibiotic resistance patterns associated with Urinary Tract Infections (UTIs). Presence of multidrug-resistant strains, including ESBL-producing E. coli and methicillin-resistant S. aureus (MRSA), complicating treatment options. The ongoing surveillance of resistance patterns will play a crucial role in shaping effective treatment strategies and safeguarding the effectiveness of existing antibiotics

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Original article

Correlation between pap smear, colposcopy, and histopathology among women with unhealthy cervices – A retrospective study

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Abstract

Background: Cervical cancer is a major cause of morbidity and mortality among women, making early detection crucial. The Pap smear, colposcopy, and histopathology are key diagnostic tools used to identify cervical abnormalities. The Pap smear is a common screening test, but it may not always provide conclusive results. Colposcopy, used after an abnormal Pap smear, allows for closer examination of the cervix and guides biopsy for histopathological analysis. Histopathology remains the gold standard for diagnosing cervical lesions. **Objective:** To assess the correlation between pap smear results, colposcopy findings, and histopathological outcomes in women with abnormal cervixes. **Methodology:** A total of 56 women with abnormal cervical conditions were included. Data were collected on age, clinical diagnosis, human papillomavirus (HPV) status, Pap smear results, colposcopic findings, and histopathological diagnoses. The correlations between the diagnostic methods were analyzed using appropriate statistical tests. **Results:** The mean age of the participants was 36.21 ± 7.30 years. The most common clinical diagnoses were vaginal discharge (53.6%) and unhealthy cervix (21.4%). HPV was positive in 28.6% of cases. Pap smear results showed that 57.1% of women had negative findings, 35.7% had ASCUS, and 3.6% had HSIL. Colposcopy revealed CIN in 53.6% and squamous metaplasia in 28.6%. Histopathology indicated cervicitis in 75.0% and CIN in 25.0%. Significant correlations were found between colposcopy and histopathological findings ($p = 0.001$). **Conclusion:** The study highlights the importance of using multiple diagnostic tools—Pap smear, colposcopy, and histopathology—to accurately assess and detect cervical abnormalities early. The strong correlation between colposcopy and histopathology suggests that colposcopy may be a more dependable method for detecting CIN, particularly in women with abnormal screening results.

Keywords: Colposcopy, PAP smear, Histopathology, Cervix

Introduction:

Cervical cancer is one of the most prevalent gynecological malignancies worldwide and a leading cause of mortality among women. An unhealthy cervix refers to a range of chronic cervical lesions, including chronic cervicitis, endocervicitis, cervical erosions, lacerations, polyps, and leukoplakia. Even when a Pap smear result is negative, these lesions can harbor premalignant conditions that may

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go undetected.[1]

The Pap smear remains the gold standard for cervical screening; however, the screening protocol also recommends colposcopy and colposcopically directed biopsy of the cervix. Colposcopy is an optical technique that allows for the visualization of the lower female genital tract under bright illumination and stereoscopic vision. This simple, non-invasive outpatient procedure helps determine the location, size, and extent of abnormal cervical lesions, guiding biopsy site selection and informing appropriate treatment decisions.[2-8]

Colposcopy complements cytology, where cytology (Pap smear) is the laboratory method, and colposcopy is the clinical method for detecting cervical abnormalities. Colposcopy is not merely an intermediate step between cytologic screening and histologic diagnosis; it plays a crucial role in confirming the diagnosis. Colposcopically guided biopsy of suspicious areas provides the final diagnosis, serving as the gold standard for detecting intraepithelial lesions.[2,3,9,10]

Histopathological confirmation is the final gold standard in diagnosis. However, in developing countries like India, implementing cytology-based screening programs is challenging due to limitations such as a lack of trained personnel, infrastructure, and resources, as well as high costs. Furthermore, these programs have limitations, including low sensitivity and high false-negative rates.[2,3,11-13] Despite these challenges, screening efforts have significantly reduced cervical cancer rates globally, although the developing world still accounts for 90% of cervical cancer-related deaths.[14,15]

In developing countries, the incidence and prevalence of cervical cancer remain high due to the absence of widespread screening programs. Colposcopy, a diagnostic procedure that allows magnified examination of cervix and vulvar tissue, is particularly effective in identifying premalignant and malignant lesions due to their distinct visual characteristics. The colposcope aids in differentiating between normal and abnormal areas of the cervix and facilitates direct biopsy or surgery for pathological analysis. The primary aim of colposcopy is to detect and treat precancerous lesions at an early stage, thereby preventing the development of cervical cancer.[14,15] As cervical cancer has a lengthy pre-invasive phase, early detection through screening can significantly reduce its incidence.[14,16] This study is to assess the correlation between pap smear results, colposcopy findings, and histopathological outcomes in women with abnormal cervices.

Materials and methods

This comparative cross-sectional study was conducted in the Department of Obstetrics and Gynecology, KPJ Specialized Hospital, Dhaka, Bangladesh., from November 2023 to October 2024. Participants were selected based on specific criteria: having an unhealthy cervix on pelvic examination, recurrent vaginitis, postcoital bleeding or both. Patients who had previously been diagnosed with cervical malignancy or received treatment were excluded from the study. The sample size of 56 participants was included. Data were collected by documenting the results of colposcopy and histology reports. Any abnormal features observed during colposcopy—such as acetowhite areas or atypical vascular patterns—were classified as abnormal findings, irrespective of their degree of severity. All participants then underwent biopsy for histopathological examination. Histological changes were classified as normal and CIN or invasive carcinoma. Patients with human papillomavirus (HPV)-related changes or other borderline conditions were not included in the study. The data collected were analyzed using SPSS for windows 25.

Result:

The study included 56 subjects, with a mean age of 36.21 ± 7.30 years (Table 1). The most common diagnosis among the participants was vaginal discharge, affecting 53.6% of the subjects. Other diagnoses included vaginal discharge (7.1%), polymenorrhagia (3.6%), unhealthy conditions (21.4%), metrorrhagia (10.7%), and postmenopausal bleeding (3.6%) (Table 2). Human papillomavirus (HPV) status was positive in 28.6% of the participants and negative in 71.4%. This indicates that the majority of the women in the study did not have an HPV infection (Table 3). For PAP smear results, the majority of the participants (57.1%) had a negative result, followed by 35.7% with ASCUS and small proportions with normal (3.6%) or HSIL results (3.6%). In colposcopic findings, 53.6% of the women had cervical intraepithelial neoplasia (CIN), while 28.6% showed squamous metaplasia, and 17.9% had normal results. Histopathology revealed cervicitis in 75% of the participants, while 25% had CIN (Table 4).

Correlation between PAP smear and colposcopic findings showed that among women with ASCUS result, 46.7% had normal colposcopy findings, while 20% had CIN, and 25% had squamous metaplasia. There was a significant portion of women with negative PAP smears (46.7%) who had CIN (80%) and squamous metaplasia (62.5%) (Table 5). The correlation between PAP smear results and histopathological findings revealed notable discrepancies. Among women with negative PAP smears, 57.1% were diagnosed with cervicitis, while an equal proportion, 57.1%, were found to have cervical intraepithelial neoplasia (CIN) upon histopathological examination. This highlights that a negative PAP smear does not always rule out underlying cervical pathology, emphasizing the importance of histopathological confirmation for accurate diagnosis (Table 6). Correlation of colposcopy and

histopathological examination. All women with CIN on colposcopy (100%) had CIN on histopathology, while 38.1% with CIN on colposcopy had cervicitis on histopathology (Table 7).

Table 1: Age distribution of the study subject (n=56)

Age in years	Frequency	Percentage (%)	Mean ± SD
22-30	14	25.0	
31-40	28	50.0	36.21±7.30
41-50	12	21.4	
51-60	2	3.6	

Table 2: Diagnosis of the study subject (n=56)

Diagnosis	Frequency	Percentage (%)
Vaginal discharge	4	7.1
Vaginal discharge	30	53.6
Polymenorrhagia	2	3.6
Unhealthy	12	21.4
Metrorrhagia	6	10.7
Post menopausal bleeding	2	3.6

Table 3: HPV of the study subject (n=56)

HPV	Frequency	Percentage (%)
Positive	16	28.6
Negative	40	71.4

Table 4: Distribution of women according to PAP smear, colposcopic and histopathological findings (n=56)

PAPS	Frequency	Percentage (%)
Normal	2	3.6
Ascus	20	35.7
HSIL	2	3.6
Negative	32	57.1
Colposcopy		
Normal	10	17.9
CIN	30	53.6
Squamous metaplasia	16	28.6
Histopathology		
Cervicitis	42	75.0
CIN	14	25.0

Table 5: Correlation of PAP Smear and colposcopic finding

PAPS	Colposcopic findings			P value
	Normal (n=30)	CIN (n=10)	Squamous metaplasia (n=16)	
	No.(%)	No.(%)	No.(%)	
Normal	0(0)	0(00)	2(12.5%)	
Ascus	14(46.7%)	2(20%)	4(25%)	0.104
HSIL	2(6.7%)	0(00)	0(00)	
Negative	14(46.7%)	8(80%)	10(62.5%)	

Data were analyzed using chi-square test

Table 6: Correlation of PAP smear and histopathological examination (n=56)

PAPS	Histopathological examination		P value
	Cervicitis (n=42)	CIN (n=14)	
	No.(%)	No.(%)	
Normal	2(4.8%)	0(00)	
Ascus	14(33.3%)	6(42.9%)	0.659
HSIL	2(4.8%)	0(00)	
Negative	24(57.1%)	8(57.1%)	

Data were analyzed using fisher exact test

Table 7: Correlation of colposcopy and histopathological examination (n=56)

Colposcopy	Histopathological examination		P value
	Cervicitis (n=42)	CIN (n=14)	
	No.(%)	No.(%)	
Normal	10(23.8%)	0(00)	
CIN	16(38.1%)	14(100%)	0.001
Squamous metaplasia	16(38.1%)	0(00)	

Discussion

Abnormal cervix conditions include chronic cervicitis (such as endocervicitis), cervical erosions, lacerations, and leukoplakia. Even if the Pap smear is negative, these lesions can be precancerous. Most early-stage cervical cancers are asymptomatic. Therefore, a diagnosis is typically made after histological analysis of biopsies obtained during colposcopy or from visibly abnormal cervical tissue.

Cervical invasive cancer is considered preventable due to its prolonged pre-invasive stage, which allows for effective screening and treatment. Routine screening and HPV vaccination are recommended to reduce future cervical cancer prevalence. However, in developing countries like India, cytology-based screening programs have faced limited success due to a lack of trained personnel, inadequate laboratory facilities, high costs, and insufficient follow-up care.[14]

The mean age of the patient in the current study was 36.21 ±7.18 years which was consistent with previous study.[14] In a study on the evaluation of an unhealthy cervix, Gohil et al. observed that most patients (53.33%) were over 40 years.[17] Comparable findings were reported in studies by Upadhyay et al.[18] and Joshi et al.[11], where the mean ages of the patients were 36.4 and 32.2 years, respectively. Other studies by Pimple et al.[19] and Boicea et al.[20] have reported similar patient distributions.

