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Editorial

Original Articles

GUIDELINES TO AUTHORS

The minimum requirements for manuscripts submitted for publication:

The manuscript should be prepared according to the modified Vancouver style as proposed by the International Committee of Medical Journal Editors (ICMJE). The entire Uniform Requirements document was revised in 1997 which is available in the Journal of American Medical Association (*JAMA*.1997; 277:927-934) and is also available at the JAMA website. Sections were updated in May 1999 and May 2000. The following section is based mostly on May 2000 update.

THREE COPIES of the manuscript should be sent in a heavy paper envelope. Manuscripts must accompany a covering letter signed by all authors. This must include (i) information on prior or duplicate publication or submission elsewhere of any part of the work as defined earlier in this document; (ii) a statement of financial or other relationships that might lead to a conflict of interest; (iii) a statement that the manuscript has been read and approved by all the authors, that the requirements for authorship have been met; and (iv) the name, address and telephone number of the corresponding author, who is responsible for communicating with the other authors about revisions and final approval of the proofs. The letter should give any additional information that may be helpful to the editor.

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BEGIN, ON A NEW PAGE, each section or component with following sequence: title page, abstract and key words, text, acknowledgments, references. Tables, figures and illustrations may be positioned within the text where they should appear.

The **TEXT** of observational and experimental articles is usually divided into sections with the headings of Introduction, Methods, Results, and Discussion. Long articles may need subheadings within some sections (especially within the Results and Discussion sections) to clarify their content. Other types of articles, such as case report, review, and editorial, are likely to need other formats.

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Below the abstract, authors should provide 3 to 10 **KEY WORDS** or short phrases that will assist indexers in cross-indexing the article and that may be published with the abstract. Terms from the medical subject headings (MeSH) list of *Index Medicus* should preferably be used.

INTRODUCTION should state the purpose of the article and summarize the rationale for the study or observation. Give only strictly pertinent references and do not include data or conclusions from the work being reported.

In **MATERIALS AND METHODS** section describe your selection of the observational or experimental subjects (patients or laboratory animals, including controls) clearly. Identify the age, sex, and other important characteristics of the subjects. Identify the methods, apparatus (give the manufacturer's name and address in parentheses), and procedures in sufficient detail to allow other workers to reproduce the results. Give references to established methods, including statistical methods; provide references and brief descriptions for methods that have been published but are not well known; describe new or substantially modified methods, give reasons for using them, and evaluate their limitations. Precisely identify all drugs and chemicals used, including generic name, dose, and route of administration. Reports of randomized clinical trials should present information on all major study elements including the protocol (study population, interventions or exposures, outcomes, and the rationale for statistical analysis), assignment of interventions (methods of randomization, concealment of allocation to treatment groups), and the method of masking (blinding). Authors submitting review manuscripts are advised to include a section describing the methods used for locating, selecting, extracting, and synthesizing data.

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the paper and to assess its support. Use graphs as an alternative to tables with many entries; do not duplicate data in graphs and tables. Number tables consecutively in the order of their first citation in the text, and supply a brief title for each. Give each column a short or abbreviated heading. Place explanatory matter in footnotes, not in the heading. Identify statistical measures of variations such as standard deviation and standard error of the mean. Do not use internal horizontal and vertical rules. Be sure that each table is cited in the text. Figures should be professionally drawn and photographed. Supply raw data in separate page so that the figures may be redrawn. For x-ray films, and other material, send sharp, glossy, black-and-white photographic prints, usually 127 x 173 mm (5 x 7 in) but no larger than 203 x 254 mm (8 x 10 in).

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Link the **CONCLUSIONS** with the goals of the study, but avoid unqualified statements and conclusions not completely supported by the data. State new hypotheses when warranted, but clearly label them as such. Recommendations, when appropriate, may be included.

ACKNOWLEDGMENTS may go as an appendix to the text, one or more statements may specify (i) contributions that need acknowledging but do not justify authorship, such as general support by a departmental chair; (ii) acknowledgments of technical help; (iii) acknowledgments of financial and material support, which should specify the nature of the support.

REFERENCES should be numbered consecutively in the order in which they are first mentioned in the text. Identify references in text, tables, and legends by Arabic numerals in parentheses. References cited only in tables or figure legends should be numbered in accordance with the sequence established by the first identification in the text of the particular table or figure.

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Standard journal article:

List the first six authors followed by et al. (Note: NLM now lists up through 25 authors; if there are more than 25 authors, NLM lists the first 24, then the last author, then et al.)

Vega KJ, Pina I, Krevsky B. Heart transplantation is associated with an increased risk for pancreatobiliary disease. Ann Intern Med 1996 Jun 1; 124 (11): 980-3.

More than six authors:

Parkin DM, Clayton D, Black RJ, Masuyer E, Friedl HP, Ivanov E, et al. Childhood leukemia in Europe after Chernobyl: 5 year follow-up. Br J Cancer 1996; 73: 1006- 12.

***Organization as author*:**

The Cardiac Society of Australia and New Zealand. Clinical exercise stress testing. Safety and performance guidelines. Med J Aust 1996;164:282-4.

No author given:

Cancer in South Africa [editorial]. S Afr Med J 1994; 84:15.

Article not in English:

(Note: NLM translates the title to English, encloses the translation in square brackets, and adds an abbreviated language designator.) Ryder TE, Haukeland EA, Solhaug JH. Bilateral infrapatellar seneruptur hostidligere frisk kvinne. Tidsskr Nor Laegeforen 1996; 116:41-2.

Volume with supplement:

Shen HM, Zhang QF. Risk assessment of nickel carcinogenicity and occupational lung cancer. Environ Health Perspect 1994; 102 Suppl 1:275-82.

Issue with supplement:

Payne DK, Sullivan MD, Massie MJ. Women's psychological reactions to breast cancer. Semin Oncol 1996; 23(1 Suppl 2): 89-97.

Volume with part:

Ozben T, Nacitarhan S, Tuncer N. Plasma and urine sialic acid in non-insulin dependent diabetes mellitus. Ann Clin Biochem 1995; 32(Pt 3): 303-6.

Issue with part:

Poole GH, Mills SM. One hundred consecutive cases of flap lacerations of the leg in ageing patients. N Z Med J 1994; 107(986 Pt 1): 377-8.

Issue with no volume:

Turan I, Wredmark T, Fellander-Tsai L. Arthroscopic ankle arthrodesis in rheumatoid arthritis. Clin Orthop 1995; (320): 110-4.

No issue or volume:

Browell DA, Lennard TW. Immunologic status of the cancer patient and the effects of blood transfusion on antitumor responses. Curr Opin Gen Surg 1993:325-33.

Pagination in Roman numerals:

Fisher GA, Sikic BI. Drug resistance in clinical oncology and hematology. Introduction. Hematol Oncol Clin North Am 1995 Apr; 9(2): xi-xii.

Type of article indicated as needed:

Enzensberger W, Fischer PA. Metronome in Parkinson's disease [letter]. Lancet 1996; 347:1337. Clement J, De Bock R. Hematological complications of Hantavirus nephropathy (HVN) [abstract]. Kidney Int 1992; 42:1285.

Article containing retraction:

Garey CE, Schwarzman AL, Rise ML, Seyfried TN. Ceruloplasmin gene defect associated with epilepsy in EL mice [retraction of Garey CE, Schwarzman AL, Rise ML, Seyfried TN. In: Nat Genet 1994; 6:426-31]. Nat Genet 1995; 11:104.

Article retracted:

Liou GI, Wang M, Matragoon S. Precocious IRBP gene expression during mouse development [retracted in Invest Ophthalmol Vis Sci 1994; 35:3127]. Invest Ophthalmol Vis Sci 1994; 35:1083-8.

Article with published erratum:

Hamlin JA, Kahn AM. Herniography in symptomatic patients following inguinal hernia repair [published erratum appears in West J Med 1995; 162:278]. West J Med 1995; 162:28-31.

BOOKS AND OTHER MONOGRAPHS

(Note: Previous Vancouver style incorrectly had a comma rather than a semicolon between the publisher and the date.)

Personal author(s):

Ringsven MK, Bond D. Gerontology and leadership skills for nurses. 2nd ed. Albany (NY): Delmar Publishers; 1996.

Editor(s), compiler(s) as author:

Norman IJ, Redfern SJ, editors. Mental health care for elderly people. New York: Churchill Livingstone; 1996.

Organization as author and publisher:

Institute of Medicine (US). Looking at the future of the Medicaid program. Washington: The Institute; 1992.

Chapter in a book:

(Note: Previous Vancouver style had a colon rather than a p before pagination.) Phillips SJ, Whisnant JP. Hypertension and stroke. In: Laragh JH, Brenner BM, editors. Hypertension: pathophysiology, diagnosis, and management. 2nd ed. New York: Raven Press; 1995. p. 465-78.

Conference proceedings:

Kimura J, Shibasaki H, editors. Recent advances in clinical neurophysiology. Proceedings of the 10th International Congress of EMG and Clinical Neurophysiology; 1995 Oct 15-19; Kyoto, Japan. Amsterdam: Elsevier; 1996.

Conference paper:

Bengtsson S, Solheim BG. Enforcement of data protection, privacy and security in medical informatics. In: Lun KC, Degoulet P, Piemme TE, Rienhoff O, editors. MEDINFO 92. Proceedings of the 7th World Congress on Medical Informatics; 1992 Sep 6-10; Geneva, Switzerland. Amsterdam: North-Holland; 1992. p. 1561-5.

Scientific or technical report:

Issued by funding/sponsoring agency: Smith P, Golladay K. Payment for durable medical equipment billed during skilled nursing facility stays. Final report. Dallas (TX): Dept. of Health and Human Services (US), Office of Evaluation and Inspections; 1994 Oct. Report No.: HHSIGOEI69200860. Issued by performing agency: Field MJ, Tranquada RE, Feasley JC, editors. Health services research: work force and educational issues. Washington: National Academy Press; 1995. Contract No.: AHCPR282942008. Sponsored by the Agency for Health Care Policy and Research.

Dissertation:

Kaplan SJ. Post-hospital home health care: the elderly's access and utilization [dissertation]. St. Louis (MO): Washington Univ.; 1995.

Patent:

Larsen CE, Trip R, Johnson CR, inventors; Novoste Corporation, assignee. Methods for procedures related to the electrophysiology of the heart. US patent 5,529,067. 1995 Jun 25.

Other Published Material

Newspaper article:

Lee G. Hospitalizations tied to ozone pollution: study estimates 50,000 admissions annually. The Washington Post 1996 Jun 21; Sect. A: 3 (col. 5).

Audiovisual material:

HIV+/AIDS: the facts and the future [videocassette]. St. Louis (MO): Mosby-Year Book; 1995.

Legal material:

Public law:

Preventive Health Amendments of 1993, Pub. L. No. 103-183, 107 Stat. 2226 (Dec. 14, 1993).

Un enacted bill:

Medical Records Confidentiality Act of 1995, S. 1360, 104th Cong., 1st Sess. (1995).

Code of Federal Regulations:

Informed Consent, 42 C.F.R. Sect. 441.257 (1995).

Hearing:

Increased Drug Abuse: the Impact on the Nation's Emergency Rooms: Hearings Before the Subcomm. On Human Resources and Inter governmental Relations of the House Comm. on Government Operations, 103rd Cong., 1st Sess. (May 26, 1993).

Map:

North Carolina. Tuberculosis rates per 100,000 population, 1990 [demographic map]. Raleigh: North Carolina Dept. of Environment, Health, and Natural Resources, Div. of Epidemiology; 1991.

Book of the Bible:

The Holy Bible. King James Version. Grand Rapids (MI): Zondervan Publishing House;1995.Ruth3:1-18.

Dictionary and similar references:

Stedman's medical dictionary. 26th ed. Baltimore: Williams & Wilkins; 1995. Apraxia; p. 119-20.

Classical material:

The Winter's Tale: act 5, scene 1, lines 13-16. The complete works of William Shakespeare. London: Rex; 1973.

UNPUBLISHED MATERIAL

In press:

(Note: NLM prefers "forthcoming" because not all items will be printed.) Leshner AI. Molecular mechanisms of cocaine addiction. N Engl J Med. In press 1996.

ELECTRONIC MATERIAL

Journal article in electronic format: Morse SS. Factors in the emergence of infectious diseases. Emerg Infect Dis [serial online] 1995 Jan-Mar [cited 1996 Jun 5]; 1(1): [24 screens]. Available from: URL: http://www.cdc.gov/ncidod/EID/eid.htm

Monograph in electronic format:

CDI, clinical dermatology illustrated [monograph on CD-ROM]. Reeves JRT, Maibach H. CMEA Multimedia Group, producers. 2nd ed. Version 2.0. San Diego: CMEA; 1995.

Computer file:

Hemodynamics III: the ups and downs of hemodynamics [computer program]. Version 2.2. Orlando (FL): Computerized Educational Systems; 1993.

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Use only standard **ABBREVIATIONS**. Avoid abbreviations in the title and abstract. The full term for which an abbreviation stands should precede its first use in the text unless it is a standard unit of measurement.

THE EDITOR reserves the right to style and if necessary, shorten material accepted for publication and to determine the priority and time of publication.

Editorial

ARTIFICIAL INTELLIGENCE IN MEDICAL PRACTICES

Md. Ziaul Islam

Professor and Head, Department of Community Medicine, Director, National Institute of Preventive and Social Medicine (NIPSOM), Mohakhali, Dhaka

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Artificial Intelligence (AI)

Artificial intelligence (AI) is no longer a futuristic concept confined to laboratories or science fiction. It is a practical tool reshaping modern medicine, enabling computers to recognize patterns, learn from experience, and assist in complex decision-making, much like a trained clinician interpreting subtle clues. In daily practice, AI sifts through imaging, laboratory results, and electronic records to support diagnosis, anticipate risks, and tailor treatment. When used wisely, AI does not replace physicians; it sharpens clinical insight and strengthens patient-centered care.

By 2030, AI is projected to influence more than 80 percent of clinical decisions in high-income healthcare systems [1]. Yet global surveys reveal that over 60 percent of medical professionals feel unprepared to use AI effectively in clinical practice [2]. This mismatch between healthcare delivery and physician training is profound. Medical students are entering hospitals where AI and automated tools guide many decisions, but they don't yet have the training, judgment, or ethical understanding to use them safely. Without this, they might trust AI blindly or make mistakes, putting patient safety at risk. Misinterpretation of AI outputs, over-reliance on flawed systems, and ethical lapses are real threats to patient safety, professional credibility, and public trust. Simply put, we are training doctors for a world that no longer exists.

AI in Medical Education

Medical education has always evolved in response to societal change. The Flexner Report of 1910 embedded rigorous science into training, followed by innovations such as simulation labs, problem-based learning, competency frameworks, and evidence-based medicine [3]. Today, AI represents a milestone of similar impact; however, many medical schools treat it as a side topic, offering only brief modules or electives. Optional is no longer acceptable. AI must be central to modern medical training.

AI enhances learning by personalizing education to individual needs. Students differ in knowledge, cognitive style, and clinical exposure, yet traditional curricula assume uniform progress. AI platforms track performance, identify gaps, and tailor content. For instance, a student struggling with ECG interpretation can receive targeted exercises with immediate feedback, preventing small misunderstandings from becoming entrenched. Intelligent tutoring systems extend faculty capacity by guiding learners outside of classroom hours. Studies show AI-enhanced tutoring improves diagnostic reasoning and knowledge retention when complementing faculty instruction [4].

Clinical reasoning, the cornerstone of competent practice, benefits from AI as well. Classical/conventional case presentations are static, offering little exposure to real-life uncertainty. Virtual patients powered by AI respond dynamically, simulating complications and deterioration that mirror clinical encounters. For example, a virtual patient with sepsis may worsen rapidly if interventions are delayed, forcing learners to reassess priorities and adjust strategies. AI-assisted case-based learning consistently produces higher engagement, stronger problem-solving skills, and iterative clinical reasoning [4].

Assessment systems also evolve with AI. Traditional exams often overlook judgment, ethics, and communication. AI tools can analyze essays, clinical documentation, and reflective logs to detect reasoning errors and conceptual gaps that human graders might miss [1]. These insights allow faculty to provide targeted mentoring, ensuring students develop both technical and ethical competence.

Understanding AI itself is critical. Students must know how models are trained, the data they rely on, potential failure points, and sources of bias [3]. Without this foundation, doctors risk blindly trusting algorithms and making

unsafe decisions. Ethics and governance must be embedded in AI education. AI relies on massive datasets, often including sensitive patient records and learner metrics, raising concerns about privacy, consent, and equitable care. Algorithmic bias is real—models trained on high-income populations can misrepresent diverse patients, producing flawed predictions and inequitable care [3,5].

Generative AI adds both opportunities and risks. Tools that draft essays, summarize research, or generate clinical scenarios are widely accessible. Left unchecked, they can encourage plagiarism, superficial learning, and blind acceptance of outputs [5]. Yet, when guided thoughtfully, generative AI can simulate rare clinical cases, create personalized practice scenarios, and support structured reflection. Students need training in digital professionalism, critical evaluation, and ethical use to harness AI as a learning ally rather than a shortcut.

AI in Clinical Practices

AI is already transforming clinical practice. Systems assist radiologists in detecting tumors, help cardiologists assess complex patient risk, and support primary care physicians in managing chronic illnesses. In Bangladesh, AI-driven diabetic retinopathy screening programs have achieved over 90 percent sensitivity, enabling early intervention for thousands of patients [1]. In India, AI algorithms detect tuberculosis on chest X-rays with accuracy comparable to trained radiologists, expanding access in rural areas [2]. In Nepal and Pakistan, AI-powered triage systems prioritize high-risk patients and optimize limited resources [2,3].

Despite these successes, regional implementation gaps are obvious. While urban centers commonly deploy cutting-edge AI, most rural hospitals and medical schools lack access, training, and infrastructure, leaving thousands of patients and future clinicians behind. Surveys show over 65 percent of students feel uncertain about using AI safely in clinical decision-making [4]. Technology without training is a threat, not a solution. Policy makers, educators, and institutions must prioritize equitable AI integration, or risk widening healthcare inequities and graduating doctors unprepared for modern practice.

AI in Public Health Practices

AI is no longer limited to hospitals; it is shaping public health on a global scale. Predictive algorithms identify outbreak hotspots, optimize vaccination campaigns, and track antimicrobial resistance in real time. During the COVID-19 pandemic, AI models predicted regional surges, guiding targeted lockdowns and resource allocation, reducing hospital strain and mortality.

In resource-limited settings, AI empowers community health workers to prioritize high-risk patients. In Bangladesh, AI-assisted diabetic retinopathy screening reached thousands of rural patients [1]. In India, AI-driven TB screening algorithms expanded access in remote areas [2]. In Africa, AI-powered mobile platforms track malaria prevalence, guiding mosquito control and bed-net distribution efficiently. AI also supports health policy by analyzing population data to identify social determinants of health, predicting regions with high maternal and neonatal mortality risk, and enabling targeted interventions such as mobile clinics or vaccination drives.

However, these advancements require proper training. Misinterpretation of AI outputs can perpetuate inequities or misallocate resources. Ethical oversight is critical, especially when using sensitive personal data or predicting risk in marginalized populations [5]. Thoughtful implementation can reduce preventable morbidity, improve equity, and enhance health system efficiency, transforming population-level care as profoundly as clinical medicine.

AI and Medical Research

AI is revolutionizing medical research, transforming it from slow, sequential investigations into dynamic, data-driven discovery. More than 60 percent of biomedical data is unstructured, including imaging, genomic sequences, clinical notes, and patient-reported outcomes. AI rapidly processes these datasets, identifying subtle patterns that elude human investigators.

During the COVID-19 pandemic, AI accelerated drug discovery, predicting potential antiviral compounds in months rather than years, and optimizing clinical trial recruitment by identifying eligible participants from electronic health records with speed and accuracy, improving diversity and representation. Beyond infectious diseases, AI predicts disease risk using genomic and multi-omic data. Polygenic risk scores powered by AI can identify individuals at

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high risk of cardiovascular disease or cancer years before symptoms appear, enabling proactive preventive care. AI has also accelerated vaccine research, modeling immune responses to pathogens and informing dose optimization.

In oncology, AI-assisted pathology systems analyze digitized tumor slides, quantifying cell morphology and immune infiltration, helping discover new biomarkers and tailor therapies. Similarly, AI-driven meta-analyses of large clinical datasets reveal correlations between lifestyle, genetics, and treatment outcomes that would be nearly impossible to detect manually. AI is not merely accelerating research; it is redefining how discoveries are made, validated, and translated into patient care, reducing costs, increasing efficiency, and supporting precision medicine [6].

Challenges with AI in Medical Practices

AI offers numerous advantages. It improves diagnostic accuracy and early detection, personalizes learning and clinical decision support, enhances research efficiency, and optimizes resource allocation in public health and low-resource settings. Yet, risks remain: algorithmic bias can produce inequitable care, over-reliance may weaken clinical judgment, and ethical challenges arise around privacy, consent, and accountability. Generative AI carries the potential for misuse in education and documentation, highlighting the need for careful guidance [3,5].

Practical challenges persist, especially in low-resource settings: limited internet, inadequate infrastructure, and faculty shortages slow adoption. Cloud platforms, mobile apps, and open-source tools provide cost-effective pathways, reducing inequities and expanding access [3].

Way Forwards

AI is no longer optional in medical education. Integration must be longitudinal, faculty development sustained, collaboration interdisciplinary, and evaluation continuous. Students should help shape curricula that are clinically relevant, ethically grounded, and technologically robust. Hesitation is not neutral; it risks producing clinicians unprepared for data-driven care, compromising patient outcomes and public trust.

AI represents the largest fundamental shift since simulation and evidence-based medicine. Its ability to deliver personalized learning, immersive simulation, and sophisticated assessment is unprecedented. However, this promise will only be realized through thoughtful, context-sensitive implementation that respects the human core of medicine. AI equips learners to navigate complexity, optimize knowledge, and enhance clinical reasoning, but only if institutions place it at the center of strategy. The choice is stark: embrace AI rigorously and ethically, or graduate doctors prepared for a world that no longer exists.

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Original Article

DISTRICT HEALTH INFORMATION SOFTWARE 2 (DHIS2) AS A DECISION SUPPORT TOOL FOR HEALTH SERVICE MANAGEMENT: EVIDENCE FROM A NATIONWIDE STUDY IN BANGLADESH

Md. Nazmul Hassan Refat[1], Baizid Khoorshid Riaz[2], ANM Shamsul Islam[3], Taufique Joarder[4], Mahmuda Khandaker[5], Md. Mainul Hassan[6]

ABSTRACT

Background: District Health Information Software 2 (DHIS2) is the world's largest open-source health management information system, adopted in Bangladesh since 2011 for decentralized online reporting. While widely used, evidence on its scopes and utilities for decision-making by health managers remains limited. This study aimed to explore how DHIS2 is being applied as a decision support tool for health service management at the sub-district or Upazila level in Bangladesh.

Methods: A nationwide convergent mixed-methods study was conducted among Upazila Health and Family Planning Officers (UH&FPOs) designated as Upazila or sub-district health managers in Bangladesh from January to December 2018. For the quantitative part, all (n = 482) UH&FPOs were included, and data were collected using a pre-tested semi-structured questionnaire distributed via official group email, with postal returns accepted where necessary. For the qualitative part, focus group discussions and key informant interviews were conducted with UH&FPOs to better understand their experiences and practices. Quantitative data were analyzed using descriptive and inferential statistics, while qualitative data were thematically analyzed.

