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Editor's Email: atlincoln71@gmail.com, amsshasan@gmail.com
Website- <https://pmjpmc.pmc.edu.bd>

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Professor of Medicine
BSMMU, Dhaka
Phone: +8801711525406
Email: mmrahman61@gmail.com

Professor Dr. Mahammad Kamruzzaman

Professor of ENT
Phone: 880 1711155024
Email: drzaman25@yahoo.com

Professor Dr. Md. Obaidullah Ibne Ali

Professor of Physiology
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Phone: +8801711 014 82
Email: dr.bachchu1966@gmail.com

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Phone: +8801711302261
Email: drkhalil64@yahoo.com

Professor Dr. Md. Habibullah Sarker

Professor of Surgery
Rajshahi Medical College, Rajshahi
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Email: habibsarkar66@gmail.com

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Pabna Medical College, Pabna
Phone: +88 01711 284 791
Email: md.rayhanur@yahoo.com

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Professor Dr. Ahmmad Taous

Professor of ENT
Pabna Medical College, Pabna
Phone: +88017117033773
Email: atlincoln71@gmail.com

Professor Dr. Abu Mohd. Shafiqul Hasan

Professor of Medicine
Pabna Medical College, Pabna
Phone: +880 1711 581 685
Email: amsshasan@gmail.com

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Professor of Medicine
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Assistant Professor of Biochemistry
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Beyond the Console: Forging the Surgeon as System Architect

Md. Sherajul Islam

For generations, the surgeon's legacy was etched in the geometry of incisions and the fidelity of healed tissue. We were master technicians, our worth measured in operative time, complication rates, and the gratitude of the patient before us. This covenant, however, is being quietly but irrevocably rewritten. The operating theatre of the 21st century is no longer an isolated arena of individual skill; it is the most complex node in a vast technological, economic, and human system. Here, the introduction of a robotic platform is not merely a new tool, but a seismic event that reshuffles workflows, redefines team dynamics, and demands new ethical and economic calculations. In this new landscape, our most critical instrument may no longer be the scalpel or the console, but the capacity to design the system itself. It is time to embrace a fundamental evolution of our professional identity: from Surgeon as Technician to Surgeon as System Architect.

The urgency of this shift is palpable across Southeast Asia and in operating rooms worldwide. Robotic-assisted surgery (RAS) promises remarkable precision, but its arrival unleashes profound systemic challenges: crippling capital costs that threaten equitable access; disruptive learning curves that strain team cohesion; and a "first-user advantage" that can create unsustainable, personality-dependent programs. When surgeons remain passive end-users of technology imposed by procurement committees, the result is friction—suboptimal utilization, clinician burnout, and a failure to realize the technology's full value. The system, poorly architected, constrains even the most skilled hands.

The System Architect is not an administrator who has left the theatre behind. They are the master surgeon who leverages their irreplaceable clinical insight to proactively design, build, and iteratively optimize the ecosystem of care. This role rests on four foundational pillars:

1. **Techno-Clinical Integration:** The architect moves from consumer to co-creator, leading clinical

needs assessments and ensuring technology serves pathology—not the other way around.

2. **Data-Driven Workflow Design:** They instrument the patient pathway, using data on docking time, instrument use, and team turnover to ruthlessly eliminate bottlenecks from clinic to recovery.
3. **Interdisciplinary Team Orchestration:** Recognizing the console's physical isolation, the architect codesigns simulation-based team training and communication protocols, forging a shared mental model for crisis management.
4. **Sustainable Training Pathway Development:** They build equitable, scalable credentialing frameworks and "train-the-trainer" programs to ensure institutional legacy outlasts any single pioneer.

Evidence for this model's impact is emerging. In Singapore, a colorectal surgeon-architect's process mapping reduced robotic rectal case preparation time by 22%. In Malaysia, mandatory multidisciplinary simulations for robotic liver resections boosted nursing confidence in handling failures by 40%. In Thailand, a surgeon-led ethics panel created a transparent consent protocol, improving patient understanding scores by 35%. These are not tales of mere technical prowess, but of surgical leadership re-engineering the context of care.

Yet, formidable barriers stand in the way. Our academic promotion rituals still worship clinical volume and basic science papers, often dismissing system innovation as "service." Our curricula lack training in implementation science, human factors, and change management. Consequently, this essential architect's work becomes unpaid "shadow labor," a fast track to disillusionment.

We must therefore consciously build the scaffolding for this new role. Hospital administrations must create and fund formal leadership positions—Medical Director of Surgical Innovation—with protected time

and measurable system-level outcomes. Surgical colleges and societies must urgently integrate systems design, data literacy, and leadership ethics into fellowship curricula and continuing certification. Most critically, academic promotion committees must expand their definition of scholarly contribution to include documented, impactful system transformation.

The legacy of the future surgeon will be dual: measured in the outcomes of the individual patient on the table, and encoded in the robustness, equity, and resilience of the system that cared for them. The disruptive technology now entering our theatres is not a call to retreat to the console, but a summons to engage more deeply – to wield our hard-earned clinical credibility not just to operate within the system, but to architect it. For the sake of our patients, our trainees, and the

sustainability of our profession, we must build this future, one designed system at a time. Our legacy, after all, depends on it.

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Dr. Md. Sherajul Islam

MBBS,FCPS,FICS,FACS,FMAS

Associate Professor of Surgery,

Pabna Medical College, Pabna, Bangladesh

Phone- +880 1818652987

E-mail: sherajdr@gmail.com

Differences in Dermatoglyphic atd Angle as a Biomarker in Children with Autism Spectrum Disorder: A Case - Control Study

*Das D¹, Anwar S², Das R³, Akand NNN⁴, Roy NR⁵

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Autism Spectrum Disorder, dermatoglyphics, atd angle, biomarker, palmar print, neurodevelopmental disorder

Abstract:

Background: Autism Spectrum Disorder (ASD) is a neurodevelopmental condition with increasing prevalence. The 'atd' angle, a palmar dermatoglyphic feature formed early in fetal development, may serve as a biomarker for prenatal disturbances. This study aimed to compare the 'atd' angle between children with ASD and typically developing controls, and to assess sex-based differences within the ASD group. **Methods:** A cross-sectional case-control study was conducted in Rangpur, Bangladesh, from January to December 2019. The sample included 100 children aged 5–15 years: 50 with ASD (38 males, 12 females) from two autism centers, and 50 typically developing controls (26 males, 24 females) from a local school. Palm prints were collected using the standard ink method, and the maximal 'atd' angle was measured bilaterally with a protractor. Statistical analysis was performed using SPSS version 23.0, with independent t-tests for group comparisons ($p < 0.05$ considered significant). **Results:** The mean 'atd' angle for children with ASD ($41.31^\circ \pm 6.45^\circ$) was wider than that of controls ($40.83^\circ \pm 5.75^\circ$), but this difference was not significant ($p = 0.275$). Stratified by sex, autistic females had the widest mean 'atd' angle ($45.66^\circ \pm 7.68^\circ$), which was greater than both autistic males ($41.24^\circ \pm 5.77^\circ$; $p = 0.072$) and control females ($40.59^\circ \pm 5.57^\circ$; $p = 0.080$). In the control group, 82% had an 'atd' angle $< 45^\circ$, compared to 75% in the ASD group.

Conclusion: While the 'atd' angle did not show significant differences between the ASD and control groups, a trend toward a wider angle was observed, particularly in autistic females. The 'atd' angle may not serve as a standalone diagnostic biomarker for ASD, but could contribute to a broader dermatoglyphic assessment. Larger studies with standardized methods are needed to further explore these outcomes.

Introduction:

Autism Spectrum Disorder (ASD) is a severe neurodevelopmental condition defined by persistent deficits in social communication and interaction, along with restricted, repetitive patterns of behavior, interests, or activities.¹ The global prevalence of ASD has increased dramatically over recent decades, with current figures indicating that approximately 1 in 160 children worldwide is affected.² In Bangladesh, while comprehensive national epidemiological data are lacking, extrapolations suggest that nearly 1.05 million individuals may have ASD, pointing to the growing

public health concern.³ The etiology of ASD is complex and multifactorial, involving interactions between hereditary predispositions and environmental elements through critical periods of prenatal development.^{4,5} The disorder is thought to result from disruptions in fetal brain development, with abnormalities observed in several brain regions, including the cerebellum, limbic system, and cerebral cortex.^{6,7}

Dermatoglyphics, the scientific study of epidermal ridge configurations on fingers, palms, and soles, gives a unique window into prenatal development.

1. *Dr. Doly Das Assistant Professor, Department of Anatomy, Prime Medical College, Rangpur, Bangladesh

2. Dr. Selina Anwar Professor, Department of Anatomy, Rangpur Community Dental College, Rangpur, Bangladesh

3. Dr. Rupayan Das Junior Consultant, Department of Orthopedics and Traumatology, Upazila Health Complex, Kishoreganj, Nilphamari Bangladesh

4. Dr. Nahida Nazmun Nahar Akand Associate Professor, Department of Anatomy, Prime Medical College, Rangpur, Bangladesh

5. Dr. Nilima Rani Roy Assistant Professor Department of Biochemistry, Prime Medical College, Rangpur, Bangladesh

Correspondence: *Dr. Doly Das Assistant Professor, Department of Anatomy, Prime Medical College, Rangpur, Bangladesh. Email: dr.dolydas@gmail.com Phone No. +880 1780772727

These ridges form between the 7th and 21st weeks of gestation and remain unchanged throughout life.^{8,9} Crucially, both the skin (including its ridges) and the central nervous system derive from the same embryological layer – the ectoderm. Therefore, any genetic or environmental insult within this critical developmental window could potentially affect both brain development and dermatoglyphic patterns.^{10,11} Among the various dermatoglyphic parameters, the ‘atd’ angle has received considerable attention in clinical research. This angle is formed by drawing lines from the digital triradius ‘a’ (located at the base of the index finger) to the axial triradius ‘t’ (situated in the hypothenar area), and from ‘t’ to the digital triradius ‘d’ (at the base of the little finger).¹² The position of the axial triradius can vary from proximal to distal on the palm, with a more distal position resulting in a larger ‘atd’ angle. An ‘atd’ angle less than 45° is considered normal (designated ‘t’), angles between 45° and 56° indicate an intermediate position (‘t’), and angles greater than 56° suggest a distally displaced axial triradius (‘t’’).¹³

The ‘atd’ angle has been extensively studied in various genetic and neurodevelopmental disorders. In Down syndrome (trisomy 21), a significantly widened ‘atd’ angle is a well-established characteristic, indicating the distal displacement of the axial triradius.^{14,15} Similarly, alterations in the ‘atd’ angle have been reported in conditions such as schizophrenia¹⁶, cerebral palsy¹⁷, and various chromosomal abnormalities.¹⁸ Given the common ectodermal origin of the skin and brain, and the temporal overlap between ridge formation and critical periods of neurodevelopment, dermatoglyphic traits may serve as indirect markers for early developmental disturbances in ASD. Several studies have investigated the ‘atd’ angle in autistic populations, but the results have been inconsistent. Some researchers have reported significantly wider ‘atd’ angles in individuals with ASD compared to controls^{19,20}, while others have found no significant differences^{21,22} or even smaller angles.²³ These discrepancies may stem from variations regarding sample size, ethnic differences, methodological methods, or the genetic heterogeneity of ASD itself. In the Bangladeshi population, baseline dermatoglyphic data for ASD are lacking. Understanding population-specific dermatoglyphic characteristics is essential, as these patterns display ethnic and racial variations [24]. Therefore, this study aimed to compare

the ‘atd’ angle between Bangladeshi children with ASD and age-matched typically developing controls, and to examine sex-based differences within the ASD group. The findings may add to the growing body of evidence regarding dermatoglyphic markers in neurodevelopmental disorders and provide population-specific reference data for future research.

Materials and Methods

Study Design and Setting

This cross-sectional, analytical case-control study was conducted in the Department of Anatomy, Rangpur Medical College, Rangpur, Bangladesh, from January 2019 to December 2019. The study aimed to compare dermatoglyphic characteristics between children diagnosed with autism spectrum disorder (ASD) and typically developing controls.

Study Population

A total of 100 children aged 5–15 years were enrolled, with 50 children diagnosed with ASD and 50 typically developing controls. ASD participants were recruited from Buddhi Protibondhi Autistic Biddaloy, Dinajpur, and Pyrabond Buddhi Protibondhi Biddaloy, Rangpur, while controls were recruited from Ashirbad- A.G. School, Rangpur. Participants were selected through purposive sampling, with specific inclusion and exclusion criteria.

Inclusion and Exclusion Criteria

- **Inclusion:** Children aged 5–15 years, both sexes, Bangladeshi origin. ASD diagnosis for the ASD group; typically developing children for the control group.
- **Exclusion:** Children with mixed ethnic origin, congenital abnormalities, identifiable neurological disorders, or a history of major trauma or head injury.

Ethical Considerations

The Ethical and Protocol Review Committee of Rangpur Medical College approved the study protocol. Written informed consent was obtained from parents/guardians, and all data were anonymized for research purposes.

Data Collection

Palm Print Acquisition

Palm prints were collected using the ink method as described by Penrose and Cummins. Briefly, the palm was inked and pressed onto an A4 paper. The process

was repeated to guarantee clear, readable prints. Prints were examined under 6× magnification to ensure quality.

Measurement of 'atd' Angle

The 'atd' angle was measured following the standardized method described by Penrose (1954). On each palm print, the digital triradii were identified: triradius 'a' at the base of the index finger, triradius 'b' at the base of the middle finger, triradius 'c' at the base of the ring finger, triradius 'd' at the base of the little finger, and the axial triradius 't' located in the hypothenar area (the fleshy part of the palm below the little finger).

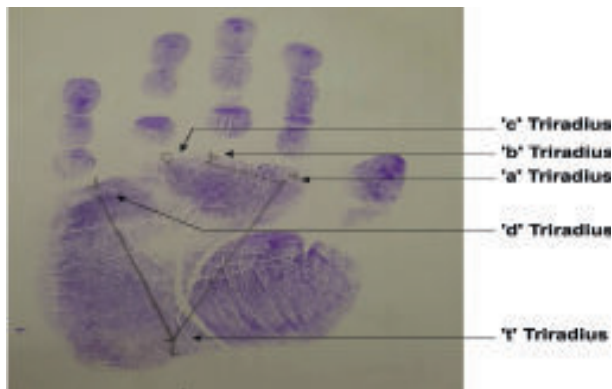


Figure 1: Palm print with 'a', 'b', 'c', 'd' and 't' triradius

Figure 1: Palm print showing the locations of digital triradii 'a', 'b', 'c', 'd' (at the bases of index, middle, ring, and little fingers respectively) and axial triradius 't' in the hypothenar area. These anatomical landmarks are used for dermatoglyphic analysis including the measurement of the 'atd' angle. After identifying these landmarks, two straight lines were drawn: one connecting triradius 'a' to the axial triradius 't', and another connecting triradius 't' to triradius 'd'. The resulting angle at the apex of triradius 't' formed by these two lines—the 'atd' angle—was measured using a standard protractor with 0.5° precision.

Figure 2: Procedure for measuring the 'atd' angle on a palm print. Two straight lines are drawn from triradius 'a' (base of index finger) to axial triradius 't' (hypothenar area), and from 't' to triradius 'd' (base of little finger). The angle formed at the apex 't' is measured using a protractor. The illustrated angle measures approximately 35°. Measurements were



Figure 2: Procedure of measuring 'atd' angle

taken for both right and left hands of each participant. The 'atd' angle was categorized according to the position of the axial triradius:

- <45°: Normal position
- 45°–56°: Intermediate position
- 56°: Distal position

Quality Control

Measurements were performed by a single investigator in duplicate, with the mean recorded. Distorted prints were excluded, and unclear triradii were re-examined.

Statistical Analysis

Data were analyzed using SPSS version 23.0. Descriptive statistics were computed, and normality was assessed using the Shapiro-Wilk test. Comparisons between the ASD and control groups were made using independent t-tests for continuous variables and chi-square tests for categorical data. A p-value of ≤ 0.05 was considered statistically significant.

Results:

A total of 100 children aged 5–15 years were included in this study. The demographic characteristics of the study population are presented in Table 1. The ASD group comprised 38 males (76%) and 12 females (24%), yielding a male-to-female ratio of approximately 3.2:1, consistent with the known higher prevalence of ASD in males. The control group consisted of 26 males (52%) and 24 females (48%). The mean age was comparable between groups (ASD: 9.4 ± 3.2 years; Control: 9.1 ± 3.0 years; $p=0.63$).

Table I: Demographic Characteristics of the Study Population

Characteristic	ASD Group (n=50)	Control Group (n=50)
Age (years)		
Mean $\pm$ SD	9.4 $\pm$ 3.2	9.1 $\pm$ 3.0
Range	5–15	5–15
Sex, n (%)		
Male	38 (76%)	26 (52%)
Female	12 (24%)	24 (48%)
Male: Female Ratio	3.2:1	1.1:1

**Figure 3:** Schematic Representation of 'atd' Angle Measurement on the Palm

Figure 3: presents a detailed diagram of the human palm, specifically focusing on the measurement of the 'ATD' angle. The diagram includes various elements of hand anatomy, such as different fingerprint patterns, including left loop (L. Loop), right loop (R. Loop), whorl, and ulnar loop (U. Loop),

each marked on the corresponding fingers. Key anatomical features, including the thenar crease, life line, and proximal transverse crease (DTC), are also indicated. The diagram is oriented to show the radial and ulnar sides of the palm, and arrows point to these sides for reference. The diagram also marks points a, b, c, d, I, II, III, and IV, which serve as reference locations for calculating the 'ATD' angle. This angle is commonly used in dermatoglyphics, the study of skin ridge patterns, to analyze palm prints. The inclusion of these anatomical features and reference points allows for a clear understanding of how the 'ATD' angle is measured on the palm, providing insights into the study of dermatoglyphics and its application in various fields. Comparison of 'atd' Angle Between ASD and Control Groups. The mean 'atd' angle measurements for the right hand, left hand, and both hands combined are presented in Table 2 and illustrated in Figure 2.