The findings of this study highlight the prevalence of various gynecological conditions among the 56 study subjects, with vaginal discharge being the most frequently diagnosed, affecting more than half of the participants. The second most prevalent diagnosis was unhealthy (21.4%). Metrorrhagia (10.7%), or abnormal bleeding between periods, was also relatively common. The diagnosis of vaginal discharge (7.1%) was less common but could be linked to specific infections or structural abnormalities that require targeted treatment. Polymenorrhagia (3.6%) and post-menopausal bleeding (3.6%) were observed in a smaller proportion of subjects. Similar study Kohale et al.[14] reported white discharge was the most common (73%) symptom, followed by irregular periods of blood loss (11%), post-coital hemorrhage (9%), and postmenopausal bleeding (7%). Savitha et al. also observed that white discharge per vagina was the most common symptom (86%) among cases.[7] Similar findings were reported by Upadhyay et al.[18], Chaudhary et al.[2], and Bhalerao et al.[1]

The distribution of women based on PAP smear, colposcopic, and histopathological findings reveals a wide range of results across these diagnostic tests. In the PAP smear analysis, the majority of women (57.1%) had a negative result, while a significant proportion (35.7%) showed ASCUS (Atypical Squamous Cells of Undetermined Significance). A smaller percentage of women had normal (3.6%) or high-grade squamous intraepithelial lesions (HSIL) (3.6%). Colposcopic examination revealed that most women (53.6%) had cervical intraepithelial neoplasia (CIN), while 28.6% exhibited squamous metaplasia, and 17.9% had normal colposcopic results. Histopathological findings indicated cervicitis in 75% of the women, with 25% diagnosed with CIN. These findings highlight the significant presence of cervical abnormalities in this population, with a high prevalence of cervicitis and CIN, both of which are crucial

indicators for cervical health and potential cancer risk. These results align with those from other studies.[4-10] A similar study by Maheshwari et al.[3] found that in a group of 80 women, 40% had ASCUS, 37.5% had LSIL, 15% had HSIL, and 7.5% had ASC-H. All women underwent colposcopy, revealing that 37.5% were normal, 26.3% had CIN I, 21.3% had CIN II, and 15% had CIN III. Histopathological examination showed non-specific cervicitis/inflammation in 35%, CIN 1 in 23.8%, CIN 2 in 22.5%, CIN 3 in 15%, and 3.8% had squamous cell carcinoma.

The correlation between PAP smear and colposcopic findings showed varying associations between the two diagnostic methods. Among women with a normal PAP smear, 12.5% exhibited squamous metaplasia on colposcopy, with no cases of CIN or normal findings. For those with ASCUS on PAP smear, 46.7% had normal colposcopic results, 20% showed CIN, and 25% had squamous metaplasia. No colposcopic findings of CIN or squamous metaplasia were noted in women with HSIL. In women with negative PAP smears, 46.7% had normal colposcopic findings, while 80% had CIN and 62.5% showed squamous metaplasia. The higher prevalence of CIN and squamous metaplasia in women with negative PAP smears underscores the complexity of interpreting PAP smear results and highlights the importance of colposcopy for further evaluation. These findings align with results from other studies.[7-11] A similar study by Maheshwari et al.[3] reported that 40% of ASCUS cases had normal colposcopic findings (21.3%), 16.3% had CIN I, and 2.5% had CIN II. Among LSIL cases (37.5%), 16.3% were normal, 8.8% had CIN I, and 12.5% had CIN II. In ASC-H cases (7.5%), 1.3% had CIN I, 3.8% had CIN II, and 2.5% had CIN III. In HSIL cases (15%), 2.5% had CIN II, and 12.5% had CIN III.

The correlation between PAP smear results and histopathological examination showed varying associations between the two diagnostic methods. Among women with a normal PAP smear, 4.8% were diagnosed with cervicitis, with no cases of CIN observed. In women with ASCUS on PAP smear, 33.3% had cervicitis and 42.9% had CIN, indicating that ASCUS may be linked to both inflammatory and neoplastic changes. For women with HSIL, 4.8% had cervicitis, but no CIN cases were found on histopathology. In the group with negative PAP smears, 57.1% had cervicitis and 57.1% had CIN. A similar study by Maheshwari et al.3 reported that among 80 cases of abnormal PAP smears that underwent biopsy, 40% with ASCUS showed 17.5% nonspecific chronic cervicitis, 13.8% CIN I, and 8.8% CIN II. In 37.5% of LSIL cases, 17.5% had nonspecific chronic cervicitis, 7.5% had CIN I, and 12.5% had CIN II. Among 7.5% ASC-H cases, 2.5% had CIN I, 3.8% had CIN III, and 1.3% had squamous cell carcinoma (SCC). In 15% of HSIL cases, 1.3% had CIN II, 11.3% had CIN III, and 2.5% had SCC.

The correlation between colposcopy and histopathological examination showed an association between colposcopic findings and histopathological diagnoses. Among women with normal colposcopic results, 23.8% had cervicitis. In contrast, all women with CIN detected on colposcopy (100%) were confirmed to have CIN on histopathology. Women with squamous metaplasia on colposcopy showed no histopathological evidence of CIN, but 38.1% were diagnosed with cervicitis. A similar study by Maheshwari et al.3 involving 80 cases that underwent histopathological examination, found that 35% were diagnosed with non-specific cervicitis, 23.8% with CIN 1, 22.5% with CIN 2, 15% with CIN 3, and 3.8% with squamous cell carcinoma. A limitation of this study is that the patient sample was drawn from a single hospital, representing only one geographical area.

Conclusion

This study identified vaginal discharge as the most common clinical presentation, followed by unhealthy symptoms and vaginal discharge. HPV positivity was detected in a notable proportion of the subjects. PAP smear results showed a predominance of negative findings, with a significant number of women having ASCUS. Colposcopic examination revealed cervical intraepithelial neoplasia (CIN) in a considerable proportion of cases, along with squamous metaplasia. Histopathological examination indicated cervicitis in most cases, while CIN was observed in a smaller number. Overall, the study emphasizes the importance of combining diagnostic tools such as Pap smear, colposcopy, and histopathology for the accurate assessment and early detection of cervical abnormalities. The strong correlation between colposcopy and histopathology suggests that colposcopy may be a more reliable method for detecting CIN, especially in women with abnormal screening results.

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Original article

Health Impacts of Dye Factory Effluents on Children Under Five in Uttarkhan, Dhaka: A Cross-Sectional Study

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Abstract

Background: Rapid industrialization in Dhaka, particularly the growth of unregulated dye factories, has led to increased environmental pollution, raising serious public health concerns. Children under five are especially vulnerable to pollution-related illnesses due to their immature immune systems and close contact with contaminated surroundings. *Objectives:* This study investigates the relationship between proximity to dye factory effluents and the prevalence of respiratory, gastrointestinal, and dermatological symptoms among children under five in Uttarkhan, Dhaka. *Materials and methods:* A cross-sectional study was conducted for 12 months (from 1st January to 31st December 2018) in two localities—Munda and Polartek—within the ward No. 4 of Uttarkhan Thana, Dhaka city. A total of 200 households, each with at least one child under five years of age, were surveyed using a semi-structured questionnaire. *Results:* Most respondents were females (94.5%) aged between 18–39 years (91.5%) and lived in overcrowded conditions (average 7.45 persons per room). A large majority (97%) used deep tube wells for daily water. Respiratory symptoms—including nasal discharge (36.5%), cough (29.0%), and wheezing (14.0%)—were most prevalent among those living within 100 yards of the river. Surprisingly, gastrointestinal and dermatological symptoms such as diarrhea (9.5%), vomiting (10.0%), rash (10.0%), and skin ulceration (8.5%) were more frequently reported by residents living more than 200 yards away. *Conclusion:* Proximity to dye-contaminated rivers is associated with a higher prevalence of respiratory symptoms in young children, while other symptom patterns suggest multiple environmental risk factors. These findings highlight the urgent need for environmental health interventions and stricter regulation of industrial waste management in urban residential zones.

Keywords: Gastrointestinal symptoms, respiratory symptoms, dermatological symptoms, dye factory wastewater.

Introduction:

Environmental pollution has become one of the most pressing public health concerns in rapidly urbanizing cities of the developing world[1]. In Dhaka, the capital of Bangladesh, industrial expansion—especially unregulated dyeing and textile industries—has dramatically reshaped both the landscape and the health profile of the vulnerable populations[2]. Among these, children under the age of five are particularly at risk due to their developing immune systems, frequent contact with the environment, and higher consumption of water and food per body weight compared to adults[3]. In many low-income neighborhoods of Dhaka,

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rivers have become toxic lifelines—visibly flowing with vibrant hues from textile dyes and chemically infused waste[4]. The waterways, once vital sources of livelihood and irrigation, are now laden with untreated industrial discharge that seeps into surrounding land, contaminates groundwater, and pollutes the air[5]. Among the affected communities, residents of the Uttarkhan Thana, specifically in areas such as Munda and Polartek of ward No. 4, live in dangerously close proximity to these contaminated waterways, often without adequate awareness of the risks they face. Despite the growing alarm over industrial pollution in Dhaka's peripheral zones, very little is known about how environmental exposures are impacting the health of the most susceptible—children under five[4]. This age group is particularly prone to developing gastrointestinal, respiratory, and dermatological symptoms when exposed to toxic chemicals, unsanitary living conditions, or polluted water sources. Respiratory infections, diarrhea, and skin diseases continue to be leading causes of morbidity and mortality in Bangladeshi children, and yet the environmental determinants of these illnesses remain inadequately explored in context-specific studies[6]. This study seeks to fill that gap by focusing on the lived realities of families residing near dye factory effluents in the Uttarkhan area. It examines how close proximity to polluted rivers correlates with the prevalence of various childhood symptoms, while also exploring socio-demographic variables, water use patterns, and household living conditions[7]. By surveying 200 households with at least one child under the age of five, this research offers a micro-level view into a macro-scale problem—how industrial pollution silently erodes community health[8]. What makes this investigation particularly compelling is its dual focus: not only does it analyze statistical associations between environmental exposure and illness, but it also paints a socio-environmental portrait of the communities most affected[9]. The findings of this study are grounded in real voices and real conditions—crowded homes, water fetched from deep tube wells, mothers who manage households while tending to sick children, and neighborhoods that have adjusted to the foul smells and colorful toxins as part of daily life. Furthermore, the study draws attention to an often-overlooked dimension of environmental justice: how poverty, gender, and education intersect to shape vulnerability. With 94.5% of the respondents being women, mostly homemakers, and 75.5% having at least secondary education, the data also speak to a relatively informed but economically constrained population. Despite moderate levels of education and water access, families still report high rates of illness, suggesting that deeper structural factors—like unregulated industry and urban planning failures—play a more decisive role in determining child health outcomes. In highlighting the spatial relationship between health symptoms and environmental exposure, this study underscores an urgent need for integrated public health and environmental policies[10]. Clean water access, stricter industrial waste regulation, and improved housing infrastructure must go hand in hand with community education and early childhood healthcare services[11]. Without a multi-sectoral approach, the invisible burden borne by children living on the fringes of industrial zones will only continue to grow. Ultimately, this research is not just about the numbers or symptoms—it is about the visibility [12]. It brings into focus the forgotten corners of the city where children cough, itch, and fall ill in the shadows of the economic growth [13]. It is about demanding accountability in places where pollution has become so normalized that even illness feels inevitable. And it is about giving voice to those whose health has become the silent collateral damage of the unregulated development [14].