Results: Among 482 UH&FPOs approached, 428 responded, yielding a response rate of 88.8%. The mean age was 47.1 (±6.3) years; 93.9% were male, and 31.1% had received DHIS2 training. Most respondents reported satisfactory use of DHIS2 for maternal health (75.7%) and neonatal and child health service (68.9%) monitoring, as well as immunization service (86.2%). However, application was lower for inpatient preparedness (63.6%), major equipment management (47%), and referral tracking (58.2%). Importantly, nearly three-quarters (74%) of UH&FPOs reported that DHIS2 has made their managerial responsibilities easier. Training was significantly associated with higher use of DHIS2 for coordination meetings, planning, and supportive management functions ($p < 0.05$). Qualitative findings highlighted challenges of complex datasets, fragmented training, and over-reliance on statisticians, but also proposed expansions such as drug databases, laboratory service reporting, and financial reporting modules.

Conclusion: DHIS2 is a valuable tool for health service management at the Upazila level in Bangladesh, though its decision-making potential remains limited by gaps in data-use capacity and functional coverage. Strengthening managers' ability to use DHIS2 data, and expanding managerial modules could enhance its effectiveness as a national decision-support platform and support progress toward Sustainable Development Goal 3.

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Keywords: District Health Information Software 2 (DHIS2); Health Information Systems; Decision Support; Health Service Management; Bangladesh; Sub-district Health Manager, Upazila Health and Family Planning Officer (UH&FPO).

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INTRODUCTION

Health information systems (HIS) are the backbone of modern health sector management, providing the evidence base required for planning, monitoring, and policy decision-making. The World Health Organization emphasizes that a functional HIS must generate, compile, analyze, synthesize, and communicate reliable and timely data to inform health-related decisions.[1] Despite this recognized importance, many low- and middle-income countries (LMICs) continue to struggle with fragmented, paper-based systems that delay reporting, reduce accuracy, and ultimately hinder effective health service management.[2] In response to these challenges, electronic platforms such as the District Health Information Software 2 (DHIS2) have been developed and widely adopted.

DHIS2 is a free, open-source, web-based health management information system, implemented at the national scale in more than 69 countries by the end of 2022.[3] In Bangladesh, the Ministry of Health and Family Welfare (MoHFW) initiated major HIS reform as part of the national health sector digitalization initiative. With technical assistance from GIZ, the Directorate General of Health Services (DGHS) customized DHIS2 beginning in 2009, and decentralized online data entry was introduced in 2011.[4] This transformation enabled routine health data previously delayed by handwritten forms to be reported electronically from Union-level facilities and Upazila Health Complexes (UHCs), aggregating data into a National Data Warehouse.[4]

Today, DHIS2 covers approximately 98% of all public health facilities in Bangladesh, making the country one of the largest global deployers of the system.[5] According to UNICEF and related sources, reporting rates averaged 98%, increasing from just 10% among community clinics in 2014 to nearly universal coverage in subsequent years.[6] Further, DHIS2 has expanded to encompass more than 14,000 public health facilities, from community clinics to tertiary hospitals.[7] This widespread adoption has enabled near real-time data flow across administrative levels.

The UHC, headed by the Upazila Health & Family Planning Officer (UH&FPO), is a critical administrative unit providing both indoor, outdoor, and domiciliary services. As such, the UHC level plays a pivotal role within the national HIS. Managers at this level are responsible for timely data reporting through DHIS2, which supports Health System Strengthening (HSS) scoring, facility performance monitoring, and resource distribution. Moreover, routine facility data reported through DHIS2 are widely used to generate national dashboards and performance monitoring indicators that inform health system planning and policy decisions.[8]

While studies have highlighted limitations of DHIS2 in Bangladesh, such as insufficient training, challenges in customizing indicators, and data quality issues.[9,10] So, a comprehensive understanding requires assessing the extended scopes and practical applications of DHIS2. The platform has evolved from a mere data entry system into a decision-support tool used in diverse domains: planning maternal, neonatal, and child health services; monitoring immunization coverage; preparing for outbreaks; forecasting facility readiness; and supervising community clinics. In many Upazilas, DHIS2-generated reports guide coordination meetings, action planning, and accountability mechanisms. The system's flexibility supports integration of modules into existing datasets; automated dashboards and summary reports further position DHIS2 as an indispensable managerial tool.[11]

Globally, experiences from countries such as Uganda, Kenya, Tanzania, and Sri Lanka demonstrate how DHIS2, when backed by infrastructure, training, and political support, can transform district-level health management.[12-15] In Bangladesh, DHIS2 adoption was aligned with the Health, Population and Nutrition Sector Program, which prioritizes HIS strengthening, and supports the country's monitoring of Sustainable Development Goals (SDGs), especially SDG 3 on health and well-being[16].

Against this backdrop, the present study evaluates the scopes and utilities of DHIS2 as a decision support tool for health service management in Bangladesh. Rather than focusing on barriers, this paper highlights how DHIS2 is leveraged by Upazila health managers across services, explores emerging opportunities for expansion, and examines its potential to institutionalize data-driven decision-making at the sub-district level. By doing so, the study contributes both to the global evidence base on DHIS2 and to policy-relevant discourse on strengthening health service delivery through comprehensive HIS integration in Bangladesh.

METHODS

Study Design

This study was a convergent mixed-methods design, combining a nationwide cross-sectional quantitative survey with a qualitative section through a focus group discussion (FGD) and key informant interviews (KIIs). This design allowed triangulation of findings and deeper insights into the scopes and utilities of DHIS2 in health service management.

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Quantitative Section

The cross-sectional quantitative survey was conducted among all UH&FPOs of Bangladesh between January and December 2018. The study population included all UH&FPOs (n = 482) posted as regular, current charge, or in-charge during the study period. Data were collected using a pre-tested semi-structured questionnaire, developed from a literature review and consultation with experts in hospital administration and health information systems. HSS scores were extracted from the DGHS national dashboard, where each facility is automatically scored monthly based on completeness, timeliness, and consistency of DHIS2 reporting across service domains. The mean scores over the preceding 12 months from October 2017 to September 2018 were used for analysis.

The questionnaire was distributed via the official group email of UH&FPOs (alluhfpo@uhfpo.dghs.gov.bd). Respondents from facilities lacking scanning or internet facilities were requested to return hard copies by post. Personal contact information of UH&FPOs was obtained from the Management Information System (MIS) of the DGHS. Assistant chief statistical officers designated for the eight divisions posted at MIS, DGHS were engaged in monitoring the data collection process.

Completed questionnaires were checked, coded, categorized, and cleaned prior to analysis. Data were compiled and tabulated according to key variables and functional assessment scoring. Missing data were handled using listwise exclusion; responses with missing values for specific variables were excluded from the corresponding analyses, which resulted in variation in sample sizes across tables and figures. Quantitative data were analyzed using SPSS version 23. Descriptive statistics summarized socio-demographic and functional variables. Bivariate associations were examined using chi-square tests for categorical data and Pearson correlation or ANOVA for continuous variables. Statistical significance was set at $p < 0.05$.

Qualitative Section

To complement the survey findings, a qualitative component was conducted. One FGD was conducted with eight UH&FPOs using homogeneous purposive sampling to ensure professional similarity and facilitate open interaction. The FGD was held in Cumilla Civil Sugreon office following a scheduled coordination meeting of Upazila Health Managers to facilitate participation. Participants were encouraged to share their personal experiences, challenges, and suggestions regarding DHIS2 use in health service management. The session lasted approximately 90 minutes and was audio-recorded with prior consent. Notes were also taken to capture non-verbal cues and contextual details. At the end of the discussion, key points were summarized and validated with participants to ensure accuracy and reliability of the responses.

KIIs were conducted with six UH&FPOs purposively selected to represent variation in gender, age, professional qualification, and HSS score ranking. Semi-structured guidelines, developed from literature review and expert consultation, were used to facilitate discussions and interviews. All tools were prepared in both English and Bengali. Sessions lasted 35–90 minutes, were audio-recorded with prior consent, and later transcribed verbatim.

Data were analyzed thematically using both inductive and deductive approaches. The analysis process included familiarization with transcripts, development of a coding framework, coding, categorization, and interpretation. Themes were generated around data elements and datasets, reporting formats, training and skills, applications in service management, proposed scopes, and limitations of DHIS2. Representative quotes were included to illustrate key findings. Data saturation guided the final sample size.

Ethical Considerations

Ethical approval for the study was obtained from the Institutional Review Board (IRB) of the National Institute of Preventive and Social Medicine (NIPSOM), Dhaka (approval date: June 28, 2018). Written informed consent was obtained from all participants. Confidentiality and anonymity were maintained throughout the study by removing personal identifiers and ensuring restricted access to research data.

RESULTS (Quantitative Part)

A total of 428 UH&FPOs participated in the study, giving a response rate of 88.8%. The mean age of respondents was 47.1(±6.3SD) years, with the largest proportion (29.2%) belonging to the 41–45 year age group, followed by 24.8% in the 46–50 year group. A small proportion (2.6%) were under 35 years, while 12.4% were aged 56 years or older. The majority of respondents were male (93.9%), with only 6.1% female. Most participants held an MBBS degree (88.8%), while a small fraction (5.1%) had an additional Master of Public Health (MPH), and 6.1% reported other qualifications.

Regarding job experience as UH&FPOs, the mean duration was 1.9 (±1.6SD) years. The largest group (39.2%) had between 1.01 and 2 years of experience, followed by 20.7% with less than or equal to one year.

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Only 3.5% had five or more years of experience in their current post.

Training exposure to DHIS2 was limited. Out of 428 respondents, only 133 (31.1%) reported having received training on DHIS2, while the majority (68.9%) had not. This reflects a significant gap in formal orientation, despite their central role in data reporting and decision-making (Table-1).

Table 1: Socio-demographic Characteristics of Respondents (n = 428)

Characteristics	Categories	Frequency (n)	Percentage (%)
Age group (years)	Under 35	11	2.6
	36–40	52	12.1
	41–45	125	29.2
	46–50	106	24.8
	51–55	81	18.9
	56 and older	53	12.4
Sex	Male	402	93.9
	Female	26	6.1
Educational level	MBBS	380	88.8
	MBBS + MPH	22	5.1
	Others	26	6.1
Job experience as UH&FPO	≤ 1 year	88	20.7
	1.01–2 years	167	39.2
	2.01–3 years	81	19.0
	3.01–4 years	47	11.0
	4.01–5 years	28	6.6
	≥ 5.01 years	15	3.5
Training on DHIS2	Yes	133	31.1
	No	295	68.9

Among 423 UH&FPOs, 59% reported using DHIS2 satisfactorily to present health-related activities in coordination meetings, while 29% used it very little, and 12% were not clearly oriented about its application. This indicates that although a majority are successfully applying DHIS2, a considerable proportion still underutilize or lack adequate orientation for effective use (Figure-1).

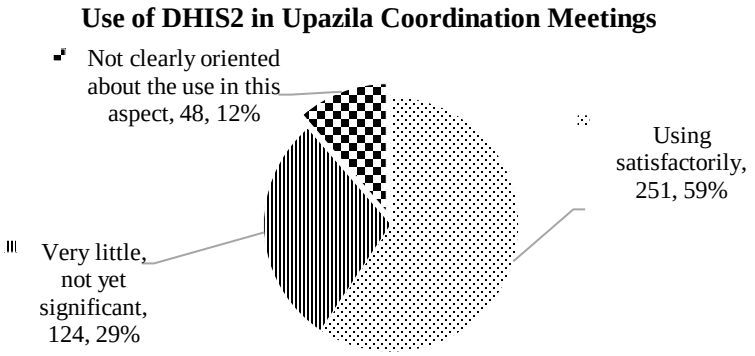

Figure 1: Distribution of UH&FPOs Using DHIS2 in Upazila Coordination Meetings (n = 423)

Use of DHIS2 to assess facility preparedness varied across divisions. Overall, Figure-2 shows 56.9% of UH&FPOs reported satisfactory use, with the highest in Khulna (66.7%) and the lowest in Rajshahi (43.1%). Between 27–35% of respondents across divisions reported very limited use, while around 10–15%

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remained not clearly oriented. These findings indicate uneven adoption, with certain divisions, particularly Rajshahi, lagging behind in applying DHIS2 for preparedness planning (Figure-2).

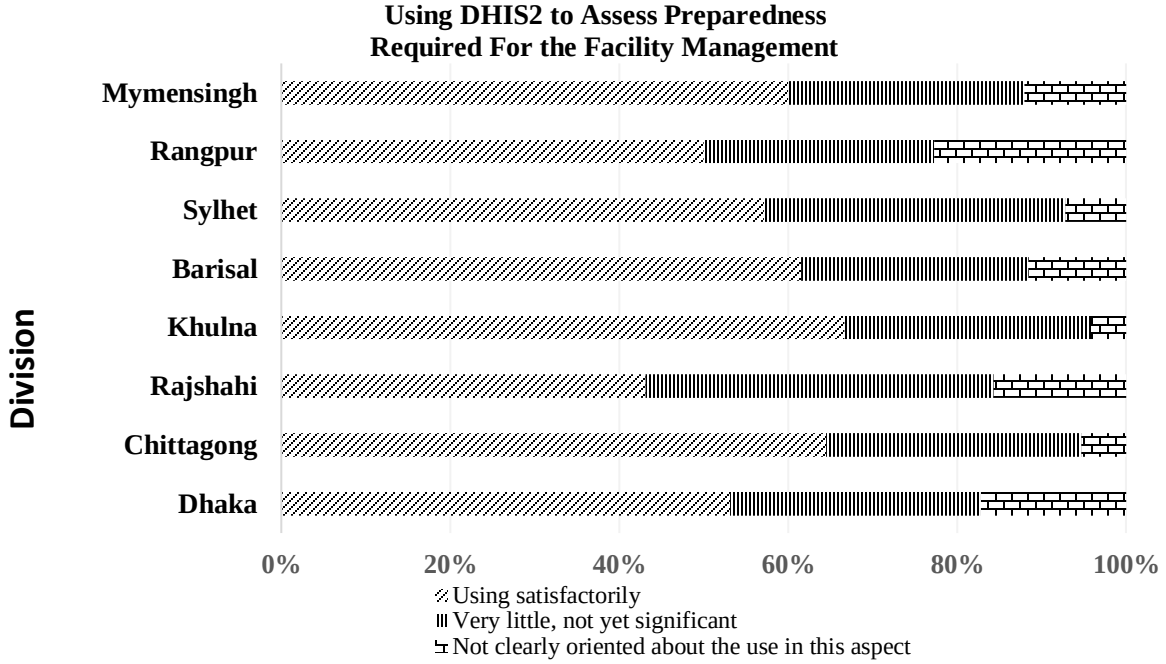

Figure 2: Distribution of UH&FPOs using DHIS2 to assess preparedness requirements for facility management (n = 363)

Among UH&FPOs, 75.7% reported (Table-2) satisfactory use of DHIS2 to monitor maternal health services, including ANC, delivery care, and PNC, while 24.3% were unable to use it effectively. The highest satisfactory use was observed in Barishal division (88.0%), followed by Sylhet (82.1%) and Khulna (79.2%). In contrast, Rajshahi (69.2%) and Mymensingh (73.1%) reported relatively lower utilization. These findings suggest that while DHIS2 is widely applied for maternal health monitoring, divisional variations persist, with some areas lagging behind (Table-2).

Table 2: Distribution of UH&FPOs, Using DHIS2 to Monitor Maternal Health Services (n=366)

Name of the Division	Effective Use of DHIS2		Total
	Yes	No	
Dhaka	50 (75.8%)	16 (24.2%)	66 (100%)
Chattogram	57 (74.0%)	20 (26.0%)	77 (100%)
Rajshahi	36 (69.2%)	16 (30.8%)	52 (100%)
Khulna	38 (79.2%)	10 (20.8%)	48 (100%)
Barishal	22 (88.0%)	3 (12.0%)	25 (100%)
Sylhet	23 (82.1%)	5 (17.9%)	28 (100%)
Rangpur	32 (72.7%)	12 (27.3%)	44 (100%)
Mymensingh	19 (73.1%)	7 (26.9%)	26 (100%)
Total	**277 (75.7%)**	**89 (24.3%)**	**366 (100%)**

Out of 366 respondents, 68.9% reported (Table-3) satisfactory use of DHIS2 for monitoring neonatal and child health services, including nutrition and counselling, while 31.1% were unable to apply it

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effectively. Divisional differences were evident: Sylhet showed the highest satisfactory use (82.1%), followed by Khulna (77.1%) and Chattogram (74.0%). In contrast, Barishal (56.0%) and Mymensingh (57.7%) had the lowest satisfactory use, with nearly half of the UH&FPOs in these divisions still unable to utilize DHIS2 effectively for child health monitoring (Table-3).

Table 3: Distribution of UH&FPOs, Using DHIS2 to Monitor Neonatal and Child Health Services (n=366)

Name of the Division	Effective Use of DHIS2		Total
	Yes	No	
Dhaka	44 (66.7%)	22 (33.3%)	66 (100%)
Chattogram	57 (74.0%)	20 (26.0%)	77 (100%)
Rajshahi	31 (59.6%)	21 (40.4%)	52 (100%)
Khulna	37 (77.1%)	11 (22.9%)	48 (100%)
Barishal	14 (56.0%)	11 (44.0%)	25 (100%)
Sylhet	23 (82.1%)	5 (17.9%)	28 (100%)
Rangpur	31 (70.5%)	13 (29.5%)	44 (100%)
Mymensingh	15 (57.7%)	11 (42.3%)	26 (100%)
Total	**252 (68.9%)**	**114 (31.1%)**	**366 (100%)**

The pie chart (Figure 3) shows that 231 UH&FPOs (63%) reported using DHIS2 reports satisfactorily to assess preparedness for indoor patient service management, based on hospital bed statements and admitted patient records. In contrast, 86 officers (24%) indicated very limited use, while 46 officers (13%) were not clearly oriented about its application. Taken together, more than one-third (36%) of respondents are still unable to utilize DHIS2 effectively for this purpose, highlighting a notable gap in its adoption for inpatient service planning (Figure-3).

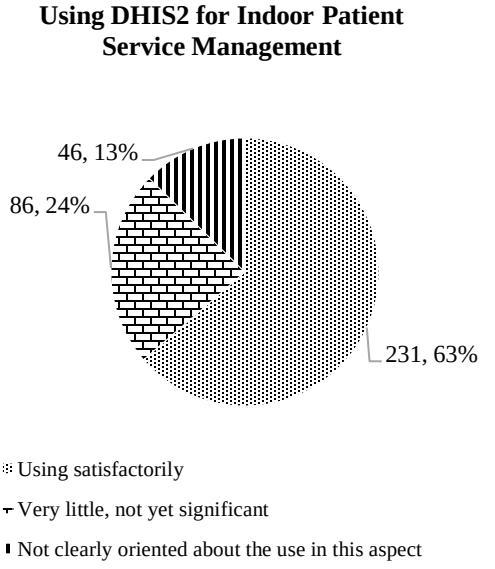

Figure 3: Distribution of UH&FPOs using DHIS2 for Indoor Patient Service Management (n = 363)

The pie chart (Figure 4) shows that 170 UH&FPOs (47%) reported using DHIS2 satisfactorily to monitor and manage major equipment of the UHC, including ambulances. However, more than half of the respondents (53%) were unable to use the system effectively for this purpose. Among them, 97 officers (27%) reported very limited use, while 96 officers (26%) were not clearly oriented about the relevant functions. This indicates that equipment management remains one of the least utilized areas of DHIS2 application, with substantial gaps in awareness and capacity (Figure-4).

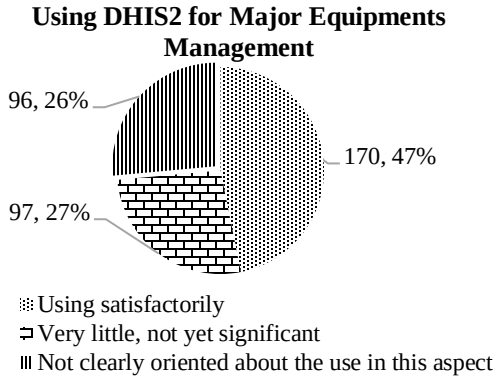

Figure 4: Distribution of UH&FPOs using DHIS2 for Major Equipment Management (n = 363)

The bar chart shows variation across divisions in the use of DHIS2 for understanding disease patterns of indoor patients through ICD-10, particularly to guide preparedness, such as medicine supply. Overall, more than half of the respondents reported satisfactory use, with Khulna division recording the highest proportion

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(74.5%) and Rajshahi the lowest (49.0%). In Barishal, 23.1% of UH&FPOs were still not clearly oriented about this application. These findings suggest that while DHIS2 is being increasingly applied to monitor disease patterns, significant divisional disparities and orientation gaps remain (Figure-5).

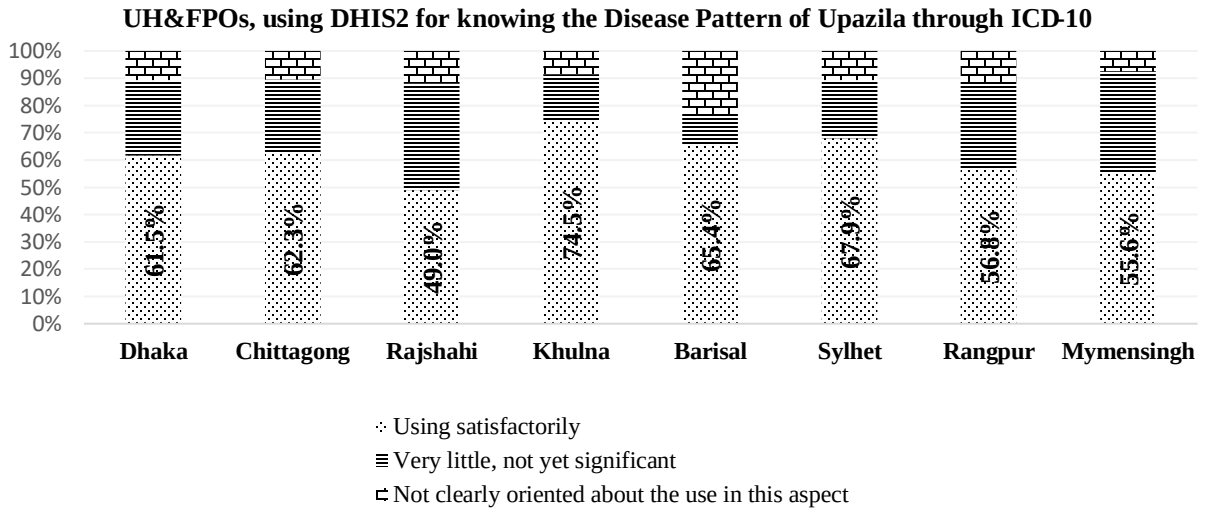

Figure 5: Distribution of UH&FPOs Using DHIS2 to Know Disease Patterns through ICD-10 (n = 365)

The bar chart shows varying levels of DHIS2 use across three key field service areas. For monitoring vaccine coverage under the EPI schedule and obtaining an overall program picture, 86.2% of UH&FPOs reported satisfactory use. For TB and leprosy patient services, 72.1% were able to utilize DHIS2 effectively. In contrast, sanitation activities of the Upazila were less frequently managed through DHIS2, with 58.3% of officers reporting inability to use the system for this purpose. Overall, 38.6% of respondents indicated they were not able to use DHIS2 in any of the three service areas, reflecting an important gap in the system's application for broader field service management (Figure-6).

