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IN THIS ISSUE

PMR in Global Health Emergencies

Autism rise and quality of life

Educational intervention on COPD rehabilitation

Referral patterns to PMR among inpatients in a teaching hospital

Spinal cord injury following gunshot injury

Prevalence and predictors of pressure injuries after stroke

Rehabilitation of elbow synovial osteochondromatosis with ulnar nerve

Climate change in PMR education

VOLUME 2 • ISSUE 1 • JAN - JUNE 2026

www.bspmr.org

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Bangladesh Journal of Physical Medicine and Rehabilitation (BJPMR) is a peer-reviewed, open-access journal published by the Bangladesh Society of Physical Medicine and Rehabilitation (BSPMR), Dhaka, Bangladesh. The journal follows the guidelines and recommendations of the International Committee of Medical Journal Editors (www.icmje.org) and the principles and standards of the Committee on Publication Ethics (www.publicationethics.org). BJPMR aims to publish high-quality, multidisciplinary research in physical medicine and rehabilitation and related areas of human health. The journal welcomes original research articles, review articles, and other scholarly contributions of varying lengths that address clinically relevant, scientific, educational, and public health issues. The journal publishes two regular issues annually, in January and July, while following a continuous publication model, whereby accepted articles are published online throughout the year as soon as they are ready for publication.

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Ownership and management: BSPMR hold ownership of the BJPMR, and management is exclusively overseen by the Journal office.

Article processing charge: There is no article processing charge or publication fee. BSPMR currently covers this cost.

Publisher: Published by the BSPMR (www.bspmr.org). The online publication service will be provided by Bangladesh Journals Online (www.banglajol.info).

Journal office: Room: 130, Block: C. Bangladesh Medical University, Shahbag, Dhaka-1000, Bangladesh.
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CONTENTS

Volume 2 | Issue 1 (Jan – June) | Year 2026

Editorial

Physical medicine and rehabilitation: A global health priority in times of conflict, disaster, and chronic disease — 1

M. Suzon Al Hasan, M. Shahidur Rahman, Taslim Uddin

Review article

Causes and consequences of autism rise: Impact on quality of life — 4

Zannatul Ferdous Farin, Sanjida Subahan, Jannath Ara, Md. Faruque Ahmed, Kamrunnaher Koly

Original articles

Effects of educational intervention on pulmonary rehabilitation of chronic obstructive pulmonary disease — 11

Md. Jouel Ahamed, Mosammad Jannatul Fardoushi, Shohel Ahmed, Md. Tanvir Zoha, Saleh Ahmad

Mapping inpatient rehabilitation needs: Referral patterns to a physical medicine and rehabilitation service in a tertiary hospital in Bangladesh — 16

AMM Ashraful Islam, Md. Mahfuzur Rahman, Aminuddin A Khan, Mohammed Arman, Md. Abirul Islam

Characteristics of spinal cord injury survivors following the 2024 Bangladesh anti-discrimination movement: A hospital-based study — 22

Mohammad A K Azad, Fatema Newaz, Md. Monirul Islam, Hasna Raihan Rahim, Md Moniruzzaman, Taslim Uddin

Prevalence and predictive indicators of pressure injuries among admitted stroke patients in a tertiary care setting — 27

Md. Ashikul Islam, Aleya Ferdush Monni, S.M. Mazharul Islam, Hasan Habibur Rahman, Neelufar Rahman

Case report

Secondary synovial osteochondromatosis of the elbow presenting with advanced ulnar neuropathy and claw hand: A multidisciplinary surgical and rehabilitation approach — 31

Md. Abirul Islam, Mohammed Arman

Perspective

Integrating climate change into postgraduate physical medicine and rehabilitation education for a climate-resilient health system — 35

Iffat Islam Khan, Fatema Newaz, Taslim Uddin

Bangladesh Journal of Physical Medicine and Rehabilitation
Bangladesh J Phys Med Rehabil 2026; 2(1):1-3

Editorial

Physical medicine and rehabilitation: A global health priority in times of conflict, disaster, and chronic disease

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Publication History
Received: 1 Jan 2026
Accepted: 7 May 2026
Published print: 30 June 2026

Responsible Editor
Not required

Physical Medicine and Rehabilitation, also known as physiatry, has evolved from a collection of fragmented therapeutic practices into a central pillar of contemporary healthcare. Its trajectory reflects the intersection of war, epidemiological transition, and health system transformation. As this new journal is launched, it is both timely and necessary to revisit the origins and evolution of Physical Medicine and Rehabilitation while critically examining its current status in the context of escalating non-communicable diseases, global conflicts, disasters, and renewed international commitments to strengthen rehabilitation within health systems.

The conceptual roots of Physical Medicine and Rehabilitation extend to antiquity, where exercise, manual therapies, and hydrotherapy were used to restore function. However, its emergence as a formal medical specialty occurred in the early 20th century, shaped profoundly by global conflicts [1]. The rehabilitation needs of injured soldiers during the World Wars catalyzed the development of structured, interdisciplinary programs. Visionaries such as Howard A. Rusk promoted a holistic model integrating physical, psychological, and social dimensions of care, laying the foundation for modern rehabilitation medicine [2].

The post-war period witnessed rapid institutional expansion, including the establishment of academic departments, professional organizations, and training programs. Over time, Physical Medicine and Rehabilitation transitioned from a disease-centered model to a function-centered paradigm, culminating in the adoption of the International Classification of Functioning, Disability and Health [3]. This framework reframed health in terms of functioning, participation, and contextual factors, positioning rehabilitation as an integral component of health systems rather than a supplementary service.

In the 21st century, Physical Medicine and Rehabilitation has gained renewed relevance due to three converging global trends. First, the rising burden of non-communicable diseases including stroke, cardiovascular diseases, diabetes, and musculoskeletal disorders has significantly increased the demand for rehabilitation. With improved survival rates and aging populations, more individuals are living with chronic conditions and functional limitations. It is estimated that over 2.4 billion people worldwide could benefit from rehabilitation services, underscoring the magnitude of unmet need [4].

Second, ongoing conflicts and humanitarian crises have reinforced the essential role of rehabilitation. Modern warfare produces complex injury patterns, including polytrauma, spinal cord injuries, traumatic brain injuries, and amputations, all of which require long-term multidisciplinary care [5]. Conflicts also disrupt fragile health systems, exacerbating inequities in access to rehabilitation. Increasingly, rehabilitation is recognized as a critical component of emergency response and post-conflict recovery, bridging acute care and long-term community reintegration.

© The Author(s) 2025; all rights reserved. Published by Bangladesh Society of Physical Medicine and Rehabilitation (BSPMR)
How to cite this article: Hasan SA, Rahman MS, Uddin T. Physical medicine and rehabilitation: A global health priority in times of conflict, disaster, and chronic disease Bangladesh J Phys Med Rehabil 2026; 2(1):1-3

Third, the increasing frequency and intensity of natural disasters particularly in vulnerable regions have exposed systemic gaps in rehabilitation capacity. Earthquakes, floods, landslides, cyclones, and pandemics such as COVID-19 create surges in disability and long-term functional impairment [6]. These realities demand resilient health systems capable of integrating rehabilitation across the continuum of care, from acute management to community-based services.

In response, rehabilitation has emerged as a global public health priority. The World Health Organization's "Rehabilitation 2030" initiative calls for scaling up rehabilitation services through strengthened governance, financing, workforce development, and data systems. This momentum was further reinforced by the landmark resolution at the Seventy-sixth World Health Assembly, which formally recognizes rehabilitation as an essential health service and a core component of Universal Health Coverage [7].

Complementing these efforts, global professional bodies have contributed significantly to advancing the rehabilitation agenda. However, despite these advances, substantial challenges persist particularly in LMICs, where more than half of those in need do not receive rehabilitation services [8]. Key barriers include shortages of trained professionals with poor multidisciplinary rehabilitation team works, inadequate infrastructure, fragmented governance, and limited financing [9]. Effective rehabilitation depends on coordinated teamwork among physiatrists, rehabilitation nurses, physiotherapists, occupational therapists, speech and language therapists, psychologists, and social workers. However, in many LMICs, these roles are either underdeveloped or poorly integrated [10].

Addressing this gap requires transforming education and training for rehabilitation professionals through competency-based curricula aligned with global health priorities. Curricula should incorporate the International Classification of Functioning, Disability and Health framework, team-based care, disaster, and community rehabilitation, with leadership development for physiatrists to serve as clinicians and system advocates. Simultaneously, rehabilitation service planning must be context-specific, adapting evidence-based models to local epidemiology, resources, and cultural realities through task-sharing, community-based approaches, and integration into primary care. The future of PM&R depends on seamless integration across all levels of healthcare, the appropriate use of technologies ranging from tele-rehabilitation to robotics, and a sustained commitment to the rights, participation, and inclusion of persons with disabilities within broader health and development agendas.

As the Bangladesh Journal of Physical Medicine and Rehabilitation steps to its journey, it must serve as a platform for advancing evidence, informing policy, and fostering collaboration. There is a critical need for context-specific research from LMICs to address gaps in knowledge, workforce development, and service delivery. By amplifying diverse perspectives and promoting scientific rigor, the journal can play a pivotal role in strengthening rehabilitation systems.

Physical Medicine and Rehabilitation has become an essential element of modern healthcare, driven by historical developments and current global challenges. In an era marked by non-communicable diseases, conflicts, and disasters, rehabilitation is no longer optional but crucial. Global commitments emphasize the shared responsibility to ensure accessible, equitable, and integrated rehabilitation services. Achieving this requires expanding services, investing in workforce education, reforming curricula, and developing context-specific, resilient, multidisciplinary systems to meet the diverse needs of populations worldwide.

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Bangladesh Journal of Physical Medicine and Rehabilitation
Bangladesh J Phys Med Rehabil 2026; 2(1):4-10

Review Article

Causes and consequences of autism rise: Impact on quality of life

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Abstract

Background: There has been a rise in autism spectrum disorder (ASD) across the world, predominantly in the low and middle-income countries where there is limited diagnostic capacity, access to healthcare and social awareness. This review employed a problem tree analysis framework to understand the causes and effects of the increasing prevalence of ASD and its impacts on quality of life, family, and systems in the society.

Methods: The literature review was conducted in accordance with the PRISMA 2020 guidelines. Articles published between 2015 and 2025 were included in the search in PubMed, Scopus, and Google Scholar. Studies meeting the eligibility criteria, including those on ASD prevalence, etiological determinants, and socioeconomic or psychosocial effects, were included. The thematic synthesis of findings and their organisation based on a problem tree model (causes, effects, impacts) was used.

Results: There is an interaction between the genetic vulnerability, environmental factors, maternal and perinatal risk factors, socioeconomic variables, augmented awareness, and diagnostic practices, which enhances the growing prevalence of ASD. This implies that the downstream implications will be huge, including increased healthcare costs, reduced workforce participation among caregivers, social exclusion, and reduced educational and job opportunities. Individuals with ASD and their families endure persistent problems with care access, stigma, and poor quality of life, particularly within resource-constrained settings.

Conclusion: ASD is an increasingly problematic burden around the world due to its intricate nature, and demands prompt diagnosis, inclusive policy, and cost-effective community- and family-based care, particularly in the low and middle-income nations.

Keywords: *autism spectrum disorder, problem tree analysis, causes and effects, quality of life, healthcare*

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Publication History
Received: 15 Jan 2026
Accepted: 23 June 2026
Published print: 30 June 2026

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Funding
None

Ethical Approval
Not required

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How to cite this article: Farin ZF, Subahan S, Ara J, Ahmed MF, Koly K. Causes and consequences of autism rise: Impact on quality of life. Bangladesh J Phys Med Rehabil 2026; 2(1): 4-10

Introduction

Autism spectrum disorder (ASD) is a neurodevelopmental disorder with complex manifestations of the persistent inability to communicate socially, with limited and repetitive behavior patterns and interests [1]. ASD is a condition that distinguishes all socioeconomic, cultural, and geographical backgrounds and is becoming an increasingly global public health issue.

In the last few decades, ASD prevalence has been reported to be growing significantly. It is estimated that approximately 13% of children worldwide are affected; however, there is a significant difference in prevalence between different regions [2, 3]. In high-income countries (HICs), including the United States, recent surveillance data showed that about 1 out of every 36 children aged 8 years has been diagnosed with ASD [4]. This rise was explained by the expansion of the diagnostic criteria, the increase in awareness, and the improvement in the surveillance systems, rather than a single causal factor [5, 6].

On the other hand, prevalence of ASD in low- and middle-income countries (LMICs) and South Asian countries, in particular, appears to be less but is most likely to be under-reported due to a lack of diagnostic facilities, stigma, and/or low access to special services [7, 8]. A community-based study in Bangladesh has shown a much greater prevalence in urban versus rural settings [9]. These differences highlight the impact of healthcare access, socioeconomic factors, and cultural beliefs on ASD detection.

ASD is a multifactorial combination of genetic vulnerability and environmental factors such as prenatal and perinatal factors, maternal health, and environmental exposures [10, 11]. The disorder has significant implications for individuals, families, health care systems, and societies, as families face emotional pressure, social exclusion, and financial strain, while individuals with ASD encounter barriers in education, employment, and independent living [12, 13].

The objective of the study was to determine the causes, effects, and impact of increasing prevalence of ASD, and present these linked issues through a problem tree analysis model. It also highlights evidence from LMICs to raise awareness of what needs to be done to improve overall quality of life.

Methods

Study design and reporting framework

A literature review was conducted following the PRISMA 2020 reporting model. The structure of the identification, screening, eligibility assessment and inclusion of the studies was structured using the PRISMA guidelines to increase the transparency and reproducibility. To keep the heterogeneity of the study designs, findings, and the measures of these studies included in the literature review, a synthesis of findings was done in a narrative context. The PRISMA 2020 flow diagram has been created and presented in a graphical format to illustrate the research selection process.

Search strategy

A comprehensive review of the literature was conducted across three electronic databases, including PubMed, Scopus, and Google Scholar, was described Figure 1. The search was conducted during the period of January 2015 to March 2025. The search strategy consisted of a mixture of controlled vocabulary and free-text words with the use of Boolean operators. The major search terms were: (Autism spectrum disorder OR AS disorder OR autism) AND (prevalence OR causes OR risk factors OR environmental factors OR impact OR economic burden OR quality of life).

Search terms were refined with minor database-specific modifications to align with platform indexing, and, in addition, the reference lists of included studies and relevant review articles were systematically hand-searched to identify any eligible publications not captured through the primary database searches.

Study selection process

The recovered records were then imported into a formatted Microsoft Excel and managed in a consensus of the two lead authors, as described in Figure 1, and finally 20 articles were selected for the review process.