Materials and methods

This was a community-based cross-sectional study conducted in two selected localities—Munda and Polartek—within the ward No. 4 of the Uttarkhan Thana, located in the northern part of Dhaka city, Bangladesh, for 12 months (1st January to 31st December 2018). These areas are in proximity to dye factories and heavily polluted river systems, making them relevant for assessing environmental health risks among children. The study population comprised households with at least one child under five years of age. A total of 200 households were selected using purposive sampling to ensure representation from different distances relative to the river: less than 100 yards, between 100 and 200 yards, and more than 200 yards. Respondents were typically the mothers or primary caregivers of the children and were interviewed in person. Inclusion criteria included residency in the study area for at least six months and having at least one child aged 0–59 months.

Data Collection Tools and Techniques

Data were collected using a semi-structured pre-tested questionnaire administered through face-to-face interviews. The questionnaire was developed in English, translated into Bengali, and then back-translated to ensure accuracy. It consisted of the following components:

- Socio-demographic data (age, sex, education, religion, marital status, occupation).

- Wealth categorization (based on household assets and income, self-reported).

- Environmental and water-use information (source of water, distance from river, agricultural involvement).

- Child-specific data (age, sex, number of children under five).

- Health symptoms (respiratory, gastrointestinal, dermatological symptoms in the past 30 days).

Variables

- Independent Variable: Distance from the river (categorized as <100 yards, 100–200 yards, >200 yards).

- Dependent Variables: Presence of specific child symptoms—respiratory (e.g., nasal discharge, cough), gastrointestinal (e.g., diarrhea, vomiting), and dermatological (e.g., rash, skin ulcers).

Data Analysis

Data were entered into Microsoft Excel and analyzed using descriptive statistics. Results were presented in frequencies, percentages, and means ± standard deviations. Associations between distance from the river and health symptoms were summarized in tables and visually interpreted to identify trends.

Ethical Considerations

Verbal informed consent was obtained from all participants before data collection. Participants were assured of confidentiality and informed that their participation was voluntary. No personal identifiers were recorded. The study was conducted in adherence to ethical principles for research involving human subjects.

Result:

The study was conducted in two localities—Munda and Polartek—within the ward No. 4 of Uttarkhan Thana, Dhaka city. A total of 200 households were surveyed, each with at least one child under the age of five. The study aimed to collect information on socio-demographic characteristics, child-related variables, and the prevalence of gastrointestinal, respiratory, and dermatological symptoms.

Table 1: Socio-Demographic Characteristics of Respondents

Variables (Age in years)	Number (n)	Percentage (%)
18-39	183	91.5
40-64	17	8.5
Sex		
Male	11	5.5
Female	189	94.5
Education		
Non-formal education	19	9.5
Primary completed	30	15.0
Secondary and above	151	75.5
Religion		
Hindu	2	1.0
Muslim	198	99.0
Marital status		
Married	195	97.5
Separated	1	0.5
Widow	4	2.0
Occupation		
Employed	16	8.0
Self -Employed	7	3.5
Day Laborer	3	1.5
Home maker	174	87.0
Average number of family members per room (Mean ± SD)		
	-	7.45±2.45

Most respondents (91.5%) were aged between 18 and 39 years, and 94.5% were females. A significant majority (75.5%) had completed at least secondary education. The vast majority were Muslims (99.0%) and married (97.5%). Homemaking was the predominant occupation (87.0%). On average, there were 7.45 family members per room.

Table 2: Wealth Category of the Respondents

Wealth category	Number (n)	Percentage (%)
Low	12	6.0
medium	188	94.0

The majority (94.0%) of respondents fell under the medium wealth category.
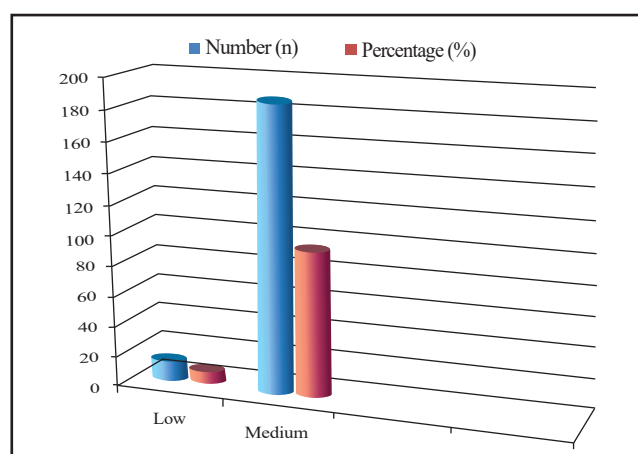
Figure 1 : "Distribution of Participants by Socioeconomic Status: Number and Percentage

Table 3: Water Use–Related Information of the Respondents

Variables	Number (n)	Percentage (%)
Distance from the river		
Less than 100 yards	89	44.5
Between 100 and 200 yards	41	20.5
More than 200 yards	70	35.0
Source of daily water use		
River water	1	0.5
Deep tube well	194	97.0
Supply water	3	1.5
Others	2	1.0
Family members involved in agriculture		
Yes	21	10.5
No	179	89.5

Approximately 44.5% of households were located within 100 yards of the river. The predominant source of household water was deep tube wells (97.0%). Only 10.5% of households had at least one family member involved in agricultural activities.

Table 4: Child-Related Information

Variables	Number (n)	Percentage (%)
Number of children under 5 years		
One	176	88.0
More than one	24	12.0
Age of children (in months)		
0–15	59	29.5
16–30	45	22.5
31–45	45	22.5
46–59	51	25.5
Mean age (months ± SD)	—	28.6 ± 16.6
Sex		
Male	98	49.0
Female	102	51.0

Most households (88.0%) had only one child under five years of age. The average age of children was 28.6 ± 16.6 months, with an almost equal distribution between boys (49.0%) and girls (51.0%).

Table 5: Relationship between Distance from the River and Respiratory Symptoms (Last 30 Days)

Distance from the River	Nasal Discharge	Cough	Shortness of Breath	Wheezing/ Whistling Chest	Throat Pain
Less than 100 yards	73 (36.5%)	58 (29.0%)	20 (10.0%)	28 (14.0%)	5 (2.5%)
100–200 yards	33 (16.5%)	30 (15.0%)	7 (3.5%)	8 (4.0%)	4 (2.0%)
More than 200 yards	48 (24.0%)	44 (22.0%)	13 (6.5%)	17 (8.5%)	7 (3.5%)

Table 5 illustrates the association between the proximity of respondents' homes to the river and the prevalence of respiratory symptoms in the past 30 days. Most respiratory symptoms—such as nasal discharge (36.5%), cough (29.0%), shortness of breath (10.0%), and wheezing (14.0%)—were more common among those living within 100 yards of the river. Throat pain was slightly more prevalent among those living more than 200 yards from the river (3.5%)

Table 6: Relationship between Distance from the River and Gastrointestinal Symptoms (Last 30 Days)

Distance from the River	Diarrhea/ Loose Stool	Vomiting	Abdominal Pain
Less than 100 yards	8 (4.0%)	17 (8.5%)	17 (8.5%)
100–200 yards	6 (3.0%)	8 (4.0%)	6 (3.0%)
More than 200 yards	19 (9.5%)	20 (10.0%)	13 (6.5%)

Table 6 shows that gastrointestinal symptoms such as diarrhea (9.5%) and vomiting (10.0%) were most frequently reported by those residing more than 200 yards from the river. Interestingly, abdominal pain was more common among those living within 100 yards (8.5%).

Table 7: Relationship between Distance from the River and Dermatological Symptoms (Last 30 Days)

Distance from the River	Itching	Rash	Skin Ulceration	Skin color change
Less than 100 yards	9 (4.5%)	10 (5.0%)	4 (2.0%)	2 (1.0%)
100–200 yards	8 (4.0%)	11 (5.5%)	5 (2.5%)	5 (2.5%)
More than 200 yards	18 (9.0%)	20 (10.0%)	17 (8.5%)	11 (5.5%)

Table 7 indicates that dermatological symptoms were more prevalent among individuals living more than 200 yards from the river. Rash (10.0%) was the most common symptom, followed by itching (9.0%), skin ulceration (8.5%), and skin color change (5.5%).

Discussion

This study investigated the relationship between proximity to dye factory effluent-contaminated rivers and the prevalence of respiratory, gastrointestinal, and dermatological symptoms among children under five years of age in two localities of Uttarkhan, Dhaka. The findings reveal important insights into the environmental health risks faced by young children in urban low-income settings impacted by industrial pollution[15]. One of the most notable findings was the significantly higher prevalence of respiratory symptoms—including nasal discharge (36.5%), cough (29.0%), and wheezing (14.0%)—among children living within 100 yards of the river. This trend is consistent with existing literature indicating that close proximity to polluted water bodies, particularly those contaminated by chemical wastes, increases exposure to airborne irritants, molds, and volatile organic compounds, all of which are known triggers of respiratory problems in children[16]. Overcrowding, as seen in the high average number of family members per room (7.45), may further compound this risk by facilitating the spread of respiratory infections, the prevalence of gastrointestinal symptoms—such as diarrhea (9.5%) and vomiting (10.0%)—was higher among children residing more than 200 yards from the river, which contrasts with the expected pattern[17]. This suggests that the cause of gastrointestinal illness may not be directly related to the river's proximity alone. Other factors, such as contaminated food, poor sanitation, and inadequate hand hygiene, may contribute significantly to these illnesses[18]. Despite 97% of households using deep tube wells, the risk of groundwater contamination through surface seepage or improperly sealed tube wells cannot be ruled out[19]. Dermatological symptoms, including rash (10.0%), itching (9.0%), and skin ulceration (8.5%), were also more prevalent among those living more than 200 yards from the river[20]. This counterintuitive finding may reflect alternative exposure routes, such as contaminated bathing water, poor hygiene conditions, or the use of polluted water for domestic chores[21]. It may also point to the uneven spread of