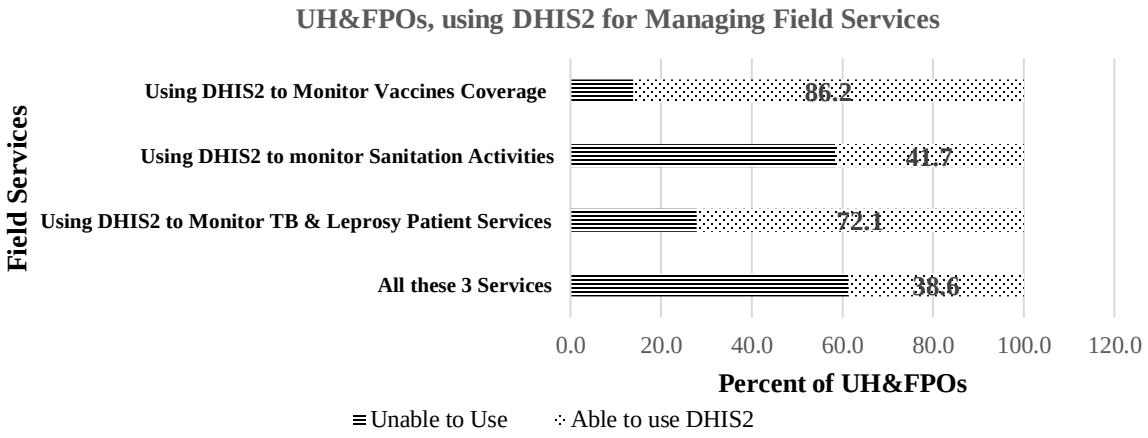

Figure 6: Distribution of UH&FPOs using DHIS2 for Management of Selected Field Services (n = 427)

The bar chart illustrates the extent to which UH&FPOs applied DHIS2 in managing four major service areas of the Community Clinics (CCs). A very high proportion (87.8%) reported successful use of DHIS2 in monitoring the individual performance of Community Health Care Providers (CHCPs) and in managing maternal and child health services, including online registration of pregnant women, newborns, and children. However, performance was relatively weaker in other domains. Only 60.8% of respondents could effectively use DHIS2 to assess the quality of services provided to general patients,

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including health education, while 39.2% were unable to apply the system for this purpose. Similarly, only 58.2% of UH&FPOs reported being able to use DHIS2 to monitor whether patients were properly referred from CCs to the Upazila Health Complex, leaving a substantial 41.8% unable to track referral flows through the system. When all four aspects of management were combined, less than half of respondents (45.8%) reported being able to use DHIS2 successfully, while 54.2% remained unable. (Figure-7).

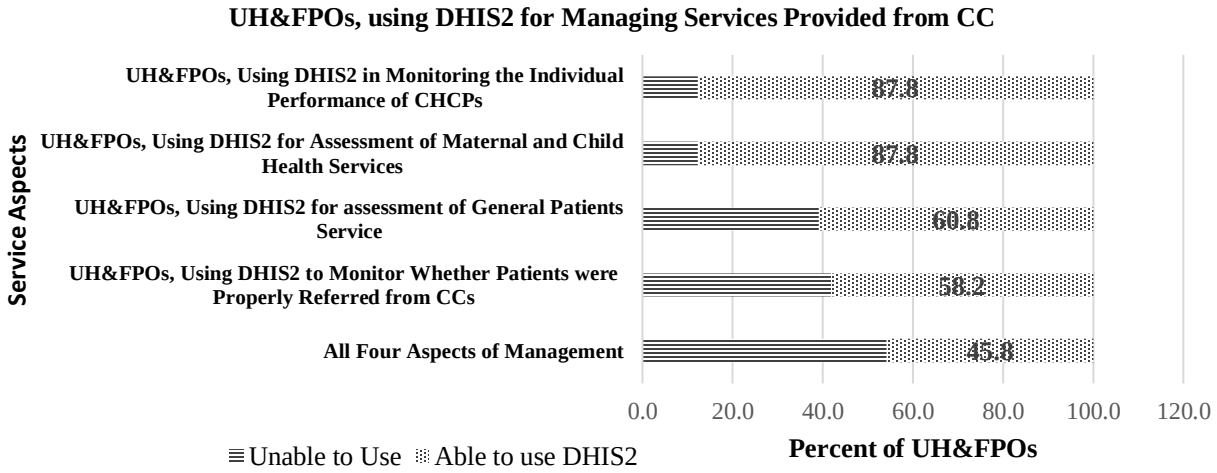

Figure 7: UH&FPOs, using DHIS2 for Management of Services Provided from Community Clinics (n = 426)

The pie chart shows that 238 UH&FPOs (57%) reported satisfactory use of DHIS2 data and reports to prepare future plans for improving overall healthcare services at the Upazila level. However, 133 officers (32%) reported using the system very little in this regard, and 46 officers (11%) were not clearly oriented about its application for planning. These findings highlight that although more than half of UH&FPOs are already integrating DHIS2 into forward planning, a substantial proportion (43%) are either underutilizing or remain unfamiliar with this function, indicating room for strengthening managerial capacity and training (Figure-8).

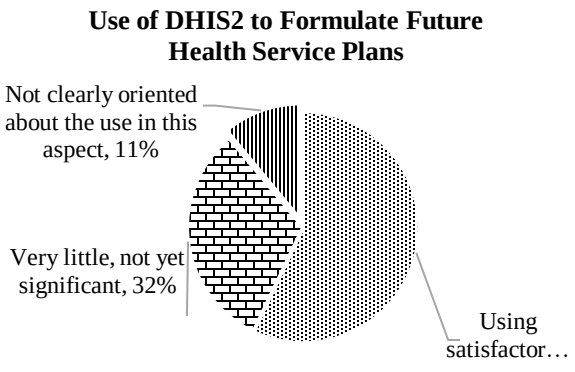

Figure 8: UH&FPOs, using DHIS2 data and reports to formulate future health service plans (n = 417)

The pie chart shows that 313 UH&FPOs (74%) reported that DHIS2 is playing a significant supportive role in making the complex tasks of Upazila health service management easier. Meanwhile, 59 officers (14%) stated that DHIS2 was not yet supporting them to their desired level, and 50 officers (12%) were not clearly oriented about how DHIS2 could help in managerial functions. This indicates that while most respondents recognize DHIS2 as an effective management support tool, a considerable minority still underutilize it or lack sufficient orientation, underscoring the need for additional training and guidance (Figure-9).

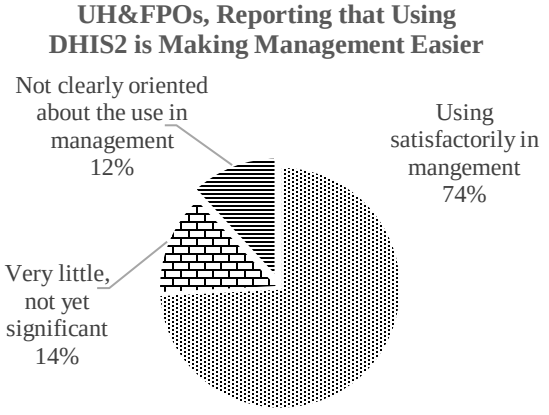

Figure 9: UH&FPOs, reporting that using DHIS2 is making management easier (n = 422)

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The bar chart presents the additional scopes of the DHIS2 application as proposed by 424 UH&FPOs. A large majority, 379 officers (89.4%), proposed the incorporation of a drug database within DHIS2 to ensure the optimum utilization of supplied medicines. Similarly, 353 officers (83.3%) proposed the inclusion of a monthly activities report for individual Health Assistants at the Upazila level. A total of 341 respondents (80.4%) recommended the incorporation of a monthly laboratory service report to assess the utilization of pathological and radiological services. In addition, 336 officers (79.2%) proposed a financial database in DHIS2 for preserving data on health-related income and expenditure of the Upazila, which would support planning for upcoming healthcare programs and management processes (Figure-10).

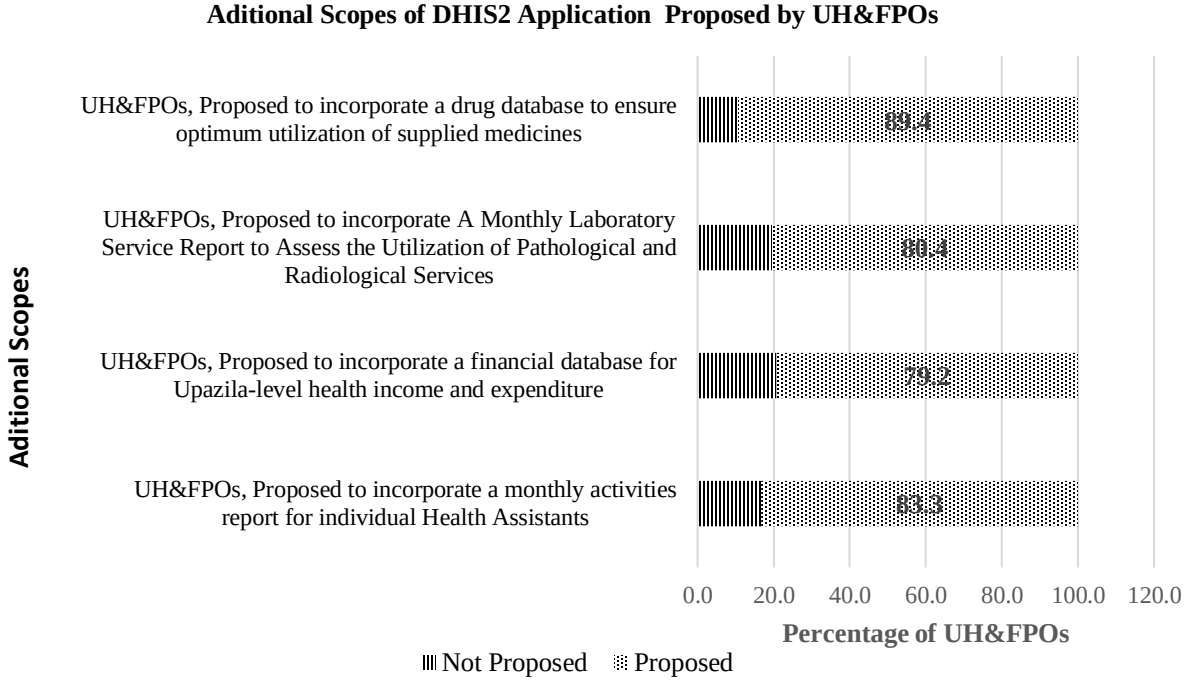

Figure 10: Distribution of UH&FPOs proposing additional scopes of DHIS2 application from a management perspective (n = 424)

The relationship between training status on DHIS2 and its application in different management domains is presented in Table 4. Among 426 respondents, a significant association was observed between training and the use of DHIS2 for decision-making in coordination meetings. Of those who received training, 70.7% reported satisfactory use compared to 57.3% of those without training ($\chi^2 = 6.874$, $p = 0.009$).

Similarly, for formulating future plans to improve overall healthcare services, 64.4% of trained UH&FPOs reported satisfactory use compared with 53.7% of those not trained, showing a statistically significant difference ($\chi^2 = 4.224$, $p = 0.040$).

A comparable pattern was seen when assessing DHIS2 as a supportive tool for making Upazila health service management easier. Among trained UH&FPOs, 80.5% reported satisfactory use, while only 71.5% of non-trained UH&FPOs did so, and this difference was also statistically significant ($\chi^2 = 4.224$, $p = 0.040$).

Overall, the findings indicate that UH&FPOs who had received DHIS2 training consistently demonstrated higher levels of satisfactory use across all three domains: coordination meetings, future planning, and supportive management functions compared with their untrained counterparts. These results emphasize the importance of structured training programs in enhancing the utilization of DHIS2 for decision-making and management at the Upazila level (Table-4).

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Table 4: Relationship between Training Status on DHIS2 & Its Application in Selected Management Domains

Variable	Category	Satisfactorily Using DHIS2 n (%)	Not Satisfactorily Using DHIS2 n (%)	p-Value
Decision-making in coordination meetings	Training Received	94 (70.7%)	39 (29.3%)	0.009* (Chi-square)
	Training Not Received	168 (57.3%)	125 (42.7%)	
Formulating future plan for improvement	Training Received	85 (64.4%)	47 (35.6%)	0.040* (Chi-square)
	Training Not Received	153 (53.7%)	132 (46.3%)	
Supportive role in making management easier	Training Received	107 (80.5%)	26 (19.5%)	0.040* (Chi-square)
	Training Not Received	211 (71.5%)	84 (28.5%)	

*Significant at $p < 0.05$

Analysis of Health System Strengthening (HSS) Scores in relation to background variables is presented in Table 5. Among 482 UH&FPOs nationwide, only 420 were included in the national HSS scoring system. Of the 428 respondents in this study, 373 were found to be included in the HSS scoring system. Since the mean of the last 12 months (October 2017 to September 2018) was considered for assessing associations, only those UH&FPOs with more than 12 months of service experience were eligible for analysis, which reduced the sample to 281 respondents. The HSS scores ranged from 30.57 to 82.73, with a mean of 62.61 (SD = 12.54) and a median of 62.77.

One-way ANOVA showed no significant differences in mean HSS scores by educational qualification. The mean scores were almost identical across MBBS (61.6), MBBS+MPH (61.6), and other qualifications (60.1) ($F = 0.703$, $p = 0.647$). Pearson correlation analysis between years of service as UH&FPO and HSS scores also revealed a weak, non-significant relationship ($r = 0.037$, $p = 0.480$). These results indicate that neither education nor experience significantly influenced HSS performance among respondents (Table 5).

Table 5: Relationship of Education and Experience with HSS Scores (n = 420)

Variable	Category / Test	Mean HSS Score	Statistical Test	Test Statistic	p-value	Result
Education	MBBS	61.6	One-way ANOVA	F = 0.703	0.647	Not significant
	MBBS + MPH	61.6				
	Others	60.1				
Experience	Correlation (years of service vs HSS score)	r = 0.037	Pearson correlation	–	0.480	Not significant

*Significant at $p < 0.05$

RESULTS (Qualitative Part)

Participant Characteristics

Eight UH&FPOs participated in the FGD (six male, two females; aged 39–53 years; experience 0.3–2.7 years). Six UH&FPOs were included in KIIs (four male, two females; aged 39–50 years; experience 1–2 years). Most respondents had MBBS degrees, with some holding additional postgraduate qualifications. Only a minority had received formal DHIS2 training.

Although no theme explicitly emerged under the label of "decision support," the issues raised by participants were closely linked to the capacity of DHIS2 to function as a managerial decision-making tool. Themes such as complexity of data elements, lack of user-friendly reporting formats, fragmented training, partial application in service domains, proposed extensions, and usability challenges all reflect underlying barriers and facilitators that shape how effectively DHIS2 can support evidence-based decisions at the Upazila level.

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Theme 1: Complexity of Data Elements and Datasets

Participants widely acknowledged the importance of DHIS2 as a supportive tool for health service management. However, they expressed difficulty in navigating the large number of data elements across different datasets, which often complicated timely managerial decision-making.

"It's true that DHIS2 is supporting us in various ways but sometimes we feel that it contains huge data elements; we face difficulties to find the necessary one." (FGD, male UH&FPO)

Several UH&FPOs suggested that DHIS2 should include a management-specific dataset, automatically summarizing key indicators across service areas and highlighting priority issues for decision-making.

Theme 2: Reporting Format and Accountability

The reporting formats of datasets were often perceived as lacking clarity and formality. Respondents emphasized the need for automatic inclusion of facility name, reporting period, and other information relating facility identification to improve the professional appearance of reports.

Additionally, the absence of signature fields for responsible personnel was identified as a limitation, as it reduced accountability. Participants suggested involving relevant consultants (e.g., Paediatrics, Gynae & Obs) and storekeepers in dataset validation, both to improve accuracy and to distribute responsibility across staff.

"It is not wise to give all responsibility to the UH&FPO only. All categories of staff should be assigned officially for monitoring data of DHIS2. If it is possible, then its acceptance will rise significantly." (FGD, female UH&FPO)

Theme 3: Training Gaps and Skills

Training was often described as fragmented, focusing on individual components of DHIS2 rather than comprehensive, management-oriented applications. Participants recommended training of trainers (TOT) programs to expand the pool of trained staff and ensure timely reporting even during staff shortages.

"Training is usually conducted on a single topic of DHIS2… We need extensive training focused on management perspective applications." (KII, male UH&FPO)

Theme 4: Application in Health Service Management

Respondents reported using DHIS2 effectively for EPI and community clinic monitoring. However, its application in hospital services was less satisfactory. A key limitation was that ICD-10 coding was restricted to indoor patients, excluding the much larger outpatient and emergency caseload. UH&FPOs strongly recommended incorporating ICD-10 in outdoor and emergency reports to better capture disease patterns and guide preparedness for medicines and manpower.

"It is not possible to tell about the disease pattern of the Upazila based on indoor reports only. If ICD-10 could be included for outdoor and emergency patients, then it would be more logical to plan for future need." (KII, male UH&FPO)

Theme 5: Proposed Scopes for DHIS2

UH&FPOs proposed several new features to strengthen DHIS2 as a decision support tool:

- **Drug database** for tracking utilization and redistribution of medicines.
- **Store management module** for monitoring reserves and crisis preparedness.
- **Monthly laboratory service reports** to improve transparency in diagnostic services.
- **Financial database** to ensure accountability, transparency, and smoother administrative handovers.
- **Union or staff-based service reports** for monitoring field-level activities of Health Assistants and Inspectors.
- **Unique patient identifier (NID/Birth ID)** to support development of a national health database.

Theme 6: Limitations and Usability Challenges

Despite its strengths, DHIS2 was described as complex and heavily dependent on statisticians. Limited training for other staffs and lack of mobile-friendly dashboards constrained its use as a real-time decision-making tool. Participants emphasized the need for simplified, user-friendly auto generated summary reports, ideally accessible with "one-click" and mobile compatibility.

"It should be more user-friendly, so that we can get a summary report from just about one click." (KII, female UH&FPO)

DISCUSSION

This convergent mixed-methods national study assessed the scopes and utilities of DHIS2 as a decision support tool for health service management in Bangladesh. Findings demonstrate that DHIS2 has

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become integral to routine health management at the Upazila level, supporting functions such as monitoring maternal, neonatal, and child health services, evaluating community clinic performance, and planning resource allocation. However, the study also highlights critical gaps in training, system usability, and comprehensive application.

Quantitative data indicate that more than three-quarters of UH&FPOs use DHIS2 to monitor maternal health services, and two-thirds apply it for neonatal and child health monitoring. These findings align with evidence from other LMICs, where DHIS2 has improved coverage and accountability in maternal and child health programs[17,18]. The system's use in tracking vaccine coverage (86%) further reflects its contribution to strengthening EPI monitoring, comparable to experiences in Kenya and Tanzania.[12,13]

However, the comparatively lower use of DHIS2 for inpatient preparedness (63%) and major equipment management (47%) suggests that certain managerial domains remain underutilized. Similar gaps have been reported in Uganda, where DHIS2 adoption was strong for routine indicators but weaker for logistics and facility preparedness.[11] Qualitative findings reinforce this, as UH&FPOs noted difficulties navigating large datasets and proposed the creation of a "management-specific dataset" to simplify access to relevant information.

Only 31% of UH&FPOs had received formal DHIS2 training, yet training was significantly associated with better use of DHIS2 for coordination meetings, future planning, and supportive management functions. This finding mirrors earlier studies in Bangladesh and Malawi, which identified insufficient training as a barrier to effective HIS utilization.[9,10,19] Qualitative insights revealed that existing training programs are fragmented, often focusing on single modules rather than comprehensive management applications. UH&FPOs strongly recommended a Training-of-Trainers (TOT) model to ensure sustainability and to build a wider pool of skilled staff. The absence of significant associations between Health System Strengthening (HSS) scores and UH&FPOs' educational qualifications or length of service suggests that system performance is less dependent on individual credentials and experience and more likely influenced by functional enablers such as effective utilization of DHIS2 as a decision support tool.

The reliance on statisticians for data entry and analysis further limits DHIS2's role as a managerial tool. As highlighted in the qualitative results, participants emphasized the need for broader staff involvement, including consultants and storekeepers, to validate and take ownership of datasets. This reflects findings from Sri Lanka, where inclusive HIS practices improved data quality and strengthened decision-making accountability.[14]

Respondents identified several potential extensions of DHIS2, including a drug utilization database, store management system, monthly laboratory service reporting, and financial database. These proposals align with global discussions on expanding DHIS2 beyond service coverage indicators to encompass supply chain and financial transparency.[20] The call for a financial reporting module is particularly noteworthy in the Bangladeshi context, where accountability in resource allocation remains a persistent concern. Moreover, the suggestion for patient-specific unique identifiers resonates with WHO's advocacy for integrated digital health systems to improve continuity of care and future preparedness for health insurance schemes.[21]

While DHIS2 has enabled near real-time reporting in Bangladesh, its complexity remains a barrier for many users. More than one-third of UH&FPOs reported difficulty using DHIS2 for inpatient planning and referral monitoring. Qualitative findings further revealed that users desire simplified, one-click summary dashboards and mobile-compatible interfaces. This echoes observations from Tanzania and Uganda, where user-friendliness was identified as a key determinant of DHIS2 sustainability.[11,13] Without addressing usability, DHIS2 risks being seen as burdensome rather than supportive.

Implications for Policy and Practice

The convergence of quantitative and qualitative findings underscores the dual reality of DHIS2 in Bangladesh: it is both a powerful tool for improving decision-making and a system still constrained by training, usability, and incomplete integration. Scaling up comprehensive training, simplifying datasets, and incorporating additional modules could substantially enhance its role as a decision support system. Furthermore, linking DHIS2 with performance-based mechanisms such as HSS scores provides an opportunity to incentivize effective use, although our analysis showed no significant relationship between HSS scores and training, education, or experience. This suggests that broader systemic and organizational factors also shape HIS performance.

Strengths and Limitations

The strength of this study lies in its nationwide coverage of all UH&FPOs, complemented by qualitative insights that contextualize quantitative

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findings. The response rate was high, and the mixed-methods design allowed triangulation of results. However, the qualitative component included a relatively small number of key informant interviews (n = 6), which may appear limited. This was addressed by purposive selection to ensure variation and by continuing interviews until data saturation was achieved, supporting the validity of the findings. In addition, the cross-sectional design captures usage patterns at a single point in time and therefore cannot establish causal relationships.

CONCLUSION

This mixed-methods study shows that DHIS2 functions as an important decision-support tool for health service management in Bangladesh, particularly for maternal, child, and community clinic services. However, its full potential remains limited by gaps in data-use capacity, dataset complexity, and insufficient application in key managerial areas. Strengthening managers' ability to interpret and use DHIS2 data, simplifying reporting systems, and expanding managerial modules could improve its effectiveness. Continued policy commitment and investment are essential to transform DHIS2 into a comprehensive platform for evidence-based decision-making across the health system.

