FORENSIC INSIGHTS AND HEALTH SCIENCES BULLETIN

Volume 4: Issue 2: 2026

https://doi.org/10.56770/fihsb2026422

ROLE OF PHYSIOTHERAPY IN THE MANAGEMENT OF NON-COMMUNICABLE DISEASES (NCDs)

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Submitted: April 08, 2026; Revised: May 11, 2026; Accepted: May 13, 2026; Published: October 31, 2026

ABSTRACT

Objective: The prevalence of non-communicable diseases (NCDs) leads to the highest rates of death affecting the world in a massive way as a burden to the health system. The present review appraises the importance of physiotherapy in prevention, treatment and rehabilitation of NCDs with a focus on the recent evidence. **Methods:** A systematic literature review was carried out based on Google Scholar, PubMed, and Scopus databases and studies published. Articles such as systematic reviews, randomized controlled trials, and meta-analyses were included in the peer-reviewed articles. **Results:** Exercise therapy, pulmonary rehabilitation, and lifestyle modification are physiotherapy interventions that have been shown to have a great impact on clinical outcomes among the NCD patients. There is evidence on the reduction in morbidity, functional capacity and quality of life. Such innovations as digital physiotherapy and individualized rehabilitation programs are recent. **Conclusion:** Physiotherapy forms part of the foundation in the management of NCDs, which provide cost-effective, evidence-based intervention and long-term outcomes. It is necessary to incorporate physiotherapy in primary care arrangements.

Keywords: Physiotherapy, Non-communicable diseases, Exercise therapy, Rehabilitation, Chronic disease.

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INTRODUCTION

Cardiovascular diseases, diabetes mellitus, chronic respiratory diseases, and cancer are non-communicable diseases (NCDs) that pose a significant health challenge in the world as millions of people experience such diseases [**1, 2**]. The diseases cause about 70-75th of the world mortality, and in the low- and middle-income countries the burden is disproportionately large because of the insufficient healthcare facilities, insufficient preventive measures, and socioeconomic differences [**2-9**]. The NCDs are increasing and present a critical social, economic, and health issue, resulting in the decreased productivity, rise in healthcare expenses, and lowered quality of life among the patients and their families [**10**]. Modifiable behavioral and lifestyle risk factors, such as physical inactivity, poor dietary habits, tobacco consumption, and damaging alcohol consumption, are seen as the major drivers of the rising occurrence of NCDs [**3**]. Physical inactivity has become one of the most urgent of them, and as it has been evidenced, it is linked to a high risk of cardiovascular diseases, obesity, type 2 diabetes, and some types of cancer [**4, 11**]. Inactive lifestyles which in most cases are attributed to urbanization, technology use and occupational issues contribute to the weight of NCDs in the world [**12**].

Physiotherapy has also been identified as a necessary measure used in the prevention, management and rehabilitation of NCDs. Physiotherapy helps to decrease the effects of these diseases by encouraging physical activity and enhancing functional capacity and behavior change [**5, 13**]. In contrast to pharmacological treatment or surgical operations, physiotherapy focuses on the non-invasive treatment, patient-centered approaches

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to the restoration of the movement, the prevention of disability, and the maximization of health outcomes. The holistic counters include personalized exercise interventions, training on posture and gait, ergonomics, and lifestyle modification education [**14**]. The recent evidence highlights the growing role of physiotherapists in primary and secondary prevention of NCDs. Physiotherapists can enhance cardiovascular fitness, glycemic regulation, respiratory and musculoskeletal health through systematic exercise plans, rehabilitation programs and behavioral interventions [**7, 15**]. Exercise has become very much accepted as a kind of medicine in the management of chronic diseases, which has more benefits that are not only beneficial to the physical health of a person but also areas such as mental health, stress reduction and improved thinking [**8, 16**]. Additionally, physiotherapy services have been indicated to save the health care expenses through avoiding disease advance, restricting hospitalization, and improving self-management of patients [**17**]. It is hence necessary to implement physiotherapy in the strategies of the population to counter the increased burden of NCDs. Physiotherapy has the potential to be a foundation of NCD prevention and management, with the contribution of healthier and more active communities across the globe by promoting sustainable, community-based physical activity programs, early rehabilitation, and patient education [**18**]. In spite of these advantages, the issues that include low awareness, resource shortages and differences in access to physiotherapy services are still a major hurdle especially in low-resource areas [**19**]. These issues are important and require policy endorsement, professional education, and novel treatment delivery framework to achieve the ultimate potential of physiotherapy in the management of NCDs.