pollutants, where drainage channels or wind patterns carry industrial discharge beyond immediate riverbanks[22]. The socio-demographic profile of the respondents—predominantly young (91.5%, aged 18–39), female (94.5%), and educated (75.5% with secondary or higher education)—suggests that while basic health knowledge may be present, limited economic means and environmental control may hinder their ability to protect children from environmental hazards[23]. The fact that 87% of women were homemakers further highlights their central role in caregiving and household water management, making them essential stakeholders in any future intervention strategies[24]. Another key takeaway is that the vast majority of respondents (94%) fell under the medium wealth category, indicating that financial status alone does not safeguard against environmental health risks[25]. This underlines the importance of structural and environmental determinants—such as waste disposal policies, industrial regulation, and urban planning—over individual or household-level wealth and behavior[26]. While this study sheds light on critical public health issues, certain limitations must be acknowledged[27]. The cross-sectional design captures only short-term prevalence and does not establish causality[28]. Additionally, health symptoms were self-reported, which may introduce recall bias. Environmental samples (air, water, soil) were not analyzed, limiting the ability to link symptoms to specific pollutants[29]. Nevertheless, the consistency of symptom patterns with distance from the river and the clustering of respiratory symptoms near known pollution sources strengthen the study's internal validity[30]. In a nutshell, this study highlights a clear association between residential proximity to polluted rivers and increased respiratory symptoms among children under five. It also reveals complex patterns of gastrointestinal and dermatological illnesses that may be influenced by additional environmental and behavioral factors [31]. These findings call for urgent, multi-sectoral interventions—including environmental clean-up, enforcement of industrial waste management, improved sanitation, and community-level health education. Without such measures, the invisible toll of industrial pollution on child health in urban Dhaka will continue to grow, posing long-term consequences for public health and development.

Conclusion

This study highlights the significant impact of environmental pollution—particularly from dye factory effluents—on the health of children under five living in Uttarkhan, Dhaka. The findings demonstrate a strong association between close residential proximity to polluted rivers and the increased prevalence of respiratory symptoms such as nasal discharge, cough, and wheezing. While gastrointestinal and dermatological symptoms were more common among those living further from the river, this may reflect additional environmental exposures, poor sanitation, or water handling practices beyond river

proximity alone. Despite most households relying on deep tube wells and having moderate socioeconomic status, the burden of illness remains high, especially in overcrowded living conditions. This underscores the complex interplay of environmental, infrastructural, and social determinants in shaping child health outcomes in urban low-income settings. The study emphasizes the urgent need for comprehensive public health interventions, including:

- Strict regulations of industrial waste disposal.
- Improved sanitation and hygiene infrastructure.
- Community awareness and education programs.
- Targeted health services for vulnerable children.

Addressing environmental pollution must become a public health priority in Dhaka and other rapidly urbanizing areas of Bangladesh. Protecting the health of children—particularly those growing up in industrially contaminated zones—is not just a medical concern but a moral and developmental imperative.

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Original article

A Study of Knowledge and Practices Regarding Infectious Diarrheal Diseases among the Adult Population in a Rural Community

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Abstract

Background: Infectious diarrheal diseases remain a significant public health problem in low-resource settings, particularly in rural communities with inadequate access to safe water, sanitation, and health services. *Objectives:* This study assessed knowledge and practices regarding diarrheal diseases among adults in a rural Bangladeshi community to identify gaps and inform prevention strategies. *Materials and Methods:* A cross-sectional descriptive study was conducted among 252 adults (≥18 years) from three villages of Keraniganj upazila, Dhaka, during January–April 2025. Data were collected via face-to-face interviews using a semi-structured questionnaire covering socio-demographics, knowledge, and practices. Descriptive statistics were applied using SPSS 21. *Results:* Participants' mean age was 41.1 years; 55% were female, 90% married, and 39% had less than one year of schooling. Most households (86%) had sanitary toilets and 76% relied on tube-well water. Good knowledge of diarrheal disease was found in 56.8% of respondents, though only 42.9% identified causative agents correctly and 56.3% knew the proper preparation of ORS. Hygiene practices were better: 93% washed hands with soap after toilet use, 90% before eating, and 94% covered food. However, 72% reported consuming unsafe street foods and only 42% practiced safe waste disposal. Overall, 42% demonstrated good practices, 46% moderate, and 13% poor. *Conclusion:* Despite relatively high awareness of diarrheal prevention and treatment, significant gaps remain in food safety and waste disposal practices. Public health interventions should focus on practical demonstrations of ORS preparation, stricter food hygiene promotion, and community-based waste management initiatives.

Keywords: Diarrhea, KAP, Knowledge, Practice, Bangladesh

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Introduction:

Infectious diarrheal diseases remain a formidable challenge to global public health, particularly in resource-limited settings. They are a leading cause of morbidity and mortality worldwide, disproportionately affecting children under five and vulnerable populations in low- and middle-income countries (LMICs).[1] The World Health Organization (WHO) estimates that diarrheal disease is the second leading cause of death in this young age group, responsible for approximately 525,000 deaths annually.[2] While mortality is highest among children, the burden of disease extends across all age groups, contributing significantly to malnutrition, reduced workforce productivity, and economic strain on families and healthcare systems.[3]

The transmission of these pathogens is primarily fecal-oral, often through the consumption of contaminated water or food, and is closely linked to inadequate sanitation, poor hygiene practices, and limited access to clean water.[4] Despite the existence of effective preventive measures, such as hand-washing with soap, safe water storage, proper sanitation, and timely management with oral rehydration therapy (ORT), the incidence of diarrheal illness remains persistently high in many regions.[5] This gap between known interventions and their implementation underscores the critical importance of community-specific knowledge, attitudes, and practices (KAP).

The adult population plays a pivotal role in the prevention and management of diarrheal diseases within a household and community. Adults are typically the primary caregivers, decision-makers regarding health-seeking behaviors, and custodians of hygiene practices. Their knowledge directly influences the health outcomes of children and other family members.[6] Therefore, understanding the level of awareness and the common practices among adults is essential for designing effective and targeted public health interventions. Rural communities often face a unique set of challenges, including poorer infrastructure, lower educational attainment, and less access to healthcare information compared to urban areas.[7] These factors can create an environment where misconceptions about disease transmission and treatment are more prevalent, and where preventive practices are not optimally adopted. While numerous studies have focused on pediatric diarrhea, there is a relative paucity of research specifically investigating the KAP of the adult population in rural contexts regarding infectious diarrhea affecting all age groups.

This study, therefore, aims to assess the knowledge and practices concerning infectious diarrheal diseases among the adult population in a rural community. The findings will help identify key knowledge gaps and risky practices, thereby providing valuable evidence for local health authorities to develop tailored health education programs and strategies to reduce the community's burden of diarrheal diseases.

Materials and methods

A cross-sectional descriptive study was conducted among adults (≥18 years) in Doleshwar, Konda, and Ainta villages of Keraniganj, Dhaka, from January to April 2025. A total of 252 participants were selected via convenience sampling. Data were collected using a semi-structured questionnaire on Google Forms, administered through face-to-face interviews (CAPI) after obtaining verbal consent. Descriptive statistics were analyzed using MS Excel and SPSS version 21. The study received ethical approval from the Community Medicine Department of Bashundhara Ad-din Medical College. Limitations include the use of convenience sampling, a small sample size, and a non-validated questionnaire. Convenience sampling was chosen due to resource constraints and ease of access within the geographically limited study area. However, we acknowledge that this non-probability method may introduce selection bias and potentially limit the generalizability of our findings to the broader adult population of Keraniganj. AI tools (ChatGPT, Gemini, and DeepSeek) were used for language editing

Result:

Socio-economic Characteristics:

The study included 252 adults. The majority were female (55.16%), married (90.1%), and Muslim (98.8%). The mean age was 41.1 (±15.4) years. Educational levels were low, with 39.3% having less than one year of schooling. Most lived in nuclear families (77.4%) with a mean of 4.8 members. The mean monthly income was 26,580.2 Tk. (±19,077.8), with 36.1% in the low-income group. Most resided in paka houses (52.0%), used tube-well water (75.8%), and had access to sanitary toilets (86.1%).

Knowledge Regarding Diarrhea:

Overall, 56.8% of respondents had good knowledge. However, specific knowledge gaps were identified: only 42.9% correctly identified causative agents, and 56.3% could describe correct ORS preparation. Knowledge was higher in other areas: transmission pathways (69.8%), preventive measures (71.8%), and general treatment (90.9%).

Practices Regarding Diarrhea Prevention:

Hand-washing practices were high after toilet use (93.3%) and before eating (90.5%). Most respondents (94.4%) kept food and drinks covered. However, key risky practices were prevalent: 71.8% consumed unsafe street foods, and only 42.1% used safe waste disposal methods. Overall, 41.7% had good practice, 45.6% had moderate practice, and 12.7% had poor practice.

Table 1: Socio-demographic and Economic Characteristics of the Respondents (n=252)

Characteristic	Category	Frequency	Percentage (%)
Sex	Male	113	44.8
	Female	139	55.2
Age Group (Years)	18-35	111	44.0
	36-49	69	27.4
	50-90	72	28.6
	Mean (±SD): 41.1 (±15.4)		
Religion	Muslim	249	98.8
	Hindu	3	1.2
Marital Status	Married	227	90.1
	Single	16	6.3
	Widow/Divorced	9	3.6
Education Level	<1 year schooling	99	39.3
	1-8 years schooling	82	32.5
	9 yrs to SSC	52	20.6
	Bachelor's or above	19	7.5
Monthly Family Income (Tk.)	Low (0-15,000)	91	36.1
	Lower-middle (15,001-25,000)	73	29.0
	Higher-middle (25,001-40,000)	42	16.7
	High (>40,000)	46	18.3
	Mean (±SD): 26,580.2 (±19,077.8)		
Drinking Water Source	Tube-well	191	75.8
	WASA/Pipeline	58	23.0
	Pond/River	3	1.2
Excreta Disposal	Sanitary Toilet	217	86.1
	Open/Non-sanitary	35	13.9

Table 2: Knowledge of Respondents on Infectious Diarrheal Diseases (n=252)

Knowledge Domain	Response	Frequency	Percentage (%)
Causative Agents	Correct	108	42.9
	Incorrect	144	57.1
Environmental Factors	Correct	161	63.9
	Incorrect	91	36.1
Mode of Transmission	Correct	176	69.8
	Incorrect	76	30.2
Vectors of Transmission	Correct	141	56.0
	Incorrect	111	44.0
Preventive Measures	Correct	181	71.8
	Incorrect	71	28.2
Treatment Awareness	Correct	229	90.9
	Incorrect	23	9.1
ORS Preparation	Correct	142	56.3
	Incorrect	110	43.7
Overall Knowledge Score	Good (30-40)	143	56.8
	Moderate (15-25)	50	19.8
	Poor (0-10)	59	23.4

Discussion

This study aimed to assess the knowledge and practices regarding infectious diarrheal diseases among adults in a rural community. The findings reveal a critical disconnect between generally good theoretical knowledge in certain areas and the persistence of high-risk practices, highlighting the complex factors that influence health behavior in this setting.