For the right hand, the mean 'atd' angle was slightly smaller in the ASD group ($40.00^\circ \pm 6.60^\circ$) compared to controls ($40.68^\circ \pm 4.90^\circ$), but this difference was not statistically significant ($p=0.259$). Conversely, for the left hand, the mean 'atd' angle was wider in the ASD group ($42.62^\circ \pm 6.31^\circ$) than in controls ($40.98^\circ \pm 6.60^\circ$), although this difference also failed to reach statistical significance ($p=0.147$). When both hands were combined, children with ASD demonstrated a wider mean 'atd' angle ($41.31^\circ \pm 6.45^\circ$) compared to controls ($40.83^\circ \pm 5.75^\circ$), but the difference remained non-significant ($p=0.275$). Notably, the ASD group showed greater variability in 'atd' angle measurements (range $28-65^\circ$) compared to controls ($34-55^\circ$), suggesting more heterogeneous palmar configurations within the autistic population.

Table II: Comparison of 'atd' Angle Between ASD and Control Groups

Side	ASD Group (n=50) Mean $\pm$ SD (Range)	Control Group (n=50) Mean $\pm$ SD (Range)	t-value	p-value
Right Hand	$40.00^\circ \pm 6.60^\circ$ (28–65)	$40.68^\circ \pm 4.90^\circ$ (34–55)	1.135	0.259
Left Hand	$42.62^\circ \pm 6.31^\circ$ (29–51)	$40.98^\circ \pm 6.60^\circ$ (38–54)	1.463	0.147
Both Hands Combined	$41.31^\circ \pm 6.45^\circ$ (28–65)	$40.83^\circ \pm 5.75^\circ$ (34–55)	1.299	0.275

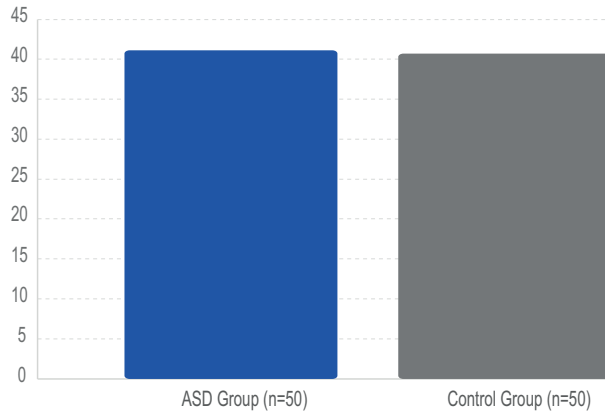


Figure 4: Comparison of Mean 'atd' Angle (Both Hands Combined) Between Autistic Children and Normal Controls

Figure 4: Comparison of mean 'atd' angle (both hands combined) between autistic children and normal controls. Error bars represent standard deviation. The ASD group showed a wider mean angle ($41.31^\circ \pm$

6.45°) compared to controls ($40.83^\circ \pm 5.75^\circ$), but the difference was not statistically significant ($p=0.275$). To explore potential sex differences, we stratified the analysis by sex. Table 3 presents the comparison of 'atd' angles between normal males and autistic males.

Among males, autistic boys exhibited slightly wider 'atd' angles across all measurements compared to normal boys, but none of these differences reached statistical significance ($p>0.05$ for all comparisons). More pronounced differences were observed when comparing females (Table 4).

Autistic females demonstrated consistently wider 'atd' angles compared to their typically developing counterparts, with differences approaching but not reaching statistical significance (p -values ranging from 0.073 to 0.080). The mean 'atd' angle for autistic females ($45.66^\circ \pm 7.68^\circ$) was approximately 5° wider than for normal females ($40.59^\circ \pm 5.57^\circ$). Table 5 compares 'atd' angle measurements between autistic males and autistic females.

Table III: Comparison of 'atd' Angle Between Normal Male and Autistic Male Children

Side	Normal Male (n=26) Mean $\pm$ SD (Range)	Autistic Male (n=38) Mean $\pm$ SD (Range)	t-value	p-value
Right Hand	$40.57^\circ \pm 4.33^\circ$ (36–53)	$40.78^\circ \pm 5.49^\circ$ (28–55)	0.173	0.864
Left Hand	$40.84^\circ \pm 3.67^\circ$ (40–51)	$41.71^\circ \pm 6.06^\circ$ (29–54)	0.706	0.481
Both Hands Combined	$40.70^\circ \pm 4.00^\circ$ (36–53)	$41.24^\circ \pm 5.77^\circ$ (28–55)	0.439	0.578

Table IV: Comparison of 'atd' Angle Between Normal Female and Autistic Female Children

Side	Normal Female (n=24) Mean $\pm$ SD (Range)	Autistic Female (n=12) Mean $\pm$ SD (Range)	t-value	p-value
Right Hand	$40.79^\circ \pm 5.54^\circ$ (34–56)	$45.83^\circ \pm 8.47^\circ$ (36–65)	1.851	0.080
Left Hand	$41.12^\circ \pm 5.60^\circ$ (40–59)	$45.50^\circ \pm 6.90^\circ$ (40–51)	1.90	0.073
Both Hands Combined	$40.59^\circ \pm 5.57^\circ$ (34–59)	$45.66^\circ \pm 7.68^\circ$ (36–65)	2.026	0.080

Table V: Comparison of 'atd' Angle Between Autistic Male and Autistic Female Children

Side	Autistic Male (n=38) Mean $\pm$ SD (Range)	Autistic Female (n=12) Mean $\pm$ SD (Range)	t-value	p-value
Right Hand	$40.78^\circ \pm 5.49^\circ$ (28–55)	$45.83^\circ \pm 8.47^\circ$ (36–65)	1.93	0.073
Left Hand	$41.71^\circ \pm 6.06^\circ$ (29–54)	$45.50^\circ \pm 6.90^\circ$ (40–51)	1.70	0.107
Both Hands Combined	$41.24^\circ \pm 5.77^\circ$ (28–55)	$45.66^\circ \pm 7.68^\circ$ (36–65)	1.93	0.072

Within the ASD group, females exhibited notably wider 'atd' angles than males across all measurements, with differences approaching statistical significance ($p=0.072$ for both hands combined). This pattern was consistent for both right and left hands individually.

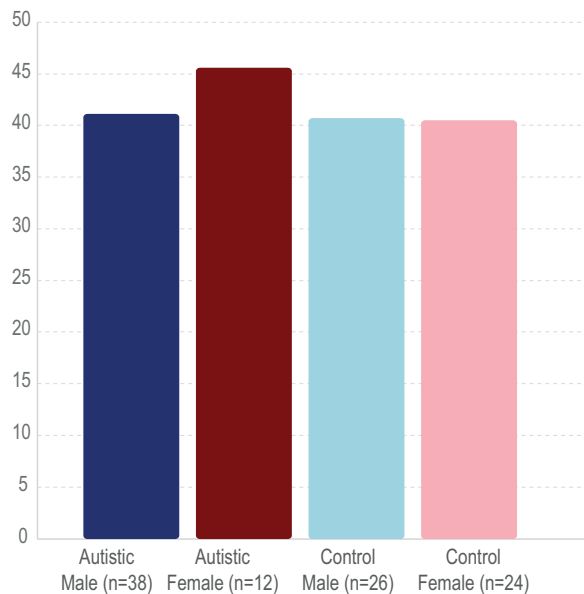


Figure 5: Sex-Based Comparison of Mean 'atd' Angle (Both Hands Combined)

Figure 5: Sex-based comparison of mean 'atd' angle (both hands combined) showing wider angles in autistic females compared to autistic males and control females. Autistic females demonstrated the widest mean angle ($45.66^\circ \pm 7.68^\circ$), followed by autistic males ($41.24^\circ \pm 5.77^\circ$), control females ($40.59^\circ \pm 5.57^\circ$), and control males ($40.70^\circ \pm 4.00^\circ$). Differences approached statistical significance ($p=0.072$ for autistic females vs. autistic males; $p=0.080$ for autistic females vs. control females). Table 6 presents the classification of 'atd' angles according to the position of the axial triradius (t, t', or t'').

Table VI: Distribution of 'atd' Angle Categories

Angle	Right Hand		Left Hand		Both Hands	
Category	Control	ASD	Control	ASD	Control	ASD
<45° (t)	80%	74%	84%	76%	82%	75%
45°–56° (t')	20%	24%	14%	24%	17%	24%
>56° (t'')	0%	2%	2%	0%	1%	1%

In both groups, the majority of participants exhibited a normal 'atd' angle (<45°), indicating a proximally placed axial triradius. However, the proportion of individuals with a normal angle was higher in the control group (82% vs. 75% for both hands combined). Conversely, a higher percentage of children with ASD fell into the intermediate category (45°–56°; 24% vs. 17% for controls). A distally displaced axial triradius

(>56°) was rare in both groups, observed in only 1% of cases overall.

Discussion:

This study investigated the potential of the palmar 'atd' angle as a dermatoglyphic biomarker for autism spectrum disorder in a Bangladeshi pediatric population. Our findings reveal that, while children with ASD showed a trend toward wider 'atd' angles than typically developing controls, these differences did not reach statistical significance. However, notable sex-specific patterns appeared, with autistic females exhibiting substantially wider angles than both autistic males and control females. The relationship between the 'atd' angle and autism has yielded inconsistent findings among various populations. Our results align with several studies that found no statistically significant difference between autistic and control groups. Milicic, Petkovic, and Bozikov²¹ reported a smaller 'atd' angle in their autistic group compared to controls, though the difference was not statistically significant. Similarly, Sanyaolu et al.²² observed no significant difference in 'atd' angle between autistic and control subjects in their Nigerian study. De Bruin et al.²⁷ also failed to find any difference in the mean 'atd' angle between adolescents with ASD and typically developing boys. In contrast, other researchers have reported significantly wider 'atd' angles in autistic populations. Arrieta et al.¹⁹ found wider angles in their Basque sample of autistic children compared to controls. Stošljevic and Adamovic²⁰ reported significantly increased 'atd' angles in Serbian autistic boys. Haroun²⁸ similarly observed wider 'atd' angles in Egyptian autistic children. The differences indicate the potential influence of ethnic and genetic heterogeneity on dermatoglyphic traits. Walker²³ reported a smaller 'atd' angle in autistic patients, suggesting congenital interference in development. This variation across studies underscores the complexity of dermatoglyphic research and the need for population-specific normative data. An especially intriguing finding of our study was the pronounced difference between autistic males and females. Autistic females demonstrated substantially wider 'atd' angles (mean 45.66°) that approached the threshold for intermediate axial triradius position (t'), while autistic males maintained angles within the normal range (mean 41.24°). This sex-specific pattern has received limited attention in the dermatoglyphic literature. Arrieta et al.¹⁹ examined sex differences in

their autistic sample and found no significant differences between males and females. However, their sample size for females was small, potentially limiting statistical power. The more pronounced dermatoglyphic deviations noted in autistic females in our study may reflect a higher “genetic load” required for females to manifest autistic traits, consistent with the female-protective effect model.²⁹ This hypothesis posits that females require a greater accumulation of genetic risk factors to express the autistic phenotype, which could appear as more pronounced developmental anomalies, including dermatoglyphic alterations. The interpretation of dermatoglyphic findings in ASD must be grounded in embryological principles. Epidermal ridges begin to form during the 7th week of gestation and are completed by the 21st week.^{8,9} This period coincides with important phases of central nervous system development, including neuronal proliferation, migration, and early synaptogenesis.³⁰ The common ectodermal origin of the skin and nervous system provides a biological rationale for using dermatoglyphics as indirect markers of neurodevelopmental disturbances.¹¹ The position of the axial triradius, reflected in the ‘atd’ angle, is determined by the relative growth of the palm during fetal development.¹³ A distally displaced axial triradius (resulting in a wider ‘atd’ angle) may indicate altered growth patterns or developmental delays during the second trimester.³¹ Such disturbances could simultaneously affect brain development, possibly contributing to the pathogenesis of ASD. The genetic architecture of dermatoglyphic traits is complex and polygenic [32]. Family studies have shown significant heritability for various dermatoglyphic parameters, including the ‘atd’ angle.³³ In the context of ASD, which is also highly heritable with estimates ranging from 50–80% [34], common genetic factors influencing both traits could explain observed associations. Milicic, Petkovic, and Bozиков²¹ conducted family analyses and found significant interclass correlations between autistic sons and their parents for various dermatoglyphic traits, suggesting genetic transmission. The sex-specific patterns detected in our study raise the possibility of X-linked influences, consistent with the observation that when a trait is X-linked, mother-son and sister-sister correlations tend to be higher.³⁵ The male predominance in ASD (3.2:1 in our sample) further supports potential X-linked

contributions. While genetic factors play a predominant role in dermatoglyphic development, environmental insults during the critical period of ridge formation can also alter patterns. Maternal factors such as infections, nutritional deficiencies, toxic exposure, and hypoxia during the first and second trimesters have been associated with dermatoglyphic alterations.^{36,37} Many of these same factors have been implicated as risk factors for ASD [38,39]. The greater variability in ‘atd’ angles observed in our ASD group (range 28–65°) compared to controls (34–55°) may reflect the heterogeneous mixture of genetic and non-genetic influences causing autism etiology. Several methodological factors may explain differences between our findings and those of previous studies. First, differences in measurement techniques and the precise definition of triradii can cause variability. We followed the standardized method of Penrose¹³ to ensure consistency, but subtle differences in technique among studies cannot be ruled out. Second, age differences between study populations could influence comparisons, although dermatoglyphic patterns are established prenatally and do not change with age.⁴⁰ The size of the palm increases with age, but the angular relationships between triradii remain constant. Third, and most importantly, ethnic and racial variations in dermatoglyphic traits have been well-documented.^{24,41} Baseline frequencies of various dermatoglyphic parameters differ markedly across populations. Our study provides the first data on ‘atd’ angles in Bangladeshi children with ASD, adding to the global understanding of population-specific variations. The utility of the ‘atd’ angle as a clinical biomarker for ASD must be considered cautiously. While our findings show trends toward wider angles in autistic children, particularly females, the overlap between groups and lack of statistical significance preclude its use as a standalone diagnostic tool. However, when combined with other dermatoglyphic parameters — such as fingerprint patterns (increased arches and radial loops, decreased ulnar loops) and total finger ridge count — the ‘atd’ angle may contribute to a broader dermatoglyphic profile that could help in early screening.^{22,42} Dermatoglyphic analysis has several advantages as a potential screening tool: it is non-invasive, inexpensive, requires no specialized equipment beyond what is available in most clinical settings, and patterns remain stable throughout life.⁴³ However, it must be

emphasized that dermatoglyphics can only serve as an adjunct to comprehensive clinical evaluation, never as a replacement for established diagnostic procedures.⁴⁴

Strengths of The Study:

This study is the first to examine the 'atd' angle in Bangladeshi children with ASD, supplying valuable population-specific baseline data. It uses a rigorous methodology with standardized measurement techniques and includes sex-based analyses, revealing important patterns. Clear inclusion and exclusion criteria help minimize confounding factors.

Limitations of The Study:

The study's limitations include a small sample size, particularly for autistic females (n=12), which affects statistical power. Its single-center design limits generalizability, and the cross-sectional nature prevents establishing causality. Technical issues in obtaining clear palm prints, along with the lack of blinding, may introduce bias. Additionally, focusing only on the 'atd' angle limits the scope of dermatoglyphic profiling.

Recommendations for Future Research

Future studies should include larger, multicenter designs with more participants, particularly autistic females, to validate findings and establish normative data. Family-based studies could provide insights into heritability, while longitudinal research might examine whether prenatal dermatoglyphic changes predict ASD. Expanding the scope of dermatoglyphic parameters and exploring their correlation with ASD severity could offer more thorough insights. Cutting-edge imaging techniques and the combination of genetic and environmental data could further clarify the complex etiology of ASD.

Conclusion:

This study investigated the palmar 'atd' angle as a potential dermatoglyphic biomarker for autism spectrum disorder in Bangladeshi children. While children with ASD demonstrated a trend toward wider 'atd' angles compared to typically developing controls, particularly in the left hand, these differences did not reach statistical significance. However, notable sex-specific patterns appeared, with autistic females exhibiting substantially wider angles that approached the threshold for intermediate axial triradius position, denoting a possible sex-

linked influence on dermatoglyphic development in autism. The findings underscore the complexity of using dermatoglyphic traits as diagnostic markers for neurodevelopmental disorders. The 'atd' angle alone is unlikely to serve as a standalone biomarker for ASD, given the overlap between groups and the influence of ethnic, genetic, and non-genetic factors.

Nevertheless, when interpreted within a comprehensive dermatoglyphic profile that includes fingerprint patterns and ridge counts, the 'atd' angle may provide valuable information for early screening and risk assessment. Our study provides the first baseline data on 'atd' angles in Bangladeshi children with ASD, stressing the importance of population-specific research in dermatoglyphics. The results encourage additional investigation with larger samples, family-based designs, and standardised methodologies to clarify the complex relationships between prenatal development, dermatoglyphic patterns, and autism spectrum disorder.

Declarations

- **Ethics Approval and Consent to Participate:** Approved by IERB, Rangpur Medical College. Informed consent/assent obtained.
- **Consent for Publication:** Not applicable.
- **Availability of Data and Materials:** The datasets used are available from the corresponding author on reasonable request.
- **Competing Interests:** The authors declare no competing interests.
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Management of Fractures of the Mandible in a District Hospital in Bangladesh

*Alam AKMS¹, Rahman MM², Taleb MA³

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Keywords: Angle, Closed reduction, Facial fracture, Fixation, Mandibular fracture, Maxillofacial trauma'

Abstract:

Background: Mandibular fractures are common maxillofacial injuries causing functional, aesthetic, and psychosocial impact. In Bangladesh, district hospitals manage the majority of cases; however, data on fracture patterns and treatment outcomes are limited. Understanding local epidemiology is crucial for optimizing trauma care and allocating resources effectively. *Objectives:* To evaluate the patterns, management approaches, and clinical outcomes of mandibular fractures treated at a district hospital in Bangladesh. *Methods:* This retrospective cross-sectional study was conducted at Pabna Medical College & Hospital, Pabna, covering the period from January 2023 to December 2024. A total of 57 mandibular fracture patients were included via purposive sampling. Data on demographics, injury etiology, fracture sites, treatment, and outcomes were collected from hospital records and analyzed using SPSS version 23.0. *Results:* Total of 57 patients with mandibular fractures were analyzed, with males comprising 78.9% and females 21.1% ($p = 0.002$). The highest affected age group was 21–30 years (36.8%). Road traffic accidents accounted for 56.1% of cases ($p = 0.015$). The body (31.6%) and angle (24.6%) were the most common fracture sites ($p = 0.032$). Closed reduction was performed in 63.2%, open reduction in 36.8% ($p = 0.041$), and satisfactory outcomes were achieved in 86.0% ($p = 0.018$). *Conclusion:* Mandibular fractures in this district hospital predominantly affected young adult males and were mainly caused by road traffic accidents. Most involved the body and angle, and treatment-primarily closed reduction-resulted in favorable outcomes with minimal complications.