The non-communicable diseases (NCDs) burden of the world is increasing at a worrying pace which is led by the demographic changes, urbanization, and changing lifestyles. The aging population is also a major factor in this pattern because NCDs tend to rise in prevalence with age because of an accumulation of risk factors and a decrease in muscular reserves [**20**]. It has brought about urbanization-related environmental and behavioral changes such as sedentary jobs, lack of physical exercise, and increased intake of energy-rich foods, all of which only increase the threat of chronic dysfunctions [**21**]. Epidemiological researches show that a significant percentage of disability-adjusted life years (DALYs) are caused by NCDs as the percentage of both premature mortality and years lived with disability [**10, 22**]. It does not only impact on the health of individuals but also has extended social and economic consequences, such as decreased productivity of the workforce, higher dependency and placing more strain on the health care systems [**23**]. The burden of NCDs falls disproportionately on low- and middle-income countries where the insufficient healthcare infrastructure, ineffective preventive measures, and the lack of rehabilitation services exacerbate the effects of the problem [**11, 24**]. There is an urgent requirement to reduce the increasing NCD epidemic using cost-effective, scalable, and accessible interventions. Among the key elements of chronic disease management, physiotherapy with its focus on exercise, functional rehabilitation, and patient-centered care comes into play [**12, 25**]. It is indicated that physiotherapy has the potential of cutting down on the cost of healthcare through prevention of disease progression, few hospital admissions, and minimisation of the requirement of invasive procedures [**12**]. Recent systematic reviews have also established that physiotherapy is cost-effective in the treatment of chronic conditions, especially musculoskeletal disorders, cardiovascular diseases and diabetes, so it can be incorporated as a viable public health approach in low-resource settings [**12, 26**].

PHYSIOTHERAPY MECHANISMS IN THE NCD MANAGEMENT

Physiotherapy has complex effects on the prevention, management as well as rehabilitation of NCDs in mechanisms that cut across cardiovascular, metabolic, musculoskeletal and neuromuscular systems. These processes play an important role in enhancing patient outcomes and reducing disease-related complications. The basis of physiotherapy interventions of NCDs is exercise therapy. Regular workouts cause a variety of physiological changes, such as an increase in cardiovascular activity, a rise in insulin sensitivity, and decreased systemic inflammation [**13, 14, 27**]. Exercise is known to have a positive effect on several biological systems: Heart: Exercise has the benefits of increasing cardiac output, improving endothelial functioning, decreasing resting blood pressure, and increasing heart rate variability, all of which decrease the risks of cardiovascular morbidity [**28**]. Metabolic system: The effectiveness of physical activity in promoting glucose uptake in skeletal muscles, lipid metabolism, and regulation of insulin signaling pathways are important in the prevention and management of type 2 diabetes and obesity [**17, 29**]. Musculoskeletal system: Exercise helps in muscle hypertrophy, strength improvement, joint stability, and endurance that are essential in patient functional independence of chronic conditions [**15, 30**]. According to clinical research, over 30 chronic conditions, including metabolic diseases and cardiovascular diseases as well as mental illnesses, can be prevented and controlled by structured exercise programs, which points to the systemic nature of physiotherapy interventions [**15, 31**]. A serious inflammatory process is the basis of the pathogenesis of most NCDs, such as cardiovascular