The finding that 56.8% of participants possessed good overall knowledge is encouraging and suggests that basic health messages regarding diarrheal diseases have reached this community. The high levels of knowledge regarding general treatment (90.9%) and transmission pathways (69.8%) are consistent with other studies conducted in similar socio-economic contexts.[8] This indicates a successful penetration of public health information, likely through government and non-governmental organization initiatives. However, the presence of significant knowledge

Table 3: Practices of Respondents on Prevention of Infectious Diarrheal Diseases (n=252)

Practice Domain	Response	Frequency	Percentage (%)
Hand-washing with soap after toilet use	Yes	235	93.3
	No	17	6.7
Hand-washing before eating	Yes	228	90.5
	No	24	9.5
Keeping food/ drinks covered	Yes	238	94.4
	No	14	5.6
Consuming unsafe street food	Yes	181	71.8
	No	71	28.2
Waste disposal method	Safe	106	42.1
	Unsafe	146	57.9
Overall Practice Score	Good (30-35)	105	41.7
	Moderate (25-30)	115	45.6
	Poor (0-20)	32	12.7

gaps is a major concern. The low proportion of respondents who could correctly identify causative agents (42.9%) and describe ORS preparation (56.3%) is particularly alarming. This aligns with the introduction's premise that rural communities face challenges in healthcare access and information, potentially leading to misconceptions.[7] Without understanding the microbial cause of diarrhea, the rationale for specific hygiene practices like hand-washing with soap may be lost on a large segment of the population.

Despite adequate knowledge in some domains, the translation of this knowledge into practice was markedly poor. Only 41.7% of respondents were classified as having good overall preventive practices. This knowledge-practice gap is a well-documented phenomenon in public health and is often influenced by deeply ingrained socio-cultural habits, economic constraints, and environmental factors.[9] For instance, while hand-washing after defecation was nearly universal (93.3%), the high consumption of unsafe

street food (71.8%) represents a major risk factor. This suggests that perceived convenience and accessibility of street food may outweigh known risks. Furthermore, the inadequate practice of safe waste disposal (42.1%) creates an environment conducive to the propagation and spread of enteric pathogens, undermining individual hygiene efforts.[4]

The socio-demographic profile of the study population provides crucial context for these findings. The low levels of formal education (39.3% with <1 year of schooling) and the significant proportion with low income (36.1%) are likely key determinants of both the knowledge gaps and the failure to adopt optimal practices. Education is a well-established social determinant of health, enabling individuals to better understand and act upon health information.10 Similarly, poverty can limit the ability to invest in safer food choices, improved sanitation infrastructure, and other preventive measures, even when knowledge is present. Specifically, the high prevalence of consuming unsafe street food (71.8%) and unsafe waste disposal (57.9%) is likely exacerbated by these economic realities, where cheaper, more convenient options outweigh known health risks.

In conclusion, this study identifies a critical knowledge-practice gap in the prevention of infectious diarrheal diseases within this rural adult population. Public health interventions must move beyond generic awareness campaigns. Future strategies should be tailored, multifaceted, and practical, focusing on addressing the specific misconceptions identified (e.g., causative agents, ORS use) and mitigating the environmental and economic drivers of risky practices, such as promoting affordable safe food alternatives and improving waste management systems.

Conclusion

Despite reasonable awareness of diarrheal prevention and treatment, critical gaps persist in practices related to food safety, waste management, and ORS preparation. Socioeconomic constraints further hinder effective hygiene adoption. Public health initiatives must combine culturally relevant education, infrastructural improvements, and community engagement to achieve sustainable reductions in diarrheal disease prevalence. Implement targeted educational campaigns to improve knowledge on disease transmission and correct ORS preparation. Strengthen food safety regulations and promote proper waste disposal and hand hygiene practices. Enhance multi-sectoral collaboration to improve WASH infrastructure and ensure healthcare access to ORS and zinc.

Acknowledgment

Conflict of interest

The authors declare that no conflict of interest exists.

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Original article

Serum Magnesium Level in Umbilical Cord Blood of Preterm and Term Babies

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Abstract

Background: Serum magnesium has important influence on the health of pregnant women and the growing fetus. The lack of this minerals can lead to major impairment of physiological and biological functions, may also induce premature birth, neurological disorder, fetal growth retardation and various abnormalities. ***Objectives:*** To evaluate serum magnesium level in umbilical cord blood of pre-term and term babies. ***Methodology:*** This cross-sectional study was conducted in the Department of Biochemistry, Dhaka Medical College, Dhaka, from July 2017 to June 2018 to evaluate the serum magnesium level in umbilical cord of preterm and term babies. For this study, one hundred newborns were chosen from Dhaka Medical College Hospital's Department of Obstetrics, following the selection criteria. Fifty of them were preterm (Group A), and the other fifty were full-term (Group B). Researchers made sure to get written permission (informed consent) from the mother or legal guardian for every baby after fully explaining what the study involved. ***Results:*** In Group A, mean ± SD of serum magnesium level was 1.67 ± 0.45 (mg/dl), where as in Group B, mean ± SD of serum magnesium level was 2.08 ± 0.35 (mg/dl). The value was significantly lower (p<0.001) in Group A than Group B. Serum magnesium level has significant (p<0.001) positive correlation with gestational age but no significant correlation with birth weight. ***Conclusion:*** Finding of this study might be helpful for early diagnosis of magnesium deficiency in the preterm babies and also help to prevent the deficiency related neonatal morbidity and mortality.

Key words: Preterm, Term, Serum magnesium, Gestational age, Birth weight. Umbilical Cord Blood

Introduction:

Preterm birth (delivery before 37 weeks of gestation) is a growing threat to newborn survival worldwide. Currently, an estimated 15 million babies are born preterm annually, translating to an 11.1% global preterm birth rate that is continuing to increase. Preterm birth complications are the leading cause of death for children under five, accounting for roughly one million deaths each year. The highest burden is concentrated in Southern Asia (3.87 million), followed by Sub-Saharan Africa (3.2 million), and South-Eastern Asia/Oceania (1.9 million). Risk factors and causes for preterm birth are diverse, including conditions like multiple pregnancies, placental issues (e.g., previa or abruption), maternal factors (e.g., teenage motherhood,

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pre-eclampsia, diabetes, chronic illness, infection), and uterine abnormalities (e.g., bicornuate uterus, incompetent cervix). [1]

Pregnancy is a natural process that causes extensive internal physiological changes in women. Because this period involves rapid growth and cell differentiation for both the mother and the fetus, both are highly sensitive to changes in their dietary intake, especially concerning nutrients that are already in marginal supply. [2]

The way minerals transfer to the fetus changes throughout pregnancy. Initially, minerals move from the amniotic fluid to the fetus via simple diffusion because the fetal skin is not yet hardened (keratinized). As pregnancy advances, the placenta and umbilical cord blood become the primary means of transferring minerals from the mother. A pregnant woman's mineral status can be influenced by several factors, including diet and supplements, her gestational age, overall health, and whether she smokes. Furthermore, it's suggested that stress and blood loss during delivery might also impact the mother's mineral levels. Research also indicates a potential correlation between the mineral composition of the mother's serum and the newborn's cord blood. [3]

The later stages of pregnancy are vital for transferring mineral stores to the fetus. Research indicates that various minerals, such as calcium, are inter-related and their levels naturally fluctuate. Since pregnancy requires significantly higher nutrient intake, a deficiency in any required nutrient poses a risk to the progression of the pregnancy, the delivery process, and the health of the newborn. [4]

Magnesium, the body's fourth most plentiful cation, is vital for numerous physiological processes. Its functions include supporting bone structure, synthesizing essential biomolecules (DNA, RNA, proteins), and enabling energy production (glycolysis). Furthermore, magnesium helps maintain cell system stability and regulates the transport of calcium and potassium across cell membranes, thereby controlling muscle contraction, nerve conduction, vascular tone, and heart function. The body primarily maintains magnesium balance (homeostasis) through the kidneys, which reabsorb it mainly in the loop of Henle and, to a lesser degree, in the distal convoluted tubule. This regulation is influenced by various factors, both hormonal and non-hormonal, and is closely tied to the reabsorption of calcium. [5]

Essential for human health, magnesium is necessary for bone formation and intracellular enzyme activity. This mineral has a well-established role in obstetrics as a key element for healthy fetal development. Insufficient magnesium during gestation may be associated with negative outcomes, including pre-eclampsia, preterm birth, and potentially low birth weight. Critical research indicates that magnesium deficiency during this period significantly elevates the chance of neonatal death and illness, and could result in the development of a chronic neurological deficit.[3] There's a strong correlation between a mother's mineral status and the baby's health, affecting both fetal development and the neonate's subsequent well-being. Mineral deficiencies are implicated in numerous poor pregnancy outcomes, including miscarriage, preterm birth, birth defects, and immune system issues. Observations of mineral deficiency in the cord blood of preterm newborns led to the current study, which aims to compare serum magnesium levels in the cord blood of preterm and term infants. The results will be used to improve early detection of deficiency and aid in preventing related neonatal morbidity and mortality. To achieve better outcomes, preventive measures are required. These should include routine antenatal screening for maternal serum magnesium and providing supplementation, given that the mother's magnesium level affects the baby's gestational age and birth weight. Overall, adequate and balanced nutrition during pregnancy is essential for a healthy infant.

Materials and methods

This cross-sectional study was executed in the Department of Biochemistry at Dhaka Medical College, Dhaka, spanning one year from July 2017 to June 2018. The research involved 100 newborn babies recruited from the Department of Obstetrics using purposive sampling. The participants were divided into two equal groups of 50: Group A (preterm babies) and Group B (term babies), all of whom were diagnosed cases of labor. Crucially, infants were excluded if their mothers had a history of specific chronic illnesses, including DM, malignancy, COPD, CKD, or liver diseases, to ensure the study population was relatively healthy in relation to these factors. Before any procedure, ethical standards were met by thoroughly explaining the study's nature and risks, and obtaining written informed consent from the baby's mother or legal guardian.

Immediately after delivery, a 5 ml blood sample was carefully collected from the maternal end of the umbilical cord of each subject, taking all aseptic precautions. The samples were placed in clean, dry, deionized test tubes without anticoagulant, labeled, and then kept slanted for up to 30 minutes. To isolate the serum, the samples were centrifuged at 3000 rpm for 10 minutes. The separated serum was transferred into labeled Eppendorf tubes. To avoid contamination or loss of bioactivity, any samples experiencing a delay in analysis were stored in an ultra-freezer. All subsequent biochemical testing was performed in the Department of Biochemistry.