RECOMMENDATIONS

- Strengthen data-driven decision-making capacity: Implement regular DHIS2 training for UH&FPOs and relevant staff, using a Training-of-Trainers (TOT) approach, with emphasis on interpreting DHIS2 data, and applying routine health information for evidence-based decision-making.
- Optimize datasets and decision-support dashboards: Develop management-focused datasets and automated summary dashboards, including mobile-compatible interfaces, to enable managers to quickly access key indicators and support timely evidence-based decision-making.
- Strengthen data governance and accountability: Introduce formal validation, authorization, and digital signature mechanisms, ensuring that responsible personnel from the respective service sections where the data are generated verify and sign the reports before submission, thereby enhancing data accuracy, transparency, and shared managerial responsibility.
- Broaden managerial functionalities within DHIS2: Expand the system's operational scope by integrating databases for drug utilization, laboratory services, store management, and financial transactions to support comprehensive and efficient health facility management.
- Enhance surveillance and service planning: Expand ICD coding through DHIS2 from indoor patients to include outpatient and emergency services, enabling a more comprehensive understanding of disease patterns and supporting evidence-based planning, preparedness, and resource allocation at the Upazila level.

Conflicts of interest

The authors declare no conflicts of interest related to the conduct, analysis, or publication of this study.

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Original Article

SPIKE GENE TARGET FAILURE AMONG RT-PCR POSITIVE SARS-COV-2 SAMPLES IN DHAKA CITY DURING EARLY VARIANT WAVES

Aunta Melan[1], Towfiq Mahmud[2], Arifa Akram[3], Md Bayzid Bin Monir[4], Tasnim Nafisa[5]

ABSTRACT

Background: Real time RT-PCR is a widely used method for detecting SARS-CoV-2, the causative agent of COVID-19 infection. A phenomenon termed 'spike gene target failure' (SGTF) has been reported in certain SARS-CoV-2 lineages, in which there is failure to detect the spike (S) gene target in samples that are positive for other RT-PCR targets, which occurs due to a deletion of six nucleotides in the spike gene (69-70del). The SGTF trait has been validated as a reliable surrogate marker for presence of 69-70del in the viral genome. We retrospectively determined the prevalence of SGTF trait among COVID-19 positive samples in Dhaka city.

Methods: The study was conducted in the department of Virology at National Institute of Laboratory Medicine and Referral Center (NILMRC), Dhaka between November 2020 and June 2021. A total of 5,259 nasopharyngeal and oropharyngeal swab samples that tested positive for SARS-CoV-2 with TaqPath COVID-19 Combo PCR kit, were screened for the SGTF marker. SGTF was defined as the non-detection of S-gene-target in samples that were positive for both N and ORF1ab targets with Ct values ≤30.

Results: Among 5,259 PCR-positive samples, 144 (2.74%; 95% CI: 2.30%, 3.20%)) showed SGTF trait in our study. The peak SGTF detection rate was observed in February 2021 (10.77%; $p<0.0031$), which corresponded with the widely-reported circulation of Alpha variant in Bangladesh that characteristically displays 69-70del in the spike gene. Sequencing was not performed, which limited lineage confirmation.

Conclusion: An abrupt increase in SGTF marker detection at PCR laboratories should be investigated thoroughly to enable the prompt identification of emerging SARS-CoV-2 lineages carrying 69–70 deletion.

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INTRODUCTION

Since its emergence in Wuhan, China in December 2019, the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) has caused an astounding number of infections – over 550 million, and more than 6 million deaths worldwide as of April 2022.[1] Real-time reverse transcription PCR (RT-PCR), a primer-probe based assay, has been used extensively for SARS-CoV-2 genome detection.[2] However, many viruses undergo substantial genetic mutation, which can over time result in mismatches between the primer-probe and the viral gene target, often manifesting as diagnostic failure in PCR.[3] One such mutation in the SARS-CoV-2 genome involves deletion of six nucleotides in the spike protein (S)

gene at position 21765–21770, resulting in the loss of two amino acids: histidine and valine at positions 69 and 70 respectively (69-70del). The deletion has led to failure of amplification of the S-gene target in an otherwise positive PCR test while using certain commercial three-target PCR assays including TaqPath COVID-19 Combo kit (ThermoFisher Scientific, USA). This occurrence, termed 'spike gene target failure' (SGTF) or 'spike gene drop out', interestingly was not associated with diagnostic failure as the amplification of the two remaining targets namely nucleocapsid (N) and open reading frame 1ab (ORF1ab) remained unaffected.[4-5] Researchers subsequently used this finding to their advantage and validated SGTF result in a PCR test as a reliable surrogate marker for the presence of 69-70del within the viral genome.[6]

SGTF trait was first detected November 2020 in England.[7] Whole genome sequencing of these strains revealed that they belonged to a novel lineage of SARS-CoV-2, termed B.1.1.7 by PANGO lineage system and Alpha variant by WHO. Separate studies conducted in England and the USA during known waves of B.1.1.7 strains reported 99.6% concordance between SGTF marker and the presence of 69-70del in the viral genome.[1,7] Thereafter, SGTF was utilized as a screening tool for early detection and monitoring of the spread of B.1.1.7 variant in multiple countries of the world, including Portugal[4], France[5], Canada[8], and Pakistan[9]. Later on, in November 2021, this marker was again effectively employed for the prompt identification of the emerging B.1.1.529 lineage (Omicron variant) in South Africa.[10] Clearly, it has the potential to identify and track any variant harbouring the 69-70del that may arise in the course of the pandemic, provided that a subset of samples is validated by sequencing.[1,6]

While sequencing is the gold standard to identify circulating strains, the capacity for routine genomic surveillance is inadequate in many countries including Bangladesh.[11] Underdeveloped laboratory infrastructure, high operational and maintenance costs, and a limited pool of trained laboratory and bioinformatics personnel collectively impede large-scale sequencing initiatives.[12] SGTF marker has been deemed a ready-made, simple tool for screening variants carrying 69-70del in resource limited settings.[8] As a leading COVID-19 testing center of Bangladesh, National Institute of Laboratory Medicine and Referral Center, Dhaka has access to a large COVID-19 RT-PCR data set. Our study aimed to perform a retrospective analysis of the data to determine the prevalence of SGTF trait and the potential circulation of 69-70del lineages in Dhaka city.

METHODS

Study design

This retrospective, observational, cross-sectional study was conducted at the Department of Virology of National Institute of Laboratory Medicine and Referral Center (NILMRC), located in Dhaka, the capital city. Our institute operates a well-equipped biosafety level-2 (BSL-2) molecular laboratory, which served as a government-designated COVID-19 testing facility during the pandemic. Between November 2020 and June 2021, a total of 40,409 nasopharyngeal and oropharyngeal swab samples from suspected COVID-19 patients were tested by RT-PCR using TaqPath COVID-19 Combo PCR kit (ThermoFisher Scientific, USA). The samples were received from various hospitals, homes and collection booths in Dhaka city.

The inclusion criteria comprised all samples testing positive for SARS-CoV-2 by RT-PCR, using TaqPath assay within the given time frame, irrespective of the patients' age and gender. Samples with missing demographic information or amplification data were excluded. Out of 40,409 specimens, 5,259 (13.01%) satisfied the eligibility criteria, and were purposively selected for inclusion in our study.

Reverse transcription RT-PCR

Viral RNA was extracted using MagMax Viral/Pathogen Nucleic Acid Isolation Kit (ThermoFisher Scientific, USA), followed by amplification with TaqPath kit. The assay employs three primer-probe sets targeting three different genomic regions of SARS-CoV-2 RNA, namely ORF1ab, N and S. As per the manufacturer's instructions, a positive RT-PCR test was defined as the amplification of at least two of the three gene targets with cycle threshold (Ct) values ≤35.

Operational definition of SGTF

For our study, the positive RT-PCR results were retrospectively screened for the presence of spike gene target failure (SGTF). SGTF was defined as the failure to detect S-gene target in otherwise RT-PCR positive samples that showed amplification of both N and ORF1ab targets with cycle threshold (Ct) values ≤30.[4] Samples with low overall viral burden can erroneously exhibit the SGTF trait,[10] so nine results showing weak amplification of N and ORF1ab (Ct value ≥30) were excluded from our analysis.

Data analysis

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Amplification-related data were obtained from the PCR instruments, and corresponding demographic information (age and gender) of the individuals was retrieved from test reports. These data were analyzed using the Statistical Package for the Social Sciences (SPSS) software, version 27.0 (International Business Machines Corporation, New York, USA). Independent samples t-test was performed to assess differences in mean values between groups. 95% confidence intervals for proportions were calculated by one-sample binomial test. Pearson's chi-square test was applied to compare categorical values between groups. To compare proportion across months, chi-square test of homogeneity was performed, followed by post-hoc analysis. Differences were considered statistically significant for p value <0.05.

Ethical clearance

Our research was approved by the Institutional Review Board of NILMRC (NILMRC/Ethical Com/Viro-2020:12).

RESULTS

Out of 5,259 RT-PCR-positive samples, 144 (2.74%; 95% CI: 2.30%, 3.20%) showed spike gene target failure, i.e., they were positive for N and ORF1ab targets but negative for S gene. Among 5,115 non-SGTF RT-PCR positive samples, 5,112 (97.20%) displayed amplifications of all three targets while the remaining three (2.80%) were positive for only N and S genes.

Out of 144 SGTF-positive cases, 96 (66.67%) were male while 48 (33.33%) were female. Non-SGTF RT-PCR positive cases comprised 3296 (64.48%) male and 1819 (35.56%) female participants. No significant association was observed between gender and SGTF status (chi-square test, p=0.581). The mean ages of SGTF and non-SGTF groups were 38.56 ± 14.382 years and 39.85 ± 14.295 years respectively, with no statistically significant difference observed (independent samples t-test, p=0.285).

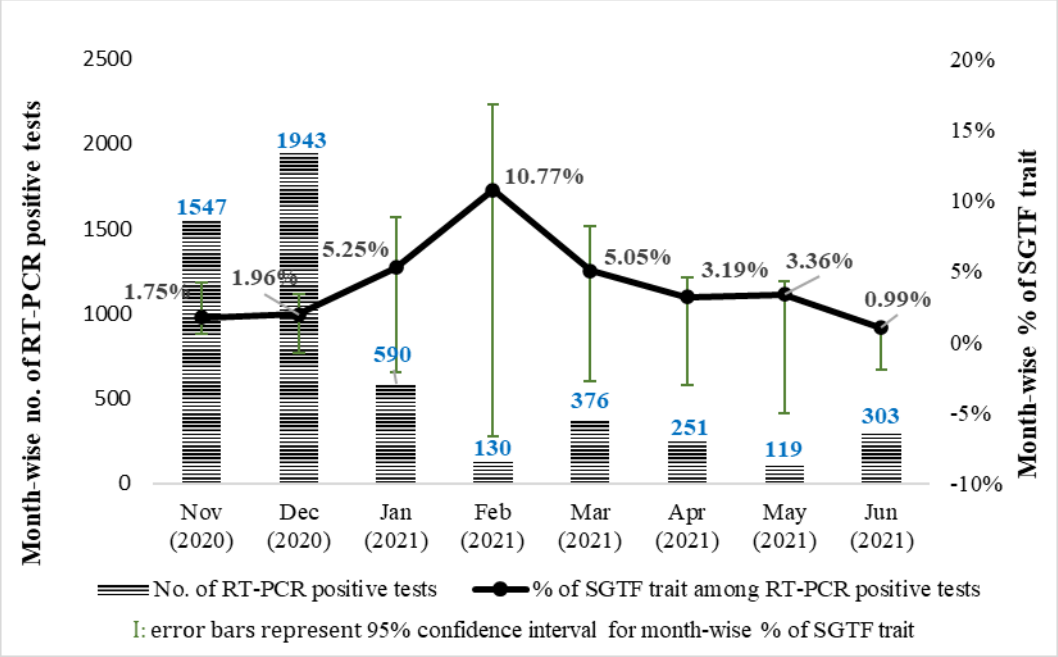

Figure-1: Month-wise proportions of SGTF trait among RT-PCR positive samples (n=144)

Note: SGTF= Spike gene target failure

SGTF trait was first detected at our institute in November 2020, comprising 1.75% of RT-PCR positive tests by the end of the month. The prevalence gradually increased over December 2020 (1.96%) and January 2021 (5.25%), reaching peak in February 2021, during which the marker was present in 10.77% of the positive tests. The rate declined from March (5.05%) onwards, with only 0.99% SGTF-positive samples identified in June 2021. (Figure 1) The month-wise variation in SGTF proportions was statistically significant (Chi-square test of homogeneity, $p<0.001$).

Post-hoc analysis using adjusted standardized residuals revealed that SGTF prevalence was significantly higher than the expected counts in January and February 2021 ($p<0.0031$, after Bonferroni correction).

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DISCUSSION

We identified spike gene target failure trait in 2.74% of RT-PCR–positive SARS-CoV-2 samples tested at NILMRC, Dhaka, between November 2020 and June 2021, with the detection rate peaking in February 2021. This temporal pattern likely reflects the circulation dynamics of the lineages carrying the 69–70 deletion in the spike protein. The overall prevalence of SGTF marker at our institute was higher than the rates reported in France (0.56%)[5], but lower than those reported in Portugal (9.2%)[4], Canada (23.4%)[8] and Pakistan (29.6%)[9]. Such variation in positivity rates may be attributable to differences in the timing of sample collection and the extent of dissemination of strains with the deletion in those regions. Studies conducted during the peak of B.1.1.7 transmission typically reported higher proportions of SGTF.

We were unable to sequence the SGTF-positive samples due to lack of funding, therefore, we could not ascertain their specific lineages, representing a significant limitation of our study. However, we compared our findings with published sequence-based data to provide insight into the potential circulation pattern of 69–70del-carrying lineages in Dhaka city. Analyses conducted by Parvin et al. (2020), Rahman et al. (2021), Saha et al. (2021), and Afrin et al. (2022) indicate the overlapping transmission of three such lineages in Bangladesh during our study period—namely, certain B.1.1.25 sub-lineages, B.1.525 (Eta variant), and B.1.1.7. Among these, B.1.1.25 strains were consistently documented from April 2020 through June 2021, whereas B.1.525 exhibited limited but steady transmission between March 2021 and June 2021.[13-16] The concurrent circulation of these lineages corresponded with the continued detection of SGTF marker at our institute throughout the study period. Notably, we observed a surge in SGTF positivity between January and March 2021 (5.05~10.77%), which aligns with the widely-reported introduction and dissemination of the B.1.1.7 lineage in our population. The peak detection rate demonstrated in February 2021 is consistent with the 16~32% prevalence of this lineage reported by other studies. The subsequent decline in SGTF mirrors the replacement of B.1.1.7 variants with other emerging strains.[15,16]

The 69–70del in the spike protein has independently appeared several times in different SARS-CoV-2 lineages during the course of the COVID-19 pandemic. Its recurrent emergence supports the hypothesis that it may enhance viral fitness and immune evasion capacity, thereby imparting greater epidemic potential and posing a heightened threat to public health globally. To effectively guide public health responses to evolving variants, vigilant tracking and monitoring are essential.[17,18] The World Health Organization (WHO) recommends sequencing at least 1% of a country's confirmed COVID-19 cases for national genomic surveillance, a target that contrasts sharply with Bangladesh's estimated sequencing rate of <0.3% of confirmed cases as of 2023.[19,20] Therefore, a critical gap prevails in the country's capacity to monitor emerging variants.

In such context, the concordance between our findings and published genomic data supports the validity of this PCR-based marker as an indirect surveillance tool. Tracking SGTF trends can serve as an early warning system for the emergence and spread of strains harbouring 69-70del, and complement genome sequencing in resource-limited settings. Such an approach may enable more rapid epidemiological responses, inform public health policy, and ultimately contribute to reducing COVID-19–associated morbidity and mortality.

CONCLUSION

We observed a 2.74% prevalence of spike gene target failure (SGTF) among RT-PCR positive SARS-CoV-2 samples in Dhaka city, with the highest detection rate in February 2021, consistent with the circulation dynamics of Alpha variant (B.1.1.7) in Bangladesh. A sudden rise in SGTF marker at PCR laboratories should warrant careful investigation. Integrating SGTF trend analysis into routine surveillance programs could strengthen early detection and monitoring capacity for any emerging SARS-CoV-2 strain carrying the 69–70 deletion, particularly in resource-limited settings.

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Authors' contributions

AM and AA designed the study protocol. AM, MBBM, TN and AA conducted the RT-PCR testing. TM and AM carried out data recording and analysis.

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AM and TM wrote the original draft. AA edited and reviewed the manuscript.

Conflict of interest

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Original Article

RELIABILITY AND VALIDITY OF 29 QUESTIONS RELATED TO PERCEPTION OF RADIOLOGISTS REGARDING APPLICATION OF ARTIFICIAL INTELLIGENCE IN RADIOLOGY AND IMAGING UNITS OF TERTIARY PUBLIC HOSPITALS

Susmita Ghosh [1], Khursheda Akhtar [2], Aiwasharia Ghosh[3]

ABSTRACT

Background: Artificial intelligence (AI) is progressively being adopted in radiology, enhancing diagnostic precision, workflow efficiency, and image interpretation. For a developing country like Bangladesh, integrating AI into radiology is essential to advance radiology departments. Therefore, this study aimed to evaluate the validity and reliability of a 29-item questionnaire developed to evaluate radiologists' perceptions regarding artificial intelligence applications in radiology and imaging units of tertiary public hospitals in Bangladesh

Methodology: A cross-sectional methodological study was conducted among radiologists working in tertiary public hospitals. Validity was evaluated through face validity, by review from the research supervisor and subject experts to ensure clarity, relevance, and representativeness of the items. Content validity was established by confirming that the questions comprehensively covered the key domains of radiologists' perception of AI and also by review from the research supervisor and construct validity was assessed by doing spearman rank correlation. Reliability of 29 questions was measured through internal consistency using Cronbach's alpha.

Results: The 29 questions which was designed to assess radiologist`s perception regarding application of AI was subjected to face validity through expert review and pilot testing to ensure clarity and relevance. Content validity was established by ensuring the 29 questions adequately covered key domains of radiologists' perception of AI in radiology and imaging units. Construct validity of the questionnaire was supported by significant positive Spearman correlations between the domains of practice, opportunities, and challenges and the overall perception of radiologists. So, 29 questions were valid to assess radiologists` perception regarding application of AI in radiology and imaging units of tertiary public hospitals in Bangladesh. The 29 questions demonstrated good internal consistency. Subsection reliability was 0.832 for practice, 0.885 for opportunities, and 0.579 for challenges related to AI in radiology. Overall Cronbach's alpha of 0.761 So, 29 questions related to perception of radiologists regarding application of AI were reliable.

Conclusion: The developed 29-items in questionnaire was valid and reliable tool to measure radiologists' perceptions regarding application of AI in radiology and imaging units of tertiary public hospitals. This instrument can facilitate further research and guide policymakers in addressing challenges and opportunities associated with AI adoption in radiology practice.

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Keywords: Perception, Radiologists, Artificial Intelligence (AI), Face validity, Content validity, Construct validity, Cronbach`s alpha.

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INTRODUCTION

Ensuring the reliability and validity of a research instrument is vital for securing precise and significant outcomes. In investigations that assess perception or viewpoints, particularly in nascent areas such as Artificial Intelligence (AI) in radiology, employing a thoroughly validated questionnaire is essential to ensure the reliability, precision, and applicability of the results [1]. Reliability refers to the degree to which an instrument consistently measures what it intends to measure, whereas validity assesses whether the instrument truly captures the construct under investigation [2]. Commonly, internal consistency or reliability is assessed using Cronbach's alpha, which determines the extent to which items within a scale are correlated, indicating that they measure the same underlying construct [3].

The integration of AI into medical imaging is set to revolutionize radiology due to its significant impact on human health and the broader healthcare system. By automating routine and time-consuming tasks, AI can enhance radiologists' efficiency, enabling them to focus on complex diagnostic challenges and improve communication with patients and healthcare professionals [4]. Tertiary public hospitals, which play a crucial role in providing specialized healthcare services, the successful implementation of AI in radiology requires a comprehensive understanding of the perceptions of radiologists and future radiologists such as post graduate trainees. To assess perception of radiologists regarding application of artificial intelligence in radiology and imaging units of tertiary public hospitals validated questionnaire is required. To achieve this goal, a semi-structured questionnaire consisting of 76 questions was created. Of these questions, 29 were designed to evaluate the general perceptions of radiologists concerning the use of AI in radiology and imaging units of tertiary public hospitals. In this research, the objective was to evaluate the reliability and validity of these 29 questions so that the data gathered accurately represents true perceptions without measurement errors. The questionnaire was modified and finalized after pretesting. In this study, face validity, content validity and construct validity were used to evaluated the validity of 29 questions related to perception of radiologists regarding application of AI in radiology and imaging units of tertiary public hospitals to ensure that the instrument adequately represents the concept of radiologists' perceptions toward AI applications in imaging practice. Establishing these psychometric properties strengthens the credibility of the questionnaire and supports its use in further studies assessing AI adoption in medical imaging settings. Face validity refers to the extent to which an instrument appears effective in terms of its stated aims and is often judged subjectively by experts or respondents [5]. Content validity involves expert evaluation of whether the instrument adequately represents the construct being measured [6]. Construct validity indicates how well an instrument or questionnaire measures the theoretical construct or concept it is designed to evaluate [7]. It assesses whether the items in a scale genuinely reflect and correspond to the fundamental concept being examined, frequently using statistical methods like factor analysis or correlations with related constructs. Cronbach's alpha is a widely reported statistic in science education literature, frequently used to indicate the reliability of research instruments employed in various studies [8]. Cronbach's alpha is often regarded as one of the most essential and widely used statistical measures in research focused on test development and application [9]. In this study, Cronbach's alpha was used to ensure the reliability and internal consistency of 29 questions.

METHODS

Questionnaire development

The questionnaire was formulated based on a comprehensive review of relevant literatures and consultation with subject experts. It was initially prepared in English and subsequently translated into Bengali. The questionnaire was modified and finalized after pretesting. It contained 76 questions and had 5 sections. Section-1 contained information related to description of respondents, Section-2 contained 6 questions regarding the information related to socio-demographic characteristics such as locations of data collection, age, gender, category of profession, monthly family income and years of experience. Section-3 illustrated 28 questions regarding information related to perception of radiologists regarding practice of Artificial Intelligence (AI) in radiology, Section-4 had 6 questions related to information regarding perception of radiologists regarding opportunities of AI application in radiology, Section-5 consists of 36 questions containing the information related to perception of radiologists regarding challenges of AI application in radiology. Out of the total 76 items in the questionnaire, 29 items were selected for validity and reliability analysis because these items specially measured the core construct relevant to the study`s hypothesis and research objectives, while the

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remaining items served supportive, descriptive and contextual purposes. 29 questions had options such as "Agree", "Strongly Agree", "Neutral", "Disagree" and "Strongly Disagree" and all options were individually scored with "1". Among 29 questions, 8 questions were in the section related to perception regarding practice of AI in radiology and imaging units of tertiary public hospitals and these questions addressed area of AI practice includes image interpretation [10], image denoising [10], disease diagnosis [11-12], disease prognosis [13], disease classification [12], decision making [12], treatment planning [10]. Among 29 questions, another 6 questions were included in the section related to perception regarding opportunities of Artificial Intelligence (AI) application in radiology and imaging units and these questions were addressed variables such as image quality [12], accuracy [10-12], AI radiologists collaboration [14], patient care [11-12], workload, workflow efficiency [11-12].Out of 29 questions, last 15 questions were in the section related to perception regarding challenges of artificial intelligence application in radiology and imaging units and these questions were related to the variables such as acceptance of AI [12], operator dependency [12], organizational guideline, expenses [10], funding, expert manpower, ethical consideration [12], legal regulations [10], privacy concern[12].