Introduction:

Mandibular fractures represent one of the most common forms of maxillofacial trauma and pose significant challenges due to their impact on mastication, speech, airway integrity, and facial aesthetics¹. The mandible is particularly vulnerable to injury because of its prominent position, mobility, and exposure to external forces during trauma². Globally, mandibular fractures account for a substantial proportion of facial bone injuries, with reported prevalence varying according to geographic location, socioeconomic conditions, and patterns of trauma^{3,4}. The etiology of mandibular fractures differs between developed and developing countries. In high-income settings, interpersonal violence and sports-

related injuries are frequently reported causes, whereas road traffic accidents (RTAs) remain the predominant cause in low- and middle-income countries⁵. Bangladesh, with rapid urbanization, increasing motorization, inadequate road safety measures, and inconsistent enforcement of traffic laws, experiences a high burden of RTA-related trauma, including maxillofacial injuries⁶. Young adult males are consistently identified as the most affected group, reflecting higher exposure to occupational hazards, outdoor activities, and high-risk behaviors⁷. The pattern of mandibular fractures is influenced by the direction and magnitude of traumatic force, as well as anatomical factors such as bone density and areas of structural weakness.

1. *Dr. A K M Serajul Alam, Associate Professor, Oral & Maxillofacial Surgery, Pabna Medical College, Pabna

2. Dr. Md. Masudur Rahman MBBS, Associate Professor (Ortho Surgery), Pabna Medical College, Pabna

3. Dr. Md. Abu Taleb, Assistant Professor (Orthopaedic Surgery) In Situ, 250 Bedded General Hospital, Pabna

4. Dr. A K M Serajul Alam, Associate Professor, Oral & Maxillofacial Surgery, Pabna Medical College, Pabna

Correspondent: *Dr. AKM Serajul Alam, Associate Professor, Oral & Maxillofacial Surgery, Pabna Medical College, Pabna, E-mail: serajul.alam@gmail.com, +880 1711538995

Common fracture sites include the symphysis, parasymphysis, body, angle, condyle, and ramus, with many patients presenting with multiple fracture locations⁸. Accurate identification of fracture patterns is essential for selecting appropriate treatment strategies and predicting outcomes. Management of mandibular fractures aims to restore pre-injury occlusion, ensure stable bone union, and preserve mandibular function while minimizing complications⁹.

Treatment modalities broadly include closed reduction with intermaxillary fixation (IMF) and open reduction with internal fixation (ORIF). While ORIF has become increasingly popular due to earlier mobilization and improved functional outcomes, closed reduction remains widely practiced in resource-limited settings because of its cost-effectiveness and reduced requirement for specialized equipment¹⁰. The choice of treatment is influenced by fracture type, displacement, patient factors, surgeon expertise, and institutional facilities. Despite advances in maxillofacial trauma care, complications such as infection, malocclusion, nonunion, and restricted mouth opening continue to be reported, particularly in delayed presentations and in settings with limited resources¹¹. Evaluating treatment outcomes is therefore crucial to assess the effectiveness of existing management protocols and identify areas for improvement. Most published studies on mandibular fractures originate from tertiary care centers, which may not reflect the realities of district-level hospitals where a large proportion of trauma patients are initially managed¹². District hospitals in Bangladesh serve as primary referral centers for trauma care for vast rural and semi-urban populations. However, there is a paucity of data regarding the patterns and outcomes of mandibular fractures managed at this level of healthcare. Local epidemiological evidence is essential to guide clinical decision-making, optimize resource allocation, and inform preventive strategies tailored to regional needs¹³. Against this background, the present study was designed to evaluate the patterns, management approaches, and clinical outcomes of mandibular fractures treated in a district hospital of Bangladesh.

Methods:

This retrospective cross-sectional study was conducted at Pabna Medical College & Hospital, Pabna. The study population comprised patients

diagnosed with mandibular fractures who were admitted to or treated in the Department of Oral and Maxillofacial Surgery during the study period from January 2023 to December 2024. A total of 57 patients were included based on the availability of complete medical records.

Inclusion criteria: Patients of all age groups and both sexes with a confirmed diagnosis of mandibular fracture were included in the study. Only cases managed at the study hospital with documented clinical findings, radiological evidence, treatment details, and outcome records were considered eligible for analysis.

Exclusion criteria: Patients with incomplete or missing medical records were excluded from the study. Cases with associated midface fractures requiring referral to higher centers, pathological fractures, and patients who left against medical advice or were lost to follow-up were also excluded.

Study procedure: Data were retrieved retrospectively from hospital case records using a structured data collection sheet. Variables included demographic characteristics, etiology of injury, fracture site and pattern, management modality, duration of hospitalization, and postoperative outcomes. Diagnosis was based on clinical examination and radiographic evaluation, including orthopantomogram and plain radiographs.

Data analysis: Collected data were entered and analyzed using SPSS version 23.0. Descriptive statistics such as frequencies, percentages, means, and standard deviations were used to summarize variables. Results were presented in tables and figures where appropriate. Statistical significance was considered at a 95% confidence level.

Results:

Total of 57 patients with mandibular fractures were analyzed. The mean age of the patients was 29.8 ± 11.6 years. The highest proportion of cases was observed in the 21–30-year age group (36.8%), followed by the 31–40-year group (24.6%). Males constituted a significantly larger proportion of the study population (78.9%) compared to females (21.1%), and this difference was statistically significant ($p = 0.002$). Road traffic accidents were the predominant cause of mandibular fractures, accounting for 56.1% of cases, followed by physical assault (24.6%) and falls (14.0%). Other causes, including sports- and work-related injuries, comprised 5.3% of cases. The distribution of etiology showed a statistically significant variation among

patients ($p = 0.015$), with road traffic accidents being more frequent among male patients (62.2%) than females (33.3%). Analysis of fracture characteristics revealed that the body of the mandible was the most commonly affected site (31.6%), followed by the angle (24.6%) and para-symphysis (21.1%). Condylar fractures accounted for 15.8% of cases, while 7.0% of patients presented with multiple fracture sites. The variation in fracture-site distribution was statistically significant ($p = 0.032$). Regarding management, closed reduction with intermaxillary fixation was employed in 63.2% of patients, whereas open reduction and internal fixation were performed in 36.8%. Closed reduction was more frequently used in single-site fractures (72.2%), while open reduction was significantly associated with multiple or displaced fractures ($p = 0.041$). Clinical outcomes were predominantly favorable. Satisfactory outcomes were achieved in 86.0% of patients, characterized by stable occlusion and adequate mouth opening. Minor complications occurred in 10.5% of cases, mainly superficial infection and transient malocclusion, while major complications were observed in 3.5% of patients. Complication rates were significantly higher in patients treated with open reduction and internal fixation compared to closed reduction ($p = 0.018$). Overall, the results indicate effective management of mandibular fractures at the district hospital level with acceptable outcome and complication rates.

Table 1: Distribution of patients by age group and sex (n=57)

Age group	n/ (%)	Male: Female
≤20yrs	9 (15.8)	6:3
21–30yrs	21 (36.8)	18:3
31–40yrs	14 (24.6)	11:3
>40yrs	13 (22.8)	10:3

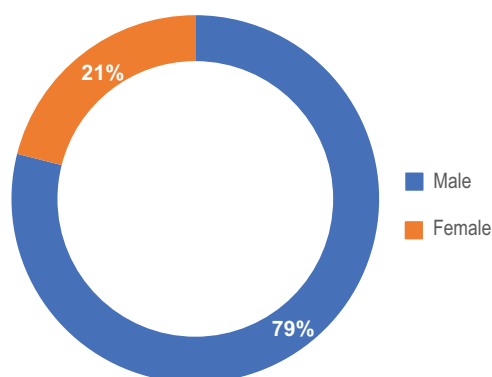


Figure 1: Sex distribution of study participants

Table II: Etiology of mandibular fractures

Etiology	n	%
Road traffic accident	32	56.1
Physical assault	14	24.6
Fall	8	14.0
Others	3	5.3

p -value = 0.015, Data analysis test: Chi-square test

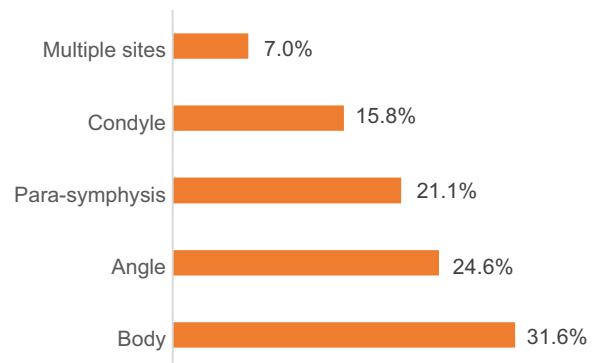


Figure 2: Distribution of fracture sites

Table III: Treatment modalities

Treatment modality	n	%
Closed reduction with IMF	36	63.2
ORIF	21	36.8
Total	57	100.0

p -value = 0.041, Data analysis test: Chi-square test, ORIF=Open reduction and internal fixation

Table IV: Treatment outcomes and complications

Outcome	n	%
Satisfactory	49	86.0
Minor complications	6	10.5
Major complications	2	3.5

p -value = 0.018, Data analysis test: Fisher's exact test

Discussion:

The present study provides insight into the patterns, management strategies, and outcomes of mandibular fractures treated at a district-level hospital in Bangladesh. The findings highlight important epidemiological and clinical trends that are broadly consistent with reports from other low- and middle-income countries, while also reflecting the realities of

care delivery in resource-constrained settings. In this study, mandibular fractures predominantly affected young adult males, with males comprising nearly four-fifths of the study population. This male predominance has been consistently reported in recent literature and is commonly attributed to greater exposure to outdoor activities, occupational hazards, and high-risk behaviors such as reckless driving and interpersonal violence^{14,15}.

The peak incidence in the third decade of life observed in this study aligns with findings from studies conducted in South Asia and other developing regions, where economically productive age groups are disproportionately affected by trauma¹⁶. Road traffic accidents were identified as the leading cause of mandibular fractures, accounting for more than half of the cases. This observation is in agreement with several contemporary studies from developing countries, where inadequate road safety measures, poor enforcement of traffic laws, and increasing vehicular density contribute significantly to maxillofacial injuries^{17,18}. In contrast, studies from high-income countries often report interpersonal violence as the primary etiology, underscoring the influence of socioeconomic and cultural factors on injury patterns¹⁹. The continued predominance of RTA-related mandibular fractures in Bangladesh emphasizes the urgent need for strengthened road safety policies and public awareness programs.

Regarding fracture patterns, the body and angle of the mandible were the most commonly involved sites in this study. Similar distributions have been reported in recent studies, which suggest that these regions are structurally vulnerable to direct lateral and oblique forces during trauma²⁰. Although condylar fractures are frequently reported in the literature, their relatively lower prevalence in this study may reflect underdiagnosis or selective referral of more complex cases to tertiary care centers. The presence of multiple fracture sites in a subset of patients further highlights the severity of trauma encountered at the district hospital level. Treatment modalities in the present study were influenced by fracture characteristics and available resources. Closed reduction with intermaxillary fixation was the most commonly used approach, particularly for single-site and minimally displaced fractures. This finding is consistent with reports from similar healthcare settings, where closed reduction remains a practical and cost-effective option²¹.

Although open reduction and internal fixation are increasingly regarded as the standard of care for displaced mandibular fractures, their utilization in district hospitals may be limited by factors such as availability of equipment, surgical expertise, and financial constraints²². Clinical outcomes in this study were generally favorable, with more than four-fifths of patients achieving satisfactory functional recovery. Comparable outcome rates have been reported in recent studies, indicating that acceptable results can be achieved even in non-tertiary settings when appropriate case selection and management protocols are followed²³. The overall complication rate was low, with minor complications such as superficial infection and transient malocclusion being the most common. As observed in other studies, complications were more frequent among patients undergoing open reduction and internal fixation, possibly due to greater injury severity and surgical exposure²⁴. The findings of this study underscore the capacity of district hospitals to effectively manage a substantial proportion of mandibular fracture cases.

However, the results also point to the need for standardized treatment guidelines, improved diagnostic facilities, and targeted training of healthcare providers to further optimize outcomes. Moreover, preventive strategies focusing on road traffic injury reduction could substantially decrease the burden of mandibular fractures in Bangladesh. Despite its contributions, this study should be interpreted in light of existing evidence. When compared with similar studies from tertiary care centers, variations in etiology, fracture patterns, and management approaches are evident, reflecting differences in referral patterns and resource availability²⁵. Nonetheless, the present study adds valuable local data and helps bridge the existing knowledge gap regarding mandibular fracture management at the district level in Bangladesh.

Limitations

This study was limited by its retrospective design, small sample size, and reliance on hospital records, which may have resulted in missing data. Being a single-center district hospital study, the findings may not be generalizable to all healthcare settings in Bangladesh.

Conclusion

This study demonstrates that mandibular fractures in a district hospital of Bangladesh predominantly

affect young adult males and are mainly caused by road traffic accidents. The body and angle of the mandible were the most commonly involved sites. Closed reduction remained the preferred treatment modality, and overall clinical outcomes were favorable with low complication rates, indicating effective management at the district hospital level.

Recommendation:

Strengthening road safety measures and public awareness programs is essential to reducing mandibular fractures. Upgrading diagnostic facilities, ensuring the availability of fixation materials, and providing regular training for healthcare professionals at district hospitals may further improve management outcomes.

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Psychosocial Impact of Blood Donation: A Cross-Cultural Study on Motivational and Sociocultural Factors Influencing Donor Behavior

*Shoyeb AKM¹, Ali MA², BurmonT³

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Blood donation, Blood donor behaviour, sociocultural factors in blood donation, public trust,

Abstract:

Background: Blood donation is essential for healthcare systems worldwide, yet maintaining an adequate donor pool remains challenging, particularly in developing countries like Bangladesh where only 30% of blood comes from voluntary donors. Understanding psychosocial and sociocultural factors influencing donor behavior is crucial for developing effective recruitment strategies.

Objective: This study aimed to assess motivational factors, barriers, and sociocultural influences affecting blood donation behavior among donors and non-donors in Sirajganj, Bangladesh.

Methods: A cross-sectional comparative study was conducted from January to June 2024 at the Department of Transfusion Medicine, Shaheed M. Monsur Ali Medical College, Sirajganj. A total of 200 participants (100 donors, 100 non-donors) were enrolled using purposive sampling. Data were collected through face-to-face interviews using a structured questionnaire covering sociodemographics, motivations, barriers, and sociocultural beliefs. Statistical analysis was performed using SPSS version 26 with descriptive statistics, chi-square tests, t-tests, and binary logistic regression.

Results: Donors were predominantly male (91.0% vs. 66.0%, $p<0.001$), educated (64.0% vs. 44.0%, $p=0.012$), and urban residents (56.0% vs. 42.0%, $p=0.020$). Altruistic motivation was the strongest domain (mean 4.40), with 92.0% reporting satisfaction from helping others. Among non-donors, primary barriers were lack of awareness (48.0%), lack of time (46.0%), fear of fainting (44.0%), and misconceptions about weakness (37.0%). Donors demonstrated significantly higher knowledge (3.42 vs. 2.18, $p<0.001$), greater public trust (4.12 vs. 3.24, $p<0.001$), and stronger social support (3.86 vs. 3.12, $p<0.001$). Independent predictors of donation were male gender (AOR=6.17), knowledge of blood group (AOR=5.37), public trust (AOR=3.45), knowledge score (AOR=2.89), and higher education (AOR=2.14).

Conclusion: Blood donation in Sirajganj is driven primarily by altruism, intrinsic rewards, and religious beliefs, while lack of awareness, fear, and mistrust are major barriers. Public trust emerged as a critical independent predictor. Targeted interventions addressing knowledge gaps, leveraging religious motivation, and building institutional trust are essential for increasing voluntary blood donation in Bangladesh.

Introduction:

Blood donation is a cornerstone of modern healthcare, essential for surgeries, trauma management, treatment of chronic diseases such as thalassemia, and maternal health emergencies. The World Health Organization (WHO) recommends that all countries achieve 100% voluntary non-remunerated blood

donation (VNRBD) to ensure a safe and adequate blood supply, with voluntary donors from low-risk populations being the safest source.^{1,2} Despite global efforts, maintaining a stable donor pool remains a significant challenge, particularly in low- and middle-income countries where replacement donation still predominates.³ Bangladesh, with a

1. *Dr. AKM Shoyeb Assistant Professor, Department of Transfusion Medicine, Shaheed M. Monsur Ali Medical College, Sirajganj, Bangladesh.

2. Assistant Professor, Department of Microbiology, Shaheed M. Monsur Ali Medical College, Sirajganj, Bangladesh

3. Assistant Professor, Department of Transfusion Medicine, Shaheed Ziaur Rahman Medical College, Bogura, Bangladesh

Corresponding Author: *Dr. AKM Shoyeb Assistant Professor, Department of Transfusion Medicine, Shaheed M. Monsur Ali Medical College, Sirajganj, Bangladesh. **Email:** akmshoyeb@gmail.com, Phone: +880 1717-553530

population exceeding 170 million, faces substantial challenges in meeting its blood requirements. According to the National Safe Blood Transfusion Programme under the Directorate General of Health Services, the estimated annual demand stands at approximately 800,000 to 1,000,000 units of blood, primarily needed for managing various medical conditions, particularly among women of childbearing age, thalassemia patients, and victims of road traffic accidents⁴. Currently, only about 30% of the country's blood supply comes from voluntary donors, with the remaining 70% sourced through family or replacement donors, highlighting a significant gap in meeting national demand through voluntary donations alone⁴.