Inclusion criteria

Peer-reviewed articles published in the defined period based on the prevalence of ASD, etiological determinants, and/or the psychosocial and socioeconomic consequences were included. Only those articles published in the English language were considered. The studies were inclusive of quantitative, qualitative, or mixed-method research studies.

Exclusion criteria

The exclusion criteria comprised non-factual books such as editorials, commentaries or opinion pieces. The published studies that stated the effects of interventions without specifying the prevalence or etiology of ASD were omitted. Duplicated articles and research on which a complete text was not accessible were likewise omitted.

Quality appraisal

The methodological quality of included studies were assessed on objectives, population representative-ness, diagnostic criteria, and outcome reporting, and qualitative studies on methodological rigor and transparency with quality appraisal used to inform, rather than exclude, study interpretation.

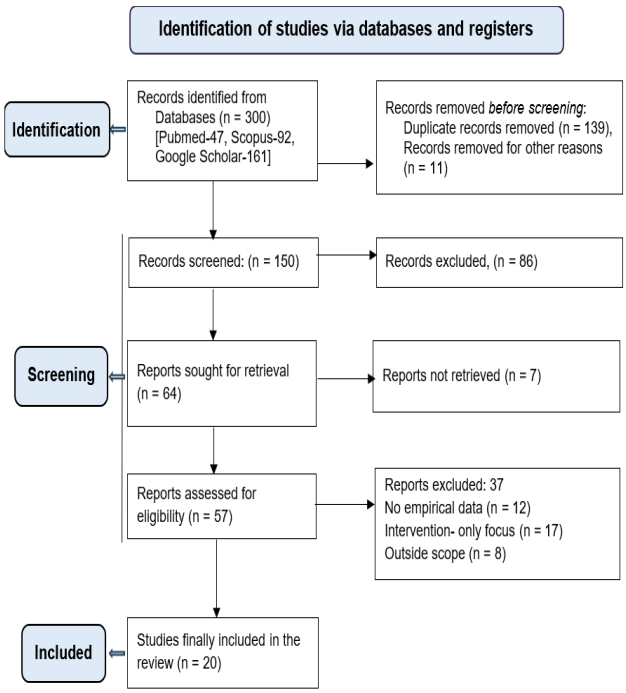


Figure 1 A PRISMA flow diagram of the study selection process

Data extraction and synthesis

The data was mined with the help of an organized data extraction sheet, which took into consideration the variables of the type of study design, the type of sample, countries, ASD diagnostic criteria, and critical findings. Narrative synthesis was used to analyze extracted data by identifying common themes and patterns. Due to the variability of the results and methodology, the quantitative summary of the findings was replaced by a descriptive one.

Results

Study selection and characteristics

A summary of the articles and the key points was presented in Table 1 and in a problem tree (Figure 2) analysis, where the increase in the prevalence of ASD was theorized as the main issue. The determinants were given as root causes and contributing factors, followed by effects on an individual and family level, and finally, the impact on the quality of life and systems in society.

Causes of the increasing prevalence of autism spectrum disorder

Prenatal and environmental exposures

As per a number of studies, prenatal exposure to environmental pollutants is associated with a high risk of ASD. Exposure of pregnant women to air pollutants, such as fine particulate matter (PM 2.5), nitrogen dioxide (NO2), and carbon monoxide, has been linked to neurodevelopmental dysfunction in the fetus because of oxidative stress and inflammatory pathways [14].

Certain research indicates that exposure to electromagnetic radiation during pregnancy can disrupt calcium signalling and neural communication, but the evidence remains inconsistent [15]. Having a city living highly populated environment, increases risk of ASD, especially in a highly populated environment [16].

Maternal and perinatal factors

The issue of maternal health in pregnancy is important in ASD risk. There is the possibility of the amplification of the fetal exposure to stress hormones by psychological stress, anxiety, and depression, which may impact the development of the brain [17]. Poor maternal nutrition premature birth and low birth weight are also considered as long-standing risk factors [9].

The infection of the mother (influenza or rubella) can increase inflammatory cytokines that disrupt the development of the fetal

Table 1. Mapping of causes, effects and impacts of autism rise

Category	Sub theme	Key point	References
Causes (n=10)	Prenatal and environmental exposures	There is an environmental and genetic interaction that enhances the risk of ASD. Low SES postpones the diagnosis and care.	[14, 15, 16]
	Maternal and perinatal factors.	City life and the pollution leading to ASD.	[17, 18]
	Factors of socioeconomic and family structure	Infection and maternal stress influence brain development.	[16]
	Healthcare and awareness factors	Low SES postpones the diagnosis and care.	[19]
	Early childhood developmental factors	Too much screen time is bad in language development.	[20, 21, 22, 23]
Effects (n=9)	Socioeconomic effects	Fiscal pressure, nursing load, loss of work.	[24, 25, 26]
	Family structure and well-being	Stress, anxiety and depression of parents, physical health problems.	[27, 28]
	Social isolation and loneliness	Isolation, nervousness, bad social interaction.	[29, 30, 31, 32]
Impacts (n=3)	Quality of life	Decreased self-sufficiency, low education/work, long-term care.	[33, 34]
	Health & mortality	Increased comorbidities, decreased life expectancy.	[34]
	System-level impact	Pressure on health, education, and welfare structures (LMICs)	[35]

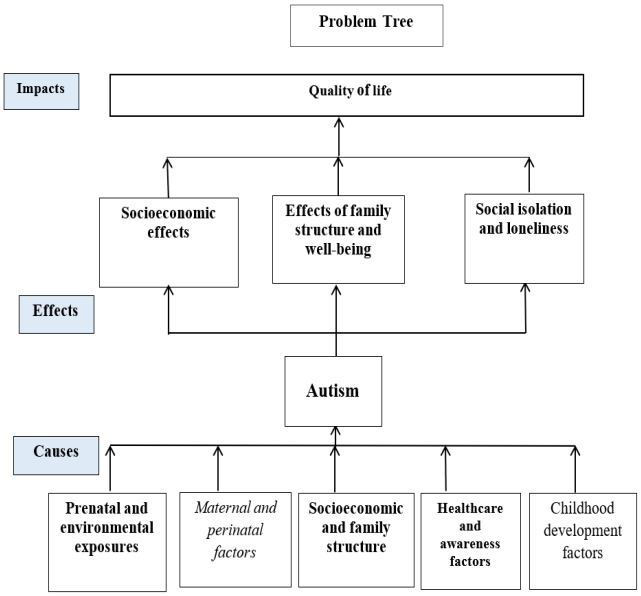


Figure 2. Problem tree analysis of rising autism

brain [16]. The risk has been attributed to advanced age of the parent especially the paternal age which is caused by de novo genetic mutations and epigenetic modifications of neurodevelopmental pathways [18].

Factors of socioeconomic and family structure

The children born to poor families have minimal access to prenatal care, early developmental care, and health care services and are more exposed to environmental risks e.g. poor diets and congestion. Evaluation and intervention can be slowed down by financial constraints [9].

The education of parents is also closely correlated with early ASD detection. If the level of education is lower than the level of health literacy then it leads to later diagnosis [9].

The family structure also influences early development. In the nuclear family, children got fewer opportunities to communicate with different peoples [16].

Healthcare and awareness factors

Lack of awareness and social stigma has been the cause of a slow ASD diagnosis and treatment. The stereotypes deter help-seeking and lead to underreporting [19]. A lack of access to healthcare, especially in underserved communities, leads to late diagnosis due to the shortage of qualified specialists, screening issues, and inadequate health infrastructure [19].

Early childhood developmental factors

There is some emerging evidence of links between excessive screen exposure in early childhood and developmental problems applicable to ASD, such as impaired social interaction and delayed language acquisition [20, 21, 22]. Few interactive play options also impair social learning, emotion control, and peer interaction [23]. Although the causality is still under study, these can contribute to the development vulnerability of at-risk children.

Effects of rising autism rates

Socioeconomic effects of rising autism

There are increasing socioeconomic implications of ASD on the victims, their families and societies. The advanced needs of caregiving and the extended reliance on specialized services put significant financial stress on families, especially in low-resource environments [24].

Moreover, the long-term treatment and rehabilitation is expensive and also makes families cut work hours, or even quit their jobs, leading to lack of income and financial instability [25, 26]. On a larger scale, the growing demand of specialized healthcare, education, and social support systems is an overload to the national health and welfare systems, particularly in developing nations.

Effects of family structure and well-being

The rising cases of children with ASD are putting substantial emotional and psychological stress on the family setup. There is increased caregiving stress, emotional exhaustion and financial strain on the families that may interfere with family dynamics and relationships [17].

Caregiving stress has been cited to be associated with physical health issues in parents, such as sleeping problems and metabolic risk [27]. The emotional impact can also be observed, and increased stress, anxiety, and depression levels among the parents are observed, especially mothers [28].

Social isolation and loneliness

The increasing prevalence of ASD is a major social consequence of social isolation and loneliness. The children with ASD are more susceptible to stress, sensory overload, and routine changes, which can contribute to heightening anxiety and problems in emotional regulation and restrict the focus on social activities [1, 29, 30]. More screen time and less time to socialize would also lead to social loneliness and ineffective communication skills [31, 32].

Poor social experiences can strengthen repetitive behavior and inhibit the emergence of social competence [33]. Problems with making friends are typical of children with ASD, which results in delayed social and emotional growth and subsequent isolation [34].

Impacts

Quality of life

The effects of ASD are long-term, not only during childhood but also during adulthood; it affects both health and independence as well as participation in society. It has been shown that mortality

rates among ASD patients are much higher, and their life expectancy is lower by about 16 years than the general population, which is mostly caused by the presence of comorbid medical and mental illnesses, including epilepsy, gastrointestinal disorders, and depression [35].

The chronic obstacles to healthcare access, education, and employment are still prevalent, especially in LMICs where there are fewer policies that are embraced and systemic long-term support structures [13, 36]. A significant portion of people with ASD need lifelong support, and a lack of proper planning of the transition between childhood and adulthood limits the prospects of living independently and becoming economically involved. These accruing impacts significantly reduce the general living standards of people with ASD as well as their families.

Discussion

This review provides a synthesis of evidence to show that the increased prevalence of ASD is a complex interplay between genetic vulnerability, prenatal health and maternal factors, socioeconomic status, and improved diagnosis. In line with the global literature, genetic predisposition remains a key factor; however, there is an increasing role of environmental and contextual factors in the observed prevalence trends, especially in low- and middle-income nations (LMICs) [11].

A comparative analysis shows that there are vast disparities between the high-income countries (HICs) and the LMICs. Elsewhere, particularly in HICs like the United States, prevalence is reported to be much greater, at approximately 1 in 36 children, largely due to well-established surveillance systems, a broader definition of the disease, and increased awareness among the public [6, 4]. Conversely, the lower rates of prevalence in LMICs are generally explained by underdiagnosis, the poor healthcare system, and sociocultural stigma instead of actual epidemiological variations [7, 37].

In South Asia, the prevalence reported is highly varied, ranging between 0.09% in India to more than 1% in Sri Lanka, highlighting the role of access to healthcare, socioeconomic status, and cultural views on neurodevelopmental disorders [9]. These results are consistent with previous studies in Iran and other LMICs in which the better the healthcare access, the higher the reported prevalence of ASD [8].

Of particular interest are the environmental risk factors, including air pollution, exposure to prenatal toxins, and maternal health complications that are particularly common in highly populated and industrializing countries such as Bangladesh [14]. Such exposures in combination with socioeconomic disadvantage can contribute to an increased risk in neurodevelopment and also inhibit access to early diagnosis and intervention.

The impact of higher prevalence of ASD is a significant downstream outcome, especially in the context of a socioeconomic burden, family structure disruption, and social isolation. As in the previous works, caregivers are subjected to elevated emotional stress, financial burden, decreased workforce involvement, and the long-term limitations of care giving [26, 38]. These impacts are not just limited to the household-induced strain on healthcare systems and social support structures.

Losses of quality of life, social isolation, susceptibility, and vulnerability are examples of the factors leading to the need to ensure the use of holistic, lifespan-focused approaches to support that can contribute to the needs of the family and the social inclusion of the person [39, 40]

In general, the framework of problem tree analysis indicates the cascading of upstream detxerminants into long-term health and social outcomes. To effectively tackle ASD, a combination of policy actions is necessary, encompassing the early identification, the possibility of obtaining medical care, the integration of education, and the rehabilitation of the affected can be facilitated by the family, especially in the conditions of LMICs, where the number of unmet needs is high.

Limitations

The review is not a systematic or scoping review, and did not include a meta-analysis due to the unavailability of funding and resources. Not all potentially relevant articles were available in full -text and thus some important studies might not have been included and this could have affected the completeness of the results. Since the review mainly used published materials in chosen databases and in English language, there is a possibility that studies published in other foreign languages or grey literature were not included.

Conclusion

The review was not a systematic review, meta-analysis, or scoping review design because of the unavailability of specific funding and resources. Not all potentially relevant articles were available in full -text and thus some important studies might not have been included and this could have affected the completeness of the results. Since the review mainly used published materials in chosen databases and in English language, there is a possibility that studies published in other foreign languages or grey literature would not have been included.

Acknowledgement

We sincerely thank Muhammad Millat Hossain for his guidance and support.

Author contribution

Concept and design, or design of the research; or the acquisition, analysis, or interpretation of data: ZFF, SS, JA, MFA, KK. Drafting the manuscript or revising it critically for important intellectual content: ZFF, SS, JA, MFA, KK. Final approval of the version to be published: ZFF, SS, JA, MFA, KK. Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved: ZFF, SS, JA, MFA, KK.

Conflict of interest

We do not have any conflict of interest.

Data availability statement

We confirm that the data supporting the findings of this study will be shared upon reasonable request.

AI disclosure

None

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Bangladesh Journal of Physical Medicine and Rehabilitation
Bangladesh J Phys Med Rehabil 2026; 2(1):11-15

Original Article

Effects of educational intervention on pulmonary rehabilitation of chronic obstructive pulmonary disease

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Abstract

Background: Chronic obstructive pulmonary disease (COPD) is a progressive respiratory condition associated with significant morbidity. Pulmonary rehabilitation (PR), incorporating medical therapy, physical exercise, and patient education, is considered an effective strategy to improve outcomes. Despite global evidence, data on the effectiveness of PR with educational interventions in Bangladeshi COPD patients remain limited. This study aimed to evaluate the impact of a structured rehabilitation program that integrates education and exercise in patients with mild to moderate COPD.