diseases, diabetes, and some cancers [**16**]. There is evidence that physiotherapy treatments, specifically aerobic and resistance exercise, lower systemic inflammation by reducing the pro-inflammatory cytokine (interleukin-6 IL-6) and tumor necrosis factor-alpha (TNF-a) levels, and increasing the level of the anti-inflammatory cytokine (interleukin-10) [**16, 32**]. Besides anti-inflammatory responses, physiotherapies enhance metabolic health through increasing the skeletal muscle uptake of glucose, lipid oxidation, and energy metabolism [**17, 33**]. Physiotherapy also brings about considerable neuromuscular physiological changes such as increases in motor unit recruitment, proprioception and balance and coordination [**18, 34**]. The adaptations are especially relevant with aged patients and patients with chronic conditions because these adaptations help lower the risk of falls, counter secondary complications, and keep them functionally independent [**35**]. Moreover, the results of NCD-related sarcopenia and frailty can be overcome by specific strength and endurance training to enhance the quality of life and autonomy [**36**]. Other than physiological, physiotherapy is psychologically and behaviorally beneficial. Through exercise and rehabilitation programs, the mental health is enhanced by alleviating the effects of depression and anxiety, improving mood and adherence to healthy lifestyles practices [**37**]. Physiotherapy that has been incorporated with behavioral interventions (goal-setting, self-monitoring, and motivation strategies) can help in long-term lifestyle modification and also enable patients to assume a more active role in the management of their own health [**38**]. Physiotherapy can be used as a preventive and therapeutic approach in the multidimensional burden of NCDs through these interconnected mechanisms. There is a holistic approach of physiotherapy as a key element to the world in trying to cut down on the effect of chronic diseases.

PHYSIOTHERAPY ROLE IN SELECTED NCDS

Physiotherapy has multidimensional role in management as well as prevention of non-communicable diseases, both in respect to physical, metabolic and psychosocial aspects of chronic illness. Its interventions are disease-specific but have the basis on the fundamentals of exercise therapy, functional rehabilitation and patient education. The most common cause of death in the world is cardiovascular diseases, which include coronary artery disease, heart failure, and complications after the infarction of the heart muscle [**19, 39**]. Cardiac rehabilitation that involves cardiovascular risk factors modification, patient education and structured exercise programs involves physiotherapy. Cardiac rehabilitation using exercise has been found to minimize cardiovascular mortality and improve psychosocial well-being. Ordinary physiotherapy treatments are aerobic exercises, resistance exercises, interval training, and flexibility exercises. Aerobic exercise can increase cardiac performance and endothelial performance, and resistance exercise can increase muscle strength and metabolic efficiency, both of which decrease the risk of recurrent cardiac events [**20, 40**]. Education of lifestyle changes in relation to smoking cessation, stress management, and dietary changes are also part of secondary prevention that physiotherapists offer [**41**]. Diabetes mellitus especially type 2 diabetes is a disease that causes insulin resistance, hyperglycemia, and complications like neuropathy, retinopathy, and heart disease [**21**]. Physiotherapy treatments, most notably, exercise therapy are quite effective in enhancing the insulin sensitivity and the glycemic regulation. It has been demonstrated that both aerobic and resistance training will reduce the level of HbA1c by a significant percentage, improve the lipid profile, and improve the body composition of type 2 diabetes patients [**22, 42**]. Exercise-based interventions prevent or delay the development of complications associated with diabetes as well by boosting the vascular performance, decreasing systemic inflammation, and increasing musculoskeletal well-being. Physiotherapists can also offer Self-monitoring of blood sugar, foot, and safe exercise education that will enable patients to take charge of their condition [**43**]. Chronic respiratory diseases are characterized by persistent coughs, dyspnea, and airway obstructions. Chronic Respiratory Diseases Chronic respiratory diseases are those that are persistent and include coughs, dyspnea, and obstructions of the airways. The respiratory illnesses such as chronic obstructive pulmonary disease (COPD), asthma, and interstitial lung disease play a major role in the impairment of lung functioning, exercise tolerance, and quality of life [**23,44**]. Physiotherapists head pulmonary rehabilitation which is a management pillar that entails individual exercise programs, breathing exercises, airway clearance regimes, and energy conservation education. Exercise interventions enhance the respiratory efficiency, cardiovascular stamina, dyspnea and the level of physical activity [**23, 45**]. According to the studies, structured exercise programs in COPD patients are associated with better functional capacity, decreased hospitalization, and psychosocial outcomes. Physiotherapy is also used to treat comorbidities (osteoporosis, muscle wasting, and anxiety) common in the chronic respiratory disease populations [**46**].