Pretesting

Before going to process of data collection, pretesting was conducted at radiology and imaging unit of National Gastroliver Institute and Hospital. During pre-testing respondents were asked if they fail to understand any specific words or sentences in the questionnaire. Any unacceptable or offensive words were also identified. Participants were also asked if they faced any language difficulties or if there were alternative wordings that would better suit their native language while filling out the questionnaires by them. The necessary modifications were made, and research instruments were finalized.

Questionnaire validation

Face Validity: The face validity of the questionnaire, particularly the 29 questions were evaluated by the research supervisor and subject expert who served as the resource person for this study. The questionnaire was reviewed to assess whether the questions appeared appropriate, clear, and relevant to the objectives of the research. The supervisor examined the wording, language, and structure of the items to ensure they were understandable to radiologists and aligned with the intended constructs. Based on the suggestions provided, necessary modifications were made before administering the questionnaire to the study participants.

Content Validity: The content validity of the 29 questions was established by ensuring that the questions comprehensively addressed the major domains of radiologists' perception regarding artificial intelligence in radiology and imaging units of tertiary public hospitals. These domains included practice-related aspects (such as area of AI practice), perceived opportunities (such as quality, accuracy, AI-radiologists collaboration, patient care, workload, workflow efficiency), and perceived challenges (such as acceptance of artificial intelligence, operator dependency, organizational guidelines, required infrastructure, expenses, funding, expert manpower, ethical consideration, legal regulations, data privacy concern). The questionnaire was reviewed by the research supervisor and subject expert who confirmed that the questions were relevant, representative, and adequately covered the intended constructs. Based on their feedback, the questions were finalized to ensure that all important aspects of radiologists' perceptions were included.

Construct validity: In this study, spearman rank correlation was done between domains and overall perception of radiologists related to their agreement with AI application to assess construct validity.

Reliability analysis of 29 items

Cronbach's alpha was used to assess the internal consistency or reliability of a set of questions that tells us how well the items in a questionnaire or test were correlated and whether they consistently measure the same concept. Cronbach`s alpha was also used to ensure quality of data because reliable instruments produce more stable and consistent results, which improved the credibility of the study. Since all 29 questions were self-developed, it was essential to evaluate their reliability to determine whether they were interrelated and measured the same underlying construct related to perception of radiologists regarding application of Artificial Intelligence (AI) in radiology and imaging units of tertiary public hospitals.

Ethical implications

Ethical clearance for this study was obtained from the Institutional Review Board (IRB) of National Institute of Preventive and Social Medicine (NIPSOM). Memo no: NIPSOM/IRB/2025/32. Permission of administrative authority of the selected tertiary hospitals was taken. Written informed consent was taken from each and every respondent before collection of data. Objectives of the study were explained in brief to the respondents.

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Privacy and confidentiality were ensured and maintained strictly.

RESULTS

Table 1 shows section level and overall Cronbach`s alpha for 29 questions related to the perception of radiologists regarding application of artificial intelligence. Here, Total Cronbach`s alpha was 0.761 for 29 items.

Table 1: Section level and overall Cronbach`s alpha for 29 questions related to perception of radiologists regarding application of AI in radiology

Cronbach`s alpha for the perception of radiologists regarding application of artificial intelligence	**Number of items**	**Cronbach`s Alpha**
Section 1: Perception of radiologists regarding practice of artificial intelligence in radiology	8 items	0.832
Section 2: Perception of radiologists regarding opportunities of artificial intelligence application in radiology	6 items	0.885
Section 3: Perception of radiologists regarding challenges of artificial intelligence application in radiology	15 items	0.579
Overall	**29 items**	**0.761**

Table 2 shows that there was statistically significant positive relationship between credibility of AI systems and overall perception of radiologists.

Table 2: Spearman rank correlation between credibility of AI systems and overall perception regarding agreement with AI application (n=226)

Attributes	**Perception of radiologists regarding agreement with AI application**	
	ρ	p (1 tailed)
Credibility of AI systems	0.408**	<0.0001

** Correlation is significant at the 0.01 level (1 tailed)

Table 3 shows that there was statistically significant positive relationship between the importance of necessary infrastructure and overall perception of radiologists.

Table 3: Spearman rank correlation between the importance of necessary infrastructure and overall perception regarding agreement with AI application (n=226)

Attributes	**Perception of radiologists regarding their agreement with AI application**	
	ρ	p (1 tailed)
Importance of necessary infrastructure	0.124*	0.031

*Correlation is significant at the 0.05 level (1 tailed)

Table 4 shows that there was statistically significant positive relationship between the importance of infrastructure cost and overall perception of radiologists.

Table 4: Spearman rank correlation between the importance of infrastructure cost and overall perception regarding agreement with AI application (n=226)

Attributes	**Perception of radiologists regarding their agreement with AI application**	
	ρ	p (1 tailed)
Importance of infrastructure cost	0.292**	<0.0001

** Correlation is significant at the 0.01 level (1 tailed)

Table 5 shows that there was statistically significant positive relationship between the importance of clear ethical guidelines with overall perception of radiologists. Spearman rank correlation analysis showed a statistically significant positive association between the domains of practice, opportunities, and

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challenges, and the overall perception, supporting the construct validity of the 29-item questionnaire.

Table 5: Spearman rank correlation between the importance of clear ethical guidelines and overall perception regarding agreement with AI application (n=226)

Attributes	**Perception regarding agreement with AI application in radiology**	
	ρ	p (1 tailed)
Importance of clear ethical guidelines	0.192**	0.002

**Correlation is significant at the 0.01 level (1 tailed)

DISCUSSION

The 29-item questionnaire designed to evaluate radiologists' perceptions of Artificial Intelligence (AI) application in radiology units of tertiary public hospitals in Bangladesh showed acceptable levels of validity and reliability. Face and content validity were established through expert consultation and an extensive literature review, ensuring that each item was relevant, comprehensive, and clearly stated. Construct validity, examined using spearman rank correlation, demonstrated significant positive relationships among the domains and the overall perception, supporting the conceptual framework of the instrument. The variables credibility of AI systems, importance of infrastructure, importance of infrastructure cost, importance of clear ethical guidelines were selected because these constructs were ordinal in nature and most critical themes influencing perception regarding the implementation and adoption of AI in radiology and imaging units of tertiary public hospitals. Construct validity was assessed using "Spearman rank correlation" rather than factor analysis because factor analysis typically assumes normally distributed data to produce reliable factor loadings. In this study, "Kolmogorov-smirnov test" was used to check normality of variables such as credibility of AI systems ($p<0.0001$), importance of infrastructure ($p<0.0001$), importance of infrastructure cost ($p<0.0001$) and importance of clear ethical guidelines ($p<0.0001$). The data were not normally distributed which made standard factor analysis potentially inappropriate. Spearman rank correlation, being a non-parametric method, allowed for the examination of associations among questionnaire domains and overall perception without assuming normality, providing a robust approach to evaluate construct validity. The Cronbach's alpha coefficient reflected high internal consistency, indicating that the items reliably measured the intended constructs. In this study, the overall results confirmed that the 29-item questionnaire was a dependable and valid tool for assessing radiologists' perceptions of AI in radiology. In this study, out of 3 sections for 29 questions, 1st section had Cronbach`s alpha score 0.832, 2nd section had 0.885 and 3rd section had Cronbach`s alpha score 0.579. Total Cronbach`s alpha score was 0.761 for 29 items which reflects acceptable internal consistency for the instrument. The practice and opportunities domains demonstrated good internal consistency, while the challenges domain showed a Cronbach's alpha of 0.579, indicating moderate reliability. This lower value may reflect the multidimensional nature of the items in this domain, which addressed multiple facets of AI-related obstacles, including ethical, professional, and technical challenges. Besides, several questions were added in this component for theoretical relevance and to explore the current situation regarding radiologists' perceptions of the challenges associated with implementing AI in radiology and imaging units of tertiary public hospitals, particularly in Bangladesh, where the adoption of AI in public healthcare settings is still a relatively new and emerging topic and this study was conducted as an exploratory investigation. In a study, Schmitt had suggested that there is no general level (such as 0.70) where alpha becomes acceptable, but rather that instruments with quite a low value of alpha can still prove useful in some circumstances [15]. In a study, Sijtsma had made the point more bluntly: "both very low and very high alpha values can go either with unidimensionality or multidimensionality of the data" [16]. It means that Cronbach's alpha alone cannot confirm whether a questionnaire truly measures a single construct or unidimensionality. A high alpha usually suggests good internal consistency, but it does not necessarily mean that all items measure only one underlying concept. Similarly, a low alpha doesn't always mean poor measurement, it could indicate the presence of multiple related dimensions or diverse aspects of a complex concept. Another study described alpha values as excellent (0.93–0.94), strong (0.91–0.93), reliable (0.84–0.90), robust (0.81), fairly high (0.76–0.95), high (0.73–0.95), good (0.71–0.91), relatively high (0.70–0.77), slightly low (0.68), reasonable (0.67–0.87), adequate (0.64–0.85), moderate (0.61–0.65), satisfactory (0.58–0.97), acceptable (0.45–0.98), sufficient (0.45–0.96), not satisfactory (0.4–0.55) and low (0.11) [17]. According to this study, the challenge related Cronbach`s alpha value

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of my study was acceptable. However, it is important to acknowledge certain limitations regarding the generalizability of the instrument. The questions were specifically developed and contextualized for radiologists working in the public tertiary healthcare sector of Bangladesh. As such, the findings may not accurately reflect the perceptions of radiologists operating in private hospitals and hospitals in different countries where the exposure to and implementation of AI may vary significantly. Furthermore, the instrument was designed with a focus on the Bangladeshi healthcare system, cultural context, and technological readiness. Differences in hospital organization, technology, workflow, and training between public and private settings may influence how radiologists perceive AI, affecting item relevance and responses. Similarly, variations in culture, regulations, and healthcare systems across countries could change the interpretation of items, particularly those related to ethical and professional issues. Therefore, although the questionnaire provides a strong foundation, it may need adaptation and re-validation before use in private hospitals or international contexts.

CONCLUSION

The 29-item questionnaire was developed to assess radiologists' perceptions of Artificial Intelligence (AI) in radiology from the Bangladesh perspective demonstrated good internal consistency, with an overall Cronbach's alpha of 0.761, indicating acceptable reliability. Both face and content validity were evaluated through expert review, confirming the relevance and clarity of the items. However, the challenge section encompassed multiple dimensions such as technical, professional, and ethical challenges which may have influenced inter-item correlations and internal consistency within subdomains. Construct validity was assessed using spearman rank correlation analysis due to non-normal data distribution, while factor analysis and content validity index (CVI) were not performed, limiting the depth of validity evaluation. Despite these constraints, the instrument provides a useful foundation for assessing radiologists' perceptions of AI in the Bangladeshi context. Validation among radiologists from diverse settings such as private institutions, rural healthcare centers, and other countries would improve representativeness and reliability. Considering these broader contexts can provide a more comprehensive understanding of radiologists' perceptions, challenges and readiness for AI adoption. Overall, the findings indicated that the questionnaire was a robust and reliable tool, capable of effectively capturing diverse perspectives on AI in radiology and supporting future research and practical applications in this field.

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Original Article

KNOWLEDGE OF PESTICIDE USE AND TOXICITY SYMPTOMS AMONG HORTICULTURE WORKERS

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ABSTRACT

Background: Pesticide toxicity is a major concern in Bangladesh, where agriculture is the backbone of the economy. Horticulture, a rapidly growing subsector, exposes workers to pesticides, making knowledge of usage and toxicity symptoms crucial. Pesticides adversely affect human health, animals, and the environment. The increasing demand for food production has led to greater pesticide use, raising concerns about exposure and adverse effects.

Methods: This was a cross-sectional study which was conducted on the population of 236 rural horticulture workers of Munshiganj district, Dhaka, Bangladesh from January to December 2021. The study place was selected purposively and respondents were selected conveniently. Data collection was done by face to face interview with semi-structured questionnaire.

Results: Among the 236 respondents, 56.8% were aged >45 years, 89% were male, all were Muslim, and 40.7% had primary-level education. Most (87.3%) were married, 34.3% earned ≤15,000 BDT, and horticulture was their primary income source. About 42.4% had lived in their current residence for 41–60 years, 39.4% had used pesticides for 10–20 years, and 71.2% had not received training from government institutions. Knowledge, assessed using Bloom's cut-off, revealed 61% had moderate, 6.8% had low, and 32.2% had good knowledge. Self-reported toxicity symptoms malaise 89.4%, skin itching 84.7%, headache 83.1%, skin rash 74.2%, epigastric discomfort 62.7% and Abdominal pain 54.7% subsequently. Significant associations ($p<0.05$) were found between age, gender, marital status, pesticide use duration, and government training with some symptoms.

Conclusion: The study highlights workers' knowledge levels and common toxicity symptoms, emphasizing the need for better pesticide-use education and safety measures. Findings can inform policies to enhance safe pesticide practices and reduce toxicity, supporting sustainable horticulture development.

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INTRODUCTION

Bangladesh, an agro-based country, has 16.5 million farming families, with nearly 40% of the labour force engaged in agriculture[1-4,11]. Horticulture, a rapidly growing subsector, significantly contributes to the national economy[5]. However, extensive pesticide use in horticulture raises concerns about occupational health risks[6-7]. Farmers and horticulture workers frequently use pesticides without adequate protective measures, leading to increased exposure and associated health risks[8]. Studies indicate that pesticide exposure causes both acute and chronic health effects, including neurological, respiratory, dermatological, and gastrointestinal issues[9-13]. Despite regulations on pesticide use, their improper handling remains a public health concern, particularly in developing countries like Bangladesh[11,14]. Inadequate training, lack of personal protective

equipment (PPE), and insufficient knowledge further exacerbate the risks[15]. Previous research highlights a strong correlation between pesticide exposure and various health problems among agricultural workers worldwide[16-21]. This study aims to assess the knowledge of pesticide use among horticulture workers in Bangladesh, identify common toxicity symptoms, and explore associations between pesticide exposure and sociodemographic factors. Findings will inform policies and interventions to promote safe pesticide use, reducing occupational health risks and ensuring sustainable agricultural development.

METHODS

This cross-sectional study was conducted among 236 rural horticulture workers in Munshiganj district, Bangladesh, from January to December 2021. Participants were selected using a convenient sampling method. Data were collected through face-to-face interviews using a semi-structured questionnaire. The questionnaire covered sociodemographic characteristics, pesticide knowledge, usage patterns, and self-reported toxicity symptoms. Knowledge levels were classified using Bloom's cut-off points into low, moderate, and good categories. Statistical analysis was performed to identify associations between pesticide exposure and various sociodemographic factors. Data were entered into SPSS version 26 for analysis. Each questionnaire was checked daily for completeness, and data clean-up was performed to ensure accuracy.

RESULTS

The study included 236 horticulture workers from Munshiganj district, Bangladesh. The age of participants ranged from 22 to 72 years, with a mean of 46.69 years (SD ±11.52). The largest proportion of respondents (28.4%) belonged to the 45–54 and ≥55-year age groups, followed by 26.7% in the 35–44-year range, and 16.5% in the ≤34-year group. The majority (89%) of the respondents were male, and all participants identified as Muslim. Regarding education, 40.7% had primary-level education, 25.4% completed secondary education, and 21.6% had higher education. A notable 12.3% had no formal education. The vast majority (87.3%) were married, while 12.7% were single. Income distribution showed that 34.3% earned ≤15,000 BDT per month, 33.5% earned 15,001–25,000 BDT, 23.7% earned 25,001–35,000 BDT, and 8.5% earned >35,000 BDT. Among them, 63.1% relied solely on horticulture for income, while 36.9% had additional sources of earnings. In terms of residence, 42.4% had been living in their current location for 41–60 years, followed by 33.9% for 21–40 years, 18.2% for ≤20 years, and 5.5% for more than 60 years. Pesticide usage varied among respondents, with 39.4% using pesticides for 10–20 years, 33.5% for <10 years, and 27.1% for more than 20 years. Alarmingly, 71.2% of respondents had not received any training from government organizations on pesticide safety. Distribution of the respondents according to their socio- demographic characteristics are presented in Table 1.

Regarding pesticide awareness, 78.8% of respondents knew the names of pesticides they used, while 70.8% were aware of the instructions on pesticide containers. However, only 65.7% knew the recommended pesticide concentration, and 72% stored empty pesticide bottles on the farm rather than disposing of them properly. The most commonly known pesticide was Carbofuran (Furadan/Fana 5G), recognized by 70.8% of respondents. Other frequently identified pesticides included Azoxystrobin+Difenoconazole (65.3%), Cypermethrin+Chlorpyrifos (46.2%), and Metribuzin (33.5%). The majority (63.6%) applied pesticides through spraying, while 36.4% used hand scattering methods.

About 78.8% of respondents knew the names of pesticides they used, while 70.8% were aware of the instructions written on pesticide bottles. However, only 65.7% knew the recommended concentration for application. Alarmingly, 72% of respondents reported storing empty pesticide bottles on farm sites, while 99.2% did not store them at home. Most (83.5%) disposed of bottles in garbage, whereas 64.8% burned or dumped them. Proper hygiene practices were noted, with 97.5% taking showers after pesticide application. However, only 65.7% took showers immediately after use. A strong awareness of pesticide health risks was observed, with 92.8% acknowledging their adverse effects. Alternative pest control methods were poorly known, as only 36% of respondents were aware of them. Regarding exposure routes, 86.4% identified inhalation as a risk, while 78.8% noted skin absorption and 64.8% recognized oral ingestion. Activities such as smoking (77.5%), drinking (86.4%), and eating (91.9%) while handling pesticides were cited as risk factors. Regarding knowledge about PPE usage for pesticide protection, most respondents (84.7%) recognized the protective benefits of gloves, 92.8% understood the importance of masks, only 55.5% acknowledged the need for special boots, 47% mentioned wide-brimmed hats, and 29.2% recognized the protective role of goggles.

Knowledge of pesticide use was categorized based on Bloom's cut-off points, revealing that 61% had

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moderate knowledge, 6.8% had low knowledge, and 32.2% had good knowledge.

Self-reported toxicity symptoms were highly prevalent among participants. Malaise was the most common, affecting 89.4% of respondents. Skin irritation was reported by 84.7%, while 83.1% experienced headaches. Skin rashes affected 74.2% of participants, and gastrointestinal symptoms such as epigastric discomfort (62.7%) and abdominal pain (54.7%) were also prevalent. Cardiovascular symptoms, including palpitations and chest pain, were experienced by 11.9%, 4.2%, while 38.1% suffered from feverish feeling (Table 2).

Regarding medical consultations due to pesticide-related health issues, 52.1% of respondents had sought medical advice, while 47.9% had not. Only 6.4% required hospital admission due to pesticide exposure, while 12.7% had knowledge of pesticide poisoning-related deaths.

Statistical analysis revealed significant associations ($p<0.05$) between various sociodemographic factors and toxicity symptoms. Older workers and those with longer pesticide use duration exhibited higher symptom prevalence. Gender differences were also notable, with male respondents reporting more severe symptoms. Workers who had received pesticide training showed a lower incidence of self-reported toxicity symptoms compared to untrained workers. However, the majority had never attended training, highlighting a crucial gap in education and awareness programs. Significant association of Socio-Demographic and Training Factors with Knowledge of Pesticide Use are presented in table 3.

Table 1. Distribution of the respondents according to their socio- demographic characteristics

Variables	Class difference	Frequency	Percentage	Remarks
Age group (years)	≤34	39	16.5	Min. age: 22, Max. age: 72 Mean SD: 46.69 ±11.522
	35-44	63	26.7	
	45-54	67	28.4	
	≥55	67	28.4	
	Total	236	100.0	
Educational qualification	No formal education	29	12.3	
	Primary	96	40.7	
	Secondary	60	25.4	
	Above	51	21.6	
	Total	236	100.0	
Marital status	Single	29	12.7	
	Married	207	87.3	
	Total	236	100.0	
Monthly Income	≤15000	81	34.3	Min: 5,000tk, Max: 50,000tk Mean SD: 22233.05 ± 9697.155
	15001-25000	79	33.5	
	25001-35000	56	23.7	
	>35000	20	8.5	
	Total	236	100.0	
Income solely from horticulture	Yes	149	63.1	
	No	87	36.9	
	Total	236	100.0	
Period of residence	≤20	43	18.2	
	21-40	80	33.9	
	41-60	100	42.4	
	>60	13	5.5	
	Total	236	100.0	
Duration of using pesticide	<10	79	33.5	
	10-20	93	39.4	
	>20	64	27.1	
	Total	236	100.0	
Training from govt. agency	Yes	68	28.8	
	No	168	71.2	
	Total	236	100.0	

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Table 2. Distribution of the respondents according to their self- reported toxicity symptoms

Self-reported toxicity symptoms	Yes Freq.(%)	No Freq.(%)	Total Freq.(%)
Malaise	211(89.4)	25(10.6)	236(100)
Headache	196(83.1)	40(16.9)	236(100)
Fits and loss of senses	9(3.8)	227(96.2)	236(100)
Palpitations	28(11.9)	208(88.1)	236(100)
Chest pain	10(4.2)	226(95.8)	236(100)
Feverish feeling	90(38.1)	146(61.9)	236(100)
Sneezing	24(10.2)	212(89.8)	236(100)
Cough	51(21.6)	185(78.4)	236(100)
Dyspnea	18(7.6)	218(92.4)	236(100)
Epigastric discomfort	148(62.7)	88(37.3)	236(100)
Abdominal pain	129(54.7)	107(45.3)	236(100)
Vomiting	55(23.3)	181(76.7)	236(100)
Diarrhea	24(10.2)	212(89.8)	236(100)
Itchy painful nose	28(11.9)	208(88.1)	236(100)
Itchy painful ear	13(5.5)	223(94.5)	236(100)
Itchy painful throat	16(6.8)	220(93.2)	236(100)
Skin itching	200(84.7)	36(15.3)	236(100)
Skin rash	175(74.2)	61(25.8)	236(100)
Itchy painful eyes	67(28.4)	169(71.6)	236(100)
Tearing eyes	50(21.2)	186(78.8)	236(100)

Table 3. Association of Socio-Demographic and Training Factors with Knowledge of Pesticide Use

Variable	Category	Low Knowledge (%)	Average Knowledge (%)	Good Knowledge (%)	Significance (p-value)
Age Category	≤34	23.1	59.0	17.9	0.001
	35-44	4.8	65.1	30.2	
	45-54	4.5	61.2	34.3	
	≥55	1.5	58.2	40.3	
Gender	Male	4.8	59.0	36.2	0.000
	Female	23.1	76.9	0.0	
Marital Status	Single	24.1	58.6	17.2	0.000
	Married	4.3	61.4	34.3	
Monthly Income (BDT)	≤15,000	16.0	75.3	8.6	0.000
	15,001-25,000	1.3	62.0	36.7	
	25,001-35,000	0.0	58.9	41.1	
	>35,000	0.0	50.0	50.0	
Duration of Pesticide Use (Years)	<10	13.9	70.9	15.2	0.000
	10-20	5.4	57.0	37.6	
	>20	0.0	54.7	45.3	
Training in Pesticide Use	No	9.3	69.8	21.0	0.000
	Yes	1.4	41.9	56.8	

DISCUSSION

Pesticides and its related toxicity symptoms should be considered as one of the major issue of Bangladesh as our country depends on agriculture for both economy and living purposes. This study assessed knowledge, practices, and self-reported symptoms among horticulture workers in Bangladesh. The findings reveal that while a significant proportion of workers had moderate

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knowledge about pesticide use, many still experienced adverse health effects, suggesting gaps in safety implementation. Similar studies from other countries support these findings. A study in Nepal reported that 65% of pesticide applications were classified as "unlikely to present acute hazards," yet improper storage and lack of PPE use contributed to pesticide-related symptoms[2]. Similarly, research in Kenya found that over 40% of horticultural workers experienced pesticide-related symptoms, with respiratory issues being a common complaint[13]. In Ghana, despite high levels of knowledge regarding pesticide names, nearly 95% of farmers lacked awareness of their environmental and health impacts, with most failing to use protective equipment. Differences in pesticide regulation and training accessibility may explain the variation in health impacts observed across studies[1]. European Union regulations mandate comprehensive risk assessment and management practices, reducing occupational risks compared to developing countries where such measures are inconsistently enforced. Additionally, a study in Malaysia indicated that education level significantly influences pesticide knowledge and safety practices, with secondary school graduates exhibiting higher compliance with protective measures[21]. This contrasts with findings in Bangladesh, where training in pesticide safety was minimal among respondents

CONCLUSION

The study highlights significant knowledge gaps and health risks associated with pesticide use among horticulture workers in Bangladesh. The high prevalence of self-reported toxicity symptoms underscores the urgent need for improved training and safer pesticide practices. Addressing these issues through policy changes and educational interventions can reduce occupational health risks and promote sustainable agriculture.