Methods: This interventional study was conducted in the Department of Physical Medicine and Rehabilitation, Dhaka Medical College Hospital. Fifty COPD patients with mild to moderate severity, confirmed by spirometry, were enrolled. All patients received standard medical treatment alongside a comprehensive PR program including breathing techniques, physical exercise, and structured education. Assessments were conducted at baseline and at 6, 12, 18, and 24 weeks. Lung function (FEV_1/FVC), dyspnea severity (modified Medical Research Council [mMRC] scale), and exercise capacity (Six-Minute Walk Test [6MWT]) were evaluated.

Results: The mean (SD) age of participants was 58.7 (6.7) years, with 72% being male. A significant improvement in FEV_1/FVC ratio was observed from 56.9 (6.2) at baseline to 65.9 (2.6) at 24 weeks ($P<0.001$). The mean mMRC score declined from 3.3 (0.4) to 1.6 (0.5) ($P<0.001$), and 6MWT distance increased from 498.9 (41.8) meters to 551.7 (32.7) meters ($P<0.001$).

Conclusion: A multidisciplinary rehabilitation approach combining education and exercise significantly improves lung function, reduces dyspnea, and enhances functional capacity in patients with mild to moderate COPD.

Keywords: *chronic obstructive pulmonary disease, rehabilitation, patient education, exercise therapy*

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Publication History
Received: 7 Feb 2026
Accepted: 14 May 2026
Published print: 30 June 2026

Responsible Editor
Taslim Uddin
0000-0002-2884-9212

Reviewers
A: Moinuddin Hossain Khan
0000-0001-6444-0599
B: AMM Ashraful Islam
0009-0000-6172-1520

Funding
We did not receive any funding for the study.

Ethical Approval
Ethical approval was obtained from the Institutional Review Board (IRB) of BMU (Memo No: BSMMU/IRB/2022/4099, Dated: 30-10-2022).

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How to cite this article: Ahamed MJ, Fardoushi MJ, Ahmed S, Zoha MT, Ahmad S. Effects of educational intervention on pulmonary rehabilitation of chronic obstructive pulmonary disease. Bangladesh J Phys Med Rehabil 2026; 1(1):11-15

Introduction

Chronic Obstructive Pulmonary Disease (COPD) is a common, preventable, and treatable condition characterized by persistent respiratory symptoms and airflow limitation due to airway and/or alveolar abnormalities. These changes are usually caused by significant exposure to noxious particles or gases and influenced by host factors, including abnormal lung development (Global Initiative for Chronic Obstructive Lung Disease) [1]. Major risk factors for COPD include tobacco smoking, indoor air pollution, occupational exposure, low birth weight, impaired lung growth, respiratory infections, low socio-economic status, and cannabis use [2-3].

Pulmonary rehabilitation (PR) is an evidence-based, comprehensive intervention in the management of COPD, known to improve quality of life and reduce healthcare costs [4]. A standard PR program typically includes medical therapy, exercise training, and patient education. Medical management aims to alleviate symptoms, decrease the frequency and severity of exacerbations, and enhance overall health status and exercise capacity [1]. Exercise, the cornerstone of PR, may involve ground walking, stair climbing, resistance training, and other modalities tailored to a patient's cardiopulmonary status [5]. Upper limb exercises, focusing on proximal muscle strength, are important for improving endurance in daily activities [6]. Breathing techniques such as pursed-lip and diaphragmatic breathing have also been shown to improve ventilatory function [7].

Patient education forms an essential component of PR, contributing significantly to both the prevention and management of COPD. Educational interventions typically address smoking cessation, immunization, oxygen therapy, nutritional counseling, occupational safety, avoidance of environmental and infectious exposures, and psychosocial support. A previous study demonstrated that combining exercise with self-management education significantly improves exercise tolerance and reduces COPD-related medication costs compared to usual care [8-9]. However, not all patients derive equal benefit from PR, as shown in various studies [10, 11].

Despite the proven benefits, limited research has been conducted on pulmonary rehabilitation incorporating patient education among the Bangladeshi population. To address this gap, the present study aims to evaluate the effectiveness of combining medical treatment with exercise and patient education in individuals with mild to moderate COPD.

Methods

Study design and setting

This prospective observational study was conducted at the Outpatient Department of Physical Medicine & Rehabilitation, Dhaka Medical College Hospital (DMCH), in collaboration with the Department of Respiratory Medicine, DMCH, Dhaka, Bangladesh. Ethical approval was obtained from the Ethical Review Committee (ERC) of DMCH prior to study initiation.

Study population and eligibility criteria

A total of 50 patients diagnosed with Chronic Obstructive Pulmonary Disease (COPD), confirmed by chest X-ray and spirometry, were enrolled using purposive sampling. Only patients with mild to moderate disease severity (scores 0–3 on the modified Medical Research Council [mMRC] dyspnea scale) were included. Patients with a history of bronchial asthma, respiratory failure, pneumothorax, pleural effusion, pulmonary tuberculosis, pulmonary lobectomy, restrictive lung disease, congestive cardiac failure (CCF), cardiomyopathy, or cognitive deficits were excluded from the study.

Assessment tools and intervention

Dyspnea severity was assessed using the mMRC dyspnea scale and Six-Minute Walk Test (6MWT). Pulmonary function was measured through spirometry, including Forced Vital Capacity (FVC), Forced Expiratory Volume in one second (FEV_1), and FEV_1/FVC ratio. A portable digital Cosmed micro–Quark Spirometer (Catalog #: C09061-01-99) was used for lung function assessment.

All participants received comprehensive intervention consisting of medical treatment, exercise therapy, and patient education. Patients were followed up at the 6th, 12th, 18th, and 24th weeks. At each follow-up, compliance with prescribed home exercises was monitored using a structured exercise evaluation checklist.

Statistical analysis

Data analysis was performed using SPSS version 26. Descriptive statistics including frequency, percentage, mean, and standard deviation were used to summarize participant characteristics. Paired sample t-tests were conducted to compare pre- and post-intervention outcomes, with statistical significance set at $P < 0.05$.

Results

A total of 50 patients with mild to moderate Chronic Obstructive Pulmonary Disease (COPD) were included. The mean age was 58.7±6.7 years, with 72% male and 28% female. Regarding education, 44% had primary, 36% secondary, and 20% higher secondary or above. Occupations included businessmen (32%), homemakers (28%), service holders and day laborers (16% each), and teachers (8%). The mean (SD)body mass index was 21.8 (2.8). Among participants, 54% were nonsmokers or ex-smokers, and 46% were current smokers (Table 1).

Figure 1 shows a progressive improvement in Six-Minute Walk Test (6MWT) distance over 24 weeks, increasing from 498.9 meters at baseline to 551.7 meters, indicating enhanced exercise tolerance following rehabilitation. Table 2 reflects similar improvement in dyspnea and physical performance. The mean

Table 1: Baseline characteristics of patients by age (n=50)

Baseline characteristics	Number (%)
Age in years, Mean (SD)	58.7 (6.7)
Gender	
Male	36 (72.0)
Female	14 (28.0)
Educational status	
Primary	22 (44.0)
Secondary	18 (36.0)
Higher secondary and above	10 (20.0)
Occupational status	
Home maker	14 (28.0)
Service holder	8 (16.0)
Day laborer	8 (16.0)
Businessman	16 (32.0)
Teacher	4 (8.0)
Body Mass Index; Mean (SD)	21.8 (2.8)
Smoking history	
Nonsmoker/ ex-smoker	27 (54.0)
Current smoker	23 (46.0)

mMRC dyspnea score decreased from 3.3 (0.4) to 1.6 (0.5), while 6MWT distance increased from 498.9 (41.8) meters to 551.7 (32.7) meters.

Pre- and post-treatment comparisons showed significant improvements: FEV_1/FVC ratio rose from 56.9 (6.2) to 65.9 (2.6), 6MWT distance from 498.9 (41.8) meters to 551.7 (32.7) meters, and mMRC score dropped from 3.3 (0.4) to 1.6 (0.5) ($P < 0.001$ for all), indicating improved respiratory function and symptom relief (Figure 1).

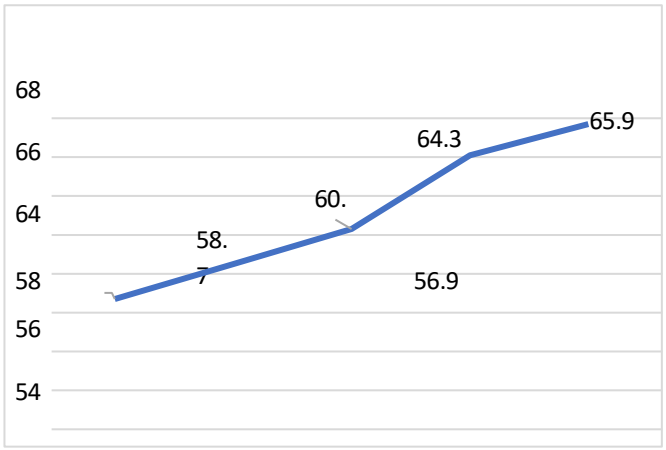


Figure 1: Distribution of patients by FEV1/FVC ratio, FEV1, Forced Expiratory Volume in First second, FVC: Forced Vital Capacity

Tobacco smoking is a well-established risk factor for COPD globally [15]. In the present study, nearly half of the patients were ex-smokers, consistent with the common smoking history seen among COPD populations worldwide.

In terms of lung function, the FEV_1/FVC ratio showed notable improvement from a baseline of 56.9 to 65.9 by the 24th week. This gradual increase from the 6th week onward demonstrates the sustained impact of PR, supported by the findings of Elkhateeb et al., who observed statistically significant improvements in both FEV_1 and FVC following 6–8 weeks of rehabilitation [16].

The degree of dyspnea, as measured by the modified Medical Research Council (mMRC) dyspnea scale, improved substantially from a mean of 3.3±0.4 at baseline to 1.6±0.5 after three months. This improvement reflects the effectiveness of pulmonary rehabilitation in reducing breathlessness, as echoed by Evans et al., who concluded that PR yields both statistically and clinically meaningful improvements in lung capacity across all mMRC grades [17]. Similar findings were also reported by Elkhateeb et al. [16].

Furthermore, the six-minute walk test (6MWT) showed progressive improvement, with the mean distance increasing from 498.9±41.8 meters at baseline to 551.7±32.7 meters at 24 weeks. These results are in agreement with previous studies that demonstrated significant gains in functional exercise capacity following PR [9, 13, 16].

Table 2: Distribution of patients by mMRC and six-minute walk test

Criteria	0 week	6th week	12th week	18th week	24th week
mMRC	3.3 (0.4)	3.2 (0.6)	2.5 (0.5)	2.1 (0.4)	1.6 (0.5)
Six-Minute Walk Test	498.9 (41.8)	501.8 (40.9)	517.1 (35.4)	533.5 (32.3)	551.7 (32.7)

All are mean (SD)

Discussion

The findings of this study suggest that a rehabilitation program combining education and exercise is effective in significantly improving dyspnea severity and lung function in patients with chronic obstructive pulmonary disease (COPD). The mean (SD) age of participants was 58.7 (6.7) years, with more than two-thirds being male, which aligns with the demographics reported in the study by Ahmed et al., who also observed similar age distribution in patients with moderate, stable COPD undergoing pulmonary rehabilitation (PR) [7]. Comparable findings have also been reported in studies conducted outside Bangladesh [9, 12, 13, 14].

Collectively, these results underscore that a comprehensive pulmonary rehabilitation program incorporating education and exercise effectively enhances lung function and symptom control in COPD patients. The randomized controlled study by Ninot et al. supports these findings, indicating that a hospital-based intervention combining supervised exercise and education significantly improves exercise tolerance compared to standard care [9].

Additionally, the work of Crisafulli et al. highlighted the educational component's contribution to patient outcomes by assessing improvements using the 6MWT and mMRC scale [18]. However, contrasting evidence was reported by Blackstock et al., who found no added benefit of education when included with PR [19]. This discrepancy may be attributed to demographic differences, as the mean age in Blackstock's study exceeded 70 years, a group potentially less responsive to educational interventions due to cognitive or compliance challenges. In contrast, the comparatively younger participants in the present study may have better adapted to the educational components, leading to more pronounced improvements..

Conclusion

This study demonstrates that a multidisciplinary pulmonary rehabilitation program integrating structured education and exercise significantly improves lung function, reduces dyspnea severity, and enhances functional exercise capacity in patients with mild to moderate COPD. The progressive improvements observed in FEV_1/FVC ratio, mMRC dyspnea scores, and Six-Minute Walk Test distances over 24 weeks highlight the sustained benefits of combining patient education with physical rehabilitation. These findings support the incorporation of comprehensive educational interventions into standard COPD management in Bangladesh to optimize patient outcomes and promote long-term respiratory health.

Acknowledgement

The authors acknowledge all the rehabilitation professionals who helped with chest physiotherapy and counselling

Author contribution

Concept and design: JA, SA. Acquisition, analysis, and interpretation of data: RS, JF. Manuscript drafting and revising it critically: SA, JA. Approval of the final version of the manuscript: JF, SA. Guarantor accuracy and integrity of the work: JA, TZ.

Conflict of interest

We do not have any conflict of interest.

Data availability statement

We confirm that the data supporting the findings of this study will be shared upon reasonable request.

AI disclosure

None

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Bangladesh Journal of Physical Medicine and Rehabilitation
Bangladesh J Phys Med Rehabil 2026; 2(1):15-21

Original Article

Mapping inpatient rehabilitation needs: Referral patterns to a physical medicine and rehabilitation service in a tertiary hospital in Bangladesh

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Abstract

Background: Early rehabilitation plays a crucial role in improving functional recovery, preventing complications, and reducing disability among hospitalized patients. Physical Medicine and Rehabilitation (PMR) services provide multidisciplinary care for neurological, musculoskeletal, and systemic disorders. However, the referral pattern to PMR departments in developing countries remains poorly documented. To analyze the source and pattern of clinical conditions of hospital admitted patients referred for consultations to the Department of Physical Medicine and Rehabilitation (PMRD) of a teaching hospital in Bangladesh.

Methods: This retrospective analysis of hospital admitted patients referred for consultation of PMRD between January and December 2025. Data were collected from inpatient consultation registers and departmental records. Variables included referring departments and primary diagnosis. Descriptive statistical analysis was performed using frequency and percentage distribution.

Results: A total of 367 inpatient referrals were analyzed. The Department of Medicine contributed the highest number of referrals to PMRD. Stroke was the most common condition for PMRD referral, accounting for 175 cases (47.7%), followed by low back pain with or without radiculopathy (45 cases, 12.3%), joint pain disorders (35 cases, 9.5%), and post-operative prolapsed lumbar intervertebral disc (PLID) (30 cases, 8.2%). Inflammatory rheumatologic conditions including rheumatoid arthritis, spondyloarthritis, reactive arthritis, and septic arthritis constituted 42 cases (11.4%).