A recent assessment conducted by WHO revealed that, despite high demand, a portion of collected blood remains unused, highlighting inefficiencies in need-based collection and utilization planning⁴. The decision to donate blood is complex and multifactorial, influenced by an interplay of psychological, social, cultural, and structural factors⁵. Altruism, the selfless desire to help others, has consistently been identified as a primary motivator for blood donation across diverse cultural settings. However, motivations extend beyond pure altruism and include personal values, social responsibility, religious beliefs, intrinsic rewards, and family obligations⁵.

The Self-Determination Theory (SDT) framework has gained attention in understanding donor motivation, distinguishing between intrinsic motivation and various forms of extrinsic regulation, with integrated and intrinsic regulation emerging as key drivers of sustained donation⁶. Conversely, numerous barriers prevent individuals from donating blood. Fear-related factors, including fear of needles, pain, dizziness, and seeing blood, are consistently reported across studies³. Logistical barriers such as lack of time, inconvenient donation center locations, and limited awareness about donation procedures further compound the problem³.

Health misconceptions, including beliefs that donation causes weakness or has negative health effects, also contribute to non-donation. A study conducted among residential students and teachers of religious institutions in Jamalpur district, Bangladesh, provides valuable insights into local barriers and motivators⁷. The study found that over

90% of participants were aged 18-30 years, yet the majority (92%) had never donated blood. Common reasons for not donating were lack of knowledge (40%), lack of opportunity (20%), thinking it was harmful to health (21%), and fearing needles (16%). Importantly, more than 67% did not know their blood group, and about 61% had never heard of or could not recall any blood donation program. However, the same study revealed strong motivational potential rooted in religious and moral beliefs. More than 80% of participants considered blood donation a moral responsibility and an Islamic act. Those who considered blood donation a religious act and a moral responsibility were twice as likely to become regular blood donors. Participants willing to donate blood to strangers were four times more likely to do so regularly. These findings underscore the importance of culturally and religiously tailored messaging in the Bangladeshi context. Recent research in Khulna city, Bangladesh, examined knowledge, attitude, and practice of voluntary blood donation among 720 residents. The study found that only 68.58% were knowledgeable about blood donation, and 64.71% had practiced voluntary blood donation. Higher education was significantly associated with better knowledge, with those having master's degrees or above showing 3.27 times higher odds of knowledge. Being male (AOR=3.6), knowing about voluntary blood donation (AOR=2.31), and having a positive attitude (AOR=3.78) were significant factors for practicing blood donation. The study concluded that residents demonstrate poor blood donation practices and limited knowledge, emphasizing the need for awareness campaigns by health authorities and organizations. Sociocultural factors play a particularly important role in shaping donation behavior in collectivist societies like Bangladesh. Research on South Asian communities has revealed context-specific beliefs about blood and blood donation. Studies in Pakistan have documented how gendered notions of blood construct reproductive blood loss as less serious than other types of blood loss, affecting donation practices.

In India, researchers have identified that blood donation is intertwined with religious experience and community dynamics⁹. These findings underscore the importance of understanding local belief systems rather than relying on uniform global policies. Recent cross-cultural research across 28 European countries demonstrated that country-level public trust in the

healthcare system significantly predicts individual donation behavior, often more strongly than objective healthcare quality indicators¹⁰. This finding highlights the role of subjective perceptions of the healthcare system for blood donation behavior. Public trust in healthcare institutions may be particularly relevant in Bangladesh, where perceptions of safety and transparency could influence willingness to donate. Despite growing international literature, limited research has been conducted on blood donation behavior in Bangladesh, particularly in semi-urban and rural settings like Sirajganj district. Most existing studies have focused on metropolitan areas such as Dhaka, Khulna, and Jamalpur^{7,8}, leaving a gap in understanding the psychosocial and sociocultural factors affecting donation behavior in smaller cities and surrounding rural communities. Sirajganj, with its mixed urban-rural population and reliance on a tertiary care hospital, provides an ideal setting to examine these factors.

Objectives:

Primary Objective:

- To assess the motivational factors influencing blood donation behavior among donors and non-donors in Sirajganj, Bangladesh

Secondary Objectives:

- To identify barriers to blood donation among non-donors
- To examine the role of sociocultural factors (religion, family influence, community norms) in shaping donation behavior
- To compare knowledge, attitudes, and public trust between donors and non-donors

Methods:

This cross-sectional comparative study was conducted from January to June 2025 at the Department of Transfusion Medicine, Shaheed M. Monsur Ali Medical College, Sirajganj, Bangladesh, a tertiary care hospital serving approximately 4 million people from northern Bangladesh. The study included 200 participants aged ≥ 18 years, comprising 100 blood donors and 100 non-donors. Donors were individuals who had donated blood at least once, while non-donors had never donated. Sample size was calculated using the formula for comparing two proportions (95% confidence level, 80% power), yielding 85 participants per group; this was increased

to 100 per group to account for incomplete responses. Donors were recruited consecutively from the transfusion medicine department and blood donation camps, while non-donors were recruited from hospital visitors and community members using purposive sampling. Inclusion criteria were age ≥ 18 years, willingness to participate, and ability to understand Bengali; exclusion criteria were age < 18 years, severe illness, inability to communicate, or refusal to consent. A structured questionnaire was developed based on literature review and consisted of seven sections: sociodemographic information (8 items), blood donation history (6 items), motivational factors (20 items across five domains), barriers (20 items across five domains), sociocultural factors (16 items), future donation willingness (3 items), and open-ended suggestions. Motivational and barrier items were measured on a 5-point Likert scale (1=Strongly Disagree to 5=Strongly Agree).

The questionnaire was translated into Bengali and back-translated to English by independent bilingual experts. Content validity was assessed by three experts (two transfusion medicine specialists and one public health expert). A pilot study with 30 participants assessed clarity and comprehensibility, leading to minor modifications. Reliability testing yielded Cronbach's alpha values of 0.82 for motivational factors, 0.79 for barriers, and 0.81 for sociocultural factors, indicating good internal consistency. Face-to-face interviews were conducted by trained research assistants in private settings at the transfusion medicine department, blood donation camps, and community outreach programs.

Each interview lasted 15-20 minutes; for participants with limited literacy, questions were read verbatim in Bengali. Ethical approval was obtained from the Institutional Review Board of Shaheed M. Monsur Ali Medical College, and written informed consent was secured from all participants. Confidentiality and anonymity were strictly maintained. Data were analyzed using SPSS version 26. Descriptive statistics (frequencies, percentages, mean, SD) were calculated for all variables. Chi-square tests compared categorical variables between groups, and independent t-tests compared mean scores. Bivariate analysis calculated odds ratios (OR) with 95% confidence intervals (CI). Binary logistic regression identified independent predictors of donation status, with variables showing $p < 0.10$ in bivariate analysis

entered into the model. Adjusted odds ratios (AOR) with 95% CI were calculated. Model fit was assessed using the Hosmer-Lemeshow test ($p > 0.05$ indicating good fit). Statistical significance was set at $p < 0.05$.

Results:

A total of 200 participants were enrolled, comprising 100 blood donors and 100 non-donors. Table I presents the sociodemographic characteristics. The majority of participants were aged 18-29 years (62.0%). Males comprised 78.5% of

the sample, with a significantly higher proportion among donors (91.0%) compared to non-donors (66.0%) ($p < 0.001$). Educational attainment was significantly associated with donation status ($p = 0.012$), with 64.0% of donors having higher secondary education or above versus 44.0% of non-donors. Monthly income ($p = 0.049$) and urban residence ($p = 0.020$) were also significantly associated with donation status. No significant difference was observed for religion ($p = 0.892$).

Table I: Sociodemographic Characteristics of Study Participants (N=200)

Characteristic	Category	Total (N=200) n (%)	Donors (n=100) n (%)	Non-Donors (n=100) n (%)	χ^2	p-value
Age Group (years)	18-29	124 (62.0)	68 (68.0)	56 (56.0)	5.23	0.073
	30-39	48 (24.0)	22 (22.0)	26 (26.0)		
	40 and above	28 (14.0)	10 (10.0)	18 (18.0)		
Gender	Male	157 (78.5)	91 (91.0)	66 (66.0)	18.24	<0.001
	Female	43 (21.5)	9 (9.0)	34 (34.0)		
Religion	Islam	183 (91.5)	92 (92.0)	91 (91.0)	0.21	0.892
	Hinduism	15 (7.5)	7 (7.0)	8 (8.0)		
	Other	2 (1.0)	1 (1.0)	1 (1.0)		
Educational Level	No formal education	18 (9.0)	4 (4.0)	14 (14.0)	14.85	0.012
	Primary (1-5)	26 (13.0)	10 (10.0)	16 (16.0)		
	Secondary (6-10)	48 (24.0)	22 (22.0)	26 (26.0)		
	Higher Secondary	54 (27.0)	32 (32.0)	22 (22.0)		
	Graduate and above	54 (27.0)	32 (32.0)	22 (22.0)		
Monthly Income (BDT)	<10,000	48 (24.0)	18 (18.0)	30 (30.0)	7.86	0.049
	10,001-25,000	72 (36.0)	36 (36.0)	36 (36.0)		
	25,001-50,000	52 (26.0)	32 (32.0)	20 (20.0)		
	>50,000	28 (14.0)	14 (14.0)	14 (14.0)		
Residential Area	Urban	98 (49.0)	56 (56.0)	42 (42.0)	5.42	0.020
	Rural	102 (51.0)	44 (44.0)	58 (58.0)		

*Data presented as frequency (percentage). Chi-square test was used to compare between groups. Bold p-values indicate statistical significance ($p < 0.05$).

Figure 1 presents the percentage of agreement with various motivational factors for blood donation among 100 donors. The data highlights the key reasons influencing individuals to donate blood, with the highest motivation being "Satisfaction from helping others" (92%), followed by "Help someone in need" (89%) and "Happiness/mental peace after donation" (88%). Other notable motivators include

the sense of moral responsibility (84%) and humanitarian duty (86%). Motivations linked to community respect, family experiences, and peer influence show comparatively lower percentages, with "Influenced by friends who donate" at 54%. This figure illustrates the diverse factors that encourage individuals to engage in blood donation, with a predominant focus on personal fulfillment and a sense of duty.

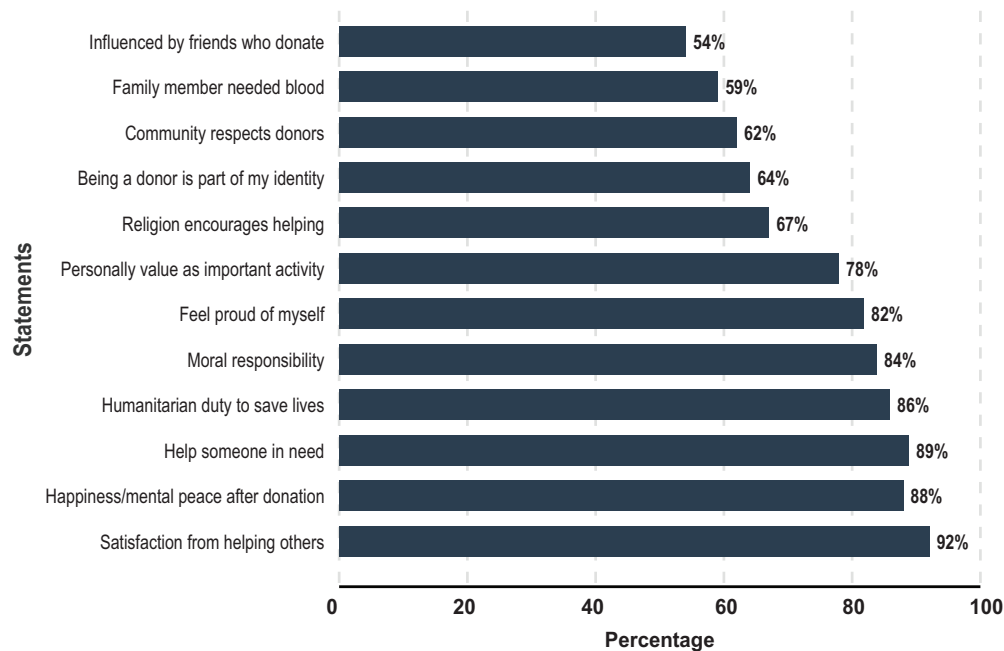


Figure 1: Motivational Factors for Blood Donation Among Donors (n=100)

Figure 2 illustrates the barriers preventing blood donation among 100 non-donors. The top barriers identified include “Don’t know where to donate” (48%) and “Lack of time” (46%), followed closely by “Fear of fainting/dizziness” and “Don’t know donation process” (44%). Other significant obstacles include fear-related concerns, such as “Fear of needles” (41%) and “Fear of pain” (38%). The data

also reveals logistical issues, including “Never had opportunity” (42%) and “Distance to center too far” (38%). The perception that donation may cause weakness (37%) and concerns about the potential sale of donated blood (36%) also contribute to hesitancy. This figure highlights the various factors that prevent individuals from donating blood, ranging from lack of knowledge and opportunity to physical and psychological barriers.

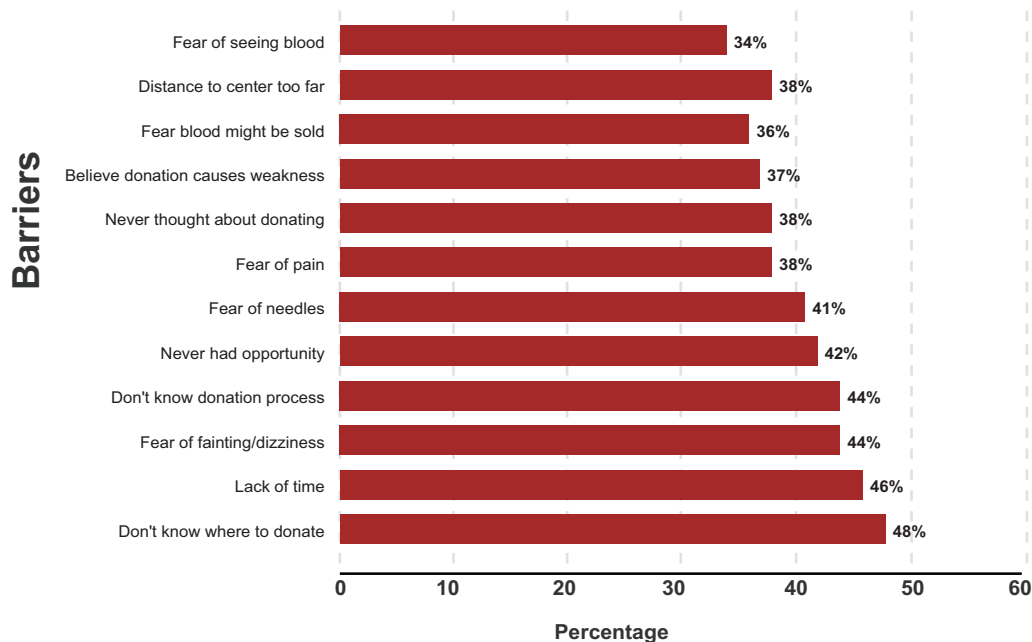


Figure 2: Barriers to Blood Donation Among Non-Donors (n=100)

Table II compares psychosocial factors between donors and non-donors. Donors demonstrated significantly higher knowledge (3.42 vs. 2.18, $p < 0.001$), more positive attitudes (4.38 vs. 3.42, $p < 0.001$), greater public trust (4.12 vs. 3.24, $p < 0.001$), and stronger perceived social support (3.86 vs. 3.12, $p < 0.001$) compared to non-donors.

Table 3 presents factors that would encourage future donation. Family need was the strongest potential motivator (68.0%), followed by convenient donation camps (61.0%), better awareness (60.0%), and safety assurance (59.0%). Non-donors rated all factors higher than donors, indicating greater responsiveness to interventions.

Table 4 presents factors associated with blood donation status. Bivariate analysis revealed that gender had the strongest association, with males having 5.20 times higher odds of donating compared to females (OR=5.20, $p < 0.001$). Knowing one's blood group was also strongly linked, with those aware having 7.37 times higher odds of donating (OR=7.37, $p < 0.001$). Higher education ($\geq$ Higher Secondary) increased the odds of donating by 2.27 times (OR=2.27, $p = 0.005$), while urban residents had 1.76 times higher odds compared to rural residents (OR=1.76, $p = 0.047$). Higher income showed a positive association but was not statistically significant (OR=1.65, $p = 0.082$).

Table II: Comparison of Psychosocial Factors Between Donors and Non-Donors

Variable	Donors (n=100) Mean $\pm$ SD	Non-Donors (n=100) Mean $\pm$ SD	Mean Difference	t- value	p-value
Knowledge about Blood Donation (0-4)	3.42 $\pm$ 0.68	2.18 $\pm$ 0.94	1.24	10.68	<0.001
Attitude toward Blood Donation (1-5)	4.38 $\pm$ 0.52	3.42 $\pm$ 0.78	0.96	10.24	<0.001
Public Trust in Healthcare System (1-5)	4.12 $\pm$ 0.65	3.24 $\pm$ 0.89	0.88	8.06	<0.001
Perceived Social Support (1-5)	3.86 $\pm$ 0.72	3.12 $\pm$ 0.84	0.74	6.72	<0.001

*Data presented as mean $\pm$ standard deviation. Independent t-test was used for comparison between groups. Bold p-values indicate statistical significance ($p < 0.001$). *

Table III: Factors Encouraging Blood Donation (Multiple Responses) (N=200)

Encouraging Factor	Donors (n=100) n (%)	Non-Donors (n=100) n (%)	Total (N=200) n (%)
Family member or friend needs blood	64 (64.0)	72 (72.0)	136 (68.0)
Donation camp near home/ workplace	58 (58.0)	64 (64.0)	122 (61.0)
Better awareness about blood donation	52 (52.0)	68 (68.0)	120 (60.0)
Assurance about safety and hygiene	56 (56.0)	62 (62.0)	118 (59.0)
Free health check-up	42 (42.0)	48 (48.0)	90 (45.0)
Seeing more community members donate	44 (44.0)	46 (46.0)	90 (45.0)
Religious leaders encouraging donation	38 (38.0)	42 (42.0)	80 (40.0)

Data presented as frequency (percentage). Participants could select multiple options.