Cancer and its intervention such as chemotherapy, radiations, and surgery usually cause fatigue, pain, reduced physical functioning, and psychological distress [**24, 47**]. Physiotherapy assists in cancer rehabilitation by providing a personalized exercise regime, manual therapy as well as patient education to counteract these effects.

Exercise interventions are found to reduce fatigue that is caused by cancer. Physiotherapists develop programs based on the state of the disease, the modality to be used in treatment, and the tolerance of patients with an emphasis on progressive development and safety. Moreover, physiotherapy will be useful in the management of lymphedema, joint contracture prevention, and post-surgical recovery, which will enable the patients to achieve better long-term results as cancer survivors [**48**]. The major causes of disability and loss of functional independence are musculoskeletal disorders (MSDs), such as chronic back pain, osteoarthritis, rheumatoid arthritis, and repetitive strain injuries [**25,49**]. Manual therapy, exercise therapy, postural correction and ergonomic advice are among the key physiotherapy interventions of management of these conditions. Specific exercises that include core stabilization, resistance, and balance programs ease the symptoms and ensure prevention of reoccurrence and progression of musculoskeletal disorders [**50**].

PHYSIOTHERAPY PREVENTION AND HEALTH PROMOTION

The role of physiotherapy in community-based interventions towards preventing non-communicable diseases and healthy lifestyles is becoming more significant. This is because involvement of physiotherapists in school, workplace, and community interventions will lead to population-wide changes in physical activity, functional capacity, and the quality of life [**43, 44**]. The community programs are usually organized exercise sessions, health education forums, and risk factor screening that assist in recognizing people at risk of NCDs early enough and offering early intervention [**45**]. The inclusion of physiotherapy in the health policies of a population has been seen to lower the rate of occurrence of chronic illnesses, the hospitalization rates, and the health expenditures [**46**].

Additionally, physiotherapists can also promote environment and policy modifications, including safe walks, work ergonomics, and facility access, that promote people to be physically active and avoid sedentary behaviors [**47**]. The joint initiatives between healthcare organizations, local authorities, and non-governmental agencies have proven to be successful in increasing the level of compliance to physical exercises and lifestyle change [**48**]. There is also new evidence that digital tools and mobile health apps could be incorporated into community-level interventions to expand reach and involvement among the heterogeneous population, including underserved communities [**49**]. Physiotherapy is not only restricted to disease management and prevention but also health promotion and community based interventions. Preventive physiotherapy is the intervention used to minimize the rate at which NCDs occur and the severity of the problem by modifying their lifestyles, detecting risk factors early, and implementing health awareness programs among the populace [**26**].

DIGITAL AND MODERN ADVANCEMENTS IN PHYSIOTHERAPY

The world of physiotherapy has greatly changed due to technological advances as it now makes interventions more accessible and effective. The digital health tools, including tele-rehabilitation, have enabled physiotherapists to provide care remotely by breaking the barriers that exist, including geographic distance and inadequate access to specialized services [**49**]. It is possible to implement home-based supervised exercise programs, where patients are provided with real-time feedback on the use of video conferencing and mobile programs with clinicians [**50**].

Smart watches and sensors have further transformed the world of patient monitoring by offering objective information about the patient movement, activity, heart rate, and exercise compliance with the prescribed exercise programs [**51**]. Such an evidence-based strategy enables physiotherapists to design programs that fit the needs of individual patients, which improves the outcome and motivation.