Only about 10 µl of serum from each sample was required to determine the serum magnesium level, which was measured by using Xylidyl blue method in semi-automated

machine and magnesium kit manufacturer was Human. Serum magnesium reference range was 1.9-2.5 mg/dl. For the statistical evaluation, continuous data were summarized using the mean ± Standard Deviation (SD). The two groups (preterm vs. term) were compared using the unpaired Student's t-test. Relationships between variables were assessed using Pearson's correlation coefficient. Statistical analysis was performed by using the SPSS software (version 22, IBM). Statistical significance was defined as a two-tailed p-value of less than 0.05 (p < 0.05) at a 95% confidence interval, ensuring the reliability of the findings regarding the difference in magnesium levels between the two groups.

Result:

In this study, the mean ± SD of birth weight was 2.10±0.51 kg and 2.93±0.40 kg in Group A and Group B respectively. The gestational age was 33.96±1.93 weeks in Group A and 38.68±1.17 weeks in Group B. There was significant difference p<0.001 0f birth weight and gestational age between two groups. (Table-I)

Table I: Demographic profile of the preterm and term babies (N=100)

| Variables | Groups | | t value | p value |
	Group A (n=50) mean±SD	Group B (n=50) mean±SD		
Birth weight (kg)	2.10 ± 0.51	2.93 ± 0.40	8.97	<0.001
Gestational age (weeks)	33.96 ± 1.93	38.68 ± 1.17	14.81	<0.001

Unpaired Student's 't' test was done to measure the level of significance. p< 0.05 is considered as significant.
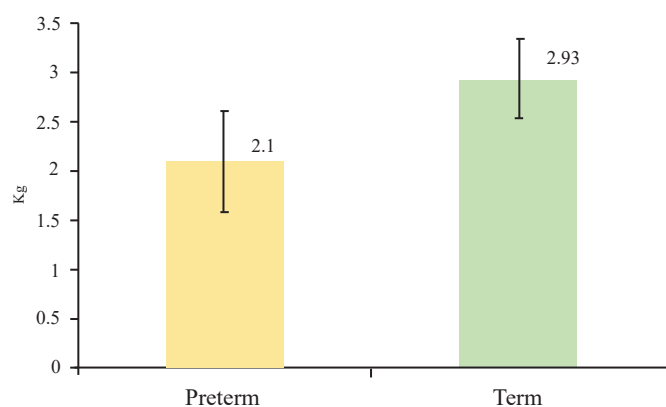

Figure 1: Bar diagram showing birth weight in preterm and term babies
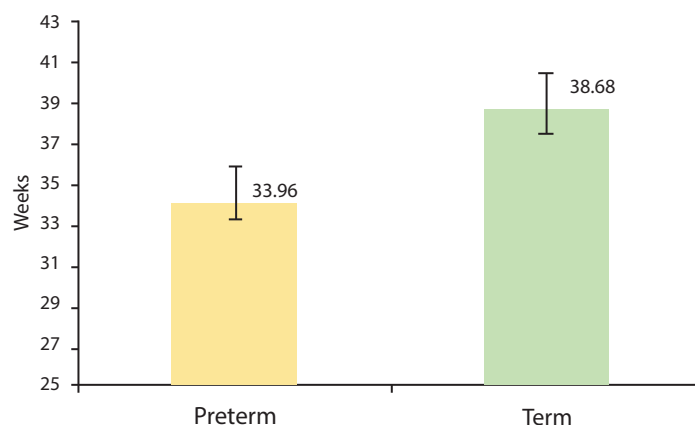
Figure 2: Bar diagram showing gestational age in preterm and term babies

In this study, the mean ± SD of birth weight was 2.10±0.51 kg and 2.93±0.40 kg in Group A and Group B respectively. The gestational age was 33.96±1.93 weeks in Group A and 38.68±1.17 weeks in Group B. There was significant difference p<0.001 0f birth weight and gestational age between two groups. (Table-I)

Table II: Laboratory findings of the preterm and term babies (N=100)

| Parameters | Groups | | t value | p value |
	Group A (n=50) mean ± SD	Group B (n=50) mean ± SD		
Serum magnesium (mg/dl)	1.67 ± 0.45	2.08 ± 0.35	5.06	<0.001

Unpaired Student's 't' test was done to measure the level of significance. p< 0.05 is considered as significant.
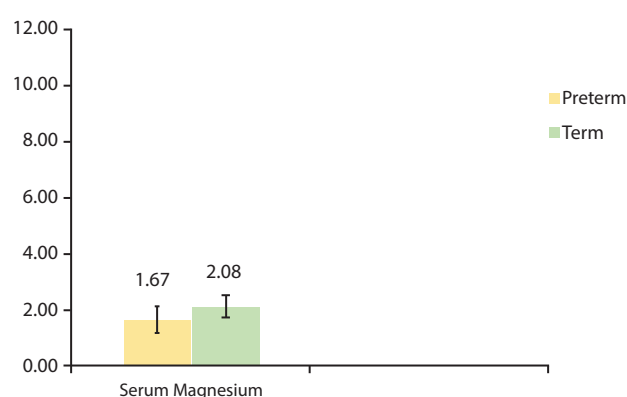
Figure 3: Bar diagram showing serum magnesium in preterm and term babies.

Figure 4: Scattered diagram showing correlation between gestational age and serum magnesium (r = 0.490; p= <0.001). Serum magnesium has significant positive correlation of gestational age.
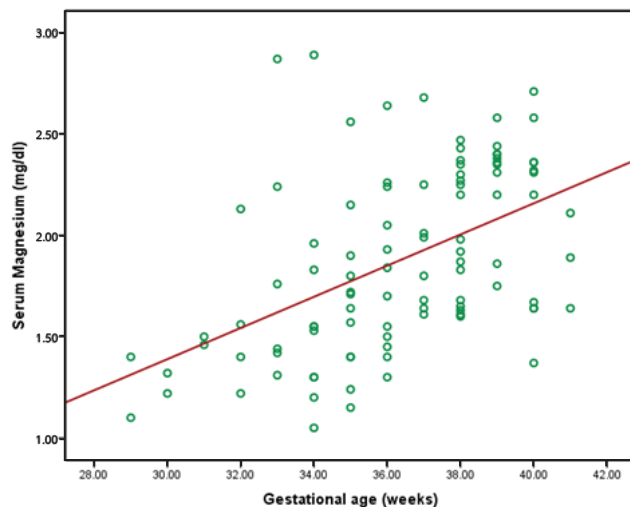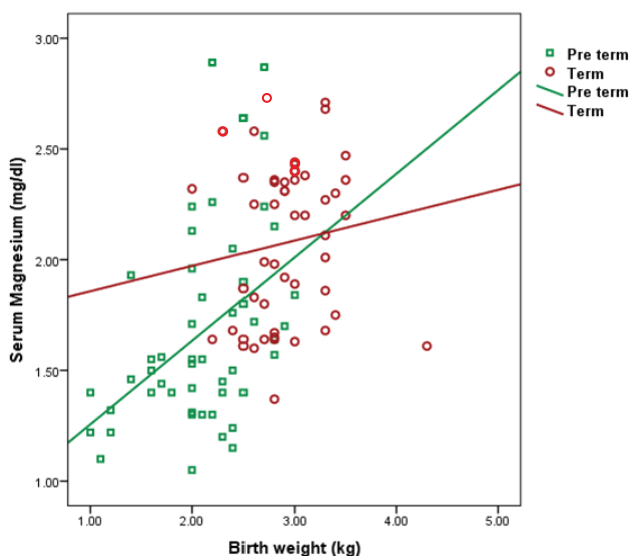

Figure 4: Scattered diagram showing correlation between gestational age and serum magnesium (r = 0.490; p= <0.001). Serum magnesium has significant positive correlation of gestational age.
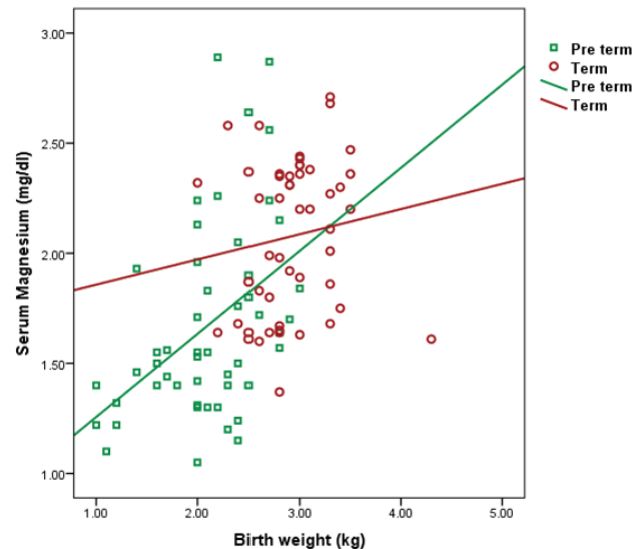
Figure 5: Scattered diagram showing correlation between birth weight and serum magnesium in preterm and term (r = +0.443; p= 0.002 and r = +0.131; p=0.364). No significant positive correlation.

Discussion

A baby born before 37 completed weeks of pregnancy is defined as a preterm birth. Conversely, a term baby is one born between 37 and 42 completed weeks of gestation. Preterm birth is an increasingly common complex condition with multiple risk factor and has substantial medical, psychological, economic and social impacts. The organ most commonly affected by preterm delivery are the lungs, as the lungs are one of the last organs to develop in utero.[6]

Preterm delivery is a critical issue in modern perinatal medicine, with stable rates of 7–10% in developed nations over the last 30 years. The incidence is rising, driven by factors such as assisted reproductive technology, multiple gestations, and increased medical intervention. The crucial hormone for sustaining pregnancy is progesterone. It triggers maternal lymphocytes to produce PIBF, which mediates its protective, anti-abortion effects by adjusting the immune system. During a normal pregnancy, the maternal immune system recognizes the pregnancy, leading to increased progesterone receptors on specific lymphocytes (including placental and CD8+ cells). Sufficient progesterone then prompts these cells to synthesize PIBF. However, patients facing a risk of preterm delivery show an abnormal immune response, characterized by elevated pro-inflammatory cytokines, decreased PIBF, and lower expression of IL-10 on lymphocytes.[7]

Now a day's progress has been made to improve the

survival of premature neonates, mostly by timely interventions, antenatal administration of corticosteroids, better NICU care and exogenous surfactant therapy but still prematurity is the leading cause of neonatal morbidity and mortality8. The most frequent neonatal morbidities are respiratory abnormalities, patent ductus arteriosus, intra cranial hemorrhage, jaundice, necrotizing enterocolitis, infections, chronic lung disease and retinopathy of prematurity9.

Serum magnesium is critical for development of fetus. Deficiency one or more of the minerals can lead to the adverse maternal and fetal outcome. This study was done to see the serum magnesium level in cord blood of preterm and term babies.