Table IV: Bivariate Analysis of Factors Associated with Blood Donation Status

Variable	Category	Donors (n=100) n (%)	Non-Donors (n=100) n (%)	Odds Ratio (95% CI)	p-value
Gender	Male	91 (91.0)	66 (66.0)	5.20(2.32-11.65)	<0.001
	Female	9 (9.0)	34 (34.0)	Reference	
Education	$\leq$ Higher Secondary	64 (64.0)	44 (44.0)	2.27 (1.29-3.99)	0.005
	$\geq$ Secondary	36 (36.0)	56 (56.0)	Reference	
Residence	Urban	56 (56.0)	42 (42.0)	1.76 (1.01-3.06)	0.047
	Rural	44 (44.0)	58 (58.0)	Reference	
Knows	Yes	94 (94.0)	68 (68.0)	7.37 (2.98-18.22)	<0.001
Blood Group	No	6 (6.0)	32 (32.0)	Reference	

*Data presented as frequency (percentage). Odds ratio (OR) and 95% confidence interval (CI) calculated using binary logistic regression. Bold p-values indicate statistical significance ($p < 0.05$). *

Table V: Binary Logistic Regression - Independent Predictors of Blood Donation

Predictor Variable	B	S.E.	Wald	df	p-value	Adjusted Odds Ratio (AOR)	95% CI for AOR
Gender (Male vs. Female)	1.82	0.48	14.38	1	<0.001	6.17	2.41 - 15.82
Education ($\geq$ Higher Secondary vs. $\leq$ Secondary)	0.76	0.38	4.00	1	0.045	2.14	1.02 - 4.51
Knows Blood Group (Yes vs. No)	1.68	0.52	10.44	1	0.001	5.37	1.94 - 14.86
Public Trust in Healthcare System (per unit increase)	1.24	0.32	15.02	1	<0.001	3.45	1.84 - 6.47
Knowledge Score (per unit increase)	1.06	0.28	14.33	1	<0.001	2.89	1.67 - 5.00
Constant	-6.84	1.42	23.20	1	<0.001	0.001	

Model Summary: Hosmer-Lemeshow Goodness-of-Fit Test: $\chi^2 = 6.24$, $df = 8$, $p = 0.62$; Nagelkerke $R^2 = 0.58$; Overall correct classification rate: 82.5%

Table V highlights the independent predictors of blood donation status identified through logistic regression. The model was statistically significant ($\chi^2=89.64$, $p<0.001$), explaining 58% of the variance and accurately classifying 82.5% of cases. The strongest predictor was male gender, with males having 6.17 times higher odds of donating compared to females (AOR=6.17, $p<0.001$). Knowledge of one's blood group was also a powerful predictor, increasing the odds of donation by 5.37 times (AOR=5.37, $p=0.001$). Public trust in healthcare played a significant role, with each unit increase in trust boosting the odds of donation by 3.45 times (AOR=3.45, $p<0.001$). Additionally, higher knowledge scores and higher education were associated with increased odds of donation, with odds increasing by 2.89 times (AOR=2.89, $p<0.001$) and 2.14 times (AOR=2.14, $p=0.045$), respectively. In contrast, factors like residence (urban/rural) and income did not remain significant in the multivariate model, suggesting their effects were mediated by other variables like education and knowledge.

Discussion:

This study examined the psychosocial and sociocultural factors influencing blood donation behavior among 200 participants in Sirajganj, Bangladesh. The findings reveal significant differences between donors and non-donors across multiple domains and provide important insights for developing targeted interventions. The socio-demographic profile of donors in this study—predominantly male (91.0%), young (68.0% aged 18-

29 years), and educated (64.0% with higher secondary education or above)—is consistent with previous research in similar settings. Studies in India and Iran have reported comparable gender disparities, with males comprising over 90% of donor populations^{11,12}.

The low representation of female donors (9.0%) in our study reflects cultural norms, higher prevalence of anemia, and gender-specific barriers that require targeted interventions¹³. Altruistic motivation emerged as the strongest domain (mean 4.40), with 92.0% reporting satisfaction from helping others. This finding aligns with global literature identifying altruism as the primary driver of voluntary blood donation¹⁴. The high endorsement of intrinsic rewards (88.0% experiencing happiness and mental peace) supports previous research documenting the “warm glow” effect of donation, where positive emotions serve as powerful reinforcers for continued donation behavior¹⁵. Religious motivation played a significant role, with 67.0% agreeing that their religion encourages helping others. This finding is particularly relevant for Muslim-majority countries. A study in Iran reported similar findings, with religious duty serving as an important motivator for donation¹².

Research in Cameroon also documented that participants viewed donation as both a humanitarian act and a form of religious responsibility¹⁶. This underscores the potential of engaging religious leaders in blood donation advocacy. Among non-donors, lack of awareness was the highest-scoring barrier domain (mean 3.26), with 48.0% unaware of

donation locations. This mirrors findings from studies in India where lack of knowledge about donation procedures and locations was a primary barrier¹³. Fear-related barriers particularly fear of fainting (44.0%) and fear of needles (41.0%) were also prominent, consistent with research across multiple countries identifying fear as a universal deterrent^{14,17}. A Nigerian study similarly identified fear of blood and time constraints as major deterrent factors¹⁷. Mistrust emerged as a concerning barrier, with 36.0% fearing blood might be sold. This finding aligns with research from Cameroon where participants expressed fear of the “ritualistic use” of donated blood and perceptions that donation is a commercial activity¹⁶. Recent cross-cultural research across 28 European countries demonstrated that public trust in healthcare systems significantly predicts donation behavior, often more strongly than objective healthcare quality indicators¹⁰. This highlights the critical importance of building institutional trust through transparency and quality assurance. The significant differences between donors and non-donors in knowledge, attitudes, public trust, and social support highlight the multifaceted nature of donation behavior.

A multi-country study of university students across 16 countries found that knowledge about blood donation was significantly associated with positive attitudes and donation behavior¹⁸. These findings suggest that interventions must address multiple domains simultaneously rather than focusing on single factors. The multivariate analysis identified male gender (AOR=6.17), knowledge of blood group (AOR=5.37), public trust (AOR=3.45), knowledge score (AOR=2.89), and higher education (AOR=2.14) as independent predictors of donation status. The strong association between knowing one's blood group and donation behavior suggests that blood group testing camps could serve as an entry point for donor recruitment. Studies in India have reported that 41.9% of non-donors were unaware of their blood group, similar to our findings¹³. Encouragingly, 60.0% of non-donors expressed willingness to donate in the future, with family need (68.0%) and convenient donation camps (61.0%) identified as the strongest potential motivators¹⁵. This represents a significant opportunity for conversion, consistent with research showing that convenient access and

personal relevance are key facilitators of donation behavior.

Conclusion:

This study examined the psychosocial and sociocultural factors influencing blood donation behavior among 200 participants in Sirajganj, Bangladesh. The findings reveal that donors are predominantly male, young, educated, and urban residents. Altruism is the strongest motivator, followed by intrinsic rewards and religious beliefs. Among non-donors, lack of awareness, fear of fainting, lack of time, and misconceptions about weakness are the primary barriers. Donors demonstrate significantly higher knowledge, more positive attitudes, greater public trust, and stronger social support compared to non-donors. Independent predictors of donation include male gender, knowledge of blood group, public trust, knowledge score, and higher education. These findings highlight the complex interplay of individual, social, and institutional factors shaping donation behavior in Bangladesh.

Recommendations:

Further research is warranted to deepen understanding of donation behavior in Bangladesh. Qualitative studies exploring gender-specific barriers through in-depth interviews with female non-donors would provide rich contextual insights. Longitudinal research tracking motivational changes over time among first-time donors could identify factors influencing retention. Intervention studies testing the effectiveness of religiously-tailored messaging and trust-building initiatives would provide evidence for program design. Expanding research to other districts would enable national-level comparisons and more generalizable findings.

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Evaluation of Treatment of Fracture Shaft of Femur in Children with Titanium Elastic Nail

*Habib HA¹, Salam SI², Hasan J³, Taleb MA⁴, Ullah MM⁵, Islam MS⁶, Md. Zaman MH⁷

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Keywords: Pediatric femur Fracture, Titanium Elastic Nail(TEN), Flynn criteria, Functional Outcome.

Abstract:

Background : Femoral shaft fracture is an incapacitating paediatric injury. It is common in our country and also in orthopaedics OPD, DMCH. The best treatment between six and sixteen years of age is a matter of debate. There has been resurgence worldwide for operative fixation. Titanium flexible elastic intramedullary nailing has become a well accepted method of treatment of paediatric femoral shaft fractures.

Objective: To assess the success of fixation by Titanium Elastic Nail for fracture shaft of femur in children aged between 6-16 years.

Methods: This prospective interventional study (quasi experimental type) was conducted over a period of one and half year from Jan 2015 to June 2016. Thirty children (23 boys, 7 girls) aged 6-16 years with femoral diaphyseal fractures were stabilized with retrograde titanium elastic nail. The results were evaluated by using Flynn's TEN scoring criteria. Two nails were used in each fracture.

Results: All thirty patients were available for evaluation and follow up for a mean duration of 10.1±2.21 months. The results were excellent in 23 patients (76.7%), successful in 7 patients (23.3%) and there was no poor result. No major per operative or postoperative complications.

Conclusion: Titanium Elastic Nail fixation of paediatric femoral shaft fractures is a safe, simple and reliable method of treatment in children aged 6-16 years.

Introduction:

Femoral shaft fractures are the most common of the lower extremity fracture in children, with an annual incidence up to 1 per 500 (Rasool et al., 2013). Automobile accidents accounts for 90% of femoral shaft fractures in children. The injuries are more common in boys, especially during the toddler years of and early adolescence. These fractures present with pain, swelling, deformity and inability to bear weight. The mechanism of injury varies from simple falls to high energy trauma.

Since the last two decades there has been a growing tendency towards a more operative approach in patients over six years of age. Titanium Elastic

Nailing, which is variously known as Elastic Stable Intramedullary Nailing, has become the choice of stabilization in paediatric femoral shaft fractures. The perceived advantage of this technique includes early union due to repeated micromotion at fracture site, respect for the physis, early mobilization, early weight bearing, scar acceptance, easy implant removal and high patient satisfaction rate (Saikia et al., 2007).

The use of TEN is technically easy to learn, facilitates the maintenance of anatomic alignment and reduces the frequency of complications when nailing is performed correctly. The generally accepted technical option is close reduction and internal fixation with intramedullary nailing under fluoroscopy control.

1. *Dr. Hasan-Al-Habib, Junior Consultant (Orthopaedics), Pabna Medical College Hospital, Pabna.

2. Prof. Dr. Sarwar Ibne Salam, Paediatric Orthopaedic Surgery Department, NITOR, Dhaka

3. Dr. Jahedi Hasan, Senior Consultant (Orthopaedics), 250 Bedded General Hospital, Pabna

4. Dr. Md. Abu Taleb, Junior Consultant (Orthopaedics), 250 Bedded General Hospital, Pabna

5. Dr. Md. Mahmudullah, Junior Consultant (Orthopaedics), Sadar Hospital, Barishal

6. Dr. Md. Hasanus Zaman, RS (Orthopaedics), 250 Bedded General Hospital, Pabna

7. Dr. Md. Shariful Islam, Registrar NITOR, Dhaka.

Correspondence: *Dr. Hasan-Al-Habib, Junior Consultant (Orthopaedics), Pabna Medical College Hospital, Pabna. Phone No. 880172701606 Email: hasanalhabibsagor.hs@gmail.com

Furthermore, minimally invasive surgery is often preferred for this fractures due to the reduction in patient morbidity, less soft tissue trauma and lower infection rates.

The ideal treatment of femoral shaft fractures in children is defined as one that controls the length and alignment, does not compress or elevate the extremity excessively, and is comfortable for child and convenient for family. Titanium Elastic Nail fulfills that qualities in children aged 6-16 years. From September 2010 to October 2012, total 30 children's were available for evaluation after 24 weeks of follow up. All the results were clinically evaluated using Flynn's scoring criteria. Result were excellent in 24 cases (80%) and good in 6 cases (20%) and poor in no cases. There was no post-operative infection, physeal injury and implant failure. (Mishra et al.,2012). Twenty children in the age group 6-16 years with femoral shaft fracture were stabilized with TEN from April 2007 to October 2009. The result were excellent in 14 patients (70%) and successful in 6 patient(30%). (Kumar et al.,2010). The aim of the present study is to evaluate the results of the use of Titanium Elastic Nailing in the treatment of femoral shaft fracture in children.

Materials &Methods:

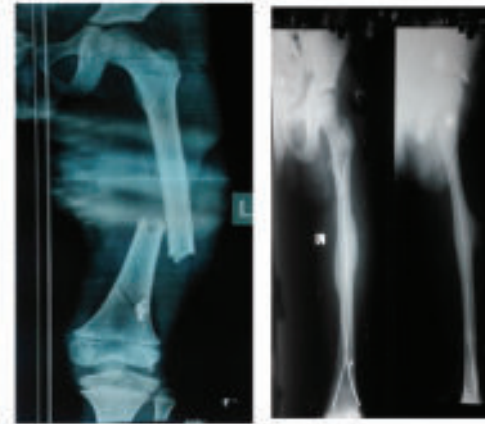
This was aProspective interventional study(quasi experimental type) conducted in Department of Orthopedics and Traumatology, DMCH after ethical committee approvalfrom January 2015 to June 2016 (18 months).Atotal 30 patients(23 boys,7girls)with femoral diaphyseal fracture (age 6-16yrs) fixed with TENS under C-ARM guidance. An informed consent was obtained from all patients. Patients were followed up regularly. Functional status of the patients assessed with Flynn's criteria for TEN. Purposive sampling (non randomized) according to availability of the patients and strictly considering the inclusion and exclusion criteria.

Inclusion Criteria:

1. Femoral mid-diaphyseal transverse, short oblique or short spiral fractures with minimal comminution.
2. Closed fractures of the shaft of femur.
3. Cases are purposively selected irrespective of sex, mechanism of injury and associated other injuries.
4. All patients between 6 to 16 years of age.
5. Patients come within 03 weeks of fracture are included

Exclusion criteria:

1. Open fractures of the shaft of femur.
2. Undisplaced fracture treated by non operative method.
3. Age of the patient before 6 years and after 16 years.
4. Infected cases.
5. Pathological fractures.



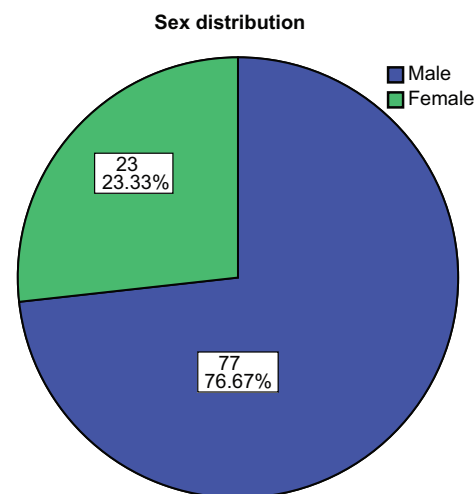
Results

Age of the patients in this series ranged from 6 to 16 years. Maximum patients 19(63.3%) were age 11-16 years, 11(36.7%) patients were age range 6-10 years. Mean age was 11.2 ± 1.96 years.

Table-I: Age distribution of the patients (n=30)

Age	Number of patient	Percentage (%)
11 – 16	19	63.3
6 – 10	11	36.7
Total	30	100.0
Mean $\pm$ SD	11.2 ± 1.96	

Sex distribution:



Pie chart: Distribution of subjects by sex (n=30)

In the present series, maximum patients were male 23(76.7%) and female 7(23.3%) female. Male female ratio 3.3:1. Male patients were predominant in this study.

Table-II: Type of fracture (n=30)

Type of fracture	Number of patient	Percentage (%)
Transverse	18	60.0
Oblique	10	33.3
Spiral	2	6.7
Total	30	100.0

In this series, type of fracture were observed that 18(60%) cases were Transverse, 10(33.3%) cases were oblique and spiral 2(6.7%).

Table-III: Duration of hospital stay (n=30)

Duration of hospital stay (wks)	Frequency	Percentage (%)
1-2 weeks	23	76.7
2-3 weeks	7	23.3
Total	30	100.0
Mean±SD	14.0±3.93	

Among 30 patients, maximum 23(76.7%) patients stayed in the hospital for 1 to 2 weeks and the rest 7(23.3%) patients 2-3 weeks. mean duration of hospital stay was 14.0±3.93 day.

Table-IV: Duration of union time (n=30)

Union time (weeks)	Frequency	Percentage (%)
7-10 weeks	20	66.7
10-13 weeks	10	33.3
Total	30	100.0

Among 30 patients, radiological evaluation of fracture site union showed that 20(66.7%) cases united within 7-10 weeks and 10(33.3%) cases united within 10-13 weeks. The mean union time was 9.6±1.9 weeks.

The surgery was performed within 9-10 days of injury. Duration of surgery on an average 80-100 minutes. Mean follow up was 10-12 months. Elastic Nail was removed after 6-8 montes.

Discussion:

The femoral shaft fractures constitute less than 2% of all children fracture and the ideal choice of treatment has remained a constant challenge. Conservative treatment for children diaphyseal femoral fractures was preferred in children and young adolescents. However to avoid the effects of prolonged immobilization, the operative approach has been gaining popularity for the last two decades (Mishra et al., 2012).

The ideal treatment of diaphyseal femoral fractures in children is defined as one that controls the length and alignment, does not compress or elevate the extremity excessively, and is comfortable for child and convenient for family and cause the least physiological impact possible. The device would exploit a child's denser bone, rapid healing, and ability to remodel, without risking the physes or blood supply to the femoral head, titanium elastic nail offers these features. The Titanium elastic nail seems advantageous over other surgical methods particularly in the age group of 6-16 because it is simple, a load-sharing internal splint that doesn't violate the physis, allows early mobilization and maintains alignment (Flynn et al., 2002 & Saika et al., 2007).

Pediatric femoral fractures are treated by a variety of methods including traction, immediate spica cast, traction followed by spica cast, internal fixation with plate and. screws, external fixation and intramedullary fixation. The indication for TENs for fixation of pediatric femoral shaft fractures are expanding as their advantages are realized and complications of other operative methods of stabilization are reported. Compression paintings are associated with high incidence of refracture. External fixators are associated with pin tract infection, loss of reduction; refracture after removal of external fixator, Rigid intramedullary nailing is associated with greater trochanter physis leading to growth arrest with subsequent coxavalga. It is also associated with damage to blood supply of femoral head leading to osteonecrosis of femoral head.