Conclusion: Neurological and musculoskeletal disorders constitute the major patient bulk of seeking inpatient rehabilitation referrals. Early PMRD consultation and interdisciplinary collaboration may improve functional outcomes in hospitalized patients.

Keywords: *physical medicine and rehabilitation, inpatient referral, stroke rehabilitation, musculoskeletal disorders, Bangladesh*

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Publication History
Received: 17 Jan 2026
Accepted: 13 Apr 2026
Published print: 30 June 2026

Responsible Editor
Md. Israt Hasan
0000-0002-5484-4968

Reviewers
A: Lilian Catherene Gomes
0009-0007-9143-5032
B: Shamim Farhad
0000-0002-3988-6430

Funding
We did not receive any funding for the study.

Ethical Approval
Approved by Institutional Ethics Review Committee of Marine City Medical College and Hospital before commencement of the study (Memo No: MCMCH/IRB/2024/08, dated: 23 Oct 2024).

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How to cite this article: Islam AMMA, Rahman MM, Khan AA, Arman M, Islam MA. Mapping inpatient rehabilitation needs: Referral patterns to a physical medicine and rehabilitation service in a tertiary hospital in Bangladesh. Bangladesh J Phys Med Rehabil 2026; 2(1):16-21

Introduction

Physical Medicine and Rehabilitation (PMR) is a medical specialty dedicated to optimizing functional recovery, minimizing disability, and improving quality of life for individuals with acute and chronic health conditions that result in functional impairment. PMR physicians (physiatrists) provide leadership role in medical rehabilitation in the care continuum of comprehensive, patient-centred care for a broad spectrum of neurological, musculoskeletal, and other disabling conditions affecting the brain, spinal cord, peripheral nerves, bones, joints, muscles, ligaments, and tendons. Through multidisciplinary rehabilitation, they aim to restore function, enhance participation, and enable individuals to achieve the highest possible level of independence and community reintegration [1].

Rehabilitation is increasingly recognized as an essential component of universal health coverage and an integral part of acute hospital care. Early rehabilitation initiated during hospitalization has been shown to prevent secondary complications such as muscle weakness, pressure injuries, joint contractures, deconditioning, and hospital-associated disability while promoting earlier functional recovery and improving discharge outcomes [2]. Evidence further indicates that inpatient rehabilitation services facilitate comprehensive functional assessment and the timely implementation of individualized multidisciplinary interventions, including physiotherapy, occupational therapy, assistive technology, patient and caregiver education, and functional training, thereby optimizing recovery and reducing long-term disability [3, 4, 5].

Neurological disorders, particularly stroke and spinal cord injury, are among the leading indications for inpatient rehabilitation worldwide. Stroke remains one of the leading causes of disability globally, and accumulating evidence demonstrates that early multidisciplinary rehabilitation significantly improves functional recovery, independence in activities of daily living, and long-term health outcomes [6, 7, 8]. Likewise, musculoskeletal disorders, including low back pain, are major contributors to disability and healthcare utilization and frequently require rehabilitation-based management to reduce pain, improve physical function, and facilitate return to daily activities [9, 10].

Despite the growing recognition of rehabilitation medicine, access to inpatient rehabilitation remains inadequate in many low - and middle-income countries, where rehabilitation services are often constrained by limited infrastructure, workforce shortages, and suboptimal referral systems. Consequently, many hospitalized patients who could benefit from rehabilitation are either referred late or not referred at all, potentially compromising functional outcomes and increasing healthcare costs. Understanding inpatient referral patterns is therefore essential for identifying service needs, optimizing resource allocation, improving multidisciplinary collaboration, and strengthening rehabilitation services within acute care hospitals.

In Bangladesh, evidence regarding inpatient referral practices to PMR services remains scarce. A previous study by Uddin et al. reported that the majority of admissions to a university hospital rehabilitation unit were referred from outpatient services, highlighting potential underutilization of inpatient rehabilitation among hospitalized patients [11]. However, the clinical characteristics and referral sources of patients receiving inpatient PM&R consultations have not been systematically described.

Therefore, this study aimed to evaluate the referral sources and clinical patterns of hospitalized patients referred for inpatient PMR consultation in a tertiary care hospital in Bangladesh. The findings are expected to provide evidence to inform referral practices, facilitate efficient utilization of rehabilitation resources, and support the integration of rehabilitation into acute hospital care.

Methods

Study design and setting

This retrospective descriptive observational study was conducted in the Department of Physical Medicine and Rehabilitation (PMR) of Marine City Medical College and Hospital, Chattogram, Bangladesh, a tertiary-level teaching hospital providing multidisciplinary inpatient and outpatient rehabilitation services. The study reviewed all inpatient rehabilitation consultation requests received over a 12-month period from January 1 to December 31, 2025.

Study population

The study population comprised all hospitalized patients who were referred for inpatient PMR consultation during the study period. Each patient's first rehabilitation consultation during a single hospital admission was considered for analysis to avoid duplication.

Eligibility criteria

Patients were eligible for inclusion if they (1) were admitted to any inpatient department of the hospital, (2) received a formal referral for PMR consultation during hospitalization, and (3) had complete consultation records available for review. Patients referred from outpatient clinics, emergency department consultations without subsequent hospital admission, repeat consultations during the same admission, and records with incomplete or missing essential information were excluded from the analysis.

Data collection

Data were extracted retrospectively from the departmental PMR consultation register and corresponding inpatient consultation records using a standardized data extraction form. The extracted variables included demographic characteristics, referring clinical department, and primary diagnosis or clinical condition leading to rehabilitation consultation. Diagnoses were subsequently categorized into major clinical groups, including neurological, musculoskeletal, rheumatological, intensive care-related, postoperative, and other medical conditions, to facilitate descriptive analysis.

Outcome measures

The primary outcomes were the distribution of inpatient rehabilitation consultations according to the referring department and the pattern of clinical conditions prompting PM&R consultation.

Statistical analysis

Data were entered into Microsoft Excel. Descriptive statistics were used to summarize the study findings. Categorical variables were presented as frequencies and percentages. Continuous variables, where applicable, were summarized using means with standard deviations or medians with interquartile ranges, depending on data distribution.

Ethical considerations

The study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Approval was obtained from the Institutional Ethics Review Committee of Marine City Medical College and Hospital before commencement of the study (Approval No.: MCMCH/IRB/2024/08). As the study involved retrospective review of routinely collected hospital records without direct patient contact, the requirement for informed consent was waived. Patient confidentiality was maintained throughout the study by anonymizing all extracted data before analysis.

Table 1: Major diagnostic categories (n=367)

Category	Conditions included	Number	(%)
Neurological disorders	Stroke, GBS, SCI	186	50.7
Musculoskeletal disorders	LBP, joint pain, PLID	110	30.0
Inflammatory arthritis	RA, SpA, ReA	30	8.2
Infectious spinal/ joint disorders	Septic arthritis, spondylodiscitis	17	4.6
Pressure injury	Pressure Injuries	10	2.7
Pediatric rheumatologic	JIA	4	1.1
Critical care rehabilitation	ICU patients	5	1.4
Others	-	1	0.3
Total		**367**	**100**

Results

Overall inpatient rehabilitation referrals

During the 12-month study period, a total of 367 inpatient rehabilitation consultation referrals were received by the Department of Physical Medicine and Rehabilitation. All eligible referrals fulfilled the study inclusion criteria and were included in the final analysis.

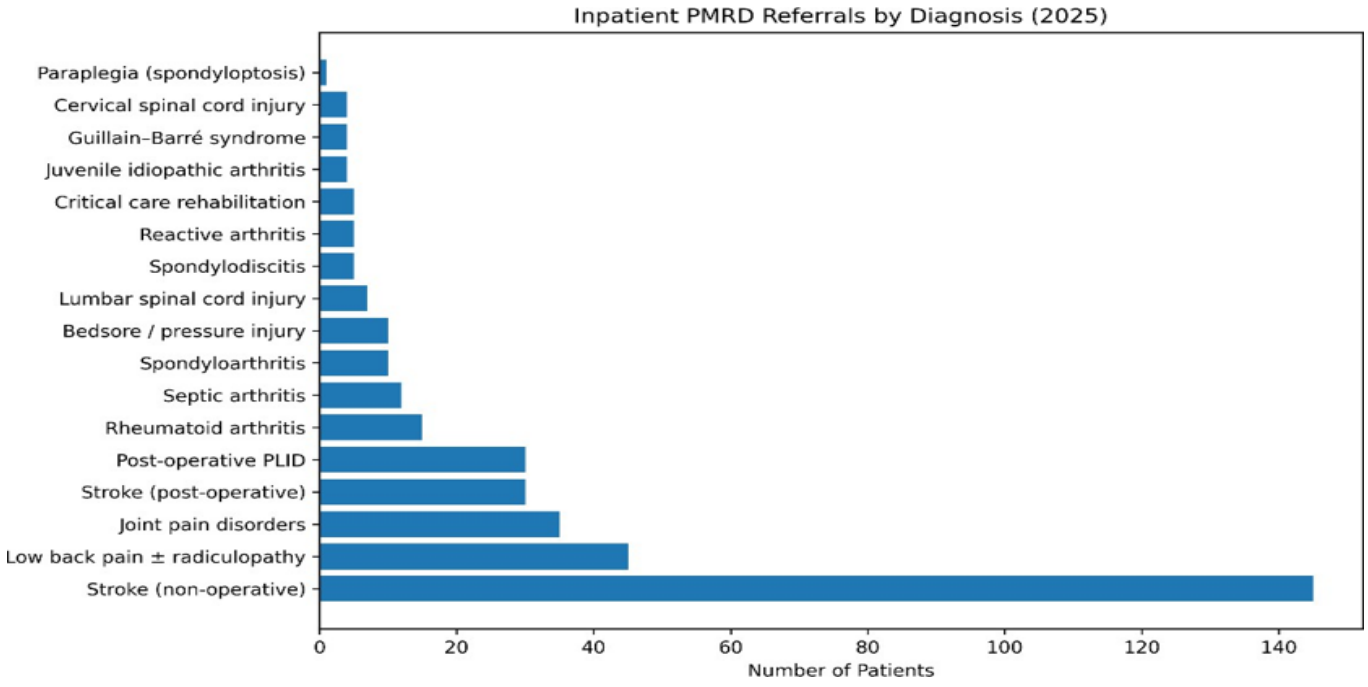


Figure 1: Distribution of inpatient referrals by diagnosis

Table 2: Department-wise Distribution of Referrals

Referring Department	Number	(%)	Major Conditions
Medicine	196	53.4	Stroke, inflammatory arthritis, GBS, spondylodiscitis
Neurosurgery	71	19.3	Post-operative stroke, PLID, spinal cord injury
Orthopedic surgery	55	15.0	Low back pain, joint pain
Nephrology	26	7.1	Musculoskeletal pain
Pediatrics	4	1.1	Juvenile idiopathic arthritis
Critical care unit	5	1.4	ICU rehabilitation
Others	10	2.7	Pressure injury management
Total	**367**	**100**	

Diagnostic profile of referred patients

The distribution of patients according to major diagnostic categories is presented in **Table 1**. Neurological disorders represented the largest diagnostic group, accounting for 186 referrals (50.7%), followed by musculoskeletal disorders (110 referrals, 30.0%). Inflammatory arthritic disorders constituted 30 referrals (8.2%), while infectious spinal and joint disorders accounted for 17 referrals (4.6%). Referrals for pressure injury management, critical care rehabilitation, and pediatric rheumatologic conditions comprised smaller proportions of the inpatient rehabilitation workload.

Among individual clinical conditions, stroke was the predominant indication for rehabilitation consultation, followed by spinal cord injury and Guillain–Barré syndrome within the neurological category. Musculoskeletal referrals primarily included low back pain with or without radiculopathy, joint pain disorders, and postoperative prolapsed lumbar intervertebral disc (PLID). The detailed distribution of individual diagnoses is illustrated in **Figure 1**.

Referring departments

Patients were referred for rehabilitation consultation from a wide range of hospital departments (**Table 2**). The Department of Medicine generated the largest number of referrals, contributing 196 patients (53.4%), more than half of all inpatient consultations. This was followed by Neurosurgery (71 referrals, 19.3%), Orthopedic Surgery (55 referrals, 15.0%), and Nephrology (26 referrals, 7.1%). Smaller numbers of referrals originated from the Critical Care Unit (5 referrals, 1.4%), Pediatrics (4 referrals, 1.1%), and other departments (10 referrals, 2.7%).

Stroke, inflammatory arthritis, Guillain–Barré syndrome, and spondylodiscitis were the principal indications for referrals from the Department of Medicine. Neurosurgery referrals mainly involved postoperative spinal disorders and spinal cord injury, whereas Orthopedic Surgery primarily referred patients with low back pain and other musculoskeletal disorders. Pediatric referrals were predominantly for juvenile idiopathic arthritis, while referrals from the Critical Care Unit were mainly for early rehabilitation of critically ill patients in **Table 2**.

Discussion

This study demonstrated that most inpatient referrals for Physical Medicine and Rehabilitation (PMR) consultation originated from the Department of Medicine, with neurological disorders representing the largest diagnostic category. Stroke accounted for nearly half of all referrals, making it the single most common indication for inpatient rehabilitation consultation. These findings are consistent with previous studies reporting stroke as the predominant condition requiring inpatient rehabilitation services [12, 13, 14]. The predominance of neurological referrals reflects the substantial burden of stroke-related disability and the critical role of rehabilitation in improving functional outcomes following acute neurological events.

Globally, an estimated 80% of persons with disabilities live in low- and middle-income countries [15], where access to timely, comprehensive, and affordable rehabilitation services remains limited. These barriers contribute to persistent functional impairments, reduced participation, and widening health inequities. In this context, strengthening inpatient rehabilitation services and establishing efficient referral pathways are essential to address the growing rehabilitation needs of hospitalized patients.

The large number of referrals for non-operative stroke from the Department of Medicine underscores the increasing recognition of rehabilitation as an integral component of acute stroke care. Accumulating evidence demonstrates that early multidisciplinary rehabilitation, including early mobilization when clinically appropriate, improves functional recovery, enhances independence in activities of daily living, reduces complications associated with prolonged immobilization, and minimizes long-term disability [16]. These findings highlight the need for close collaboration between physicians managing acute neurological conditions and rehabilitation specialists to ensure timely initiation of rehabilitation interventions.