According to this study, mean ± SD of serum magnesium was 1.67±0.45 mg/dl and 2.08 ± 0.35 mg/dl in preterm and term babies respectively. Mean serum magnesium level was significantly lower (p<0.001) in preterm than term babies. This result was consistent with an observational study of Elizabeth et al.9 who found significant lower magnesium level in cord blood of preterm than term babies.
In the present study, serum magnesium level was positively connected with gestational age and birth weight. During search, no study was found about correlation of serum magnesium level with gestational age and birth weight.

The limitations of this study were- sample was taken purposively, so there may be chance of bias which can influence the result, correlation of serum magnesium between mother and baby was not done. Large scale prospective study may be carried out nationwide to confirm the alteration of serum magnesium level in the umbilical cord blood between preterm and term babies. Correlation of serum magnesium levels between mother and baby would be done. Routine estimation of serum calcium, magnesium and zinc levels of pregnant women during antenatal check-up would be done.

Conclusion

It is concluded from this study that, serum magnesium level in cord blood of preterm babies is lower than the term babies. There is significant positive correlation of serum magnesium level with gestational age but no significant correlation with birth weight. So, routine checkup of mother for serum magnesium and level is needed to prevent hypomagnesemia of babies and to prevent this element deficiency related neonatal morbidity and mortality.

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Review article

Knowledge, Attitude, and Practice Regarding COVID-19 Among the Adult Population in Bangladesh: A Review

Mohammad Mazharul Islam

Abstract

The COVID-19 pandemic has posed unprecedented challenges to public health systems worldwide. Understanding the knowledge, attitudes, and practices (KAP) of populations is essential for guiding policy, strengthening health communication, and improving disease-prevention behaviors. Bangladesh, with its dense population and limited healthcare resources, faced unique obstacles in COVID-19 containment. This review synthesizes current evidence on knowledge, attitudes, and practices regarding COVID-19 among Bangladeshi adults, highlights trends across different demographic groups, evaluates determinants of KAP, and identifies persistent gaps that require public health attention. A narrative review was conducted using peer-reviewed articles published between January 2020 and December 2024. Eligible studies assessed at least one KAP domain among adults aged ≥18 years in Bangladesh. Data were extracted on study characteristics, KAP outcomes, associated factors, and methodological approaches. Across studies, general knowledge regarding COVID-19 transmission, symptoms, and preventive measures was moderately high, although misconceptions persisted, especially among individuals with low education and rural residence. Attitudes were largely positive, with strong support for preventive measures and confidence in avoiding infection; however, stigma toward infected individuals was reported in some communities. Preventive practices—hand hygiene, mask use, and social distancing—were widely adopted early in the pandemic but declined over time due to risk-fatigue, economic pressures, and perceived reduced threat. Determinants of higher KAP scores included education, income, urban residence, internet access, and exposure to official health information. While Bangladesh achieved commendable levels of COVID-19-related knowledge and generally positive attitudes, gaps in consistent preventive practices remain. Strengthening risk communication, correcting misinformation, and tailoring interventions toward vulnerable groups can improve pandemic preparedness for future health emergencies.

Keywords: COVID-19, knowledge, attitude, practice, KAP, Bangladesh, public health, risk communication

Introduction

The coronavirus disease 2019 (COVID-19), first detected in late 2019, rapidly evolved into a global pandemic affecting millions of individuals worldwide. Bangladesh reported its first confirmed case on 8 March 2020, and since then experienced multiple waves of infection, widespread social and economic disruptions, and significant public health challenges. In such epidemiological emergencies, the knowledge, attitudes, and practices (KAP) of the general population play crucial roles in determining the success of disease prevention and control strategies. Public cooperation with health recommendations—such as mask use, physical distancing, and vaccination—depends on awareness, perception of risk, and social acceptability.

KAP studies help policymakers evaluate the population's understanding of disease prevention, identify

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misinformation, and design targeted interventions. Numerous KAP studies were conducted in Bangladesh during the pandemic, examining diverse groups including the general population, healthcare workers, students, and workers in specific sectors. However, findings across studies vary widely due to differences in sampling, geographic coverage, and timing within the pandemic timeline.

This review compiles and synthesizes available evidence on COVID-19-related KAP among adults in Bangladesh, with the goal of informing public health preparedness for future outbreaks.

Methods

Literature Search

A narrative review was conducted. PubMed, Scopus, Web of Science, and Google Scholar were searched using combinations of the following terms: COVID-19, SARS-CoV-2, knowledge, attitude, practice, KAP, Bangladesh, public awareness, and risk perception. Search limits included English-language articles published between January 2020 and December 2024.

Inclusion and Exclusion Criteria

Inclusion criteria:

- Study population: adults (≥18 years) residing in Bangladesh.
- Study design: cross-sectional, observational, mixed-methods, or community surveys.
- Focus: assessment of at least one KAP domain regarding COVID-19.

Exclusion criteria:

- Studies focusing exclusively on children or non-Bangladeshi populations.
- Reviews, commentaries, and editorials without primary data.
- Articles lacking clear KAP assessment methodologies.

Data Extraction and Synthesis

Data extracted included study characteristics, sample size, participant demographics, KAP levels, determinants of KAP, and conclusions. The review uses narrative synthesis due to heterogeneity in methodology and outcomes.

Results

Overview of Included Studies

Twenty-two primary studies met the inclusion criteria (Table 1). Most used online surveys due to movement restrictions early in the pandemic. Sample sizes ranged from 200 to over 5,000 participants. Urban residents, younger adults, and individuals with higher education were often overrepresented due to greater internet access.

Knowledge Regarding COVID-19

General Knowledge Levels

Most studies reported moderate to high knowledge levels among Bangladeshi adults about COVID-19 transmission, symptoms, and prevention measures. Reported mean knowledge scores ranged from 60% to 85% across studies [1–6]. Key facts were widely understood, including the role of respiratory droplets, fever and cough as symptoms, and the effectiveness of masks.

Common Misconceptions

Despite overall good knowledge, misconceptions persisted:

- Belief that hot weather kills the virus [3,7].
- Misunderstanding surrounding traditional remedies (herbal substances, steam inhalation) [5].
- Confusion about the role of asymptomatic transmission [6].
- Misinformation spread through social media, particularly WhatsApp and Facebook [9].

Determinants of Knowledge

Higher knowledge was consistently associated with:

- Higher education level [3,7].
- Urban residence [3,6].
- Higher socioeconomic status [4]
- Regular use of official health information sources, including government briefings and WHO guidelines [6]
- Internet literacy and smartphone access [2]

Conversely, lower knowledge was reported among:

- Rural residents
- Older adults with limited digital access
- Women in certain regions with restricted mobility [7]

Attitudes Toward COVID-19 Prevention

Attitudes Toward Preventive Measures

Most studies reported predominantly positive attitudes toward COVID-19 prevention measures. A majority of respondents supported lockdown measures, mask use, and isolation of infected individuals to prevent spread [4,10].

Perceived Risk and Optimism Bias

Although fear was prevalent during early waves, risk perception declined over time as infection rates fluctuated, leading to optimism bias, especially among younger adults [11]. This decline in perceived severity contributed to lower adherence to preventive measures in later periods.

Stigma and Social Attitudes

Several studies highlighted stigma associated with infection, ranging from fear of social rejection to reluctance to disclose symptoms [12,13]. Misconceptions regarding transmission contributed to discriminatory attitudes toward frontline workers.

Trust in Government and Health Services

Trust was mixed. Initial confidence in governmental efforts was high; however, concerns later emerged regarding healthcare capacity and management of testing centers [14]. Vaccine-related attitudes were initially cautious but improved after widespread immunization.

Preventive Practices

Mask Use and Hand Hygiene

Mask use was high (>80%) during the early waves, declining slightly as restrictions eased [8]. Handwashing with soap or sanitizer remained relatively consistent across the pandemic. Barriers included cost and inconsistent availability of hygiene supplies in rural areas [1,4].

Social Distancing

Social distancing was challenging in Bangladesh due to population density, economic pressures, and cultural norms involving communal gatherings [15]. Adherence improved temporarily during government-mandated lockdowns but decreased afterward.

Vaccination Practices

Vaccine acceptance evolved from initial hesitancy to widespread uptake following mass campaigns and improved public communication [16]. Factors associated with higher vaccine uptake included education, trust in healthcare, and perceived vulnerability.

Barriers to Adoption of Preventive Practices

Reported barriers included:

- Economic necessity requiring continued work outside the home
- Limited access to protective equipment
- Perceived low risk
- Pandemic fatigue
- Conflicting information in the media

Factors Influencing KAP Across Bangladesh

Socio-Demographic Factors

- **Education:** Strongest predictor of knowledge and preventive practices.
- **Age:** Younger adults showed higher knowledge but lower preventive practice consistency.
- **Gender:** Some studies found women had better practices despite lower knowledge scores.
- **Residence:** Urban respondents demonstrated higher knowledge and better practices.

Information Sources

Individuals relying on official sources—DGHS, IEDCR, WHO—had significantly higher KAP scores compared to those relying mainly on social media [6,9].

Economic and Occupational Factors

Low-income workers and daily laborers had lower compliance due to economic constraints. Frontline workers showed high knowledge but stress-related risk attenuation [12].

Discussion

This review reveals that Bangladeshi adults generally possessed moderate to high levels of knowledge about COVID-19 and maintained positive attitudes throughout the pandemic. Preventive practices were widely adopted, though consistency varied due to socioeconomic and cultural challenges.

Interpretation of Findings

The high initial adherence to preventive measures reflects the effectiveness of early public communication. However, over time, risk perception declined, and preventive behaviors weakened, mirroring global trends. Misinformation remained a persistent challenge, particularly among rural populations and individuals dependent on informal communication networks.

Strengths of Bangladesh's Public Health Response

- Multi-platform communication strategies (TV, SMS, online dashboards).
- Community health workers contributed to local awareness campaigns.
- Rapid vaccine rollout in 2021–2022.
- Use of religious leaders and local authorities to reinforce public health messages.

Persistent Gaps

- Difficulty in maintaining physical distancing in congested settings.
- Limited digital literacy in rural areas.
- Misinformation spread via social media.
- Stigma and fear of social repercussions among infected individuals.

Implications for Future Pandemics

Bangladesh can utilize lessons from COVID-19 to strengthen preparedness:

- Enhancing digital health literacy.
- Expanding community-based awareness programs.
- Investing in rural healthcare infrastructure.
- Developing targeted communication for vulnerable populations.
- Training local leaders in crisis communication.

Limitations of Existing Research

Studies varied in methodology, with many relying on online convenience samples, limiting generalizability. Rural populations and elderly adults were underrepresented. Longitudinal research is scarce, making it difficult to assess evolving KAP trends.