The ideal device to treat pediatric femur fractures would be a simple, load-shearing internal splint allowing mobilization and maintenance of alignment for a few weeks until bridging callus forms. The device would exploit a child's denser bone, rapid healing, and ability to remodel, without risking the physis or blood supply to the femoral head.

In this study, the total numbers of cases were 30 which are similar to the number of cases in the study of Mishra et al., (2012). The mean age at injury of this study was 11.2 ± 1.96 years; range 6 to 16 years almost similar to Kumar (2010) who found mean age 10.8 years; range 6 to 16 years and Hassan (2006) found the age incidence in the series ranged from 8 years to 12.5 years, mean age 10.5 years. Moroz et al. (2006) documented that mean age at the time of fracture 10.3 years.

In present study among 30 patients 23(76.7%) were male and 7(23.3%) were female. Male-female ratio was 3.3:1. In the study of Kumar et al. (2010) male- female ratio was 3:1.

In this study, in terms of deformity in Sagittal plane like anterior-posterior angulation and in the coronal plane like varus deformity occurred $5-6^\circ$ in 3(10.0%) patients, $6-8^\circ$ valgus deformity occurred in 4(13.3%) patients and majority of the patients 23(76.7%) had no malalignment were observed. Kumar et al. (2010) reveals that out of 20 patients 3 patients showed 10 degree or less angulations in the lateral plane and one patient had an eight degree angulation in the anterior-posterior plane, this findings correlate our study. Al-Sayed (2006) noted angular alignment was normal in 20 cases, valgus angulation of 8° occurred in one case.

In current study 21(70.0%) exhibited wide range of knee fixation more than 130 degree, 2(6.7%) patients restricted knee motion range 120-130 degree and 7(23.3%) patients restricted knee motion range of 100-120 degree. Razzak et al. (2008) noted the mean range of knee flexion score at the end of follow up was 5.3 ± 0.98 points ($> 120^\circ$). Kumar et al. (2010) stated at the end of study period 75% patients could do full range of motion at knee joint.

In this study follow up period was observed that 70% patients complete follow 8-10 months and rest 30% of the patients complete 10-14 months. Mean follow up period was 10.1 ± 2.21 months. Our findings similar with study of Moroz et al. (2006) noted mean length of follow up was 14.2 months.

In present study out of 30 cases, 2(6.7%) patients had nail-tip irritation and rest of the patients 28(93.3%) had no complications developed.

In the final outcome of the study according TEN outcomes scoring by Flynn et al demonstrated that successful results in 7(23.3%) cases and excellent

results were found 76.7% patients. Mishra et al. (2012) noted similar results out of 30 patients, excellent in 80% cases and good in 20% cases. Kumar et al. (2010) observed result out of 20 patients excellent in 14(70%) cases and successful in 6(30%) cases. Gamal et al. (2009) reveals 75.8% were excellent and 24.2% were satisfactory outcome. There is no poor results.

Conclusion:

In this study outcome of mid-diaphyseal pediatric femoral shaft fractures treated by closed reduction and internal fixation with Flexible elastic intramedullary nail demonstrated excellent to successful result in all of the cases. Intramedullary fixation with TEN may be the preferred method for the treatment femoral shaft fractures in children aged 6 to 16 years. It is a minimal invasive procedure, appears to be safe, low morbidity and good functional outcome.

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Severity of Suicidal Intent, Psychiatric Morbidity and Associated Factors among Poisoning Attempters: An Observational Study in Rural Area of Brahmanbaria District, Bangladesh

*Hossain M¹, Ghosh R², Galib MA³, Habibullah M⁴

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Keywords: Suicidal Intent, Psychiatric Morbidity, Poisoning, Impulsivity

Abstract:

Background: Suicide remains a major public health concern, with poisoning being a common method of self-harm. The easy availability of toxic substances and limited access to mental health care contribute to the growing burden of deliberate self-poisoning. This study aimed to assess the severity of suicidal intent, psychiatric morbidity, and associated sociodemographic factors among poisoning attempters.

Methods: This observational study was conducted in the Medicine Inpatient Department of Brahmanbaria Sadar Hospital over seven months from June 2022 to December 2022. 84 patients admitted following deliberate self-poisoning were included. Suicidal intent was measured using Beck's Suicidal Intent Scale (SIS), and psychiatric morbidity was assessed according to ICD-10 criteria. Sociodemographic data were collected and analysed using SPSS version 26, with a significance level set at $p < 0.05$.

Results: Most participants were aged 11–20 years (39.3%) and female (53.6%). Low suicidal intent was observed in 94% of cases, with impulsive acts in 90.4%. Psychiatric morbidity was present in 9.6%, showing a significant association with higher suicidal intent ($p < 0.001$). No significant associations were found between suicidal intent and age, gender, education, or income.

Conclusion: Low suicidal intent and impulsivity predominated among poisoning attempters, while psychiatric morbidity strongly influenced higher intent.

Introduction:

Suicide represents a critical global public health challenge, claiming approximately 700,000 lives annually worldwide, with 77% of these deaths occurring in low- and middle-income countries¹. This reflects the disproportionate burden of suicide in resource-limited settings. In these areas, mental health services, preventive measures, and crisis intervention strategies are often inaccessible. The burden of suicide is particularly pronounced in South Asia, where poisoning is one of the most prevalent methods of self-harm². The widespread use of toxic

substances, along with socioeconomic stressors, contributes to high rates of deliberate self-harm in these populations. In Bangladesh, the estimated suicide rate ranges from 5.9 to 8.7 per 100,000 population³.

The country faces unique challenges in addressing this crisis, especially in rural areas where access to mental health services remains severely limited. The shortage of trained mental health professionals and the lack of adequate infrastructure for psychiatric care further increase the risks in these communities. Deliberate self-poisoning accounts for a major

1. *Dr Maruf Hossain, Assistant Professor (Medicine), Satkhira Medical College. phone : +8801715550346, Email: drmarufhossain@gmail.com

2. Dr Rajib Ghosh, Associate Professor (Medicine), Rangamati Medical College

3. Dr Md Ashadullah -Al-Galib, Assistant Professor (Medicine), Satkhira Medical College

4. Dr. Mohammad Habibullah, Associate Professor (Medicine), Dhaka Medical College, Bangladesh

Correspondence: *Dr Maruf Hossain, Assistant Professor (Medicine), Satkhira Medical College. phone : +8801715550346, Email: drmarufhossain@gmail.com

proportion of suicide attempts in Bangladesh. Pesticides, medications and household chemicals are the most commonly ingested substances⁴. These substances are often easily available in homes and agricultural settings, making impulsive suicide attempts more likely. The rural landscape of Bangladesh presents distinct risk factors. These include easy access to agricultural pesticides, limited medical infrastructure for managing poisoning cases, and significant barriers to psychiatric care⁵. Many rural patients also experience delays in reaching medical facilities, which can worsen outcomes and increase mortality. Severity of suicidal intent among poisoning attempters is crucial for developing targeted intervention strategies and preventing future attempts. Beck's concept of suicidal intent encompasses the degree of preparation, expectations of fatality and the individual's determination to die, which significantly influences both immediate clinical management and long-term prognosis⁶.

Accurate assessment of suicidal intent not only informs emergency care decisions but also aids in planning follow-up psychiatric interventions. Studies have shown that individuals with high suicidal intent exhibit increased risk of completed suicide within one year of the index attempt, emphasising the importance of accurate assessment in emergency settings⁷. Psychiatric morbidity plays a fundamental role in suicidal behaviour, with research indicating that a significant proportion of individuals who attempt suicide have at least one diagnosable psychiatric disorder⁸. In rural South Asian contexts, the intersection of psychiatric illness with socioeconomic stressors, including poverty, domestic violence, and agricultural debt, produces complex vulnerability patterns that require culturally sensitive investigation⁹.

Identification of associated factors specific to rural populations is essential for developing context-appropriate prevention programs. Previous studies in Bangladesh have documented the role of interpersonal conflicts, economic hardship, and chronic illness as precipitating factors for suicide attempts¹⁰. Additionally, demographic variables such as age, gender, education level and marital status represent significant associations with both the choice of poisoning agents and the severity of suicidal intent¹¹. This study aims to address the severity of suicidal intent, psychiatric morbidity patterns and associated sociodemographic factors among poisoning attempters in rural Brahmanbaria.

Methods:

This descriptive observational study was carried out in the Medicine inpatient department of Brahmanbaria

Sadar Hospital, a 250-bedded district hospital in rural Bangladesh, for seven months, from June 2022 to December 2022. 84 patients admitted following suicidal self-poisoning were selected using consecutive sampling. Patients who were medically stable enough to participate in an interview (typically within 24-48 hours of admission) and provided informed consent (or guardian assent for minors) were included. The following were excluded: patients with severe medical complications requiring intensive care, cognitive impairment preventing reliable assessment, those who declined participation, and accidental poisoning cases. Suicidal intent was assessed using Beck's Suicidal Intent Scale (SIS), with scores categorised as low, medium, or high [12]. Gross psychiatric morbidity was determined through structured clinical evaluation following ICD-10 diagnostic criteria [13]. Ethical clearance was obtained from the Institutional Review Board of Brahmanbaria Sadar Hospital. Data analysis was done using SPSS software version 26. Descriptive statistics were used to summarise demographic and clinical profiles. The point-biserial correlation coefficient (RPB) was applied to assess the relationship between psychiatric illness and suicidal intent, and a p-value of less than 0.05 was considered statistically significant.

Results:

Table 1: Socio-demographic Characteristics of Suicide Attempters (N=84)

Characteristic	Category	n	%
Age Group (Years)	11–20	33	39.3
	21–30	26	30.9
	>30	25	29.8
Gender	Female	45	53.6
	Male	39	46.4
Educational Status	Illiterate/Primary	33	39.3
	Secondary/Higher	51	60.7
Family Income (BDT/Month)	< 20,000	43	51.2
	≥20,000	41	48.8

The Table shows that most participants were aged 11–20 years (39.3%), followed by 21–30 years (30.9%) and above 30 years (29.8%). Females made up 53.6%, while males comprised 46.4%. Regarding education, 60.7% had secondary or higher education, and 39.3% were illiterate or had primary education. In terms of income, 51.2% earned below 20,000 Taka per month, while 48.8% earned 20,000 Taka or more. [Table I]

Table II: Suicidal Intent, Impulsivity, and Psychiatric Morbidity (N=84)

Variable	Finding	N	%
Overall Suicidal Intent (SIS Score)	Low Intent	79	94.0
	Medium/High Intent	5	6.0
Act Impulsivity (SIS Premeditation Score)	Impulsive (Score 1)	76	90.4
	Planned (Score 2/3)	8	9.6
Gross Psychiatric Morbidity (ICD-10 Aligned)	Absent	76	90.4
	Present	8	9.6
Correlation	(Psychiatric Illness vs. High Intent)	1	$p < 0.001$

Table III: Associated Factors Among Poisoning Attempters (N=84)

Factor	Category	Low Intent n (%)	Medium/High Intent n (%)	p- value
Age Group (Years)	11–20	32 (97.0)	1 (3.0)	0.39
	21–30	24 (92.3)	2 (7.7)	
	> 30	23 (92.0)	2 (8.0)	
Gender	Female	43 (95.6)	2 (4.4)	0.48
	Male	36 (92.3)	3 (7.7)	
Educational Status	Illiterate/Primary	30 (90.9)	3 (9.1)	0.31
	Secondary/Higher	49 (96.1)	2 (3.9)	
Family Income (Taka/Month)	< 20,000	41 (95.3)	2 (4.7)	0.44
	≥20,000	38 (92.7)	3 (7.3)	
Psychiatric Morbidity (ICD-10)	Absent	74 (97.4)	2 (2.6)	< 0.001
	Present	5 (62.5)	3 (37.5)	

The table shows that most participants had low suicidal intent (94%), while 6% showed medium or high intent. Impulsive acts were common (90.4%), with 9.6% being planned. Psychiatric morbidity was absent in 90.4% and present in 9.6%. A significant correlation existed between psychiatric illness and high suicidal intent ($p < 0.001$). [Table II]

No significant associations ($p > 0.05$) were found between the severity of suicidal intent and sociodemographic factors such as age, gender, education, or family income. A strong and statistically significant association ($p < 0.001$) was found between psychiatric morbidity and higher suicidal intent. [Table III]

Discussion:

The present study investigated the severity of suicidal intent, psychiatric morbidity, and associated factors among poisoning attempters in rural Brahmanbaria, Bangladesh. This study found that the majority of

poisoning attempters were young, with 39.3% aged 11–20 years and 30.9% aged 21–30 years. A demographic pattern of youth vulnerability in self harm through poisoning has been reported in South Asia: for example, in a large study of deliberate self harm in the Sundarban region of India. Sarkar et al¹⁴ found that women in younger age groups constituted the majority of poisoning attempts and that poisoning accounted for over 98% of self harm acts. Furthermore, the slight female predominance (53.6%) in our cohort aligns with general trends, as a systematic review in Muslim majority and South Asian countries showed elevated self harm rates among young females¹⁵.

A notable finding was the high prevalence of low suicidal intent (94%) and impulsive acts (90.4%) in this study, suggesting that many acts may be acute responses rather than planned suicides. This mirrors findings from a comparative study in India, where Nazeer et al¹⁶ reported that patients who attempted

self poisoning exhibited significantly higher impulsivity and lower intent scores compared with self immolation. While our impulsivity proportion (90.4%) is even higher, the similarity underscores that poisoning in resource limited rural settings is often an impulsive means of relief rather than a firmly decided attempt to die. Regarding psychiatric morbidity, this study identified its presence in only 9.6%, yet we found a strong and statistically significant association between psychiatric morbidity and higher suicidal intent ($p < 0.001$). This rate is considerably lower than pooled estimates: a meta analysis of suicidal behaviour in South Asia by Arafat et al.¹⁷ found that among non fatal attempts, the pooled prevalence of depression was around 32.7%. In Bangladesh specifically, a case-control psychological autopsy study by Arafat et al.¹⁸ identified a psychiatric disorder as the strongest risk factor for completed suicide (OR/ 15.33).

The much lower morbidity in our rural sample might reflect underdiagnosis, limited psychiatric referral, or predominance of low intent acts; yet the robust association between morbidity and intent severity echoes the established evidence that mental illness increases suicidal intent. This study did not find significant associations between the severity of suicidal intent and socio demographic factors such as age, gender, educational status, or family income ($p > 0.05$ for all). This diverges from some research where demographic variables appeared influential, but it aligns with a recent review by Knipe et al.¹⁹, which reported that while mental illness correlated with suicidal risk, sociodemographic factors did not significantly predict the severity of ideation or intent in poisoning cases. It suggests that once someone attempts self poisoning, the severity of intent may depend more on proximal psychological variables than broader demographics. These results indicate that the severity of psychiatric illness and impulsive behaviour plays a more important role in suicidal intent than demographic factors among poisoning attempters.

Conclusion:

The study shows that attempters of poisoning are generally young, with a high female preponderance, low suicidal intent, and high impulsivity. Psychiatric morbidity significantly enhances the suicidal intent whereas demographic factors contribute little. Specific interventions aimed at the underlying psychiatric

condition and impulsive behavior hold the key to effective prevention of suicide among poisoning attempters.

Recommendation:

For future research, it is suggested to increase the sample size and involve multiple centres to enhance representativeness. Conducting longitudinal studies could help track changes in suicidal intent over time. Using standardized psychiatric evaluations and qualitative interviews may offer a more comprehensive understanding.

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Advancements in Blood Donor Screening: A Comparative Study of Molecular vs. Serological Testing for Pathogen Detection

*Shoyeb AKM¹, Ali MA², Burmon T³

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Abstract

Background: Transfusion-transmissible infections (TTIs) remain a significant concern for blood safety, particularly in resource-limited settings. Nucleic acid testing (NAT) can detect infections during the window period before seroconversion, offering advantages over conventional serology. This study compared the efficacy of serological and molecular methods for detecting TTIs among blood donors in Bangladesh.

Methods: A cross-sectional study was conducted at the Department of Transfusion Medicine, Shaheed M. Monsur Ali Medical College, Sirajganj, from January to December 2025. A total of 150 blood donors were enrolled through consecutive sampling. Blood samples were tested using both serological (ELISA for HBsAg, Anti-HCV, Anti-HIV, and malaria antigen) and molecular (real-time PCR for HBV DNA, HCV RNA, and HIV RNA) methods. Window period infections were identified as serology-negative but NAT-positive cases. Data were analyzed using SPSS version 26.

Results: The study population was predominantly male (92.0%) and young adults (mean age 31.5 years). Voluntary donors comprised 65.3% of the sample. Overall TTI prevalence was 15.3% (23/150), with HBV most common (8.0%), followed by HCV (4.0%) and HIV (2.7%). NAT detected 25% more infections than serology (20 vs. 16), with significant differences for HBV ($p=0.023$), HCV ($p=0.045$), and HIV ($p=0.032$). Seven window period infections (4.7% of donors) were detected by NAT but missed by serology, including 3 HBV, 2 HCV, and 2 HIV cases. Serology demonstrated poor sensitivity (65.0%) but excellent specificity (99.3%). McNemar's test confirmed significant overall difference between methods ($p=0.023$), with substantial agreement ($\kappa=0.78$).

Conclusion: NAT detects significantly more TTIs than serology alone among Bangladeshi blood donors, with 7 window period infections identified that would have been missed by routine screening. Serology misses 35% of active infections, leaving unacceptable residual risk. These findings support phased implementation of NAT to improve blood safety in Bangladesh.