Musculoskeletal disorders, particularly low back pain and joint pain, represented the second largest group of referrals. This finding is unsurprising given that low back pain remains one of the leading causes of disability worldwide and is associated with substantial healthcare utilization and productivity loss [17, 18]. Comprehensive rehabilitation, incorporating exercise therapy, patient education, pain management, and functional restoration, is recommended as a cornerstone of evidence-based

management for these conditions.

Inflammatory rheumatologic disorders, including rheumatoid arthritis and spondyloarthritis, also constituted an important proportion of referrals. Rehabilitation complements pharmacological treatment by preserving joint mobility, improving muscle strength and physical function, reducing disability, and maintaining participation in daily and vocational activities [19]. These findings further emphasize the multidisciplinary role of PM&R across a broad spectrum of chronic musculoskeletal disorders.

Although relatively few referrals originated from intensive care units, the presence of these referrals suggests growing awareness of early rehabilitation for critically ill patients. Emerging evidence supports the implementation of early mobilization and multidisciplinary rehabilitation in intensive care settings to prevent intensive care unit-acquired weakness, preserve physical function, shorten hospital stay, and improve long-term functional outcomes [20]. Expanding rehabilitation services within critical care may therefore provide additional opportunities to improve patient outcomes.

Appropriate patient selection remains a fundamental determinant of successful inpatient rehabilitation. Evidence indicates that timely identification of patients with rehabilitation needs and appropriate referral based on their capacity to benefit from intensive multidisciplinary rehabilitation optimize clinical outcomes while ensuring efficient utilization of limited rehabilitation resources [21]. Increased awareness among referring clinicians and allied health care professionals regarding the scope, indications, and benefits of rehabilitation medicine has been associated with more appropriate referral practices, improved admission decisions, and enhanced delivery of inpatient rehabilitation services [22]. These findings reinforce the importance of developing standardized referral criteria, strengthening interdisciplinary collaboration, and increasing education regarding rehabilitation medicine within acute care hospitals to maximize the effectiveness of inpatient rehabilitation services, particularly in resource-constrained settings such as Bangladesh.

Limitations

This single-center retrospective study may limit the generalizability of the findings. The analysis was based on routinely maintained consultation records and did not assess the timing or appropriateness of referrals, rehabilitation interventions, or functional outcomes. In addition, patients with rehabilitation needs who were not referred could not be identified.

Conclusion

Neurological disorders, particularly stroke, were the leading indications for inpatient rehabilitation consultation, followed by musculoskeletal and inflammatory rheumatological conditions. Most referrals originated from the Department of Medicine, highlighting the importance of early integration of rehabilitation into acute hospital care. Strengthening interdisciplinary collaboration and standardized referral pathways may enhance the utilization of inpatient rehabilitation services and improve patient care in Bangladesh.

Acknowledgement

We would like to thank Professor Md Taslim Uddin, Bangladesh Medical University for the critical review of the manuscript.

Author contribution

Conceptualization, study design, supervision, manuscript drafting, critical review, and final approval: AMMAI. Study design, data interpretation, review, and final approval. AAK: Supervision, manuscript review, revision, and final approval: MMR. Data analysis, revision, and final approval: MA. Data analysis, manuscript writing, revision, and final approval: MAI.

Conflict of interest

We do not have any conflict of interest.

Data availability statement

We confirm that the data supporting the findings of this study will be shared upon reasonable request.

AI disclosure

None

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Bangladesh Journal of Physical Medicine and Rehabilitation
Bangladesh J Phys Med Rehabil 2026; 2(1):22-26

Original Article

Characteristics of spinal cord injury survivors following the 2024 Bangladesh anti-discrimination movement: A hospital-based study

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Abstract

Background: The 2024 anti-discrimination movement in Bangladesh led to violent confrontations and numerous civilian spinal cord injuries (SCIs), often from gunshots. This study examines the demographic and lesion characteristics of patients with protest-related SCIs.

Methods: A cross-sectional mixed-methods study was conducted in four tertiary-level hospitals across Bangladesh. Hospital records of patients admitted with traumatic SCI between July and August 2024 were reviewed. Demographic and injury-related variables including age, sex, occupation, income level, mechanism and level of injury were extracted and cross-verified through structured telephone interviews. Data analysis was performed using SPSS version 27.

Results: Among 47 reviewed records, 33 patients met the inclusion criteria. The majority were young adults aged 16–30 years (67%), predominantly student activists (67%), and from low-income households (76% reported monthly income between BDT 10,000–20,000). Gunshot wounds accounted for 79% (n=26) of SCIs. Thoracic spine involvement was most common, and incomplete SCIs were more frequent than complete lesions. Paraplegia was observed in 91% of cases.

Conclusion: This study reveals a disproportionate burden of gunshot-related SCI among young, socioeconomically disadvantaged individuals during civil unrest. The findings emphasize the urgent need for enhanced trauma care, context-specific rehabilitation services, and public health strategies aimed at minimizing injury risk during political and social conflicts.

Keywords: *spinal cord injury, gunshot wounds, Bangladesh 2024 movement, paraplegia, thoracic vertebrae*

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Publication History
Received: 11 Jan 2026
Accepted: 29 Mar 2026
Published print: 30 June 2026

Responsible Editor
Suzon Al Hasan
0009-0002-1978-3941

Reviewers
A: A.B.M. Zafar Sadeque
0009-0003-4514-1448
B: Anika Tasnim
0000-0002-4983-0086

Funding
Not required

Ethical Approval
Approved was obtained from the Ethical Review Board of the National Institute of Traumatology and Orthopedic Rehabilitation (Memo No. NITOR/2024/264 dated 15/09/2024).

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How to cite this article: Azad MAK, Newaz F, Islam MM, Rahim HR, Moniruzzaman M, Shoma FK, Uddin T. Characteristics of spinal cord injury survivors following the 2024 Bangladesh anti-discrimination movement: A hospital-based study. Bangladesh J Phys Med Rehabil 2026; 2(1):22-26

Introduction

Spinal cord injuries (SCI) represent a significant global health challenge, particularly in developing countries. These injuries can arise from both traumatic and non-traumatic causes. More than 15 million people are living with spinal cord injury (SCI) globally, most of the SCI cases resulting from falls, road traffic accidents, and violence [1, 2]. Large-scale natural disasters, such as earthquakes, often lead to a sudden surge in traumatic SCIs [3], while the impact of political or social violence on SCIs remains largely understudied. Evidence on traumatic SCI due to gunshot injuries in the Asia region is unexplored, although SCI due to gunshot injury reportedly accounts for 15.2% of all spinal cord injuries [4]. One multinational cohort described the demographic and clinical characteristics in Latin America, with the majority of gunshots from low-energy firearms, and most patients had other associated injuries [5].

In 2024, widespread social movements and political unrest in Bangladesh, marked by violent clashes, led to mass killings, mob justice, and numerous casualties, significantly contributing to the country's rising burden of SCIs and rehabilitation system [6, 7]. Especially among young activists and students. There are reports that security forces battle protesters armed with sticks and rocks with armored vehicles and even open fire upon crowds from a helicopter [8]. This resulted surge of injuries, including SCI caused by gunshot injuries. SCI due to gunshot injury is a leading cause, understanding the socio-economic and clinical characteristics of traumatic SCI, due to gunshot injury, and its pattern of associated lesions is vital for effective rehabilitation [9, 10, 11].

Bangladesh faces significant challenges in managing spinal cord injuries (SCIs) due to gaps in data, prevention of injury, and rehabilitation services [12]. The 2023 International Spinal Cord Injury Community Survey emphasized the need for comprehensive datasets to understand patient profiles and recovery outcomes, especially among vulnerable groups during unrest [13, 14].

This study aims to link injury patterns to protest-related circumstances, addressing the amplified challenges of resource allocation, long-term disability, and societal impacts through targeted interventions. The aim is to explore demographics and clinical characteristics of persons with SCI resulting from trauma linked to the 2024 Bangladesh revolution.

Methods

Study design and setting

This was a cross-sectional mixed-methods study. Data were collected from four tertiary hospitals in Bangladesh: Bangladesh Medical University (BMU), National Institute of Traumatology and Orthopedic Rehabilitation (NITOR), Combined Military Hospital (CMH), and Dhaka Medical College Hospital (DMCH) known for handling emergencies and complex spinal trauma cases.

Study population

Participants included all SCI patients admitted to the selected hospitals between July 1 and August 10, 2024, with a history of trauma related to the 2024 anti-discrimination movement.

Ethical considerations

Ethical approval was obtained from the Ethical Review Board of the National Institute of Traumatology and Orthopedic Rehabilitation, No. NITOR/2024/264 dated 15/09/2024. Informed consent was secured from all participants. The study adhered to the Declaration of Helsinki, ensuring confidentiality, anonymity, and voluntary participation.

Data collection and analysis

Patient data were extracted from hospital admission registers with a diagnosis of paraplegia or tetraplegia, or spinal cord injury, with demographic and clinical information. A SCI-trained rehabilitation physician crosschecked, verified, and updated this data through phone interviews with eligible patients, covering age, gender, occupation, monthly family income, injury cause, and level of SCI. Data were recorded in a structured datasheet, checked for accuracy, and analyzed using SPSS version 27. Descriptive statistics (frequencies, percentages), summarized demographic and clinical data.

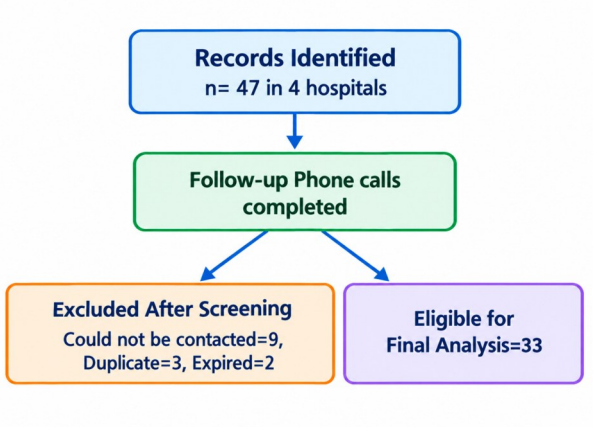


Figure 1: Sampling frame

Results

We received information on 47 subjects with a traumatic spinal cord injury diagnosis from four care settings and verified it with phone interviews, and finally, 33 subjects were eligible for analysis as presented in Figure 1. Most of the study populations belong to the 16-30 yrs age group, illustrated in Figure 2.

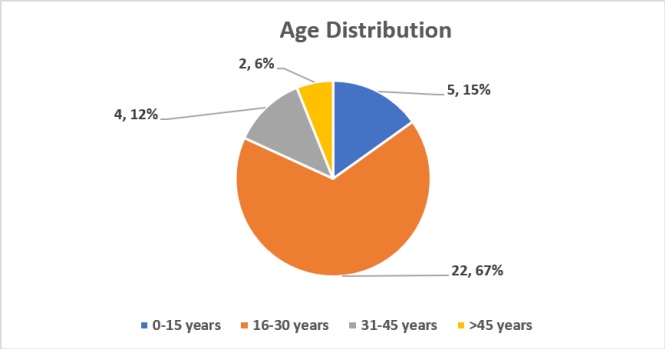


Figure 2: Age distribution of the participants

Figure 3 illustrates the analysis of 33 subjects from different facilities and monthly family income and occupation, with 67% being student activists in the Bangladesh 2024 anti-discrimination movement. Analysis of subjects from different facilities and monthly family income, and occupation.

The combined chart summarizing the lesion characteristics of 33 SCI cases related to the 2024 anti-discrimination movement

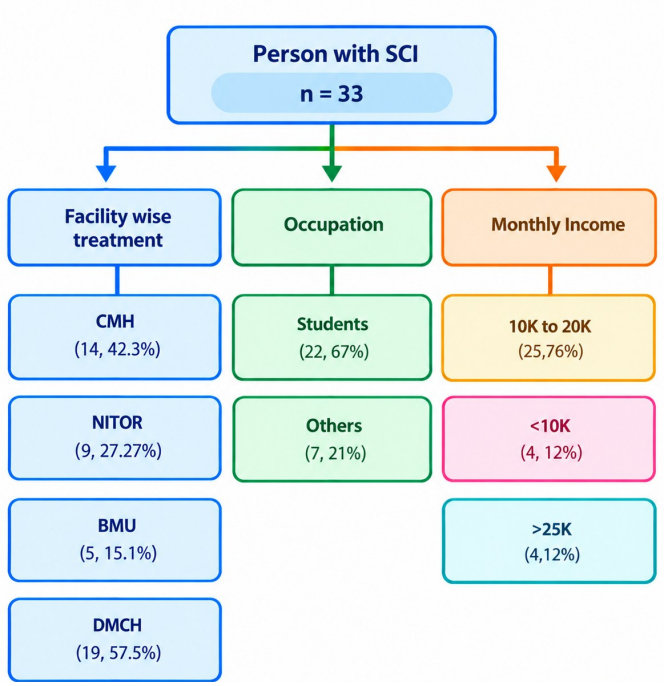


Figure 3: Analysis of subjects from different facilities and monthly family income, and occupation

CMH indicates Combined Military Hospital; NITOR, National Institute of Traumatology and Orthopaedic Rehabilitation; BMU, Bangladesh Medical University; DMCH, Dhaka Medical College and

spinal trauma in Bangladesh is presented in Figure 4.

In this study, incomplete spinal cord injuries (n=19) were more prevalent than complete injuries, with the thoracic level identified as the most common site of lesion. Gunshot injuries overwhelmingly accounted for the leading cause (n=26), resulting predominantly in paraplegia (n=30) rather than tetraplegia among the subjects.

Discussion

This study investigated the demographic and clinical characteristics of individuals who sustained spinal cord injuries (SCIs) during the 2024 Bangladesh anti-discrimination movement. The participants of the study are predominantly young student activists, with most belonging to the 16-30 years age group (67%), indicating that students and professionals constituted the large group in the revolution. Our 2023 publication with more than 3000 samples reported age group 18-30 yrs, and a US study reported the age for traumatic SCI was more than 45yrs [14, 15]. The majority of participants (76%) reported a monthly family income between 10,000 to 20,000 BDT (about US$180.5), indicating the students were from a low socioeconomic background.

Gunshot injuries were significantly the leading cause of SCI (n=26) among the study subjects. Forensic examinations of 130 cases of deaths related to the protests conducted by the Dhaka Medical College Forensic Department indicate that more than 75% of all deaths were caused by firearms commonly used by government forces [6]. In our study the thoracic level was identified as the most common site of injury, and incomplete spinal cord injuries (n=19) were more prevalent than complete injuries. The finding aligns with other studies, and cases could be managed non-operatively [16, 17, 5]. Most of the acute cases of SCI are managed by National Institute of Traumatology, Dhaka Medical college and Bangladesh Medical university [18, 19, 20].