Limitations

This study relied on self-reported data, which may be subject to recall bias. The convenient sampling method limits generalizability to a broader population. Additionally, the study did not include direct biological assessments of pesticide exposure.

Recommendations

- Implement mandatory training programs on safe pesticide use.
- Increase accessibility and affordability of PPE for horticulture workers.
- Strengthen regulations and enforcement on pesticide handling and application.
- Promote integrated pest management (IPM) strategies to reduce pesticide reliance.
- Conduct further research on long-term health effects of pesticide exposure.
- Improve healthcare services for agricultural workers, including screening and treatment for pesticide-related health issues.

Ethical considerations

Ethical approval was obtained from the Institutional Review Board (IRB) of the National Institute of Preventive and Social Medicine (NIPSOM). The code of approval was: NIPSOM/IRB/2017/09.

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Original Article

SATISFACTION OF PATIENTS REGARDING HEALTH CARE SERVICES AT SELECTED UPAZILA HEALTH COMPLEXES OF BANGLADESH

ANM Shamsul Islam [1], Khursheda Akhtar [2], Amena Khatun Mita [3]

ABSTRACT

Background: Hospitals are important vehicles for the delivery of health care services to the patients and feedback from patients in essential to measure the quality of care provided by health personnel. The study aims to determine the level of patient satisfaction in selected upazila health complexes of Bangladesh.

Materials and methods: A descriptive cross-sectional study was conducted in 59 randomly selected UHCs across four Bangladeshi divisions from December 2023 to May 2024. Data were collected from 882 patients using a pre-tested semi-structured questionnaire. Patient satisfaction was assessed using the SERVQUAL framework to evaluate healthcare quality in the Bangladeshi context.

Results: Among the respondents (patients), 66.2% were female and 82% were married. About 53.3% respondents were housewife and 33% had no formal education. Regarding easy to getting services, 77.6% were satisfied on waiting time in reception area, 79.8% in registration area and 78% in visit to doctor. Regarding interpersonal manner, 17.3% were dissatisfied on courtesy towards the doctor, 5.9% towards the nurses and 16.8% towards the staff. About 89.1% patients were satisfied on doctors' willingness, 87.2% on time taken to answer question, 79.1% on physical examination but only 54% satisfied on privacy arrangements. On the other hand, more than 86% were satisfied on explanation of illness, explanation of treatment, instruction regarding medication and follow-up. About 52.9% dissatisfied on facilities to safe drinking water supply, 57.5% about toilet facilities and 29.5% on overall cleanliness in the hospital. Among the respondents, 89.4% patients had average level of satisfaction in emergency department, 86.7% had average level in in-patient department and 89.3% had average level of satisfaction in out-patient department of the selected UHCs. Regarding overall satisfaction of UHCs, around 88.3% respondents had average level of satisfaction.

Conclusion: This study revealed an average level of patient satisfaction with the services provided by the selected UHCs in Bangladesh. Improving cleanliness, safe drinking water, toilet facilities, investigation services, special public relation related training and privacy during examinations can significantly boost patient satisfaction in the Upazila Health Complexes.

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Key words: Patient Satisfaction, Upazila Health Complex (UHC)

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INTRODUCTION

In emerging nations, the health sector plays a pivotal role in ensuring sustained socioeconomic progress, as it directly impacts the well-being of the population. One of the key indicators of the effectiveness of healthcare delivery is patient satisfaction, which reflects the views and needs of patients regarding the services they receive. A major government report of

Bangladesh: Unlocking the Potential (2005) recognized public health services have been rated the lowest among all types of service providers in term of user's satisfaction. Evaluating patient satisfaction is critical, as it provides valuable insights into the quality of healthcare, particularly in the absence of established quality indicators. However, patient satisfaction as an important dimension for ensuring quality healthcare is getting priority in the developed countries [1,2]. In the context of Bangladesh, where healthcare delivery encompasses public, private, and non-governmental organizations (NGOs), understanding patient satisfaction is essential for improving the health system's responsiveness and efficiency. Another study on patient satisfaction with quality of hospital services in Bangladesh showed that there is a loss of faith in public hospitals. The study also identified some factors such as doctors' treatment, the behavior of nurses and their services patient are significantly influencing patients' satisfaction [3].

Bangladesh's healthcare system is structured across various levels, ranging from national super-specialized institutions to community-level clinics. The Ministry of Health and Family Welfare (MoHFW) is the main body responsible for organizing and implementing healthcare services at the national and local levels. Despite the government's efforts to provide free healthcare through a vast network of community clinics, challenges such as limited access to modern healthcare services, inadequate service quality, and high out-of-pocket expenses persist. These issues have contributed to widespread dissatisfaction, with many patients opting for treatment abroad, particularly in neighboring countries, leading to significant losses in foreign exchange.

While progress has been made in improving healthcare in Bangladesh, much remains to be done. The country's healthcare system continues to face issues related to equitable service distribution, efficiency, and affordability. The lack of trust in local healthcare services and dissatisfaction with the quality of care have become significant barriers to improving overall health outcomes. There are some qualitative studies yet to be conducted to explore the issues. Provider's behavior, especially respect and politeness are the most powerful predictor for client satisfaction with the public health care services [4].

Despite this, there is a notable gap in the research on patient satisfaction in Bangladesh, particularly studies that utilize extensive field-level data.

This study aims to fill this gap by assessing patient satisfaction across various UHCs in Bangladesh. By measuring the satisfaction levels of patients, this research seeks to provide valuable insights that can inform the development of public health strategies tailored to patients' expectations and needs. Understanding these determinants of satisfaction will help improve healthcare services and contribute to the creation of a more responsive and efficient healthcare system in Bangladesh.

METHODS

The descriptive type of cross-sectional study was carried out in randomly selected 59 UHCs from 10 districts of 4 divisions from 15 December 2023 to 14 May 2024 to determine the level of patients' satisfaction in selected upazila health complexes of Bangladesh. A total of 882 service receivers (patients) from were taken as sample. SERVQUAL Framework refined [3] in the context of Bangladesh was used to find out the level of patient satisfaction of above mentioned UHCs. Pretest of the questionnaire was done in Keraniganj and Shibpur UHC considering 10% of calculated sample. Then the questionnaire was finalized after necessary correction and modification based on findings of pre-test. Relevant data were collected by using pre-tested semi-structured questionnaire by face-to-face interview. Before starting data collection, institutional permission from concerned authority of UHC was taken. A written informed consent was taken from each of the respondents, in maintaining full autonomy of the participants. After collection of data these were checked, verified, coded and edited. The data entry was started immediately after completion of data collection. Data processing and analysis ware done using SPSS (Statistical Package for Social Science) version 22 and Microsoft excel. Data were analyzed according to objectives of the study. Descriptive statistics was used for all variables. Values were expressed as frequency and percentage, arithmetic mean, bivariate and multivariate analysis.

RESULT

Socio-demographic information of the patients: The significant findings of the study revealed that about 66.2% of the service receivers were female and age group was (19-40) years, 82% were married, 90.9% were Muslim, no formal education was 33%. About 62% were old patients and rest 38% were new patients.

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Table 1: Socio-demographic characteristics of patients (service receivers) (n=882)

Socio-demographic information	Categories	Frequency	Percent
Age	0-5 Years	1	0.1
	6-18 Years	45	5.1
	19-40 Years	471	53.4
	Above 40 Years	365	41.4
Sex	Male	297	33.7
	Female	584	66.2
	Others	1	0.1
Marital status	Married	723	82.0
	Unmarried	126	14.3
	Divorced	6	0.7
	Widowed/ widower	27	3.1
Religion	Islam	802	90.9
	Hindu	78	8.8
	Buddhist	2	0.2
Educational Level	No formal education	291	33.0
	Primary education	208	23.6
	Secondary education	175	19.8
	SSC	82	9.3
	HSC	79	9.0
	Diploma	5	0.6
	Graduation	26	2.9
	Masters and above	16	1.8
Occupational status	Job	61	6.9
	Business	97	11.0
	Farmer	55	6.2
	Housewife	470	53.3
	Retired	17	1.9
	Student	71	8.0
	Day laborer	60	6.8
	Jobless	39	4.4
	Others	12	1.4
Type of patient	New	335	38.0
	Returning	547	62.0

Table 2: Dimension 1: Ease of getting service (n-882)

Ease of getting service	Category	Frequency	Percentage
Satisfaction on waiting time in the reception area	Very dissatisfied	7	0.8
	Dissatisfied	155	17.6
	Satisfied	687	77.9
	Very satisfied	32	3.6
	Extremely satisfied	1	01
Satisfaction on waiting time in the registration area	Very dissatisfied	4	0.5
	Dissatisfied	154	17.5
	Satisfied	704	79.8
	Very satisfied	17	1.9
	Extremely satisfied	3	0.3
Satisfaction on waiting time to visit the doctor	Very dissatisfied	3	.3
	Dissatisfied	167	18.9
	Satisfied	693	78.6
	Very satisfied	18	2.0
	Extremely satisfied	1	0.1

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Among 882 respondents (patients), 77.9% patients were satisfied on waiting in reception area, 79.8% were satisfied on waiting in registration area and 78.6% were satisfied on waiting for doctor's visit.

Table 3: Dimension 2: Interpersonal manner, communication, time given (n-822)

Interpersonal manner, communication, time given	Very dissatisfied	Dissatisfied	Satisfied	Very satisfied	Extremely satisfied
Courtesy towards the doctor	2 (0.2%)	153 (17.3%)	713 (80.8%)	5 (0.3%)	2 (0.2%)
Courtesy towards the nurse	3 (0.3%)	52 (5.9%)	747 (84.7%)	79 (9.0%)	1 (0.1%)
Courtesy towards ward boy/staff	2 (0.2%)	148 (16.8%)	707 (80.2%)	12 (1.4%)	1 (0.1%)
Doctors' willingness	1 (0.1%)	41 (4.6%)	786 (89.1%)	52 (5.9%)	2 (0.2%)
Time taken to answer by doctors	1 (0.1%)	49 (5.6%)	769 (87.2%)	61 (6.9%)	2 (0.2%)
Thoroughness of examination	1 (0.1%)	79 (9.0%)	698 (79.1%)	23 (2.8%)	25 (0.9%)
Privacy arrangements	2 (0.2%)	242 (27.4%)	476 (54.0%)	5 (0.6%)	1 (0.1%)
Explanation of illness	2 (0.2%)	83 (9.4%)	780 (88.4%)	17 (1.9%)	0 (0%)
Explanation of treatment	3 (0.3%)	105 (11.9%)	759 (86.1%)	14 (1.6%)	1 (0.1%)
Instruction regarding medication & follow-up	3 (0.3%)	55 (6.2%)	769 (87.2%)	16 (1.8%)	0 (0%)
Investigation done	3 (0.3%)	63 (7.1%)	329 (37.3%)	4 (0.5%)	0 (0%)
Medicine given	23 (2.6%)	184 (20.9%)	642 (72.8%)	4 (0.5%)	0 (0%)
Parking management	1 (0.1%)	24 (2.7%)	544 (61.7%)	1 (0.1%)	4 (0.5%)
Outpatient schedule	1 (0.1%)	97 (11.8%)	626 (71.0%)	4 (0.5%)	0 (0%)
Sitting arrangements	8 (0.9%)	177 (21.5%)	561 (85.4%)	7 (0.4%)	0 (0%)
Water facility	31 (3.5%)	467 (52.9%)	335 (38.0%)	4 (0.5%)	1 (0.1%)
Toilet condition	38 (4.3%)	507 (57.5%)	291 (33.0%)	4 (0.5%)	0 (0%)
Overall cleanliness	35 (4.0%)	260 (29.5%)	579 (65.6%)	8 (0.9%)	0 (0%)
Disease solving	25 (2.8%)	16 (0.8%)	519 (58.8%)	2 (0.2%)	1 (0.1%)

Among 882 respondents, most were satisfied with staff courtesy (doctor 80.8%, nurse 84.7%, ward staff 80.2%), doctors' willingness (89.1%), consultation time (87.2%), and explanation of illness and treatment (88.4% and 86.1%). However, dissatisfaction was noted in privacy (27.4%), investigation services (only 37.3% satisfied), water supply (52.9%), toilet facilities (57.5%), and cleanliness (29.5%), while 71% were satisfied with outpatient scheduling and 67.1% with waiting arrangements.

Recommend others to visit the hospital

Among 882 respondents, 93.30 % of the respondents would recommend others people to visit the hospital

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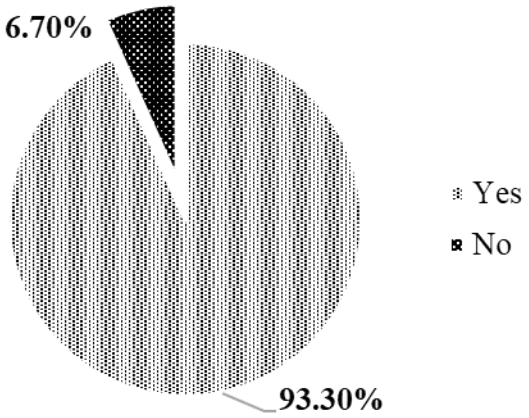

Figure 1: Recommend others to visit the hospital people

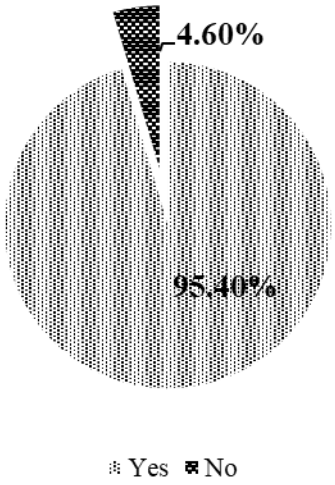

Figure 2: Interest in receiving services again in hospital

Interest in receiving services again in hospital

Among 882 respondents, 95.40 % of the respondents showed their interest to receive the services from the hospital again.

Table 4: Dimension-3 Overall Satisfaction (n-833)

Overall Satisfaction	Categories	Frequency (f)	Percentage (%)
Satisfaction on hospital whole services	Very dissatisfied	7	0.8
	Dissatisfied	56	6.3
	Satisfied	784	88.9
	Very satisfied	32	3.6
	Extremely satisfied	3	0.3
Satisfaction on availability & responsiveness of help desk	Very dissatisfied	3	0.3
	Dissatisfied	152	17.2
	Satisfied	599	67.9
	Very satisfied	8	0.9
	Extremely satisfied	1	0.1
Satisfaction regarding find different department booth	Very dissatisfied	4	0.5
	Dissatisfied	52	5.9
	Satisfied	784	88.9
	Very satisfied	11	0.3
	Extremely satisfied	1	0.1

Among the respondents, 88.9% patients were satisfied on overall services provided by the hospital, 67.9% were satisfied on availability & responsiveness of help desk and 88.9% satisfied on regarding find different department booth.

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Table 5: Department wise Satisfaction and overall satisfaction

Department wise Satisfaction	Poor	Average	Good	Total
Emergency Department (n=189)	5 (2.6%)	169 (89.4%)	15 (7.9%)	189 (100%)
In-Patient Department (n=330)	18 (5.5%)	286 (86.7%)	26 (7.9%)	330 (100%)
Out-Patient Department (n=363)	23 (6.3%)	324 (89.3%)	16 (4.4%)	363 (100%)
Overall Satisfaction of Emergency, In-patient and Out-patient Department				
Overall Satisfaction (n=882)	46 (5.2%)	779 (88.3%)	57 (6.5%)	882 (100%)

Among patients from the emergency department, 89.4% reported average satisfaction, 7.9% good, and 2.6% poor. In the in-patient department, 86.7% were average, 7.9% good, and 5.5% poor. Out-patient respondents showed 89.3% average, 4.4% good, and 6.3% poor satisfaction. Overall, 88.3% of all respondents reported average satisfaction, 6.5% good, and 5.2% poor. These findings indicate that while most patients across all departments are moderately satisfied with services, there remains a small proportion experiencing poor satisfaction.

DISCUSSION

The study aims to determine the level of patient satisfaction in selected upazila health complexes of Bangladesh with a sample size of 882 respondents. The findings provide valuable insights into the quality of services offered by the hospital and highlight areas of strength as well as opportunities for improvement.

In this study, most patients expressed satisfaction with the waiting times in different areas of the hospital, including the reception (77.9%), registration (79.8%), and waiting for the doctor (78.6%). Previous studies from Aldana et al. (2001) [4] and Rahman et al. (2002) [5] also identified long waiting time and insufficient consultation time as factors contributing to patient dissatisfaction in Bangladesh. However, the presence of minor dissatisfaction in these areas could indicate a need for continued improvements in streamlining processes to further reduce waiting times, thus improving patient experience.

Patient satisfaction was high with the courtesy shown by healthcare professionals. In this study, 80.8% of respondents were satisfied with the doctor's courtesy, 84.7% with the nurse's courtesy, and 80.2% with the ward hospital staff's courtesy. Furthermore, 89.1% of patients were satisfied with the doctor's willingness to engage with them, and 87.2% were satisfied with the doctor's response time and thoroughness during examinations [6]. These positive responses reflect the hospital's commitment to professional, compassionate care. However, a notable area for concern was the 27.4% of patients dissatisfied with the privacy arrangements. This suggests a potential gap in ensuring confidentiality and privacy, which is crucial for maintaining patient trust and comfort.

Clear communication is a cornerstone of effective healthcare delivery, and patients expressed high satisfaction in this domain. Most respondents were satisfied with the explanation of their illness (88.4%), treatment (86.1%), and medication instructions (87.2%). Another study showed Almost 90% of respondents indicated that they were satisfied with their period of inpatient care [6]. These findings underscore the hospital's efforts to ensure that patients are well-informed and engaged in their care decisions. However, 37.3% of patients were dissatisfied with the investigations conducted at the hospital, which may point to perceived delays, a lack of thoroughness, or concerns about the quality of diagnostic services provided. Similarly, while a majority were satisfied with the medication given (72.8%), the relatively lower satisfaction rate for investigations and some aspects of hospital amenities warrants further attention.

Hospital facilities received mixed reviews. A significant proportion of respondents expressed dissatisfaction with basic amenities such as water supply (52.9%), toilet facilities (57.5%), and overall cleanliness (29.5%). These results indicate that there is room for improvement in maintaining a hygienic and comfortable environment for patients. Although the hospital received high marks for signage and

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direction (87.25%), the dissatisfaction with cleanliness and basic amenities suggests a need for more focused attention on non-clinical services, which significantly contribute to patient comfort and satisfaction.

Across the various departments, patient satisfaction was generally positive, with a predominant level of average satisfaction. In the Emergency Department, 89.4% of patients reported average satisfaction, 7.9% reported good satisfaction, and only 2.6% reported poor satisfaction. Similarly, in the In-Patient and Out-Patient Departments, 86.7% and 89.3% of respondents reported average satisfaction, respectively. These findings highlight that while most patients are generally satisfied, there are areas that could benefit from improvements in service delivery and patient care. Notably, the Out-Patient Department showed a slightly higher percentage of patients reporting poor satisfaction (6.3%) compared to the Emergency and In-Patient Departments, pointing to potential gaps in outpatient care that could be explored further. Recent reviews on patients' satisfaction also highlighted that importance of providers' interpersonal communication skills outweighs their technical competence and recommended to strengthen training and evaluation on providers' interpersonal skills and empathetic skills [7,8]

Despite some areas for improvement, the hospital received positive feedback overall. A remarkable 93.3% of respondents would recommend the hospital to others, and 95.4% expressed a desire to return for future services. These high percentages indicate strong loyalty and positive perceptions of the hospital, suggesting that the institution's strengths in service delivery, such as patient-provider interactions and treatment quality, outweigh the dissatisfaction reported in certain aspects.

The present study is subject to several limitations. Respondents (patients) were selected using a convenient sampling method, which introduces the possibility of selection bias. This could affect the generalizability of the findings as the sample may not accurately represent the broader population of patients. Some respondents (managers) were unavailable for data collection, either due to being on training or being in the field during office hours. This resulted in missing data from certain individuals, potentially limiting the comprehensiveness of the study.

CONCLUSION

Regardless above limitation, the study enables to identify the satisfaction level of patients of selected upazilla health complexes. Data were taken from fifteen patients from selected each UHC. Around two third of the respondents were female, age group (19-40) years, married, housewives and old patients. More than two third of the respondents were satisfied on waiting time in the reception, registration and visit to doctor. They also satisfied on courtesy towards doctor, nurse and hospital staff. But around half of the respondents were not satisfied on privacy arrangement in the hospital. More than one third respondents was satisfied on investigation done by hospital. Most of the respondents

were interested to receive service again in the hospital and recommended others to visit the hospital. More than eighty percent patients' satisfaction level was average in emergency, in-patient and out-patient department of the hospital. Special public relation related training should be arranged for all health personnel at regular interval and this could help them to work more professionally.

RECOMMENDATIONS

- Authorities should arrange special public relation related training for all health personnel as early as possible and also refresher training at regular interval.
- Authorities should take immediate measure to improve overall cleanliness, safe drinking water supply, toilet facilities.
- Authorities should improve laboratory investigation facilities by uninterrupted supply of reagent and other logistics.
- Authorities should take appropriate measure to maintain privacy arrangement strictly during patient examination

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Original Article

POST-TRAUMATIC STRESS DISORDER AMONG MEDICAL SUPPORT STAFF IN BANGLADESH DURING THE COVID-19 PANDEMIC

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ABSTRACT

Background: The healthcare professionals, especially the medical support staff, suffered a huge physical as well as psychological trauma during the COVID-19 pandemic. By recognizing their role as frontline workers, they were the most exposed group who faced the terrifying virus, which created mental health problems during the pandemic. The purpose of this study is to find the prevalence of PTSD among medical support staff during the COVID-19 pandemic.