Introduction:

Blood transfusion is a critical life-saving therapeutic intervention performed worldwide in various clinical settings such as surgery, trauma, hematological disorders, and obstetric emergencies. Each year, millions of blood transfusions are conducted globally, saving countless lives and improving patient

outcomes. However, despite its undeniable benefits, blood transfusion carries inherent risks, with transfusion-transmissible infections (TTIs) posing a significant concern for blood safety globally.¹ TTIs are caused by pathogens that are transmitted from donor to recipient through contaminated blood or blood products. The most clinically significant TTIs

1. *Dr. A.K.M Shoyeb, Assistant Professor, Department of Transfusion Medicine, Shaheed M. Monsur Ali Medical College, Sirajganj, Bangladesh.
2. Dr. Md. Arafat Ali, Assistant Professor, Department of Microbiology, Shaheed M. Monsur Ali Medical College, Sirajganj, Bangladesh
3. Dr. Tonmoy Burmon Assistant Professor, Department of Transfusion Medicine, Shaheed Ziaur Rahman Medical College, Bogura, Bangladesh

Corresponding Author: *Dr. A.K.M Shoyeb, Assistant Professor, Department of Transfusion Medicine, Shaheed M. Monsur Ali Medical College, Sirajganj, Bangladesh., Email: akmshoyeb@gmail.com, Phone: 01717-553530

include hepatitis B virus (HBV), hepatitis C virus (HCV), human immunodeficiency virus (HIV), syphilis, and malaria.² These infections present serious public health challenges, especially in developing countries where the prevalence of these pathogens is often higher, and resources for screening are limited.³ The consequences of TTI transmission can be devastating, leading to chronic liver disease, cirrhosis, hepatocellular carcinoma, acquired immunodeficiency syndrome (AIDS), and even death. To mitigate these risks, the World Health Organization (WHO) recommends comprehensive screening of all donated blood for at least HBV, HCV, HIV, and syphilis as a minimum requirement for blood safety⁴. Despite these recommendations, the risk of TTI transmission through blood transfusion has not been completely eliminated.

A significant factor contributing to this residual risk is the “window period” the time between infection and the appearance of detectable antibodies or antigens. During this window, an infected donor may test negative using conventional serological methods but still harbor infectious pathogens⁵. Serological testing, including enzyme-linked immunosorbent assay (ELISA) and rapid diagnostic tests, has been the cornerstone of blood donor screening for decades. These methods detect specific antibodies produced by the immune system in response to infection or, in some cases, viral antigens. While serological assays are cost-effective, easy to perform, and suitable for high-throughput screening, they have significant limitations⁶. The most critical limitation is the diagnostic window period, which can range from several days to weeks depending on the pathogen. During this time, serological tests may remain negative despite the presence of active infection, potentially allowing contaminated blood to enter the blood supply⁷. Additionally, serological tests may yield false-negative results in immunocompromised individuals who fail to mount an adequate antibody response, and false-positive results due to cross-reactivity⁸. In recent years, nucleic acid testing (NAT) has emerged as a powerful alternative for blood donor screening.

NAT detects the genetic material (DNA or RNA) of pathogens directly, significantly reducing the window period compared to serological methods⁹. For instance, the window period for HIV can be reduced from approximately 22 days with serology

to just 5-10 days with NAT. Similarly, for HCV, the window period can be shortened from 70 days to 3-5 days, and for HBV from 50 days to 20-25 days¹⁰. This dramatic reduction in the window period has the potential to prevent thousands of TTI transmissions annually. Several developed countries, including the United States, Germany, and Japan, have already implemented NAT screening for blood donations, either partially or universally. Studies from these countries demonstrate that NAT implementation improves blood safety by detecting window-period infections that would otherwise go unnoticed^{11,12}. However, in resource-limited settings like Bangladesh, the implementation of NAT remains restricted due to high costs, technical complexity, and infrastructure requirements¹³. Most blood banks in Bangladesh continue to rely on serological screening, which could leave gaps in blood safety.

The country bears a high burden of viral hepatitis and other TTIs. Studies have reported HBV prevalence among blood donors ranging from 5.4% to 7.5%, while HCV prevalence ranges from 0.6% to 2.2%^{14,15}. Although HIV prevalence is low in the general population, it is rising among high-risk groups. Despite the substantial TTI burden, there is limited data on the comparative performance of serological and molecular (NAT) methods in Bangladesh. The primary aim of this study is to assess the prevalence of transfusion-transmissible infections (TTIs) such as HBV, HCV, HIV, and malaria among blood donors at Shaheed M. Monsur Ali Medical College, using both serological and nucleic acid testing (NAT) methods. Additionally, the study seeks to identify infections that are detectable exclusively by NAT during the window period. A comparative analysis will be conducted to evaluate the effectiveness of serological screening against NAT, with NAT serving as the benchmark. Finally, the research aims to explore the potential benefits of implementing NAT in improving overall blood safety and reducing the risk of TTI transmission in resource-limited settings like Bangladesh.

Methods:

This was a cross-sectional study conducted to compare the efficacy of serological and molecular (Nucleic Acid Testing, NAT) methods for detecting transfusion-transmissible infections (TTIs) in blood

donors. The study was carried out at the Department of Transfusion Medicine, Shaheed M. Monsur Ali Medical College, Sirajganj, Bangladesh, over a one-year period from January 2025 to December 2025. A total of 150 blood donors were recruited, with informed consent obtained from all participants prior to enrollment. A structured questionnaire was used to collect data, which was divided into sections covering sociodemographic characteristics (age, gender, donor type), risk factor assessment (history of jaundice, surgery, transfusion, tattoos, dental procedures, travel to malaria-endemic areas, and high-risk behaviors), and laboratory test results from both serological and molecular methods. Blood samples were collected from each donor and tested using two methods.

Serological screening was performed using Enzyme-Linked Immunosorbent Assay (ELISA) to detect HBsAg (HBV), Anti-HCV antibodies (HCV), Anti-HIV antibodies with p24 antigen (HIV), and malaria antigen. Molecular testing was conducted using real-time polymerase chain reaction (RT-PCR) on the COBAS® TaqMan® system to detect HBV DNA, HCV RNA, and HIV RNA, with cycle threshold (Ct) values recorded for quantification. Window period infections, defined as cases where the pathogen is present in blood but has not yet triggered a detectable immune response, were identified by comparing serological negative but NAT positive samples. These infections were further analyzed for viral load using Ct values. All data were compiled and analyzed using Statistical Package for Social Sciences (SPSS) version 26. Descriptive statistics such as frequency, percentage, mean, and standard deviation were used

to summarize demographic data. For comparative analysis, Chi-square tests were applied to determine differences in infection rates between serology and NAT.

McNemar's test was used to analyze paired data and assess discordance between the two methods. Kappa statistics were calculated to measure agreement. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and accuracy were computed for serology using NAT as the gold standard. A p-value <0.05 was considered statistically significant. Ethical approval was obtained from the Institutional Review Board of Shaheed M. Monsur Ali Medical College prior to data collection, and written informed consent was secured from all participants. Confidentiality and anonymity of the respondents were strictly maintained throughout the study.

Results:

Total 150 blood donors participated in this study. The demographic characteristics of the study population are summarized in Table I. The majority of participants were male (n = 138, 92.0%), while females comprised 8.0% (n = 12). The age distribution of donors was as follows: the largest group (34.7%) was in the 26-35 years age range (n = 52), followed by 30.0% (n = 45) in the 18-25 years range, 25.3% (n = 38) in the 36-45 years range, and 10.0% (n = 15) over 45 years of age. The mean age of participants was 31.47±8.92 years (range: 18-58 years). Voluntary donors represented 65.3% (n = 98) of the study population, whereas 34.7% (n = 52) were replacement donors.

Table I: Demographic Characteristics of Study Participants (N=150)

Characteristic	Category	Frequency (n)	Percentage (%)
Age Group	18-25 years	45	30.0
	26-35 years	52	34.7
	36-45 years	38	25.3
	>45 years	15	10.0
Gender	Male	138	92.0
	Female	12	8.0
Donor Type	Voluntary	98	65.3
	Replacement	52	34.7

Table II: Serological vs. Molecular Testing Results by Pathogen (N=150)

Pathogen	Serology Positive (n, %)	NAT Positive (n, %)	Both Methods Positive (n)	Total Detected (n)	p-value
HBV	9 (6.0%)	11 (7.3%)	8	12	0.023
HCV	4 (2.7%)	5 (3.3%)	3	6	0.045
HIV	2 (1.3%)	3 (2.0%)	1	4	0.032
Malaria	1 (0.7%)	1 (0.7%)	1	1	-
Total	16 (10.7%)	20 (13.3%)	13	23 (15.3%)	-

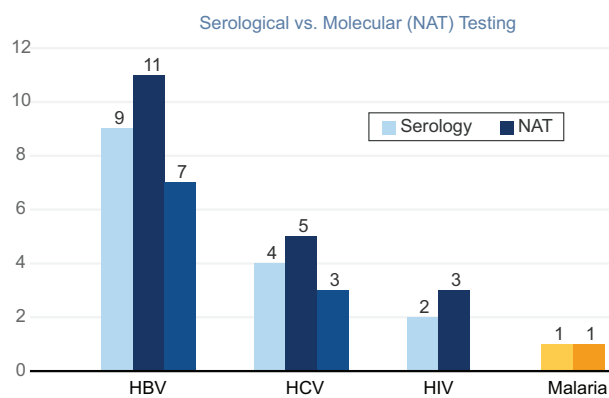
*One case of HBV-HCV co-infection is included in both HBV and HCV counts

The results of the serological screening and molecular testing are presented in Table 2. Serological screening, utilizing ELISA, detected reactivity in 16 of the 150 samples (10.7%). In contrast, NAT (Nucleic Acid Testing) identified pathogen nucleic acids in 20 samples (13.3%). The difference in detection rates was statistically significant for HBV ($p = 0.023$), HCV ($p = 0.045$), and HIV ($p = 0.032$). For HBV, serology detected 9 cases (6.0%), while NAT identified 11 cases (7.3%). For HCV, serology detected 4 cases (2.7%), while NAT detected 5 cases (3.3%). For HIV, serology detected 2 cases (1.3%), while NAT detected 3 cases (2.0%). Malaria was detected by both methods in 1 case

(0.7%). One case of HBV-HCV co-infection was identified. Overall, NAT identified 4 additional infections compared to serology, representing a 25% increase in the detection rate.

Figure 1 visually demonstrates the higher detection capability of NAT across all pathogens, showing a greater number of positive cases identified by molecular testing compared to serology.

A critical finding in this study was the detection of window period infections/donations that tested negative by serology but positive by NAT. These infections represent early-stage, potentially infectious donations that would have been released for transfusion if only serological screening had been used. As summarized in Table III, a total of 7 window period infections were detected, representing 4.7% of all donors screened. These included 3 HBV cases (2.0% of total donors), 2 HCV cases (1.3%), and 2 HIV cases (1.3%). The mean cycle threshold (Ct) values for these infections were 32.1 ± 2.3 for HBV, 30.5 ± 1.8 for HCV, and 33.2 ± 2.1 for HIV, indicating early infections with low viral loads. These 7 window period donations, if transfused, would have exposed recipients to HIV, HBV, or HCV infection, highlighting the critical role of NAT in preventing transfusion-transmitted infections.

**Figure 1:** Comparison of Pathogen Detection Rates**Table III:** Window Period Infections Detected by NAT

Pathogen	Window Period Cases (Serology-/NAT+)	Percentage of Total Samples (%)	Percentage of Pathogen -Specific Positives (%)	Mean CT Value
HBV	3	2.0	25.0	32.1 ± 2.3
HCV	2	1.3	33.3	30.5 ± 1.8
HIV	2	1.3	50.0	33.2 ± 2.1
Total	7	4.7	30.4	-

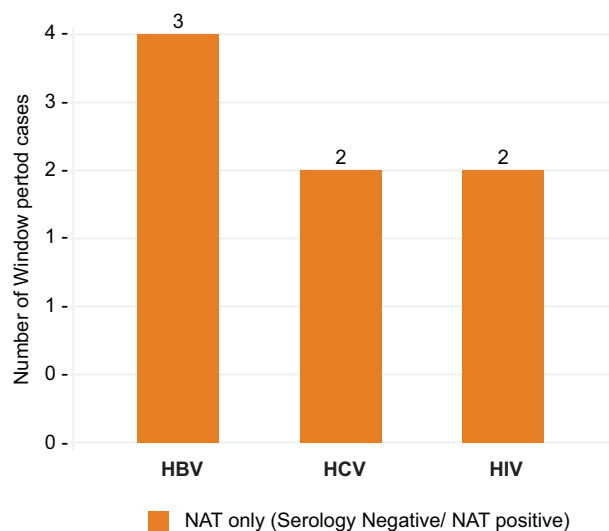


Figure 2: Window Period Infections Detected by NAT

Figure 2 visually illustrates the window period detection across different pathogens, emphasizing the infections that would have been missed by routine serological screening.

Using NAT as the gold standard for active infection, the diagnostic performance of serological testing was assessed and is presented in Table 4. Serology demonstrated an overall sensitivity of 65.0% (95% CI: 40.8-84.6%), meaning it missed 35% of active infections. The specificity was excellent at 99.3% (95% CI: 98.1-99.8%). Pathogen-specific sensitivities were as follows: 72.7% for HBV, 60.0% for HCV, and only 33.3% for HIV. The positive predictive value (PPV) was 81.3%, while the negative predictive value (NPV) was 98.4%. The overall accuracy of serology was 97.8%, indicating a high level of reliability, though it demonstrated limited sensitivity for detecting HIV infections.

Table IV: Diagnostic Performance of Serological Testing (NAT as Gold Standard)

Parameter	HBV	HCV	HIV	Overall
True Positive (TP)	8	3	1	12
False Positive (FP)	1	1	1	3
True Negative (TN)	138	144	146	428
False Negative (FN)	3	2	2	7
Sensitivity (%)	72.7	60.0	33.3	65.0
Specificity (%)	99.3	99.3	99.3	99.3
Positive Predictive Value (%)	88.9	75.0	50.0	81.3
Negative Predictive Value (%)	97.9	98.6	98.6	98.4
Accuracy (%)	97.3	98.0	98.0	97.8
Youden's Index	0.72	0.59	0.33	0.64

Discordant results were observed in 10 samples (6.7% of total). These were categorized as follows:

- **Window period infections (Serology-/NAT+):** 7 cases (4.7% of total donors; 70% of discordant results), representing true active infections in the early phase before seroconversion.
- **False positive serology (Serology+/NAT-):** 3 cases (2.0% of total donors; 30% of discordant results), which included one HBV case (anti-HBc positive but HBV DNA negative), one HCV case (possible false positive serology), and one HIV case (confirmed false positive on Western blot).

Table V: Summary of Discordant Results

Type of Discordance	HBV	HCV	HIV	Total (n)	% of Total (150)
Window Period (Serology-/NAT+)	3	2	2	7	4.7%
False Positive Serology (Serology+/NAT-)	1	1	1	3	2.0%
Total Discordant	4	3	3	10	6.7%

McNemar's test revealed a statistically significant difference between the two testing methods ($\chi^2 = 5.14$, $p = 0.023$), confirming that NAT detects significantly more infections than serology alone. The Kappa statistic indicated substantial agreement between the methods ($\hat{\kappa} = 0.78$; 95% CI: 0.65-0.91; $p < 0.001$), with an overall percent agreement of 93.3%.

Combining both testing methods, a total of 23 infections were identified, representing 15.3% of the study population. Figure 3 illustrates the distribution of these positive cases, with HBV contributing to the largest proportion of infections (52.2%).

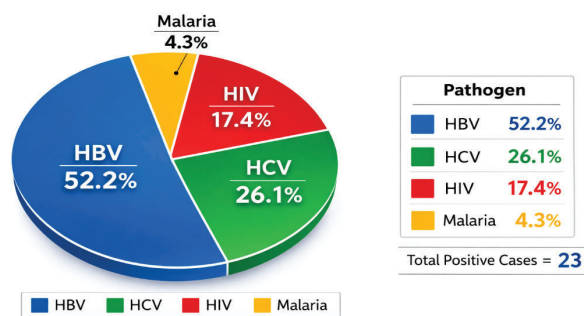


Figure 3: Distribution of Total Positive Cases

Discussion:

This study compared the efficacy of serological and molecular (NAT) methods for detecting transfusion-transmissible infections (TTIs) among 150 blood donors at Shaheed M. Monsur Ali Medical College, Sirajganj, Bangladesh. The findings demonstrate that NAT detects significantly more infections than serology alone, primarily through identification of window period donations.

The demographic profile showed male predominance (92.0%) and young adult majority (18-35 years, 64.7%), consistent with blood donor patterns across Bangladesh and South Asia^{1,16}. Voluntary donors comprised 65.3% of the sample, while replacement donors accounted for 34.7%, reflecting ongoing efforts to promote voluntary donation though replacement donation remains substantial^{14,18}. The overall TTI prevalence was 15.3% (23/150), with active NAT-confirmed infections in 13.3% (20/150). This is comparable to other Bangladeshi studies (12.8-14.2%)^{18,19} but higher than developed countries, underscoring the need for robust screening. HBV was most common (8.0%), consistent with Bangladesh's intermediate endemicity¹⁹. HCV (4.0%) was higher than previous reports (0.6-2.2%)^{15,18}, likely due to NAT

detection of window period cases. HIV (2.7%) exceeded national estimates (<0.1%)²⁰, possibly reflecting the higher-risk replacement donor population. NAT detected 25% more infections than serology (20 vs. 16), with statistically significant differences for HBV ($p=0.023$), HCV ($p=0.045$), and HIV ($p=0.032$). McNemar's test confirmed significant overall difference ($p=0.023$), with substantial agreement between methods ($\hat{\kappa}=0.78$). These findings align with international experience where NAT has consistently demonstrated added value for blood safety^{11,22}.

The most critical finding was detection of 7 window period infections (4.7% of all donors) that were serologically negative but NAT positive donations that would have been released for transfusion using routine screening. These comprised 3 HBV (2.0%), 2 HCV (1.3%), and 2 HIV (1.3%) cases. Mean Ct values (32.1, 30.5, and 33.2) indicated low viral loads characteristic of early infection⁵. Window period cases constituted 25% of HBV, 33.3% of HCV, and 50% of HIV positives, reflecting varying window period durations: HIV (22 days with serology vs. 5-10 days with NAT), HCV (70 vs. 3-5 days), and HBV (50 vs. 20-25 days)¹⁰. These 7 donors, if undetected, could have transmitted chronic viral infections to recipients. Our window period detection rate (4.7%) is higher than in developed countries¹¹ but reflects Bangladesh's higher background TTI prevalence, similar to findings in India (1:1,500-2,000)²³. Using NAT as gold standard, serology demonstrated poor overall sensitivity of 65.0% (95% CI: 40.8-84.6%), missing 35% of active infections. Pathogen-specific sensitivities were 72.7% for HBV, 60.0% for HCV, and only 33.3% for HIV.