Given that most subjects sustained incomplete SCIs and presented with paraplegia, there is a high potential for rehabilitation. A multicenter cohort study reported that most of the gunshot injury SCI cases were treated nonoperatively with antibiotic prophylaxis. [5, 17] Effective rehabilitation for these patients would necessitate a physiatrist-led, team-based approach, supported by adequate rehabilitation facilities equipped with modern equipment. This comprehensive approach is crucial for addressing the amplified challenges of resource allocation, long-term disability, and societal impacts highlighted by the study

This study was the first of its kind to document spinal cord injuries resulting from civil unrest in Bangladesh, using a multi-center approach and validated data through follow-up interviews.

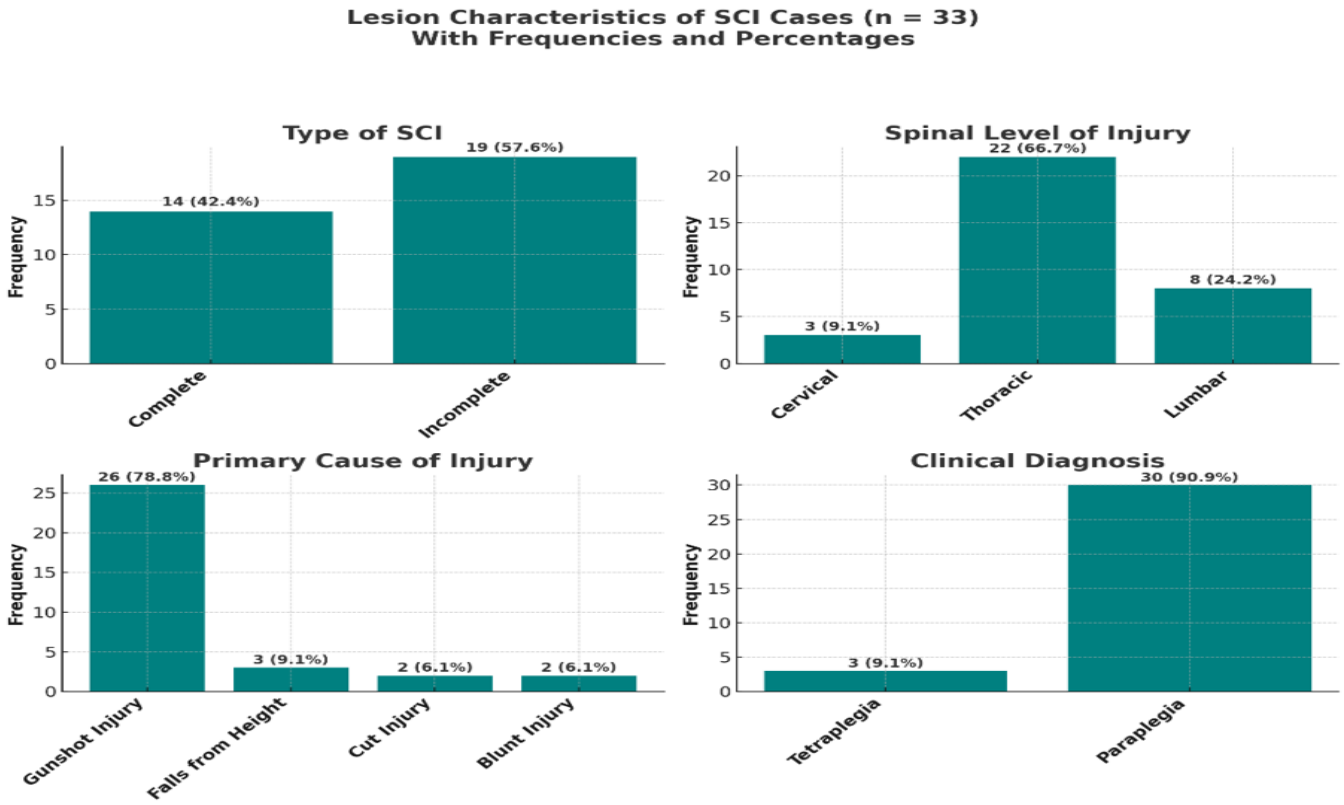


Figure 4: combined chart summarizing the lesion characteristics (n=33)

The study is limited by its small sample size, inability to report neurological classifications, and potential recall bias due to reliance on phone-based follow-up.

Conclusion

This study reveals that the 2024 Bangladesh anti-discrimination movement led to a surge in gunshot-related spinal cord injuries, predominantly affecting young student activists from low-income backgrounds. The majority sustained incomplete thoracic lesions, indicating a favorable prognosis for functional rehabilitation. These findings emphasize the critical need for a coordinated, physiatrist-led rehabilitation strategy and policy-level responses to prevent long-term disability in vulnerable protest-affected populations.

Acknowledgement

We sincerely thank the patients and families for their participation. We appreciate the support of the Department of Physical Medicine and Rehabilitation of Bangladesh Medical University, National Institute of Traumatology and Orthopedic Rehabilitation (NITOR), Combined Military Hospital (CMH), and Dhaka Medical College Hospital (DMCH). Gratitude is extended to the patients and colleagues for their guidance and feedback.

Author contribution

Conception and design: AKA, FN, MMI, HRR, MMZ, FKS, TU. Acquisition, analysis, and interpretation of data: FN, HHR, FKS, TU. Manuscript drafting and revising it critically: MMZ, AKA, MMI, TU. Approval of the final version of the manuscript: FN, AKA, MMZ.

Funding

We did not receive any funds for this study.

Conflict of interest

We do not have any conflict of interest.

Data availability statement

We confirm that the data supporting the findings of the study will be shared upon reasonable request.

AI disclosure

None

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Bangladesh Journal of Physical Medicine and Rehabilitation
Bangladesh J Phys Med Rehabil 2026; 2(1):27-30

Original Article

Prevalence and predictive indicators of pressure injuries among admitted stroke patients in a tertiary care setting

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Abstract

Background: Pressure injuries are common complications among stroke patients, contributing to prolonged hospitalization, delayed recovery, and increased healthcare costs. Identifying predictive indicators is crucial for effective prevention and management. The aim of this study is to determine the prevalence of pressure injurie and identify predictive indicators among stroke patients admitted to a tertiary care hospital in Bangladesh.

Methods: A cross-sectional study was conducted from March to October 2024, involving 79 consecutively admitted stroke patients. Data were collected on sociodemographic variables, comorbidities, Braden Scale scores, functional independence measure, and Barthel index. Statistical analyses were performed to assess associations between these factors and pressure injury development.

Results: Of the 79 patients, 17 (21.5%) developed pressure injuries. The occurrence of pressure injuries was significantly associated with higher risk groups on the Braden Scale ($P < 0.05$), lower functional independence measure scores ($P < 0.05$), and reduced Barthel Index scores ($P < 0.05$). No significant associations were observed with comorbidities such as diabetes, hypertension, or cardiovascular disease.

Conclusion: The study highlights that pressure injuries affect over one-fifth of stroke patients in tertiary care. Low Braden Scale, functional independence measure, and Barthel Index scores are strong predictive indicators. Routine assessment using these tools can aid in early identification of at-risk patients and implementation of targeted preventive strategies, ultimately reducing morbidity and healthcare burden.

Key words: *pressure ulcer, stroke, risk factors, activities of daily living*

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Publication History
Received: 3 Feb 2026
Accepted: 18 May 2026
Published print: 30 June 2026

Responsible Editor
Md. Israt Hasan
0000-0002-5484-4968

Reviewers
A: Md. Imamur Rashid
0009-0008-6452-4619
B: Fariel Bilkis
0009-0005-1318-6312

Funding
We did not receive any fund for the study.

Ethical Approval
Approved by Ethical Committee of Colonel Malek Medical College and Hospital, currently Manikgonj Medical College (Memo no: CMMC/IRB/2024/222, date 15 Apr 2024).

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How to cite this article: Islam MA, Monni AF, Islam SMM, Rahman HH, Rahman N. Prevalence and predictive indicators of pressure injuries among admitted stroke patients in a tertiary care setting. Bangladesh J Phys Med Rehabil 2026; 2(1):27-30

Introduction

Pressure injuries, also called pressure ulcers or bedsores, are localized damage to the skin and underlying tissue caused by sustained pressure. They represent a major concern in healthcare settings, particularly among stroke patients with limited mobility. Stroke, a sudden disruption of cerebral blood supply, often results in hemiparesis, impaired sensation, and cognitive deficits, all of which increase pressure injurie risk [1].

The high incidence of pressure injurie among stroke patients imposes a considerable burden on both health outcomes and healthcare systems, contributing to prolonged hospital stays, delayed recovery, and increased costs [2]. In tertiary care hospitals, where patients often present with severe strokes and complex comorbidities, this risk is especially concerning [3]. Global studies reveal variable prevalence rates, but evidence consistently suggests that stroke patients are disproportionately affected. For example, a U.S. tertiary hospital reported pressure injurie prevalence of up to 20%, particularly in acute stroke phases [4]. Such findings highlight the urgent need for preventive interventions.

Predictive indicators of pressure injuries are multifactorial. Intrinsic factors include age, comorbidities (e.g., diabetes, hypertension), nutritional status, and mobility, while extrinsic factors involve quality of nursing care, environmental influences, and hospital bed conditions [5]. Tools such as the Braden Scale are widely applied in clinical practice to assess risk, covering sensory perception, moisture, activity, mobility, nutrition, and friction/shear [6, 7]. Malnutrition is also strongly associated with pressure injurie development, as stroke-related dysphagia and cognitive impairments often limit adequate intake [8]. Moreover, neurological deficits can impair sensation, preventing patients from recognizing or reporting discomfort, which accelerates pressure injurie formation [9]. The combined effects of immobility, sensory loss, and malnutrition significantly heighten vulnerability.

Despite progress in understanding pressure injurie mechanisms, many stroke patients in tertiary care remain at high risk due to clinical gaps. These include inadequate repositioning, inconsistent monitoring, and limited application of evidence-based protocols. Although preventive strategies—such as regular repositioning, pressure-relieving devices, and nutritional support—are proven effective, they are inconsistently implemented [10]. Identifying predictive indicators is therefore essential to guide early intervention, improve patient outcomes, and reduce the burden of pressure injuries among stroke patients.

Methods

This cross-sectional study was conducted in the Department of Physical Medicine and Rehabilitation (PMR) of a tertiary care hospital in Bangladesh between March and October 2024. A total of 79 stroke patients were recruited using purposive sampling. The study aimed to determine the prevalence and predictive indicators of pressure injuries among admitted stroke patients. Ethical approval was obtained from the institutional review board, and all procedures adhered to established research protocols, ensuring data integrity and patient confidentiality.

Inclusion and exclusion criteria

Adult patients (≥18 years) with a confirmed diagnosis of stroke and admitted during the study period were included. Exclusion criteria were patients aged <18 years, those with other significant neurological disorders, hospital stays <48 hours, or neurological instability.

Data collection

A semi-structured questionnaire was used to collect demographic information, comorbidities, Braden Scale scores, Functional Independence Measure (FIM), and Barthel Index scores. Physical examinations were performed to assess the presence of pressure injuries, and relevant clinical records were reviewed to document comorbid conditions.

Data were analysed using SPSS software (version 27.0). Descriptive statistics were calculated for demographic and clinical characteristics as well as the prevalence of pressure injuries. Associations between clinical variables and the development of pressure injuries were assessed using chi-square tests. A p-value of <0.05 was considered statistically significant.

Results

Among the 79 stroke patients included, 59.5% were male and 40.5% female. The majority (79.7%) were from rural areas, while 20.3% resided in urban areas. Overall, 17 patients developed pressure injuries, giving a prevalence of 21.5% (**Figure 1**).

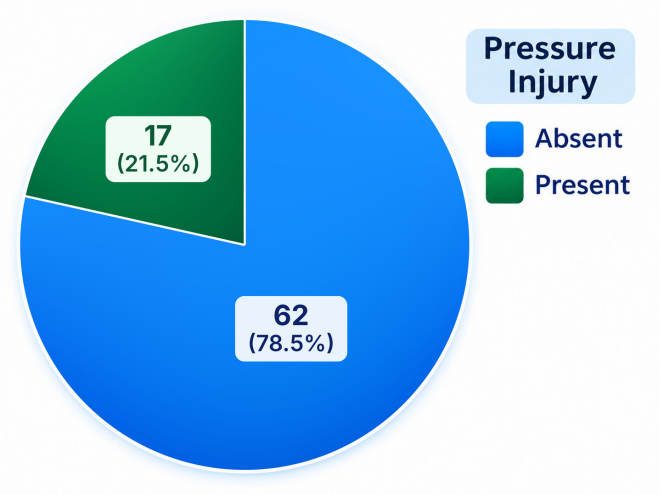


Figure 1: Pie chart showing prevalence of PIs

Table 1: Braden Scale Risk Categories

Risk of developing PI	Number of patients	Percentage	P
Mild risk: 15–16	31	39.2	<0.001
Moderate risk: 12–14	26	32.9	
High risk: Less than 12	22	27.8	

Braden Scale analysis (**Table 1**) showed that 39.2% of patients were at mild risk, 32.9% at moderate risk, and 27.8% at high risk for pressure injuries. The prevalence of pressure injuries was significantly higher in the high-risk group (P< 0.05).

Functional Independence Measure (FIM): Nearly half of the patients (49.4%) had scores <50, which was significantly associated with pressure injurie development (P< 0.001). Barthel Index: More than half (58.2%) scored <40, and this was also significantly associated with pressure injurie occurrence (P< 0.005) (**Table 2**).

Table 2: Functional Independence

Variable	Number of patients	Percentage	P
FIM Score <50	39	49.4	<0.001
FIM Score ≥50	40	50.6	
Barthel < 40	46	58.2	<0.005
Barthel ≥ 40	33	41.8	

Comorbidities

A large proportion of patients (94.9%) had at least one comorbid condition (**Figure 2**). However, no statistically significant association was found between comorbidities and pressure injurie prevalence (P>0.05).

In summary, most patients were male, from rural areas, and presented with comorbidities. Pressure injuries were most prevalent among patients categorized as high risk on the Braden Scale. Lower FIM and Barthel scores were significantly associated with pressure injurie development, reflecting substantial mobility and self-care limitations in this population.

Discussion

This study found that 21.5% of admitted stroke patients in a tertiary care hospital in Bangladesh developed pressure injuries. Predictors included low Braden Scale, Barthel Index, and Functional Independence Measure (FIM) scores. These findings align with global evidence showing that immobility, nutritional deficits, and limited resources drive pressure injurie risk in stroke patients [11].