Conclusion

Bangladesh demonstrated commendable knowledge and positive attitudes toward COVID-19 throughout the pandemic, yet consistent preventive practices were influenced by socioeconomic and cultural factors. Addressing gaps in health literacy, misinformation, and behavioral fatigue can improve future outbreak responses. Strengthening public health infrastructure and tailored risk communication strategies will better prepare Bangladesh for upcoming health emergencies.

Tables

Table 1. Summary of Representative KAP Studies Conducted Among Bangladeshi Adults

Study ID	Year	Sample Size	Study Population	Knowledge Score (Mean %)	Positive Attitude (%)	Good Practice (%)	Key Notes
A1	2020	1,520	Urban adults	82%	89%	78%	High internet literacy; widespread mask use
A2	2020	980	Rural adults	63%	74%	55%	Misconceptions common; limited digital access
A3	2021	2,340	Mixed urban/rural	76%	85%	72%	Knowledge improved after government campaigns
A4	2021	560	Female garment workers	58%	67%	49%	Economic constraints reduced practice adherence
A5	2022	1,100	University students	88%	92%	84%	High knowledge; declining practice in later waves
A6	2023	420	Older adults (≥60 yrs)	54%	70%	52%	Low digital literacy; strong vaccine hesitancy
A7	2023	3,050	General adult population	74%	82%	66%	Risk perception declining compared to earlier waves

Table 2. Common COVID-19 Misconceptions Among Bangladeshi Adults

Misconception	Proportion of Respondents Holding Misconception (%)	Primary Demographic Groups Affected	Potential Public Health Impact
Hot weather can kill the virus	38%	Hot weather can kill the virus	Reduces adherence to mask use during summer months
Herbal/home remedies cure COVID-19	27%	Low-income groups, women in rural areas	Delayed healthcare seeking, increased transmission
Only symptomatic individuals can transmit COVID-19	41%	All groups, especially rural	Higher community transmission due to asymptomatic spread
Vaccines cause infertility	12%	Young adults (18–29), rural communities	Lower vaccine uptake during initial roll-out
Steam inhalation prevents infection	33%	Middle-aged adults	False confidence, decreased adherence to proven measures
COVID-19 is a "city disease" not affecting villages	22%	Rural/remote communities	Neglect of preventive behaviors during early pandemic phase

Table 3. Determinants of Higher KAP Scores Among Adults in Bangladesh

Determinant	High Knowledge Score (%)	Positive Attitude (%)	Good Preventive Practice (%)	Interpretation
High internet literacy; widespread mask use	88%	91%	84%	Education consistently increases KAP performance
Urban residence	81%	87%	76%	Better access to information and health services
High income (upper 20%)	85%	89%	82%	Greater ability to purchase masks/sanitizers
Use of official sources (DGHS/WHO)	90%	93%	86%	Most reliable predictor of high KAP
Social media as primary source	62%	71%	58%	Misinformation lowers accurate KAP
Daily laborers/ low-income workers	55%	69%	49%	Economic pressure reduces compliance
Older adults (≥60 yrs)	52%	74%	53%	Lower digital literacy; higher fear but lower preventive consistency

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Case report

A Multidisciplinary Approach to Managing Schizophrenia in a Young Adult Male in a Low-Resource Setting: A Case Report from Bangladesh

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Abstract

Schizophrenia is a chronic and severe psychiatric disorder that affects perception, thought, emotion, and behavior, with paranoid-type schizophrenia being the most prevalent form. In low-resource settings like Bangladesh, the diagnosis and treatment of schizophrenia are frequently delayed due to social stigma, limited mental health literacy, and inadequate access to psychiatric services. This case report describes a 27-year-old male who presented to the Psychiatry Outpatient Department of Sir Salimullah Medical College (SSMC), Dhaka, with persecutory delusions, second-person auditory hallucinations, social withdrawal, and functional decline. Diagnosis was made using the DSM-5 criteria following thorough psychiatric evaluation and caregiver interviews. Management included antipsychotic therapy (risperidone 4 mg/day, titrated as necessary), psychoeducation for the patient and family, and psychosocial support such as family counseling and behavioral activation. Progress was monitored over a six-month period using the Positive and Negative Syndrome Scale (PANSS). At baseline, the patient had a PANSS score of 102, indicating severe psychotic symptoms. By the third month of treatment, his symptoms showed substantial improvement, including reduced intensity of delusions, decreased frequency of hallucinations, and enhanced social interaction. By the sixth month, his PANSS score had decreased to 58, reflecting significant clinical recovery. The patient exhibited improved treatment compliance and functional independence, with no major adverse effects reported from medication. This case highlights the importance of early detection, consistent pharmacological treatment, family involvement, and comprehensive psychosocial support in the effective management of schizophrenia. It also emphasizes the urgent need to address barriers to psychiatric care in low-resource settings through public education and health system strengthening.

Key word: Schizophrenia, Paranoid type, Delusions, Antipsychotic therapy, Bangladesh, Low-resource psychiatry, Psychoeducation, Social withdrawal

Introduction

Schizophrenia is a severe, chronic mental disorder affecting approximately 1% of the global population.[1] It is characterized by disturbances in thought processes, perception, emotion, and social functioning.[2] The illness typically presents in late adolescence or early adulthood and is divided into positive symptoms (delusions, hallucinations), negative symptoms (apathy, social withdrawal), and cognitive impairments.[3] Diagnosing schizophrenia in low-resource settings like Bangladesh presents unique challenges due to cultural misconceptions, low mental health literacy, and the underdevelopment of psychiatric services.[4] Stigma attached to mental illness

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often leads to delayed healthcare-seeking behavior exacerbating the disease course.[5] The pathophysiology of schizophrenia involves dysregulation of dopaminergic and glutamatergic neurotransmission, along with structural and functional brain abnormalities.[6] Early diagnosis and timely initiation of antipsychotic treatment are critical in improving long-term outcomes and functional recovery.[7] This report presents the case of a young Bangladeshi male with classic features of paranoid schizophrenia, highlighting the importance of a comprehensive and family-inclusive management approach in an outpatient setting. The case also sheds light on the social and cultural barriers that may impact care in South Asian contexts.

Case Presentation

A 27-year-old unmarried male, Mr. R.K. (name anonymized), was brought to the Psychiatry Outpatient Department of Sir Salimullah Medical College (SSMC) by his mother with complaints of behavioral changes and social withdrawal over the past year. The patient had no significant past medical or psychiatric history. He had previously been a student but had dropped out of his university program due to progressive disinterest, declining academic performance, and interpersonal difficulties.

Presenting Complaints:

- Suspiciousness and persecutory delusions for 12 months
- Auditory hallucinations (second-person voices) for 10 months
- Social withdrawal and functional decline for 8 months
- Neglect of self-care and disorganized behavior for 6 months

The mother reported that Mr. R.K. frequently claimed that neighbors and relatives were conspiring against him. He would often mutter to himself, respond to unseen stimuli, and isolate himself in his room for hours. Over time, he became emotionally detached, stopped maintaining hygiene, and developed sleep disturbances.There was no history of substance use, head trauma, seizures, or any co-occurring medical illness. Family history was negative for psychiatric disorders. The patient expressed severe distress when questioned about his beliefs and refused to accept that his perceptions were false.The patient's assessment and formulation of the treatment plan were conducted by the psychiatry team at Sir Salimullah Medical College (SSMC) under the supervision of senior faculty.

Management Plan

Pharmacological Management

1. Antisychotics:

- Initiated on **Risperidone** 2 mg/day, titrated to 4 mg/day based on response and tolerance.
- **Trihexyphenidyl** 2 mg/day added to prevent extrapyramidal side effects.

2. Sedative (short-term):

- **Lorazepam** 1 mg at night to aid sleep and reduce initial agitation.

3. Monitoring:

- Baseline labs: CBC, LFT, RFT, fasting blood glucose, lipid profile.
- ECG and prolactin level monitoring.
- Monthly weight and metabolic screening planned.

Psychosocial and Supportive Interventions

1. Psychoeducation:

- Patient and caregiver were counseled about the nature of schizophrenia, medication adherence, and signs of relapse.
- Emphasis placed on reducing expressed emotion in the home environment.

2. Behavioral Activation:

- Daily routine structure developed to reintroduce social and occupational activity gradually.

3. Family Support:

- The family was advised to maintain a low-stress environment and attend monthly sessions.

4. Long-Term Considerations:

- Option of long-acting injectable antipsychotics considered if medication non-adherence emerges.
- Future referral to a psychiatric rehabilitation program discussed.

Follow-up and Outcome

Over a six-month follow-up period, the patient showed steady improvement. After two months, delusional intensity reduced, auditory hallucinations became less frequent, and the patient began to engage minimally in family interactions. By the fourth month, Mr. R.K. demonstrated improved hygiene, better sleep, and was able to participate in basic household tasks. Psychiatric assessments showed a reduction in both positive and negative symptoms. He reported fewer hallucinations and expressed partial insight into his illness. Importantly, adherence to medication was ensured through family involvement and continuous psychoeducation. No significant side effects from medication were observed. The patient tolerated risperidone well, and metabolic parameters remained within normal limits. The mother reported a decrease in stress within the family, improved communication, and greater hope for the patient's long-term recovery.

Discussion

Schizophrenia remains a major cause of disability worldwide, particularly in young adults.[8] The early twenties to late twenties is a common age of onset, as was the case with Mr. R.K. His presentation included hallmark features: persecutory delusions, auditory hallucinations, disorganized speech, and functional impairment—all

consistent with paranoid-type schizophrenia. In low-resource settings like Bangladesh, barriers such as stigma, myths about mental illness, and lack of access to psychiatric care delay diagnosis.[9] This case illustrates the consequences of untreated psychosis, including academic discontinuation and social isolation. The management of schizophrenia requires more than just pharmacological intervention.[10] While second-generation antipsychotics like risperidone are effective in treating positive symptoms, adherence can be a challenge.[11] Therefore, the inclusion of family members in psychoeducation and regular follow-ups is critical to long-term success. The psychological burden on both patient and caregivers must be addressed. Incorporating family-based therapy and involving mental health professionals in a community-based care model improves not only compliance but also reintegration into society.[12] The case also reflects the importance of tailoring interventions to individual patient needs—taking into account financial constraints, education level, and available support systems. By integrating behavioral activation, medication adherence, and psychoeducation, this case exemplifies a cost-effective and sustainable approach to treating schizophrenia in resource-limited settings.

Conclusion

This case highlights the challenges and strategies in diagnosing and managing schizophrenia in a young adult from a low-resource setting in Bangladesh. The patient presented with classic psychotic symptoms and benefited significantly from early pharmacological intervention, family involvement, and psychoeducation. Over a six-month follow-up, he showed marked improvement in social functioning, hygiene, and psychotic symptoms. The success of this case underscores the importance of a multidisciplinary and family-centered approach in treating schizophrenia and reinforces the need for expanding mental health services and awareness in developing countries.

Acknowledgment

Conflict of Interest

The authors declare no conflict of interest exists.

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