Specificity was excellent (99.3%), but yielded 3 false positives (2.0%). PPV was 81.3% overall but only 50.0% for HIV, reflecting low HIV prevalence where even specific tests produce false positives emphasizing need for confirmatory testing²⁵. NPV was 98.4%, meaning 1.6% of seronegative donors had active infection in a 10,000-donor annual pool, 160 infected units would enter the blood supply with serology alone. Discordant results (10 samples, 6.7%) comprised 7 window period infections (70%) and 3 false positives (30%), including one HBV (resolved infection), one HCV (possible false positive), and one HIV (confirmed false positive by Western blot)^{26,27}. This highlights NAT's dual role: detecting window

period infections and resolving reactive serology to prevent unnecessary donor deferral²⁴. Extrapolating nationally (~250,000 annual donations)²⁸, serology alone would miss approximately 11,750 window period infections yearly. While NAT cost remains a barrier, minipool NAT reduces costs while maintaining 90-95% window period detection sensitivity²⁹. Targeted NAT for high-risk groups (e.g., replacement donors) or phased implementation could make NAT feasible³⁰. Cost-effectiveness analyses from other countries support NAT implementation^{31, 32}. local economic evaluations are urgently needed. Our findings align with regional studies. In India, NAT detected 1:1,500-2,000 additional infections²³, in Pakistan, 0.18% additional yield³³, in Nepal, 14.2% TTI prevalence¹⁸. Variation reflects differing prevalence, but all confirm NAT's added value. In conclusion, this study demonstrates that NAT detects significantly more TTIs than serology alone among Bangladeshi blood donors.

Limitations of the Study:

The sample size of 150 donors, while adequate for descriptive purposes and basic comparative analysis, limits the precision of subgroup analyses. A larger sample would provide more robust estimates, particularly for low-prevalence infections like HIV.

Conclusion:

This study shows that NAT detects substantially more transfusion-transmissible infections (TTIs) than serological screening alone, identifying 7 window period cases (4.7% of donors: 3 HBV, 2 HCV, 2 HIV) that would have been missed and potentially transfused. Serology missed 35% of active infections, leaving unacceptable residual risk in a population with 15.3% TTI prevalence (HBV predominant). The high proportion of window period HIV cases (50%) highlights the clear limitations of antibody-based methods. NAT offers a powerful solution to enhance blood safety in Bangladesh, despite cost and infrastructure challenges. Feasible steps include minipool NAT, targeted screening of replacement donors (who showed higher risk here), and phased implementation. Accelerating the shift to 100% voluntary non-remunerated donation is equally critical. In conclusion, adopting NAT would markedly reduce preventable transfusion-transmitted infections. The 7 window period cases detected represent a compelling call to action for policymakers, transfusion specialists, and public health authorities

to prioritize feasible NAT strategies in Bangladesh.

Recommendations:

Based on the study findings, phased implementation of NAT should be initiated in high-prevalence regions, supported by a national task force to develop standardized guidelines. Local cost-effectiveness studies are urgently needed, while accelerating the transition to 100% voluntary blood donation remains a fundamental priority. Blood banks should strengthen donor selection protocols and implement confirmatory testing for reactive serology to prevent unnecessary deferral. Minipool NAT offers a cost-effective intermediate step toward individual donation NAT, alongside improved counseling for TTI-positive donors. Future research requires multi-center prevalence studies, operational research on cost-reduction strategies, and longitudinal follow-up of window period donors. Clinicians should discuss residual TTI risks with transfusion recipients and emphasize alternatives where appropriate. Replacement donors need targeted education about their higher risk profile and window period limitations to encourage transition to voluntary donation.

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Evaluation of Burn Care Infrastructure and Stakeholder Opinions: A Cross-Sectional Study at the National Institute of Burn and Plastic Surgery, Bangladesh

*Nasrin Z¹, Soumik MI², Islam MS³, Rashid MH⁴

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Abstract:

Background: Having the right facilities and enough skilled staff is crucial for giving proper burn care, especially in places with limited resources. The National Institute of Burn and Plastic Surgery (NIBPS) is a significant step forward for Bangladesh's healthcare system, aiming to tackle the serious issue of burn injuries.

Objective: To evaluate the available infrastructure for burn care at the NIBPS and to assess the perceptions and challenges reported by its healthcare providers.

Methods: We ran a cross-sectional study at NIBPS from January to December 2019. To gather information, we interviewed 20 service providers, mostly doctors, and used an observational checklist for the facilities. We analyzed the data on manpower, workload, working environment, training, and the availability of both physical and technical resources using descriptive statistics.

Results: We discovered a serious shortage of human resources, with 95% of the providers saying they didn't have enough staff. We did have some essential equipment, like burn tanks and advanced imaging, but unfortunately, it wasn't working. Plus, dietary and ambulance services were missing. On a positive note, 80% of the providers had burn-specific training, and 95% were sticking to protocols. The main recommendation from 70% of the providers was to urgently bring in skilled workers.

Conclusion: The NIBPS has a major operational issue due to a lack of staff and malfunctioning equipment. We really need to hire specialized personnel and get all our medical equipment up and running if we want to provide proper burn care.

Keywords: Burn care, Health resources, Health workforce, Medical equipment, Need assessment.

Introduction

Burn injuries are a serious global health issue, and they hit low- and middle-income countries (LMICs) especially hard. In these areas, things like poverty, using open flames for cooking, and crowded living situations really raise the chances of getting severe burns. At the same time, these

factors make it tough to get the right medical care for those injuries^{1,2,3}. Dealing with serious burns really requires a specialized and resource-heavy approach. It's best handled in dedicated burn units where they have top-notch surgical tools, skilled nurses, and thorough rehab services all working together⁴.

1. *Dr. Zinat Nasrin Assistant Professor, Department of Dental Public Health, Islami Bank Medical College, Rajshahi, Bangladesh.
 2. Dr. Minhaz Ibna Soumik, Assistant Registrar, Department of ENT and Head Neck Surgery, Shaheed Ziaur Rahman Medical College Hospital, Bogura, Bangladesh.
 3. Dr. Md. Shahadul Islam, Assistant Professor, Department of Maxillofacial Surgery, Shaheed Ziaur Rahman Medical College, Bogura, Bangladesh.
 4. Dr. Md Harun Or Rashid, Medical Officer (Co-ordinator), Department of Public Health, Civil Surgeon Office, Gaibandha, Bangladesh.
- Corresponding Author:** *Dr. Zinat Nasrin Assistant Professor, Department of Dental Public Health, Islami Bank Medical College, Rajshahi, Bangladesh. E-mail: drjinat18@gmail.com, Phone No. +8801735-816864

Setting up these specialized centers is really important for low- and middle-income countries looking to cut down on burn-related deaths and health issues. Bangladesh, where around 365,000 individuals experience burn injuries each year, is a prime example of a country that desperately needs better, centralized burn care⁵ In reaction to this issue, the National Institute of Burn and Plastic Surgery (NIBPS) opened its doors as the biggest burn care facility in South Asia. It's a clear sign of the nation's serious commitment to tackling this public health crisis with better infrastructure. Still, looking back at healthcare growth in areas with limited resources, there's a recurring problem: the difference between building facilities and making sure they actually work effectively⁶.

The success of a burn center isn't just about having fancy buildings or the right equipment. It's really about how well three key elements work together: a capable and adequate team, reliable technology and supplies, and smooth operational systems. If any of these parts are lacking, even the most high-tech facility can end up being useless, turning into what people call 'empty-shell' institutions that can't provide the care they're supposed to⁷ When it comes to burn care, this issue is really serious. If there aren't enough staff, it puts patient safety at risk, affects how wounds are treated, and can lead to problems with infection control. Plus, if the equipment doesn't work—like imaging machines or specialized burn tanks—then diagnosing issues takes longer and treatment options get limited. On top of that, not having support services like proper dietary aid or dependable ambulance transport really hampers overall patient care⁸ To really grasp how ready the new national institute is, we need to look past just the physical assets and dive into a thorough evaluation of how prepared it is operationally, especially from the viewpoint of the people actually providing care. Even though the NIBPS is crucial, there's not much research out there that systematically checks its infrastructure readiness or takes into account the experiences of healthcare workers on the ground.

Existing studies from Bangladesh have primarily focused on epidemiological patterns of burn injury^{5,9} with limited inquiry into the health system's capacity to manage these cases. The perceptions of doctors—who navigate daily clinical realities within the institute—offer an invaluable, ground-level lens

through which to identify systemic bottlenecks, resource gaps, and operational challenges. This study set out to take a two-pronged look at the NIBPS. The goals were pretty straightforward: on one hand, we wanted to check if the key physical resources, equipment, and support services needed for burn care were available and working well; on the other hand, we aimed to understand what the doctors working in the institute think, what challenges they're facing, and any suggestions they might have. The idea is to use what we find to come up with solid, evidence-based recommendations. That way, we can help make sure this important national resource meets its full potential in providing top-notch burn care.

Methods:

From January to December 2019, we carried out a detailed cross-sectional study at the National Institute of Burn and Plastic Surgery (NIBPS) in Dhaka, Bangladesh. The aim was to assess both the infrastructure and the views of providers.

Study population: The study population included two components: 1) Service providers: Permanent doctors employed at NIBPS. A total of 20 doctors were selected via purposive sampling. 2) Facility audit: The physical infrastructure and equipment of the institute itself.

Inclusion and exclusion criteria: We welcomed providers who met a few key criteria: they needed to be permanent employees at NIBPS, have at least six months of experience at the institute, and give their informed consent. Anyone who was on leave or didn't want to participate was not included.

Study procedure and instruments: We gathered data using two tools. First, we conducted face-to-face interviews with a semi-structured questionnaire that looked into provider demographics, their views on staffing, workload, training, and any suggestions they had. Then, the researcher used a pre-tested observational checklist to assess the availability and performance of essential facilities, including reception areas, physical spaces, equipment, investigations, and support services.

Data analysis: We analyzed the data using SPSS version 23. To give an overview, we used descriptive stats like frequencies and percentages to summarize all the categorical info we gathered from the provider interviews and the facility checklist. This helped us create a profile of resource availability and the providers' views.

Results:

The study involved 20 doctors from service providers and a thorough audit of the facilities. The data showed that most of the providers (70%) were men, with the largest group (35%) falling in the age range of 31 to 35 years. In terms of roles, 35% were post-graduate trainees, 30% were medical officers, and 15% were assistant professors; the rest included junior consultants, associate professors, and assistant registrars. Notably, 70% of these doctors had been at the institute for less than three years. In terms of challenges, a significant 95% of doctors felt there weren't enough service providers to handle patient care demands, while 90% described their workload as excessive. Surprisingly, despite these pressures, 60% viewed their working conditions as healthy, and 90% thought cooperation from patient attendants was good. In practice, 80% of doctors confirmed they had received specialized training in managing burn patients, and a remarkable 95% said they used established protocols for patient management. When it came to managing unusual cases, 90% felt there were sufficient facilities available. However, the audit revealed some serious gaps between what resources were supposed to be there and how well they functioned. While basic reception areas and essential physical facilities like signposts, separate toilets, emergency beds, and operating theatres were present, a significant issue was that Intensive Care Unit (ICU)

facilities were found to be unavailable. Most essential medical equipment was present, but the burn tank was not working. Diagnostic investigations faced bigger challenges. Pathological and microbiological services were running, but all key diagnostic machines – like ultrasonography, X-ray, MRI, CT scan, ECG, and Echocardiogram – were there but non-operational, mainly because of a shortage of technical staff. The physiotherapy department also had non-functional wax bath facilities. Moreover, the support services were lacking: dietary services were outsourced to another hospital and not provided by NIBPS directly, and while ambulance services were listed, they were non-operational due to not having enough staff. The human resource situation was particularly troubling. Out of a sanctioned total of 473 doctor positions, only 64 were filled, which means 409 positions are vacant (an 86.4% vacancy rate). The nursing situation was even worse, with 54 nurses working against 671 sanctioned positions, leading to a vacancy rate of 92% (617 vacant). Support staff was nearly nonexistent, with 874 out of 884 positions unfilled (98.9% vacancy). Providers had clear suggestions for improvement. Most notably, 70% of doctors stressed the urgent need to hire enough skilled manpower. Following that, 25% called for more support staff, while 10% emphasized the importance of having modern equipment and logistics.

Table 1: Profile of service provider doctors (N=20)

Characteristic	Category	Number	Percentage
Age group (Years)	<31	5	25
	31-35	7	35
	36-40	5	25
	>40	3	15
Gender	Male	14	70
	Female	6	30
Designation	Post-graduate trainee	7	35
	Medical officer	6	30
	Assistant professor	3	15
	Junior consultant	2	10
	Associate professor / Asst. registrar	2	10

Table II: Work experience and perceptions of service providers

Variable	Category	Number	Percentage
Length of service	<3 years	14	70
	3-4 years	3	15
	>4 years	3	15
Cooperation from attendants	Cooperative	18	90
	Not cooperative	2	10
Received special burn training	Yes	16	80
	No	4	20
Follows clinical protocols	Yes	19	95
	No	1	5

Table III: Provider perceptions of manpower, workload, and environment

Perception	Category	n	%
Adequacy of manpower	Adequate	1	5
	Not adequate	19	95
Perceived workload	Normal	2	10
	Excessive	18	90
Working environment	Healthy	12	60
	Not healthy	8	40
Facilities for unusual situations	Adequate	18	90
	Not adequate	2	10

Table IV: Gap analysis of key facility availability and functionality

Facility category	Status	Key findings
Critical physical facility	Unavailable	Intensive care unit (ICU)
Major equipment	Present, not functional	Burn tank
diagnostic Investigations	Present, not functional	Ultrasonography, X-ray, MRI, CT scan, ECG, echocardiogram
Support services	Outsourced/Non-functional	Dietary service (outsourced), ambulance (non-functional)
Physiotherapy equipment	Present, not functional	Wax bath

Table V: Human resource vacancy status at NIBPS

Staff category	Sanctioned post	Posted	Vacant	Vacancy rate (%)
Doctors	473	64	409	86.4
Nurses	671	54	617	92
Support staff	884	10	874	98.9

Table VI: Top suggestions from providers for service improvement

Suggestion	Number	Percentage	Rank
Recruit adequately skilled manpower	14	70	1
Recruit more supportive staff	5	25	2
Ensure modern equipment & logistics	2	10	3
Improve the working environment	1	5	4
Automated record keeping	1	5	4

Discussion:

This study provides a stark look at how ready a key national burn institute actually is, pointing out a significant disparity between what its infrastructure could offer and how well it functions. The results highlight a major hurdle in developing health systems in low- and middle-income countries: moving from just building facilities to creating a service that is operational and sustainable^{6,11}. The NIBPS really shows a dedication to burn care, but at the moment, it feels more like a shell of what it could be. The facilities and tools just aren't doing their job due to severe shortages of staff and a lack of proper support⁷.

What's really concerning is the huge shortage of staff. We've got vacancy rates at 86.4% for doctors, 92.0% for nurses, and a staggering 98.9% for support staff, which means the institute is running on fumes. So, it's no surprise that 95% of the providers said they don't have enough staff, and 90% complained about being overloaded with work. This level of understaffing is risky for patient safety, it affects how often and well we can provide wound care, and it raises the chances of infections related to healthcare – especially critical for burn patients who are already at high risk^{3,12}. The high workload also places providers at risk of burnout, which can further degrade care quality and staff retention, creating a vicious cycle¹³. It's interesting to note that even with all these serious limitations, a lot of doctors still feel positively about certain aspects of their work.

For instance, 90% said patient attendants were helpful, 80% had special training, 95% stuck to clinical protocols, and 90% felt ready to handle unusual situations. This mix might show how dedicated they are and how they manage to cope, but it also points to a troubling normalization of crises. While it's great that so many are sticking to protocols, it raises concerns about how effective these complex processes can be with so few staff available. The audit of the facility adds to the problem. The fact that advanced diagnostic tools like ultrasound, MRI, and CT machines, along with crucial therapeutic

equipment like burn tanks, aren't working seriously constrains clinical decision-making and treatment options. As a result, there's a heavy reliance on outside referrals or less-than-ideal care pathways. This aligns with findings from other low- and middle-income countries, where high-tech equipment that was either donated or bought often just sits unused because there aren't enough trained people to operate it, maintenance agreements, or essential supplies¹⁴.

Not having a working ICU, proper dietary services, or an ambulance is a huge problem for patient care. For someone with burns, they really need close monitoring, the right nutrition, and reliable transport. If there are holes in these services, it really takes away from the institute's ability to claim they offer complete care^{15,16}. The feedback from providers really emphasizes the basics. The biggest concern – hiring enough skilled workers (70%) – hits right at the heart of the issue. This should be the top priority for those in charge. The second point, about needing more support staff (25%), acknowledges that doctors and nurses can't do their jobs well without a solid administrative and logistical setup. Right now, the NIBPS is in a tough spot, trying to make the most of what it has. Moving ahead, it's clear what needs to happen. Policymakers should switch from focusing on finishing construction to actually making operations work.

Bringing in a large number of specialized burn surgeons, nurses, anesthetists, and technicians needs to happen right away. At the same time, we need a quick plan to assess and get all the installed equipment up and running, while also ensuring there are budgets for maintenance and supplies. Until we tackle these key issues of staff and equipment, the institute will just be a missed opportunity, and its potential to improve burn care in Bangladesh won't be realized^{17,18}. It's pretty obvious what the takeaway is for future health infrastructure projects: from the start, the budget and timeline for staffing and operational support should be factored in, rather than just being an afterthought^{19,20}.

Limitations:

This study has some limitations due to its cross-sectional design, which means we can't draw direct cause-and-effect conclusions. Plus, the small, intentionally selected sample of providers does reflect the overall workforce, but it makes it tough to generalize the findings. Also, while the facility checklist looked at whether the equipment was available, it didn't really evaluate how often it was used or its quality.

Conclusion:

The NIBPS is really struggling right now, facing a huge gap in its operations. It has some advanced facilities but is held back by a lack of skilled staff and equipment that just doesn't work. To actually become a functional burn care center instead of just being a name, we need to quickly hire specialized personnel and get all the medical equipment up and running. It's crucial to put sustainable plans in place to close the big gap between what we can do and the care we provide to patients.

Recommendation:

Right now, we need to quickly recruit a lot of burn surgeons, nurses, and technicians. It's also crucial to get a skilled technical team in place to ensure all the diagnostic and treatment equipment is up and running. Plus, we need to set up in-house dietary services and functional ambulance services as soon as possible.

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