The observed prevalence is comparable to regional data, such as 17.3% in India [12], but higher than rates in developed countries (8–12%), including 10.5% in the UK [13]. This disparity likely reflects differences in healthcare infrastructure, preventive equipment, and care practices. In resource-limited settings like Bangladesh, reliance on conventional care contributes to higher prevalence, underscoring the need for cost-effective preventive approaches [14].

Functional status strongly influenced pressure injurie risk. Patients with low FIM and Barthel scores had significantly higher prevalence, consistent with findings by Seo et al., who reported 40–50% pressure injurie rates among stroke patients with limited independence [15]. Reduced mobility increases prolonged pressure on bony prominences, leading to tissue damage and delayed recovery. Early mobilization and rehabilitation are therefore essential.

No significant association was observed with comorbidities, though conditions such as diabetes, hypertension, and chronic kidney disease are known to impair circulation and wound healing. Hao et al. similarly noted comorbidity increased pressure injurie risk by more than fourfold in stroke patients [16]. Effective comorbidity management within multidisciplinary care models remains critical.

The higher prevalence observed compared to high-income settings reflects systemic gaps, including limited access to pneumatic beds, inconsistent repositioning schedules, and shortages of trained staff. In developed countries, standardized prevention protocols and advanced technologies, such as alternating-pressure mattresses and robotic rehabilitation, reduce pressure injurie incidence [17]. In Bangladesh, however, absence of such infrastructure leads to markedly higher risk. Bridging these gaps requires locally appropriate, low-cost innovations and international collaboration to implement evidence-based strategies.

Future research should include longitudinal studies to evaluate pressure injurie progression, mortality, and recovery impacts. Cost-effectiveness studies on affordable interventions (e.g., pneumatic beds, nutrition support) and community-based strategies (caregiver training, home-based prevention) are also needed. Incorporating emerging technologies such as wearable pressure sensors and telemedicine may improve early detection and management.

Conclusion

Pressure injuries affect 21.5% of stroke patients in tertiary care, with key predictors including high Braden Scale risk and low FIM and Barthel scores. Early risk assessment, targeted interventions, and multidisciplinary care—including nutrition and appropriate technology—can reduce pressure injurie incidence. Resource-

tailored strategies are essential to improve outcomes in low-resource settings and align care with global standards.

Acknowledgement

Department of Physical Medicine and Rehabilitation, Manikgonj Medical College and Hospital.

Author contribution

Conception and design: MAI, AFM, SMMI, HH, NR. Acquisition, analysis, and interpretation of data: MAI, AFM, SMMI, HH, NR. Manuscript drafting and revising it critically: MAI, AFM, SMMI, HH, NR. Approval of the final version of the manuscript: MAI, AFM, SMMI, HH, NR. Guarantor of accuracy and integrity of the work: MAI.

Conflict of interest

We do not have any conflict of interest.

Data availability statement

We confirm that the data supporting the findings of this study will be shared upon reasonable request.

AI disclosure

None

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Bangladesh Journal of Physical Medicine and Rehabilitation
Bangladesh J Phys Med Rehabil 2026; 2(1):30-33

Case Report

Secondary synovial osteochondromatosis of the elbow presenting with advanced ulnar neuropathy and claw hand: A multidisciplinary surgical and rehabilitation approach

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Publication History
Received: 27 Feb 2026
Accepted: 21 June 2026
Published print: 30 June 2026

Responsible Editor
Fatema Newaz
0009-0004-2365-0740

Reviewers
A: Md Rashid Al Mahmood
0000-0003-2753-6887
B: Jamil Uddin
0009-0009-1160-4516

Funding
No external funding was received for this study.

Ethical Approval
Ethical approval was not required for this case report. Written informed consent was obtained from the patient to publish the manuscript.

Abstract

Introduction: Synovial osteochondromatosis (SOC) is a rare benign disorder characterized by synovial metaplasia and formation of intra-articular loose bodies, most commonly affecting large joints. Elbow involvement is uncommon, and neurological complications such as ulnar nerve palsy are particularly rare.

Case management and description: A case of a 43-year-old woman presenting with a three-year history of progressive elbow swelling, followed by two years of worsening hand weakness, numbness, and clawing of the fourth and fifth digits. Clinical examination revealed features of advanced ulnar neuropathy, including hypothenar wasting, sensory loss in the ulnar distribution, and positive Froment's sign. Imaging studies demonstrated multiple calcified loose bodies with degenerative changes, and biopsy confirmed secondary SOC. Nerve conduction studies established the severity of ulnar nerve involvement. The patient underwent surgical excision of loose bodies, synovectomy, and ulnar nerve decompression, followed by a structured rehabilitation program incorporating range of motion exercises, intrinsic muscle strengthening, neuromuscular electrical stimulation, splinting, and occupational therapy with remarkable improvements.

Conclusion: This case highlights the potential for delayed diagnosis and progression to advanced neurological deficits in SOC. Early recognition, combined surgical intervention, and comprehensive rehabilitation are essential to optimize functional recovery and prevent long-term disability.

Keywords: *synovial osteochondromatosis, elbow joint, ulnar nerve palsy, claw hand deformity, rehabilitation*

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How to cite this article: Islam MA, Arman M. Secondary synovial osteochondromatosis of the elbow presenting with advanced ulnar neuropathy and claw hand: A multidisciplinary surgical and rehabilitation approach. Bangladesh J Phys Med Rehabil 2026; 2(1):31-34

Introduction

Synovial osteochondromatosis (SOC) is a rare, benign disorder characterized by synovial metaplasia and the formation of cartilaginous or osteochondral nodules, which may detach and form intra-articular loose bodies [1, 2, 3]. These nodules may undergo calcification or ossification and can produce joint swelling, mechanical symptoms, and progressive restriction of movement [2, 3]. SOC most commonly affects large joints, particularly the knee and hip, whereas involvement of the elbow is relatively uncommon [2, 3].

SOC is broadly classified into primary and secondary forms. Primary SOC is characterized by synovial chondroid metaplasia, whereas secondary SOC occurs in association with pre-existing joint abnormalities, including osteoarthritis and other degenerative conditions [2, 3]. Secondary disease typically demonstrates loose bodies of variable size and shape in association with underlying articular degeneration [3].

Although SOC generally presents with local joint symptoms, neurological complications are uncommon. When present, they may result from compression of adjacent neural structures by loose bodies or associated synovial changes [3, 4]. At the elbow, the ulnar nerve is particularly susceptible to compression around the cubital tunnel, potentially resulting in sensory disturbance, intrinsic hand weakness, and clawing deformity [4, 5].

We report a rare case of secondary SOC of the elbow presenting with advanced ulnar nerve palsy and claw hand deformity, highlighting the diagnostic challenges associated with delayed presentation and the importance of multidisciplinary management incorporating rehabilitation.

Case management and description

A 43-year-old right-hand-dominant woman presented to the outpatient department of Physical Medicine and Rehabilitation with a three-year history of progressive, painless swelling of the left elbow. Over the preceding two years, she developed gradual weakness of the left hand, accompanied by deformity characterized by clawing of the ring and little fingers.

She also reported numbness along the ulnar border of the hand, affecting daily activities such as writing, gripping objects, and buttoning clothes. There was no history of trauma, inflammatory arthritis, gout, or systemic illness. Family history was non-contributory.

The chronic, insidious progression of symptoms contributed to delayed healthcare seeking, and the neurological deficits had significantly advanced by the time of presentation.

Physical examination revealed a diffuse swelling around the left elbow, more prominent over the posteromedial aspect. The overlying skin appeared normal without erythema or warmth. Palpation revealed a firm, non-fluctuant swelling without tenderness. Range of motion at the elbow was mildly restricted at terminal flexion and extension, though gross joint stability was preserved. Neurological examination revealed features of ulnar nerve palsy, including wasting of hypothenar eminence, positive Froment's sign, sensory loss over the ulnar distribution of the hand and clawing deformity of the fourth and fifth digits. Hand grip strength was 3/5 and fine motor coordination were significantly reduced.

Systemic examination was unremarkable. Laboratory investigations showed mild anemia, while inflammatory markers, rheumatoid factor, anti-CCP antibody, and serum uric acid levels were within normal limits. Nerve conduction studies and electromyography objectively quantified the severity of ulnar neuropathy.

Plain radiographs of the elbow demonstrated multiple calcified loose bodies with mild osteoarthritic changes. MRI confirmed synovial thickening, joint effusion, osteophytosis, and multiple ossified intra-articular bodies, wide bore needle biopsy consistent with secondary SOC.

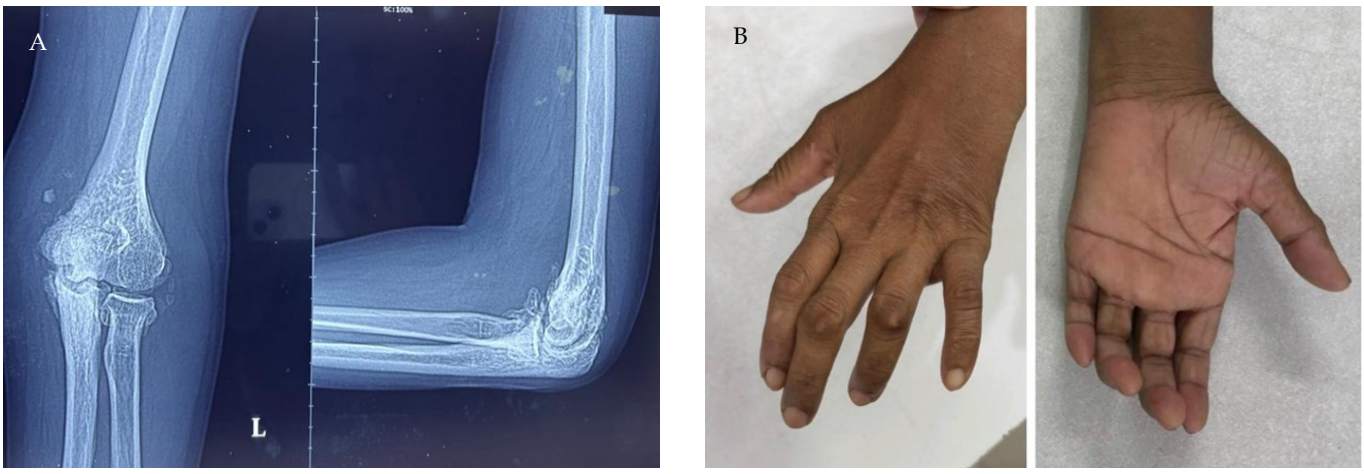


Figure 1: Clinical, radiological, and functional findings in synovial osteochondromatosis with ulnar neuropathy

The patient undergone surgical excision of loose bodies, synovectomy and Ulnar nerve decompression at the cubital tunnel. A comprehensive rehabilitation plan was initiated, emphasizing both preoperative functional assessment and postoperative recovery.

Rehabilitation Interventions included range of motion exercises for early postoperative elbow mobilization to prevent stiffness, strengthening exercises targeted to intrinsic hand muscle and progressive resistance training. Therapeutic modalities applied neuromuscular electrical stimulation to facilitate activation of denervated or weak intrinsic muscles, use of anti-claw orthosis to correct deformity and to improves functional hand positioning. Occupational Therapy focused on hand dexterity, training in activities of daily living and functional task-oriented rehabilitation. This integrated approach aimed to restore hand function, improve independence, and prevent long-term disability. Therapy sessions were supervised hybrid department and home based.

After a period of four weeks, there was reduction of pain, the grip strength improved to 4+/5, sensory improvements, with range of motion of elbow joint.

Discussion

Secondary SOC is frequently associated with degenerative joint disease, as evidenced in this case by radiological osteoarthritic changes [3, 5]. The presence of multiple calcified intra-articular bodies supports the diagnosis [3, 7]. Neurological complications in SOC are uncommon but clinically significant [4, 5]. Ulnar nerve compression in the cubital tunnel may lead to progressive neuropathy [4, 5]. Previous reports describe similar cases [4, 5]; however, most were identified earlier before severe intrinsic muscle wasting occurred.

In contrast, this patient presented with advanced neurological deficits, including established claw hand deformity. This highlights the insidious progression of SOC and the risk of delayed diagnosis, particularly in resource-limited settings. Surgical management remains the gold standard, with synovectomy and loose body removal providing symptomatic relief and reducing recurrence risk [6, 7]. Ulnar nerve decompression is essential when neuropathy is present [4, 5]. From a rehabilitation perspective, this case underscores the importance of early functional assessment, addressing both joint and nerve-related impairments and implementing structured postoperative rehabilitation [8].

Rehabilitation interventions such as nerve gliding, splinting, and NEMS are crucial in optimizing nerve recovery and functional outcomes [8, 9]. Furthermore, this case demonstrates the need for multidisciplinary care, involving orthopedic hand surgeons, physiatrist and physiotherapist, occupational therapists, to achieve optimal recovery.

Conclusion

Secondary synovial osteochondromatosis of the elbow is a rare condition that can present with compressive ulnar neuropathy and claw hand deformity. Early recognition through clinical evaluation and imaging is essential. Surgical management combined with structured rehabilitation plays a critical role in restoring function and preventing long-term disability. This case highlights the importance of considering SOC in chronic elbow swelling, early evaluation of neurological symptoms and integrating rehabilitation into management pathways.

Acknowledgments

We would like to sincerely thank the patient for providing consent for publication of this case report. We also acknowledge the support and permission of the authorities of Rangunia Upazila Health Complex, Chattogram, for facilitating the management and documentation of this case.

Author contributions

Manuscript drafting and revising it critically: MAI, MA. Approval of the final version of the manuscript: MAI, MA. Guarantor of accuracy and integrity of the work: MAI.

Conflict of interest

We do not have any conflict of interest.

Data availability statement

We confirm that the data supporting the findings of the study will be shared upon reasonable request.

AI disclosure

AI-assisted language editing was used to improve grammar and clarity of the manuscript. The authors reviewed and approved the final content.