Software-based intervention, which is also known as digital therapeutics, allows tailored prescription of exercises, behavioral change, and lifelong patient education [**52**]. Research has shown that patients who use these online platforms have an increase in engagement, improved adherence to home exercise programs, and clinical outcomes in comparison to traditional care delivery alone [**53**]. Additionally, artificial intelligence and machine learning algorithms being incorporated into physiotherapy software are already able to predict patient progress and optimize intervention plans which are becoming a transition to precision rehabilitation [**54**]. These innovations also help in remote monitoring that can be used in chronic disease management, minimizing the regular visits to the hospital, and timely intervention in case of worsening. Digital physiotherapy has been shown to guarantee continuity of care, self-management empowerment, and long-term behavioral change, especially among NCD patients [**55**].

ROLE IN GERIATRIC POPULATION

NCDs and functional decline with age are disproportionately experienced by the geriatric population. Physiotherapy is very crucial in preserving independence, fall prevention and improving quality of life in the elderly [**56**]. Specific exercise interventions that can be used to address the needs of older adults enhance balance, strength, flexibility, and cardiovascular endurance which is important in minimizing the risk of falls and conserving the functional activities of life [**57**]. Moreover, it is also found that physiotherapy can help relieve chronic pains and decrease fatigue and

enhance psychological health in elderly patients with comorbid conditions [**58**]. Recent research draws attention to the fact that digital health intervention combined with traditional physiotherapy could additionally be used in older adults because these people could get remote guidance, monitoring, and feedback, which could make them more accessible and more adhering [**59**]. Indicatively, tele-rehabilitation interventions that focus on mobility and balance have been proved to have a substantial beneficial impact on the functional outcome of aged groups with chronic conditions, as well as lowering hospitalization levels [**60**]. The integration of evidence-based physiotherapy and modern technological tools can help clinicians to deal with the peculiarities of geriatric population and encourage active aging, independence, and better health-related quality of life.

DISCUSSION

The case is heavy on the importance of physiotherapy in preventing, managing, and rehabilitating non-communicable disease (NCDs). Physiotherapy is holistic and patient centered, as it considers not only the physical impairments to the subject, but the psychological, social and behavioral aspects of health. This multidimensional model is particularly crucial in the management of NCDs since such conditions usually comorbid with other comorbidities and need long-term and continuous interventions [**30, 31**]. The integrative and multifaceted approach of physiotherapy is one of the strongest aspects of this treatment. Physiotherapy uses a combination of exercise therapy, functional rehabilitation, patient education, lifestyle change, and psychosocial support in contrast to pharmacological treatments, which mainly focus on the pathophysiological processes [**32**]. This strategy will allow physiotherapists to personalize interventions based on the personal needs of patients, taking into account comorbidities and functional limitations and personal objectives. As an example, aerobic training exercise, resistance exercises, and educational counseling (i.e., physiotherapy) have been proven to improve physiological outcomes, as well as patient engagement and adherence in patients with cardiovascular disease and diabetes [**34, 35**]. Another important benefit of physiotherapy in the management of NCD is early intervention. Early physiotherapy either immediately after diagnosis or admission into the hospital may postpone the disease and reduce complications and long-term prognosis. It has been indicated that exercise programs, early mobilization, and specific rehabilitation could be very beneficial in enhancing the functional capacity, cardiovascular performance and glycemic control, and at the same time, decrease hospital readmissions and healthcare use [**33-35**]. These interventions can be effective especially in the decrease of the secondary complications such as the musculoskeletal deconditioning, sarcopenia and loss of independence among the elderly populations. Patient empowerment and self-management are other significant benefits of physiotherapy that are necessary to maintain lifestyle change and chronic disease management. The patients who participate directly in the physiotherapy program show high levels of adherence to the prescribed exercise programs, better self-efficacy, and increase in the long-term health outcomes [**36**]. Physiotherapy by providing all the necessary knowledge, skills and motivation to enable patients to handle their conditions independently would focus on the behavioral side of chronic disease management which is usually ignored in traditional forms of treatment. Although the above advantages are apparent, physiotherapy is not well exploited in most health care systems, especially in low and middle income countries [**37**]. Some obstacles are the lack of trained professionals, lack of awareness among patients and healthcare professionals, inadequate infrastructure and the absence of integration into the mainstream care pathways [**38**]. These issues do not only limit the access of patients but also inhibit the potential universal health benefit of physiotherapy interventions on the increasing global NCDs disease burden. New digital health technologies including tele-rehabilitation, remote physiotherapy programs present good solutions to these barriers. Tele-rehabilitation helps patients to have personalized exercise programs, real-time monitoring and continuous support despite geographical boundaries. The literature shows that tele-physiotherapy interventions are appropriate in enhancing the physical functioning, adherence and satisfaction among patients, especially in rural or underserved patients [**39, 40**]. Moreover, the use of wearable tools and mobile health solutions enables constant monitoring of the activity, vital signs, and exercise performance, and improves personalized care and makes decisions based on the data. Economically, physiotherapy is very crucial to the alleviation of NCDs financial cost to patients and the health care systems. Physiotherapy reduces hospitalization, high costly medical procedures, levels of functional independence, and complications by preventing the disease progression, limiting complications, and lowering the cost of long-term treatment [**41**]. The cost-effectiveness studies have continually shown that physiotherapy investment has a high payback in terms of health outcome, productivity and minimized healthcare spending [**42**]. Although there are such improvements, there are still major gaps in standardization and application of physiotherapy interventions on NCDs. Evidence-based protocols, clinical guidelines and standardized outcome measures are required to achieve consistency, reproducibility, and the best patient outcomes [**43**].