Methods: This cross-sectional study was designed to assess the prevalence of post-traumatic stress disorder (PTSD) among purposefully selected 289 medical support staff working at treating COVID-19 patients in government hospitals during the COVID-19 pandemic in Bangladesh. The Impact of Event Scale-Revised (IES-r) was used to prepare the questionnaire.

Results: The mean age of the medical support staff was 31.09±8.91 years. All of them suffered from mild to severe types of PTSD. Most of the participants were male (65.7%), aged between 26 to 35 years (46.7%), married (70.6%), working indoors (64.4%), and living with family (73.4%). 65.1% of the participants didn't have any co-morbidities, 12.1% of the participants were suffering from hypertension, 11.4% of them were suffering from asthma/copd, 8.0% were suffering from diabetes, and the rest of them were suffering from other chronic diseases. This study also found that about two-thirds of the participants (181) were suffering from mild PTSD.

Conclusion: Appropriate measures were urgent to make the frontliner health care support staff's mental health conditions recognized and well-treated, as well as for prevention.

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INTRODUCTION

In late December 2019, the Chinese city of Wuhan was informed about some cases of pneumonia that had no known cause.[1] China was affected by a new type of virus called the 2019 novel coronavirus (2019-nCoV). This virus was named COVID-19. It quickly spread around the world, causing the WHO

to declare it a pandemic.[2] This pandemic is causing a lot of damage all over the world. So far, there have been over 92.51 million confirmed cases and about 2 million deaths.[3] Bangladesh has seen almost 29,500 deaths out of over 20.42 million confirmed cases so far.[4] The ongoing pandemic has caused uncertainty and worries about the economy, jobs, money, relationships, and both physical and mental well-being. Medical support staff are on the frontlines of the pandemic, and their profession has been linked to increased mental health issues during emergencies.[5,6] These workers are more likely to develop PTSD. Especially, medical support staff have a higher chance of getting sick, becoming impatient, and having their usual support systems changed.[7] In healthcare workers, the number of people experiencing PTSD is higher compared to the general public. In a recent study in Singapore about COVID-19, it was found that 6-10% of healthcare staff had PTSD.[8] Overall, 18% of hospital nurses in different studies also had PTSD,[9] and during the SARS outbreak, the percentage was 20%.[10] Therefore, during pandemics, people are more likely to experience higher levels of PTSD compared to non-pandemic times. As shown in past pandemics like SARS and MERS, having close contact with infected people is linked to experiencing strong PTSD symptoms.[11-13] In Bangladesh, there is a serious lack of resources for healthcare professionals for medical support staff (MSS). Due to not having enough protective gear and having to handle a lot of work, they are at risk of feeling worried, tired, and not able to sleep well.[14] The mental health of medical support staff in Bangladesh is getting worse because they are worried about getting infected with the disease they are in contact. They also feel stressed because they worry about spreading the infection to their families and being isolated from others because of the stigma around the disease.[15] Many medical support staff (MSS) have been exposed to the virus, either directly or indirectly, and have also witnessed the deaths of patients. Such exposure to traumatic events can contribute to the development of post-traumatic stress disorder (PTSD). The incidence of PTSD amongst medical support staff throughout the COVID-19 pandemic isn't yet completely known; however, it's anticipated to be high. A recent study reported that the overall prevalence of PTSD among healthcare workers was 14%, which suggests that approximately one in seven HCWs exposed to the COVID-19 pandemic may develop PTSD.[16] Symptoms of PTSD can include flashbacks, nightmares, avoidance of reminders of the disturbing occasion, and problem-napping. PTSD can also lead to social isolation, depression, and anxiety. The look at the superiority of PTSD amongst medical support staff is vital for several reasons.[17] First, it can help raise awareness about the problem of PTSD among medical support staff. Second, it can help identify those who are at risk of developing PTSD. Third, it can support the development of interventions to prevent and treat PTSD in this group. The study provides important information on the prevalence of PTSD among medical support staff (MSS) and identifies factors associated with an increased risk of developing PTSD. The findings of this study can be used to expand interventions to help us prevent and treat PTSD in MSS. In addition to the above, there are several other reasonswhy it is important to observe the prevalence of PTSD among scientific guides during the covid-19 pandemic to understand the long-term mental health impact of the pandemic on healthcare professionals, perceive threat factors for PTSD with MSS, expand and explore interventions to save and treat PTSD in MSS, recommend rules and procedures to promote the mental health of MSS.

METHODS

Study design and settings:

This cross-sectional study was conducted among 289 medical support staff working in COVID-19 units of five government hospitals in the Dhaka division of Bangladesh (Dhaka Medical College Hospital, Bangladesh Kuwait Moitree Hospital, Mugda Medical College Hospital, Kurmitola General Hospital, and Tungipara Upazila Health Complex) between July and December 2020.

Study population:

The study was conducted with 289 medical support staff at five government hospitals in Bangladesh during the COVID-19 pandemic. The hospitals were Dhaka Medical College Hospital, Bangladesh Kuwait Moitree Hospital, Mugda Medical College Hospital, Kurmitola General Hospital, and Tungipara Upazila Health Complex. People who were not able to participate in this study were medical support staff who were not working in the COVID unit.

Data source and tools:

Participants were asked questions in person or on the phone, depending on what was easiest for them, from July 2020 to December 2020. Information was gathered using a questionnaire that had been tested beforehand and was designed to provide flexibility in how the questions were answered. The sociodemographic characteristics of the participants and the IES-R were used to find out if medical support staff had PTSD and their characteristics. The research included things like age, gender, marital

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status, education level, living situation, work history, and whether someone had COVID-19. The IES-R has 22 questions and a cutoff score of 33 or higher. It is suggested that the initial diagnosis of PTSD. Patients can use numbers from 0 to 4 to show how often certain comments have been true in the past 30 days. 0 means "not at all", 1 means "a little bit" or "mild", 2 means "moderately", 3 means "quite a bit", and 4 means "extremely". The total scores, which go from 0 to 88, show how bad PTSD is.[18] At first questionnaire was prepared in English. Then it was translated into Bangla and then re-translated into English to verify the translation. Bangla questionnaire was used to collect data.

Statistical analysis:

The information was carefully organized, inputted, corrected, and prepared, and then put into SPSS v25. We did a preliminary analysis to describe the group of people in the study. The information about different categories will be shown in tables that tell us how often each category appears. We looked at continuous numbers and found out their mean, percentile, and standard deviation. To determine if there was a meaningful connection, the Chi-square test ($\chi 2$) and Fisher's exact test were used. They both checked for associations and had a 95% confidence level. If the p-value was less than 0.05, it meant there was a significant association. The findings were displayed in tables and charts.

Selection Criteria:

Inclusion Criteria:

a. Any medical support staff of hospitals where COVID-19 patients get treatment.

b. Currently working and must have been working for at least 1 month.

c. Medical support staff of all sexes and ages.

Exclusion Criteria:

a. Medical support staff currently on leave.

b. Diagnosed patient with insomnia.

Ethical Implication

Ethical approval was obtained from the Institutional Review Board (IRB) of NIPSOM (memo no: NIPSOM/IRB/2020/1225). An informed written consent in Bengali was used to take consent from the respondents. Before starting the interview, the respondents were informed about the general and specific objectives of the study and its purpose of the study. Respondents were assured of the confidentiality of the data. The risks and benefits of the study were also explained clearly. They were informed about their full right to participate and refuse the study at any time. No invasive procedures or interventions were done in this study. Data were collected only from those respondents who participated voluntarily. This study was conducted according to the guidelines laid down in the Declaration of Helsinki protocols.

RESULTS

This cross-sectional study was carried out on 289 medical support staff working at hospitals where COVID-19 patients were admitted for treatment. Data were analyzed using the appropriate statistical procedure by SPSS 25, and the results are presented in this chapter through tables and figures.

Figure 1 depicts the distribution of post-traumatic stress disorder (PTSD) symptoms among the respondents. The majority, 181 participants, had subclinical PTSD. 81 respondents experienced mild symptoms, 25 experienced moderate symptoms, and only 2 medical support staff had a severe impact of events on their mental health.

Figure 1: Frequency distribution of PTSD medical support staff (N = 289)

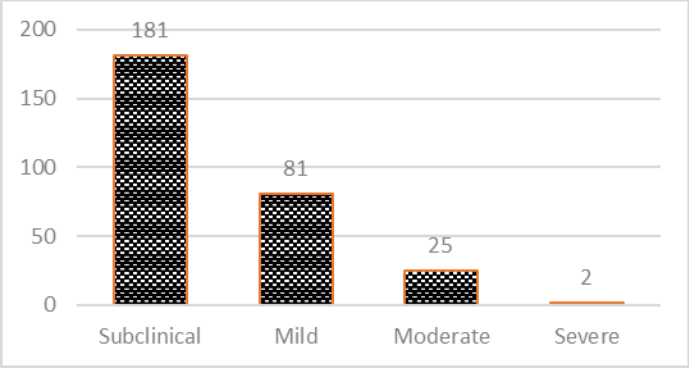

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Table 1 presents the socio-demographic characteristics of the individuals who participated in the study. The majority of participants were male, accounting for 65.7% of the total sample, while the remaining 34.3% were female. The age range of participants was between 18 and 63 years, with a mean age of 31.09 years and a standard deviation of 8.91. Nearly half of the participants (46.7%) were in the age group of 26 to 35 years. The majority of participants (70.6%) were married, while 26.6% were single, and only 2.8% were widowed or divorced. All participants had basic literacy skills, and only 9.7% had completed graduation or post-graduation. Among the remaining participants, 12.1% studied primary education, 25.3% studied junior school, 26.6% studied secondary school, and 26.3% studied higher secondary school.

Table 1: Socio-demographic characteristics of the respondents (N = 289)

Socio-demographic characteristics	Frequency (f)	Percentage (%)
Sex		
Female	99	34.3
Male	190	65.7
Age group (in years)		
18 to 25	83	28.7
26 to 35	135	46.7
36 to 45	49	17.0
46 and above	22	7.6
Marital status		
Single	77	26.6
Married	204	70.6
Widowed or divorced	8	2.8
Educational status		
Primary	35	12.1
Junior school	73	25.3
S.S.C.	77	26.6
H.S.C.	76	26.3
Graduation or above	28	9.7

Table 2 displays the work-related characteristics of the study participants. Of the total respondents, 31.1% worked as cleaners, 24.6% worked as ward boys, and 15.6% worked as security guards. Additionally, 17.0% worked as healthcare attendants (aya), and the remaining participants worked as cooks or in other positions. The majority (64.4%) worked indoors, while 11.1% worked outdoors, 8.0% worked in emergency departments, and 16.6% worked in operating theatres (OT), intensive care units (ICU), or high dependency units (HDU). Of the 289 respondents, 51.2% had direct contact with feverish or infected patients, while 48.8% did not have such contact.

Table 2: Work-related characteristics of the respondents (N = 289)

Work-related characteristics	Frequency (f)	Percentage (%)
Respondents' profession		
Cleaner	90	31.1
Cook	9	3.1
Security guard	45	15.6
Aya	49	17.0
Ward boy	71	24.6
Others	25	8.7
Current work station		
Indoor	186	64.4

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Outdoor	32	11.1
O.T./ICU/HDU	48	16.6
Emergency	23	8.0
Direct contact with feverish or infected patients		
Yes	148	51.2
No	141	48.8

Table 3 presents the social characteristics of the respondents. Of the participants, 73.4% lived with their family, 21.8% lived with colleagues, and 4.8% lived with friends. Overall, 64.7% did not contract COVID-19, while 35.3% of MSS or their cohabitants did contract the virus.

Table 3: Social characteristics of the respondents (N = 289)

Social characteristics of the respondents	Frequency (f)	Percentage (%)
Living situation of the respondents in the past 2 weeks		
Family	212	73.4
Friends	14	4.8
Colleague	63	21.8
A person her/himself or persons living with her/him got infected		
No	187	64.7
Yes	102	35.3

Table 4 illustrates the presence of co-morbidities among the respondents. The majority of medical support staff (65.1%) did not have any comorbidities, while hypertension and asthma/COPD were the most common conditions.

Table 4: Presence of co-morbidities among medical support staff (N = 289)

Co-morbidities (Multiple response)	Frequency (f)	Percentage (%)
No	188	65.1
Diabetes mellitus	23	8.0
Hypertension	35	12.1
Hyperthyroid	4	1.4
Arthritis	15	5.2
Asthma/COPD	33	11.4
Others	8	2.8

* Multiple responses

Table 5 indicates that there is no significant association of different variables with the prevalence of various types of PTSD levels among medical support staff, except that direct contact with feverish or infected patients had a borderline result ($\chi^2(3) = 7.812$, $p = 0.050$).

Table 5: Association of different variables with the prevalence of PTSD levels among medical support staff

Characteristics	PTSD levels among medical support staff				Total N (%)	χ^2	p-value
	Subclinical n (%)	Mild n (%)	Moderate n (%)	Severe n (%)			
Sex							
Female	60 (60.6)	30 (30.3)	9 (9.1)	0 (0)	99	0.693	1.452
Male	121 (63.7)	51 (26.8)	16 (8.4)	2 (1.1)	190	df=3	
Age group							

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18 to 25	52 (62.7)	23 (27.7)	7 (8.4)	1 (1.2)	83		
26 to 35	85 (63)	38 (28.1)	11 (8.2)	1 (0.7)	135	0.992	1.945
36 to 45	32 (65.3)	13 (26.5)	4 (8.2)	0 (0)	49	df=9	
46 and above	12 (54.5)	7 (31.9)	3 (13.6)	0 (0)	22		
Marital status							
Single	50 (64.9)	18 (23.4)	7 (9.1)	2 (2.6)	77	0.354	6.650
Married	126 (61.8)	61 (29.9)	17 (8.3)	0 (0)	204	df=6	
Widowed or divorced	5 (62.5)	2 (25)	1 (0.5)	0 (0)	8		
Education level							
Primary							
Junior school	23 (65.7)	9 (25.7)	3 (8.6)	0 (0)	35		
S.S.C.	48 (65.8)	19 (26)	6 (8.2)	0 (0)	73	0.720	8.799
H.S.C.	52 (67.5)	19 (24.7)	6 (7.8)	0 (0)	77	df=12	
Graduation or	41 (53.9)	27 (35.5)	7 (9.3)	1 (1.3)	76		
Post-graduation	17 (60.7)	7 (25)	3 (10.7)	1 (3.6)	28		
Respondents' profession							
Cleaner	64 (71.1)	22 (24.5)	4 (4.4)	0 (0)	90		
Cook	2 (22.2)	5 (55.6)	2 (22.2)	0 (0)	9		
Security guard	30 (66.7)	12 (26.6)	3 (6.7)	0 (0)	45	0.172	20.004
Aya	31 (63.3)	15 (30.6)	3 (6.1)	0 (0)	49	df=15	
Ward boy	40 (56.3)	20 (28.2)	10 (14.1)	1 (1.4)	71		
Others	14 (56.0)	7 (28.0)	3 (12.0)	1 (4.0)	25		
Current workstation							
Indoor	126 (67.7)	47 (25.3)	12 (6.45)	1 (0.5)	186	0.103	
Outdoor	14 (43.8)	13 (40.6)	5 (15.6)	0 (0)	32	df=12	18.439
O.T./ICU/HDU	29 (60.4)	13 (27.1)	6 (12.5)	0 (0)	48		
Emergency	12 (52.2)	8 (34.8)	2 (8.7)	1 (4.3)	23		
Direct contact with feverish or infected patients							
No	98 (69.5)						
Yes	83 (56.1)	35 (24.8)	8 (5.7)	0 (0)	141	0.050	7.812
		46 (31.1)	17 (11.4)	2 (1.4)	148	df=3	
Living situation of the respondents in the past 2 weeks							
Family	128 (60.4)	65 (30.7)	18 (8.5)	1 (0.4)	212	0.649	4.204
Friends	9 (64.3)	3 (21.4)	2 (14.3)	0 (0)	14	df=6	
Colleague	44 (69.8)	13 (20.6)	5 (7.9)	1 (1.6)	63		
A person her/himself or persons living with her/him got infected							
No	121 (64.7)	52 (27.8)	14 (7.5)	0 (0)	187	0.182	4.870
Yes	60 (58.8)	29 (28.4)	11 (10.8)	2 (2)	102	df=3	
Presence of co-morbidities							
No	123 (65.5)	48 (25.5)	16 (8.5)	1 (0.5)	188	0.556	2.078
Yes	58 (57.5)	33 (32.7)	9 (8.9)	1 (0.9)	101	df=3	

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DISCUSSION

During the pandemic in Bangladesh, this cross-sectional study was conducted. Almost all the research on PTSD discusses lifespan prevalence, which provides higher numbers for individuals with PTSD. In this research performed among US and Canadian people, the lifetime prevalence ranged from 6.1 to 9.2%.[19-23] Many studies have been conducted on medical personnel, but among medical support staff, there are few. Our study reveals that the prevalence is under-reported. According to the WHO, it is estimated that in lower-middle- to upper-income countries, around 2.1% to 2.3% of permanent residents suffer from PTSD once in a lifetime.[23-25] The current study reveals that the prevalence of PTSD among male medical support staff (65.7%) is nearly double that of female support staff (34.3%). According to age group, the medical support staff aged between 26 and 35 (46.7%) is nearly the same as those aged 18 to 25 (28.7%), 36 to 45 (17%), and 46 to above (7.6%) combined. According to a study conducted in Canada to determine PTSD and associated comorbid conditions, the prevalence of PTSD among females is 51.7%, among males is 48.3%, and the age group 18 to 35 is 40.3%, and the age group 35 to 60 is 42.8%, which is the reverse in this study.[19] According to marital status, married people are suffering from PTSD (70.6%) nearly three times more than that of unmarried persons (26.6%), which is in contrast to the previous studies.[26,27] Reduced social and other types of socio-cultural support might play negative roles in creating PTSD. The association between marital status and PTSD is significantly strong. Previously, it was found that single citizens had a higher number of referrals than married citizens, which is nearly similar to these study results.[8,12,25] The study shows that around one-third of the medical support staff (34.9%) are suffering from different co-morbidities like hypertension (12.1%), asthma/copd (11.4%), and diabetes mellitus (8.0%). A previously conducted study found that around 24.8% of doctors are suffering from at least one of the chronic diseases, including asthma.[27] In this study, around two-thirds of the study subjects are suffering from subclinical PTSD (181), nearly one-third are suffering from mild PTSD (81), and only two are suffering from severe PTSD. The test of significance shows that there is no significant relation between PTSD and the participant's sex, age group, marital status, education level, professional discipline, current work station, living situation, or presence of co-morbidities ($p > 0.05$). Table 5 shows that the oldest group (≥46 years) had a somewhat higher proportion of moderate PTSD (13.6%) compared with younger groups (~8%). The chi-square test did not find a statistically significant association ($\chi^2(9) = 1.95$, $p = 0.99$), likely because the sample size in this subgroup was small. However, the HSC group showed the highest proportion of mild PTSD (36.8%), compared with ~23–30% in other education groups. In Table 5, the chi-square test shows χ^2 (15) = 20.0, $p = 0.172$, indicating no significant association between profession and PTSD severity. However, the descriptive results suggest potentially meaningful patterns: cooks (n=9) had high levels of mild (55.6%) and moderate (22.2%) PTSD, ward boys showed the highest proportion of moderate PTSD (14.1%), and the "other" group included severe cases (4%). While these differences are not statistically significant, they may still be clinically relevant since the small sample sizes limit the statistical power. However, direct contact with feverish or infected patients had a borderline result ($p = 0.050$). Even if it does not reach conventional significance, it is an important finding because it is clinically plausible that direct exposure increases PTSD risk. The research was done on only a few hospitals, so the results cannot be applied to all hospitals. There could be some recall bias because the people themselves shared the information. The past experiences of having mental disorders were not ignored, so there is a possibility that they might come back or worsen during the COVID period.

CONCLUSION

This study reveals that all the medical support staff are suffering from PTSD, which is a serious health issue and must be of concern to the relevant ministries, divisions, and other authorities. This is important both in pandemic and normal situations because of its long-term effect on persons and their related family and friends. An appropriate and coordinated approach should be taken to treat and prevent mental health disorders. Adequate supply of PPEs, sufficient training, motivational incentives, etc., should be provided to ensure mental health safety to reduce PTSD and other psychological disorders.

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Ethical Implications:

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Written permission from the participants in the Bengali language was used, which was translated from the English version that was prepared beforehand when applicable. At the beginning of the interview, the participants were told about the overall and specific goals of the research and why the research was being conducted. The people who answered were told that their information would be kept private. The study's possible dangers and advantages were also clearly described. They were told that they had the choice to join and leave the study whenever they wanted. No surgeries or treatments were performed in this study. Only information from people who willingly took part was collected. This study followed the rules set out in the Declaration of Helsinki protocols.

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Original Article

SEXUAL FUNCTION AND QUALITY OF LIFE AMONG POSTMENOPAUSAL WOMEN

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ABSTRACT

Background: Menopause is often accompanied by symptoms that disrupt physical, psychological, and sexual well-being. Sexual dysfunction is particularly common in postmenopausal women and may contribute to reduced quality of life. However, this relationship remains underexplored in many developing-country settings.

Methods: This cross-sectional study was conducted in the Department of Gynecology and Obstetrics at Shaheed Suhrawardy Medical College Hospital, Dhaka, from January to December 2023. A total of 96 postmenopausal women attending the outpatient department were recruited using purposive sampling. Data were collected through face-to-face interviews using a semi-structured questionnaire. Sexual function was assessed using the Female Sexual Function Index (FSFI), and quality of life was evaluated with the Menopause-Specific Quality of Life (QoL) Questionnaire (MENQOL). Associations between FSFI total scores and MENQOL domain scores were examined using appropriate statistical tests, with statistical significance set at $p < 0.05$. Written informed consent was obtained from all participants.

Results: The mean age of participants was 53.7 ± 4.7 (SD) years. The prevalence of sexual dysfunction was 53.2%, with the lowest FSFI domain scores in arousal (1.89 ± 0.5) and desire (2.25 ± 0.6). The mean total FSFI score was 14.14 ± 1.5. Poor QoL was reported by 56.2% of participants, with the highest impairment observed in vasomotor (3.1 ± 1.6) and sexual (2.02 ± 1.03) MENQOL domains. Sexual dysfunction was significantly associated with joint family structure ($p < 0.001$) and poor marital relationship ($p = 0.009$). Poor QoL was significantly linked with lower educational attainment ($p = 0.003$), joint family setting ($p = 0.011$), and negative spousal relationship ($p = 0.040$).

Conclusion: Sexual dysfunction and impaired quality of life were highly prevalent among postmenopausal women of this study. Socio-demographic and relational factors significantly influenced both outcomes. Addressing sexual health as part of comprehensive menopausal care may improve women's overall well-being and QoL in similar sociocultural settings.

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Key words: Sexual function, quality of life, postmenopausal women, menopause, FSFI, MENQOL

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INTRODUCTION

Due to increased life expectancy, women spend more than one third of their lives in the postmenopausal stage, making quality of life during this period a significant public health concern (1,2). Menopause is clinically defined as twelve consecutive months of amenorrhea (3) and this transition is typically occurs gradually over several years as a natural consequence of aging. Nevertheless, for many women, the physical and mental symptoms experienced during this period can impose a substantial burden on daily

functioning and overall well-being, leading to reduced quality of life (QoL). More than half of the women report menopausal symptoms such as hot flushes, night sweats, sleep disturbances, fatigue, and depression contributing to poorer QoL(2,4).