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Bangladesh Journal of Physical Medicine and Rehabilitation
Bangladesh J Phys Med Rehabil 2026; 2(1):35-39

Perspective

Integrating climate change into postgraduate physical medicine and rehabilitation education for a climate-resilient health system

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Publication History
Received: 7 Jan 2026
Accepted: 20 Mar 2026
Published print: 30 June 2026

Responsible Editor
Md. Akhtaruzzaman
0009-0005-7356-7758

Reviewers
A: Moinuddin Hossain Khan
000-0001-6444-0599
B: Mohammad Azizur Rahman
0009-0008-6446-1320

Funding
None

Ethical Approval
Not required

Introduction

Climate change has emerged as one of the defining global health challenges of the twenty-first century, with profound implications for population health, disability, and the resilience of healthcare systems. The World Health Organization has identified climate change as the greatest threat to global health, as rising temperatures, extreme weather events, environmental degradation, and changing disease patterns increasingly affect morbidity, mortality, and health service delivery [1]. Low- and middle-income countries, particularly Bangladesh, are disproportionately vulnerable because of their geographic location, high population density, socioeconomic challenges, and limited adaptive capacity [2]. Recurrent floods, cyclones, heatwaves, river erosion, salinity intrusion, and other climate-related hazards not only cause immediate injuries but also contribute to long-term disability, exacerbate chronic diseases, interrupt essential health services, and increase the demand for rehabilitation [3].

Physical Medicine and Rehabilitation (PMR) is uniquely positioned to address the functional consequences of climate-related health conditions. Rehabilitation physicians play a pivotal role in restoring function, preventing secondary complications, promoting participation, and improving quality of life for individuals affected by injuries, neurological disorders, chronic diseases, and disabilities [4]. As climate-related disasters become more frequent and severe, the scope of rehabilitation medicine is expanding beyond conventional hospital-based practice to include disaster preparedness, emergency rehabilitation, community recovery, and health-system resilience [5]. Despite this changing landscape, postgraduate PMR education in Bangladesh has yet to adequately prepare future physiatrists for these emerging responsibilities. Integrating climate change, disability, and rehabilitation into postgraduate training is therefore no longer optional but an essential educational priority [6].

Climate change, disability, and the expanding role of rehabilitation

Climate change influences disability through multiple interconnected pathways. Extreme weather events such as floods, cyclones, landslides, and storms cause traumatic injuries, spinal cord injuries, traumatic brain injuries, fractures, burns, and limb amputations that often require long-term rehabilitation [7]. Heatwaves increase cardiovascular, respiratory, and renal complications while exacerbating neurological and musculoskeletal disorders. Climate-sensitive infectious diseases, malnutrition, poor air quality, and environmental pollution further increase the burden of chronic illness and disability [8]. Mental

Keywords: *climate change, physical and rehabilitation medicine, medical education, disaster preparedness, health systems*

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How to cite this article: Khan II, Newaz F, Uddin T. Integrating climate change into postgraduate physical medicine and rehabilitation education for a climate-resilient health system. Bangladesh J Phys Med Rehabil 2026; 2(1):35-39

health conditions, including anxiety, depression, and post-traumatic stress disorder following disasters, also create substantial rehabilitation needs.

Climate change not only creates new disabilities but also magnifies existing inequities experienced by persons living with disabilities. During disasters, inaccessible evacuation systems, disruption of medications, loss of assistive devices, interruption of rehabilitation services, inaccessible shelters, and reduced caregiver support expose this population to disproportionate risks. Damage to healthcare infrastructure, disruption of transportation, and shortages of rehabilitation professionals further compromise continuity of care. Consequently, rehabilitation should be viewed as an integral component of climate adaptation, disaster preparedness, humanitarian response, and long-term recovery rather than solely as post-acute clinical care.

For physiatrists, these changing realities require competencies extending beyond diagnosis and treatment. Future rehabilitation physicians must understand climate-sensitive health risks, disability-inclusive disaster risk reduction, rehabilitation service continuity during emergencies, multidisciplinary coordination, community-based rehabilitation, and health-system resilience. Such competencies are increasingly necessary to ensure equitable rehabilitation services before, during, and after climate-related disasters.

Climate-health education: Current status and existing GAPS

Growing recognition of climate change as a health issue has stimulated educational initiatives worldwide. Medical schools and public health programmes increasingly incorporate concepts of climate-health, planetary health, environmental sustainability, and disaster medicine into undergraduate curricula. International organizations, including the World Health Organization, the Global Consortium on Climate and Health Education, and several academic institutions, have developed educational resources, competency frameworks, and faculty development programmes to support climate-health education [9].

Across Asia, several countries have initiated educational activities on climate change and health through workshops, policy dialogue, postgraduate training, and continuing professional development programmes that emphasize disaster preparedness, climate resilience, and health system adaptation [10]. These initiatives demonstrate increasing institutional recognition of climate-health education; however, they remain largely confined to undergraduate medicine, public health, or short-term training programmes [11]. However, formal integration into specialty postgraduate curricula remains limited.

The situation is even more pronounced in rehabilitation medicine. Existing educational efforts predominantly focus on emergency medicine, public health, environmental health, or primary care, whereas PMR-specific climate education remains scarce [12]. Rehabilitation competencies related to climate adaptation, disaster rehabilitation, disability-inclusive emergency planning, rehabilitation system resilience, and community recovery have received comparatively little attention within postgraduate specialty training.

In Bangladesh, postgraduate PMR education provides comprehensive training in musculoskeletal medicine, neurological rehabilitation, pain management, electrodiagnosis, prosthetics and orthotics, spinal cord injury, stroke rehabilitation, paediatric rehabilitation, and multidisciplinary team management. Nevertheless, publicly available curriculum documents reveal no explicit competencies addressing climate change, environmental

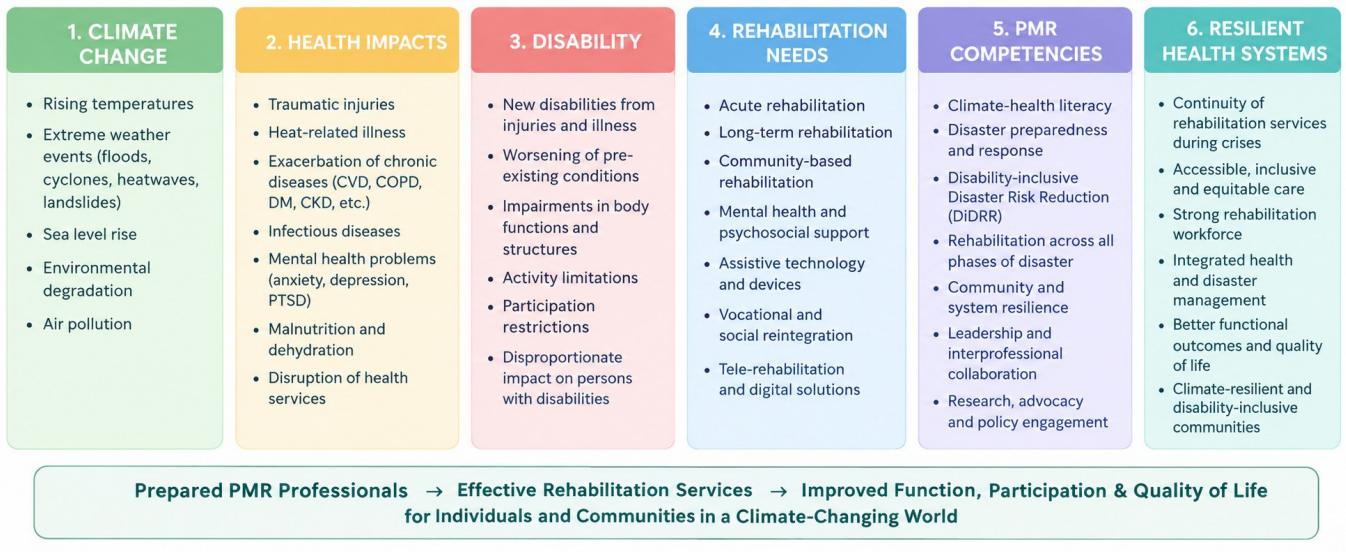


Figure 1. Concept of climate change education for PMR Physicians flowchart

Table 1. Suggested Competencies for Integrating Climate Change and Rehabilitation into Postgraduate PMR Training

Domain	Suggested Competencies
Climate and health	Understand the health impacts of climate change, environmental determinants of health, and planetary health concepts relevant to rehabilitation.
Climate-related disability	Recognize mechanisms through which climate change contributes to injury, chronic disease, disability, and functional decline.
Disaster rehabilitation	Deliver rehabilitation across preparedness, emergency response, recovery, and long-term reconstruction phases.
Disability-inclusive disaster risk reduction	Plan inclusive evacuation, shelter accessibility, continuity of rehabilitation services, and protection of persons with disabilities during disasters.
Rehabilitation system resilience	Maintain essential rehabilitation services during emergencies, strengthen referral pathways, and improve service continuity.
Community-based rehabilitation	Coordinate rehabilitation in displaced and underserved communities using community participation and local resources.
Digital rehabilitation	Apply tele-rehabilitation and digital health technologies to ensure continuity of care during service disruptions.
Leadership and teamwork	Coordinate multidisciplinary rehabilitation teams and collaborate with emergency responders, public health professionals, and policymakers.
Research and quality improvement	Conduct research on climate-related disability, rehabilitation outcomes, service evaluation, and evidence-informed policy.
Advocacy and policy	Promote disability-inclusive climate adaptation, rehabilitation planning, and national policies supporting resilient health systems.

health, disaster rehabilitation, rehabilitation system resilience, humanitarian response, or disability-inclusive disaster risk reduction. This educational gap raises important concerns regarding workforce preparedness in one of the world's most climate-vulnerable countries.

Why climate change education matters for PMR

The traditional role of rehabilitation physicians is rapidly evolving. Climate-related disasters increasingly require physiatrists to participate in emergency response teams, coordinate multidisciplinary rehabilitation services, establish rehabilitation pathways within disaster settings, facilitate continuity of care, prescribe and replace assistive technologies, and support long-term community reintegration of affected populations [7].

Furthermore, rehabilitation physicians are expected to contribute to health policy development, disaster preparedness planning, advocacy for persons with disabilities, and strengthening rehabilitation systems capable of functioning during emergencies. These responsibilities require knowledge and skills rarely included in conventional postgraduate PMR curricula. Figure 1 illustrates the concept of climate change education for PMR physicians leading to resilient health system.

The concept of rehabilitation system resilience has become particularly relevant. Resilient rehabilitation systems maintain essential services during crises, rapidly restore disrupted care, protect vulnerable populations, and adapt to changing environmental conditions. Developing such systems requires rehabilitation leaders who understand disaster risk reduction, health systems management, intersectoral collaboration, digital health technologies, tele-rehabilitation, and community engagement. Education is therefore fundamental to preparing future physiatrists for these expanded professional roles.

Building climate-responsive PMR education

Rather than introducing climate-health education as an isolated subject, postgraduate PMR programmes should integrate relevant competencies throughout existing training. Clinical rotations, case-based discussions, disaster simulation exercises, community postings, multidisciplinary teaching sessions, and research activities provide opportunities for embedding climate-related learning without substantially increasing curriculum burden (Table 1).

Such competencies align with broader global efforts to strengthen rehabilitation within health systems while addressing the growing health consequences of climate change. Incorporating these themes into competency-based education would enhance the preparedness of rehabilitation physicians without fundamentally restructuring existing postgraduate programmes.

The way forward for Bangladesh

Embedding climate change, disability, and rehabilitation education into postgraduate PMR training requires coordinated action by academic institutions like Bangladesh Medical University and Bangladesh College of Physicians and Surgeon, Bangladesh Society of PMR (BSPMR), regulatory authorities, and policymakers. Curriculum revision should be accompanied by faculty development programmes, interdisciplinary teaching, simulation-based disaster training, and opportunities for climate-related rehabilitation research. BSPMR can contribute by developing continuing professional development courses, clinical guidelines, and educational resources that complement formal postgraduate training.

Collaboration with international organizations such as International Society of PMR and regional academic partners would facilitate adaptation of existing educational frameworks to the Bangladeshi context. Equally important is the generation of locally relevant evidence examining climate-sensitive disability patterns, rehabilitation needs following disasters, rehabilitation service disruptions, and innovative models of community-based and digital rehabilitation. Such evidence would inform curriculum development while strengthening national rehabilitation policies and disaster preparedness strategies.

Conclusion

Climate change is fundamentally reshaping the future of rehabilitation medicine. As climate-related disasters, environmental hazards, and health-system disruptions increase, rehabilitation physicians will increasingly care for individuals whose disabilities are directly or indirectly influenced by climate change. Preparing this workforce requires a transition from optional educational activities toward competency-based postgraduate training that integrates climate science, disability, disaster rehabilitation, rehabilitation system resilience, and community adaptation. For Bangladesh, one of the country's most vulnerable to climate change, embedding these competencies within postgraduate PMR education represents more than curriculum modernization; it is an essential investment in resilient rehabilitation services, disability-inclusive health systems, and the future health of its population.

Acknowledgments

None

Author contributions

Conceptualization: IIK, FN. Manuscript writing: TU, IIK. Revised manuscript and submission: TU, FN.

Conflict of interest

We do not have any conflict of interest.

Data availability statement

None

AI disclosure

None

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The Editorial Board of BJPMR gratefully acknowledges the following reviewers for their time and expertise in evaluating manuscripts.

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2. A completed relevant EQUATOR checklist (www.equator-network.org).

Manuscript preparation: Use the prescribed template given on the Journal's website – (www.bspmr.org/index.php/BJPMR/AuthorInstruction). We follow IMRD format, ICD and Case reports.

Requirements for article preparation

Article types	Abstract	Main text	Key messages (words)	References	Tables/figures	Main text format	EQUATOR checklists
Research article a	250 c	3000	60	40	6	IMRD	Yes
Research letter a,b	-	1000	60	10	1	IMRD	Yes
Case report b	250 c	1000	60	10	1	ICD d	Yes
Review article	300 c	5000	60	300	6	IMRD	Yes
Letter to editor	-	400	50	6	-	-	-
Perspective/ Commentary	-	600	50	6	-	-	-
Editorial	-	600	50	6	-	-	-
Data e	250	1500	50	20	6	-	-

a Based on original work. b Maximum 5 authors. c Abstract having background (including objective), methods, results, and conclusion headlines; for Case report Background, Case description and management, Conclusion. Introduction, Case description and management, Discussion. d Description of routine hospital data. e Maximum 6 authors for original research articles derived from a thesis or dissertation.

A manuscript must have (in sequential order):

1. Title page: Title in sentence case, short title, list of authors (with affiliation, email, ORCID), indicating corresponding author. Identify the author if the manuscript is based on his or her thesis.

2. Abstract page: Structured abstract (see table above).

3. Key messages page: Key messages in descriptive terms.

4. Main body: Introduction (clearly mention the objective/s), Methods, Results (only text referring to tables/figures), and Discussion (conclusion should be the subheading).

5. Footnotes: Acknowledgements, authors contribution, funding, conflict of interest, AI disclosure, and data sharing statement.

6. References: should be in Vancouver style. DOIs for journals and URLs for websites to be given.

7. Table(s) or figure(s) page (separate page for each table/figure).