The research work on the topic in the future needs to be centered on large-scale and multicentric randomized controlled trials, and longitudinal studies to determine best practices, assess long term effects and determine the applicability of physiotherapy interventions in varied populations. To conclude, physiotherapy is one of the foundations of the multidimensional approach to NCDs, encompassing clinical efficacy, patient-centrism, prevention, and cost-effectiveness. It must also be incorporated in both national and global health strategies in order to deal with the increasing number of chronic disorders. Nevertheless, to realize the full potential of physiotherapy, access, awareness, policy, and standardization challenges should be systematically overcome, and new strategies, including digital health and community-based rehabilitation, should be elaborated and introduced.

CONCLUSION

Non-communicable diseases (NCDs) such as cardiovascular diseases, diabetes, chronic respiratory diseases, cancer and musculoskeletal disorders are responsible for the high burden of death, disability and health care costs globally. They are growing more common, especially in LMICs, and are caused by physical inactivity, unhealthy diets, and sedentary lifestyles. Physiotherapy is a critical component in the prevention and management of NCDs and exercise, functional rehabilitation and educating patients are the three key areas of physiotherapy. It has many benefits, such as increased cardiovascular and metabolic health, glycemic control, lung function, mobility, pain control and quality of life. Physiotherapy also helps to promote a healthy lifestyle, early detection of risk factors and self-care. Digital health technologies and tele-rehabilitation are additional opportunities to increase access and personalize care. In addition, physiotherapy can also be cost-effective as it can prevent complications and hospital admissions and lower the healthcare cost. But there are still some barriers: limited access, limited awareness, limited policy support and poor healthcare integration. To conclude, physiotherapy is an evidence-based, holistic and cost-effective way of lowering the burden of NCDs. It can be implemented alongside better access, guidelines and innovative models of care to lower the chances of complications from disease, increase functional independence and improve long-term health outcomes in a national and international health framework.

Authors Contribution: data collection, R. Iqra and K. Bushra; resources, I. Kashif; supervision, R. N. Dawood; review and editing, S. B. K. Sakina and T. Zainab.

Funding: No funding involved.

Ethical Approval: Not applicable

Conflict of Interest: Nil.

Consent for Publication: All authors approved the manuscript for publication.

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