In addition to these symptoms, many postmenopausal women also experience changes in sexual health, with declining estrogen levels contributing to a range of sexual concerns. Sexual functioning comprises multiple domains, including desire, arousal, satisfaction, and the presence or absence of sexual pain(5). As a result, sexual dysfunction is particularly prevalent in postmenopausal women, with estimates ranging from 68% to 86.5%, compared with 25% to 63% among women overall (6). These concerns are clinically and socially important as sexual activity and functioning are recognized as important components of overall quality of life (QoL) and an essential dimension of social health, which is distinct from mental and physical health. The World Health Organization (WHO) reinforces this by defining sexual health as a state of physical, emotional, mental, and social well-being in relation to sexuality, rather than merely the absence of disease, dysfunction, or infirmity (7). And so, sexual functioning is an essential aspect of women's lives and has increasingly attracted attention within public health, pharmaceutical, and medical fields (8).

Several large cross-sectional surveys have investigated sexual dysfunction and QoL outcomes among postmenopausal women (6,9,10). Evidence suggests that poorer sexual function is associated with reduced and sexual function can significantly predict QoL. Such as, one point increase in the Female Sexual Function Index (FSFI) total score has been associated with a 0.395-point increase in the overall QoL (2). However, sexual functioning is closely linked to many of the same factors that influence global QoL and health-related quality of life (HRQL), including age, education, health status, lifestyle behaviors, psychological well-being, and relationship quality (11). In addition, the QoL of postmenopausal women is shaped by sociocultural and behavioral factors, which may be further influenced by health-related perceptions and health-seeking behaviors (12). As a result, it is essential to adjust for these potential confounders when evaluating the relationship between sexual function and QoL. In many settings, including our context, this relationship remains underexplored, highlighting the need for further investigation.

Although menopause has a substantial impact on women's health and sexuality, it remains underrepresented, under-researched, and taboo in many societies. Most studies examining the quality of life of postmenopausal women have been conducted in developed countries, where sociocultural contexts may influence both perceptions of quality of life and experiences of menopausal symptoms. In contrast, evidence on the quality of life of postmenopausal women in developing countries remains limited. Given the strong links between sexual function, menopausal symptoms, and QoL, further research is needed to clarify these relationships while accounting for key confounders within diverse sociocultural settings. Therefore, this study aimed to find the association between sexual function and quality of life among postmenopausal women.

METHODS

Study Design and Setting

This cross-sectional study was conducted from January to December 2023 among postmenopausal women attending the Gynecology and Obstetrics outpatient department at Shaheed Suhrawardy Medical College Hospital, Dhaka, Bangladesh. Ethical approval was obtained from the Ethical Review Committee and Institutional Review Board of the National Institute of Preventive and Social Medicine (NIPSOM). Informed written consent was secured from all participants prior to enrollment.

Participants and Sampling

About 96 women who had experienced natural menopause were included in this study following inclusion and exclusion criteria. Inclusion criteria included cessation of menstruation for ≥12 months. Patients who underwent any surgical intervention or hormone therapy resulting in menopause were excluded from this study. Purposive sampling method was adopted.

Data Collection

A pretested semi-structured questionnaire was used for data collection containing socio-demographic and clinical data across three sections: a) participant characteristics; b) sexual function assessment and c) quality of life. Informed written consent was ensured from each participant before enrollment in this study.

Sexual Function Assessment

Female Sexual Function Index (FSFI), a validated 19-item instrument was used in this study. This tool assesses the sexual function across six domains over the history of past 4 weeks. For each domain, raw item scores (0-5 scale) were summed, then multiplied by domain-specific factors to yield standardized scores (0-6 range):

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- Desire (Q1-2): sum × 0.6
- Arousal (Q3-6): sum × 0.3
- Lubrication (Q7-10): sum × 0.3
- Orgasm (Q11-13): sum × 0.4
- Satisfaction (Q14-16): sum × 0.4
- Pain (Q17-19): sum × 0.4

Total FSFI score (range 2-36) was calculated by summing domain scores. Postmenopausal sexual dysfunction was diagnosed using the cutoff value ≤14.0 which corresponds to the mean total score of the study participants.

Quality of Life Assessment

Quality of life was assessed through Menopause-Specific Quality of Life Questionnaire (MENQOL) tool. This tool evaluates 29 symptoms across four domains based on the experienced in the past month.

- Vasomotor domain (3 items: hot flushes, night sweats, sweating)
- Psychosocial domain (7 items: anxiety, depression, memory problems, impatience, social isolation, etc.)
- Physical domain (16 items: fatigue, joint pain, sleep difficulties, weight gain, urinary symptoms, skin changes, etc.)
- Sexual domain (3 items: decreased sexual desire, vaginal dryness, avoiding intimacy)

Each item uses a 7-point Likert scale (0 = symptom not present; 1-6 = bothersome if present). Absent symptoms score 1; present symptoms score 2 (not bothersome) to 7 (extremely bothersome). Domain scores represent the mean score of all items within that domain (higher scores = greater impairment). Only symptoms reported as present contribute to domain mean calculations, providing a comprehensive measure of menopausal symptom impact on daily functioning.

Statistical Analysis

Statistical analysis was conducted using SPSS version 23.0. Categorical variables were presented as frequency (n) and percentage (%), while continuous variables were summarized as mean ± standard deviation. Chi-square tests assessed associations between socio-demographic characteristics and binary outcomes—sexual dysfunction (presence vs absent) and quality of life (good vs poor). Statistical significance was set at $p < 0.05$.

RESULTS

The mean age of participants was 53.7 ± 4.7 (SD) years, with most (70.8%) aged 45-55 years. Nearly half (45.8%) had only basic literacy, while most husbands had education up to class 8 (38.5%) or were literate only (28.1%). Over four-fifths were housewives (83.3%), and 54.3% reported good economic status. Participants predominantly lived in joint families (62.5%), with 50% having 3-4 children. Menopause duration was 2-5 years for 40.6% and >5 years for 30.2%. Oral contraceptive use was reported by 33.3%, and comorbidities included hypertension (31.3%) and diabetes (22.9%). Gynecological check-ups occurred annually for most (51%), every 6 months for 28.1%, less than yearly for 16.7%, and quarterly for 4.2%. Most rated their relationship with husbands as average (67.7%), followed by bad (21.9%) and good (9.4%).

Table 1: Baseline characteristics of the study participants (n=96)

	Frequency (n)	Percentage (%)
Age group (years)		
45-55	68	70.8
56-65	28	29.2
Mean ± SD	53.7 ± 4.7	
Highest educational attainment (participant)		
Literate only	44	45.8
Up to class 8	33	34.4
Class 9 to 12	15	15.6
Graduate	4	4.2
Highest educational attainment (husband)		
Literate only	27	28.1
Up to class 8	37	38.5
Class 9 to 12	19	19.6
Graduate	13	13.5
Occupation		

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Housewife	79	83.30
Professional	12	12.50
Service holder	3	3.10
Others	2	1.10
Economic status		
Very good	16	17.0
Good	51	54.3
Bad	27	28.7
Family type		
Nuclear	36	37.5
Joint	60	62.5
Number of children of the respondent		
1 to 2	34	35.4
3 to 4	48	50
5-6	14	14.6
Duration of menopause		
1 year	28	29.2
2-5 years	39	40.6
>5 years	29	30.2
History of OCP		
Yes	32	33.3
No	64	66.7
Presence of comorbidity		
HTN	30	31.3
Diabetes	22	22.9
HTN and diabetes	29	30.2
Asthma	9	9.4
Others	6	6.2
Gynecological check-up by respondents		
Every 3 months	4	4.2
Once every 6 months	27	28.1
Once a year	49	51
< Once a year	16	16.7
Respondents' relationship with husband		
Bad	21	21.9
Average	65	67.7
Good	9	9.4

OCP: Oral contraceptive pills, HTN: Hypertension

FSFI domain scores revealed severe sexual dysfunction across all domains, with total score 14.14±1.5. Lowest scores observed in arousal (1.89±0.5) and desire (2.25±0.6) domain, while highest scores were observed in satisfaction (2.89±0.6) domain.

Table 2: Female sexual function index (FSFI) domain and total scores among postmenopausal women (n=96)

FSFI Domains	Mean score ± SD
Desire	2.25±0.6
Arousal	1.89±0.5
Lubrication	2.27±0.4
Orgasm	2.49±0.4
Satisfaction	2.89±0.6
Pain	2.29±0.6
Total score	14.14±1.5

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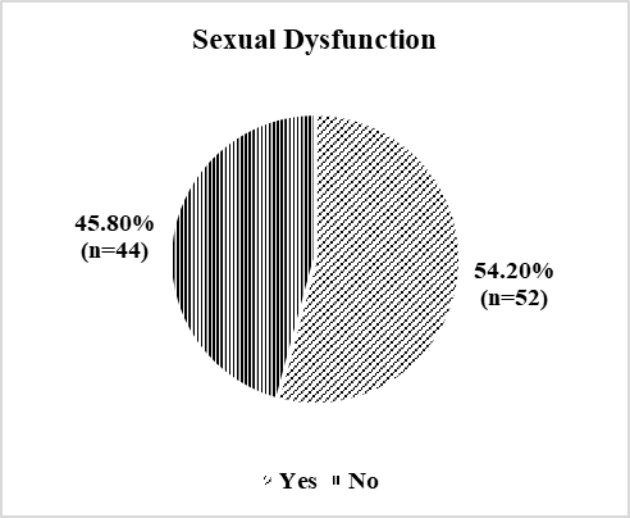

Figure 1: Presence of sexual dysfunction among study participants (n=96)

Prevalence of sexual dysfunction was 53.2% in study participants. Sexual dysfunction was significantly associated with joint family structure (78.8% vs 43.2%; p<0.001) and having bad relationship with husband (25% vs 19.2%; p=0.009).

Table 3: Relationship between socio-demographic characteristics and sexual dysfunction among the study participants (n=96)

Socio-demographic factors	Sexual dysfunction		p value*
	Yes n= 52 n (%)	No n=44 n (%)	
Age group			
45 to 55 years	38 (73.1)	30 (68.2)	0.656
56 to 65 years	14 (26.9)	14 (31.8)	
Highest education attainment (participant)			
Literate only	30 (57.7)	14 (31.8)	
Up to class 8	14 (26.9)	19 (43.2)	0.060
Class 9-12	7 (13.5)	8 (18.2)	
Graduate	1 (1.9)	3 (6.8)	
Highest education attainment (husband)			
Can sign only	15 (28.8)	12 (27.3)	
Up to class 8	24 (46.2)	13 (29.5)	0.230
Class 9-12	7 (13.5)	12 (27.3)	
Graduate	6 (11.5)	7 (15.9)	
Occupation			
Housewife	47 (90.4)	33 (75)	
Professional	3 (5.8)	9 (20.4)	0.054
Service holder	1 (1.9)	2 (4.6)	
Others	1 (1.9)	0	
Economic condition			
Very good	5 (9.6)	11 (25)	
Good	31 (59.6)	24 (56.8)	0.118
Bad	16 (30.8)	9 (20.5)	
Family type			
Nuclear	11 (21.2)	25 (5.8)	<0.001
Joint	41 (78.8)	19 (43.2)	
Number of children			

DOI: https://doi.org/10.3329/jopsom.v44i1.88191

1-2	16 (30.8)	18 (40.9)	
3-4	25 (48.1)	23 (52.3)	0.146
5-6	9 (21.2)	3 (6.8)	
Duration of menopause			
1 year	16 (30.8)	12 (27.3)	
2-5 years	19 (36.5)	20 (45.4)	0.684
>5 years	17 (32.7)	12 (27.3)	
OCP intake for family planning			
No	36 (69.2)	28 (63.6)	
Yes	16 (30.8)	16 (36.4)	0.665
Presence of comorbidity			
HTN	17 (32.7)	13 (29.5)	
Diabetes	13 (25)	9 (20.5)	0.390
HTN and diabetes	14 (26.9)	15 (34.1)	
Asthma	3 (5.8)	6 (13.6)	
Others	5 (9.6)	1 (2.3)	
Frequency of gynecological checkup			
Every 3 months	2 (3.8)	2 (4.5)	
Once every 6 months	15 (28.8)	12 (27.3)	1
Once a year	26 (50)	23 (52.3)	
< once a year	9 (17.4)	7 (15.8)	
Relation with Husband			
Bad	11 (25)	10 (19.2)	
Average/good	33 (75)	42 (80.1)	0.009

*p value was determined by Chi-square test

Menopause-Specific Quality of Life Questionnaire (MENQOL) scores revealed worst score in vasomotor (3.1±1.6) and sexual domains (2.02±1.03). Lack of energy was reported by all participants (100%) and most common symptoms after this included hot flushes (91.7%), vaginal dryness (95%), impatience (97.9%), flatulence (95.8%).

Table 4: Menopause-Specific Quality of Life Questionnaire (MENQOL) Domain Scores and Symptom Prevalence Among Postmenopausal Women (n = 96)

	Mean score ± SD	n (%)
Vasomotor domain		
Hot flushes	3.6±1.8	88 (91.7)
Night sweat	3.5±1.9	87 (90.6)
Sweating	2.2±1.8	71 (76)
Total	3.1±1.6	
Psychosocial domain		
Dissatisfaction with personal life	4.1±1.8	92 (95.8)
Feeling anxious or nervous	3.4±1.7	88 (91.7)
Experiencing poor memory	2.9±1.4	91 (94.8)
Accomplishing less than earlier	3.1±2.1	80 (83.3)
Feeling depressed or down or blue	2.6±1.7	79 (82.3)
Being impatience with other people	2.7±1.3	94 (97.9)
Feeling of wanting to be alone	2.7±1.4	93 (96.9)
Total domain score	2.6±1.1	96 (100)
Physical domain		
Flatulence or gas pains	4.1±1.8	92 (95.8)
Aching in muscles and joints	3.4±1.7	88 (91.7)
Feeling tired or worn out	2.9±1.4	91 (94.8)
Difficulty sleeping	3.1±2.1	80 (83.3)
Aches in back of neck or head	2.6±1.7	79 (82.3)
Decrease in physical strength	2.7±1.3	94 (97.9)

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Decrease in stamina	2.7±1.4	93 (96.9)
Feeling lack of energy	2.6±1.1	96 (100)
Drying skin	1.6±1.8	63 (65.6)
Weight gain	1.1±1.2	60 (62.5)
Increased facial hair	0.7±1.2	44 (45.8)
Changes in appearance, texture, tone of my skin	1.6±1.6	72 (75)
Feeling bloated	4.1±1.9	92 (95.8)
Low backache	3.5±1.8	87 (90.6)
Frequent urination	2.5±1.6	78 (81.3)
Involuntary urination when laughing or coughing	2±1.5	69 (71.9)
Total domain score	2.57±0.75	
Sexual domain		
Change in your sexual desire	2.3±1.6	83 (86.5)
Vaginal dryness during intercourse	3.4±1.6	95 (95)
Avoiding intimacy	0.3±0.8	21 (21.9)
Total domain score	2.02±1.03	

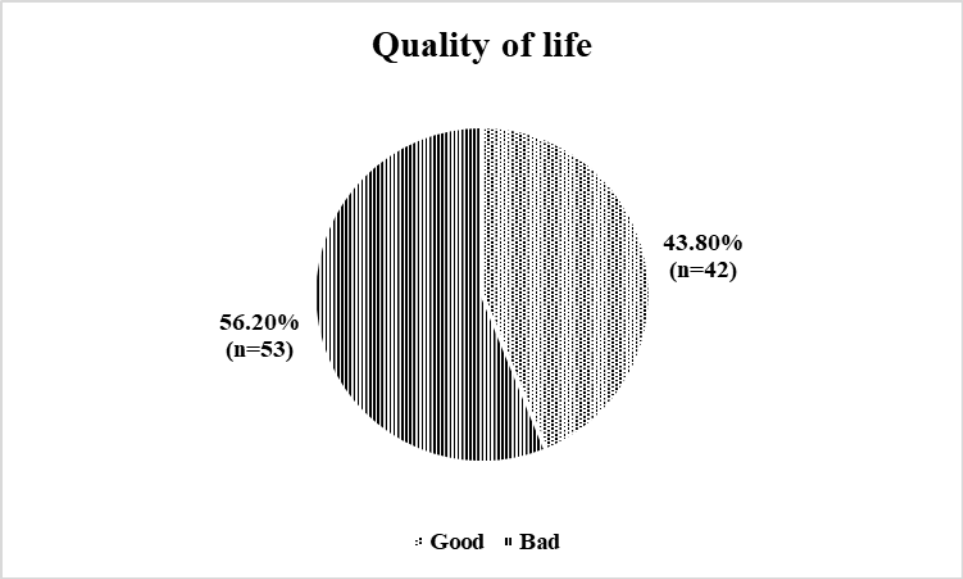

Figure 2: Quality of life among study participants (n=96)

About 56.2% of the study patients were observed with poor quality of life. Poor quality of life was significantly associated with lower levels of both participants' (59.3% vs 28.6%; p=0.003) and their husbands' education (40.7% vs 11.9%; p=0.009), joint family structure (74.1% vs 47.6%; p=0.011), and bad relationship with relationship (18.5% vs 28.1%; p=0.040).

Table 5: Relationship between socio-demographic characteristics and quality of life among the study participants (n=96)

Socio-demographic factors	Quality of life		p value*
	Good n= 42 n (%)	Poor n=53 n (%)	
Age group			
45 to 55 years	32 (76.2)	36 (66.7)	0.369
56 to 65 years	10 (23.8)	18 (33.3)	
Highest education attainment (participant)			
Literate only	12 (28.6)	32 (59.3)	

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Up to class 8	16 (38.1)	17 (31.5)	0.003
Class 9-12	10 (23.8)	5 (9.2)	
Graduate	4 (9.5)	0 (0)	
Highest education attainment (husband)			
Can sign only	5 (11.9)	22 (40.7)	
Up to class 8	17 (40.5)	20 (37)	0.009
Class 9-12	10 (23.8)	9 (16.7)	
Graduate	10 (23.8)	3 (5.6)	
Occupation			
Housewife	37 (88.1)	43 (79.6)	
Professional	3 (7.1)	9 (16.3)	0.054
Service holder	2 (4.8)	1 (1.8)	
Others	0 (0)	1 (1.8)	
Family type			
Nuclear	22 (52.4)	14 (25.9)	0.011
Joint	20 (47.6)	40 (74.1)	
Economic condition			
12 (28.6)	12 (28.6)	4 (7.4)	
22 (52.4)	22 (52.4)	33 (61.1)	0.024
8 (19)	8 (19)	17 (31.5)	
Number of children			
1-2	19 (45.2)	15 (27.8)	
3-4	16 (38.1)	32 (9.2)	0.115
5-6	7 (16.7)	7 (13)	
Duration of menopause			
1 year	15 (35.7)	13 (24.1)	
2-5 years	17 (40.5)	22 (40.7)	0.362
>5 years	10 (23.8)	19 (35.2)	
OCP intake for family planning			
No	25 (59.5)	39 (72.2)	
Yes	17 (40.5)	15 (27.8)	0.275
Frequency of gynecological checkup			
Every 3 months	1 (2.4)	3 (5.6)	
Once every 6 months	15 (35.7)	12 (22.2)	0.472
Once a year	19 (45.2)	30 (55.5)	
<once a year	7 (16.2)	9 (16.7)	
Relation with Husband			
Bad	12 (28.1)	10 (18.5)	
Average/good	31 (73.8)	43 (79.6)	0.040
Presence of comorbidity			
HTN	11 (26.2)	19 (35.2)	
Diabetes	10 (23.8)	12 22.2)	0.272
HTN and diabetes	11 (26.2)	18 (33.3)	
Asthma	7 (16.7)	2 (3.8)	
Others	3 (7.1)	3 (5.5)	

*p value was determined by Chi-square test

DISCUSSION

Postmenopausal women face numerous health challenges that profoundly affect their quality of life, with female sexual dysfunction emerging as one of the most prevalent yet frequently overlooked issues (13,14). This condition, which tends to worsen with age through multiple contributing factors, commonly presents as difficulties with arousal, lubrication, or achieving orgasm even when stimulation is adequate. This cross-sectional study sought to explore the connections between these sexual and reproductive health concerns and overall quality of life in a cohort of 96 Bangladeshi postmenopausal women, employing the well-validated Female Sexual Function Index (FSFI) and Menopause-Specific Quality of Life Questionnaire (MENQOL).

The average age of the study participants was 53.7 ± 4.7 (SD) years, with the majority (70.8%) falling

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between 45 and 55 years old. This age profile closely mirrors findings from Nazarpour et al., who reported mean ages of 52.8 ± 3.7 years and 51.2 ± 3.5 years in their postmenopausal groups (10). Hence, the reported age is this study presents somewhat younger distribution compared to Parajuli et al., where women aged 55-64 years predominated, and to Ismail et al. reporting much younger reproductive-age participants averaging 32.94 ± 9.76 years (15,16).

Assessment with the FSFI captured a stark picture of sexual health, showing a mean total score of 14.14 ± 1.5 against our study-derived cutoff of ≤14.0. This translated to an alarming 81.3% prevalence of sexual dysfunction- substantially higher than the 61.0% reported by Nazarpour et al.(10) and 67.8% reported by Ismail et al.'s (16). Arousal function was observed as the most compromised at 1.89 ± 0.5, though even the highest-scoring satisfaction domain (2.89 ± 0.6) fell well into pathological territory. These results align with broader literature indicating postmenopausal FSD rates between 68% and 86.5% (17).

Quality of life fared similarly poorly on the MENQOL, with 56.2% of participants experiencing diminished well-being. Impairment was highest in the vasomotor domain with a mean of 3.1 ± 1.6, where 91.7% reported hot flushes and in the sexual domain with a mean of 2.02 ± 1.03) where 95% reported vaginal dryness. Symptoms permeated daily life universally—100% reported energy depletion, 97.9% felt constant impatience, and 95.8% suffered flatulence—patterns that echo the symptom clusters identified by Mohamed et al. (18). Sexual dysfunction was associated with living in joint family structures and bad/average relationships with husbands. Poor quality of life was associated with limited education among both participants and husbands, alongside joint family living and bad/average relation with husband. Such patterns likely stem from Bangladesh's unique socio-cultural landscape. With joint families comprising 62.5% of households, women may face persistent privacy constraints and heightened psychosocial strain. Coupled with low educational attainment, health literacy remains constrained in ways not as pronounced in other settings. The participant characteristics including 83.3% housewives- further muted age or occupational influences seen in studies like Parajuli et al. (15).

Ultimately, this study uncovered a clear two-way street between sexual dysfunction and quality of life-profound sexual impairments erode overall well-being, even as relational and familial pressures deepen sexual difficulties(13,19). These insights call for targeted, culturally attuned strategies in South Asian contexts—focusing on spousal communication, family dynamics, and basic health education—to better support postmenopausal women.

CONCLUSION

This study demonstrates high rates of sexual dysfunction (53.2%) and poor quality of life (56.2%) among postmenopausal Bangladeshi women, with severe impairments in arousal, desire, vasomotor, and sexual domains. Joint family structure, lower education, and poor spousal relationships were significantly associated with both outcomes. Routine sexual health screening, counseling, and lifestyle interventions are urgently needed to improve postmenopausal well-being in this under-researched population.

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