



ANALYSIS OF INFECTIOUS COMMUNICABLE AND NON-COMMUNICABLE DISEASES IN PAKISTAN: A SYSTEMATIC REVIEW

Saeeda Anjum Buriro^{1*}, Sultan Muhammad², Major Munnaza Parveen Rtd³, Husan Bano Channar⁴, Shakeel Ahmed Memon⁵, Irshad Chandio⁶

^{1*,6} PhD Scholar University of Sindh, Jamshoro, Pakistan.

^{2,3} Assistant Professor Sohail University

⁴ Assistant Professor Peoples' Nursing School Liaquat University of Medical & Health Sciences Jamshoro

⁵ Assistant Professor, Department of Zoology Government College University Hyderabad, Sindh Pakistan

***Corresponding author:** Saeeda Anjum Buriro

*email: buriro.saeeda@gmail.com

Abstract

With a population of approximately 241.49 million people, Pakistan faces challenges in providing quality healthcare due to the high incidence of both communicable and non-communicable diseases. Understanding the factors that contribute to the prevalence of communicable and noncommunicable diseases in Pakistan is the driving force behind this study. Secondary information was gathered from academic works published between 2017 and 2023 for this investigation. Springer Link, ScienceDirect, PubMed, Semantic Scholar, and Google Scholar were only few of the scholarly databases used to assemble the data for this review. The research is centered on both communicable and noncommunicable diseases that have an impact on human health. With an emphasis on epidemiological, socioeconomic, and healthcare system-related variables, this study provides a detailed evaluation of the occurrence and effect of several diseases in Pakistan. Several variables were discovered to contribute to the country's high sensitivity to infectious disease epidemics. These included the high population density in metropolitan areas, poor water quality, inadequate sanitary infrastructure, unfavorable socioeconomic situations, and low immunization rates. A lack of a comprehensive surveillance plan and technology has hindered the successful management of infectious disease epidemics. Both diseases require urgently needed targeted medications.

Keywords: Infectious diseases, communicable and non-communicable diseases, outbreak, Pakistan

Introduction

Risk factors for communicable and non-communicable diseases include social, environmental, and behavioral factors. Over 90% of the world's sick live in Saudi Arabia, Syria, Afghanistan, Peru, Iran, Pakistan, and Brazil. These countries have most of the world's sickness. The World Health Organization reports 2–2.5 million new cases of these illnesses year (WHO, 2023). According to Buriro et al. (2019) the prevalence of these disorders continues to be a major problem for public health, as they are the key factor in determining morbidity and mortality rates.

Pakistan, known for its many ethnicities and large population, faces a healthcare crisis caused by communicable and non-communicable diseases. Pakistan has made headway in modernising its healthcare system, but illness burden continues to rise. Infectious diseases like tuberculosis, hepatitis, and malaria have been prominent throughout history. However, non-communicable diseases (NCDs) like cardiovascular disease, diabetes, and cancer have complicated Pakistani healthcare. Complexities, factors, and healthcare techniques for numerous disorders are examined in this article. Infectious communicable diseases (CD) have been the leading cause of global mortality for generations. Non-communicable diseases (NCDs) in industrialised nations have grown due to medical advances in immunisation, antibiotics, and living conditions. Healthcare systems in wealthy nations face cardiovascular disease, neoplastic problems, metabolic disorders including diabetes, and chronic respiratory and psychological ailments (Boutayeb, 2006; 2023). Due to population increase, urbanisation, climate change, and economic globalisation, infectious disease dynamics have changed dramatically in recent years. In recent years, infectious disease epidemics have become more common due to drug-resistant bacteria. Diseases have spread due to vector ecology changes, including an increase in *Aedes* activity. Modern society's interconnectedness and urbanisation make people more susceptible to diseases (Bedford et al., 2023).

About 100 million people contracted dengue fever in 2016, and 38,000 died (Bloom et al., 2019). Infectious diseases threaten people's physical and emotional health and require human, material, and financial resources to regulate. Serious infectious diseases can cause civic unrest and slow societal progress in emerging nations. Therefore, it is crucial to analyze the transmission patterns of infectious diseases as well as the corresponding control strategies. (Hou & Wang, 2023).

Method

This study combines inclusion and exclusion criteria and a data extraction process to create a systematic review. This study followed Arksey and O'Malley's (2005) scoping review framework. Scoping research was chosen over systematic review since there was no need to evaluate all existing literature.

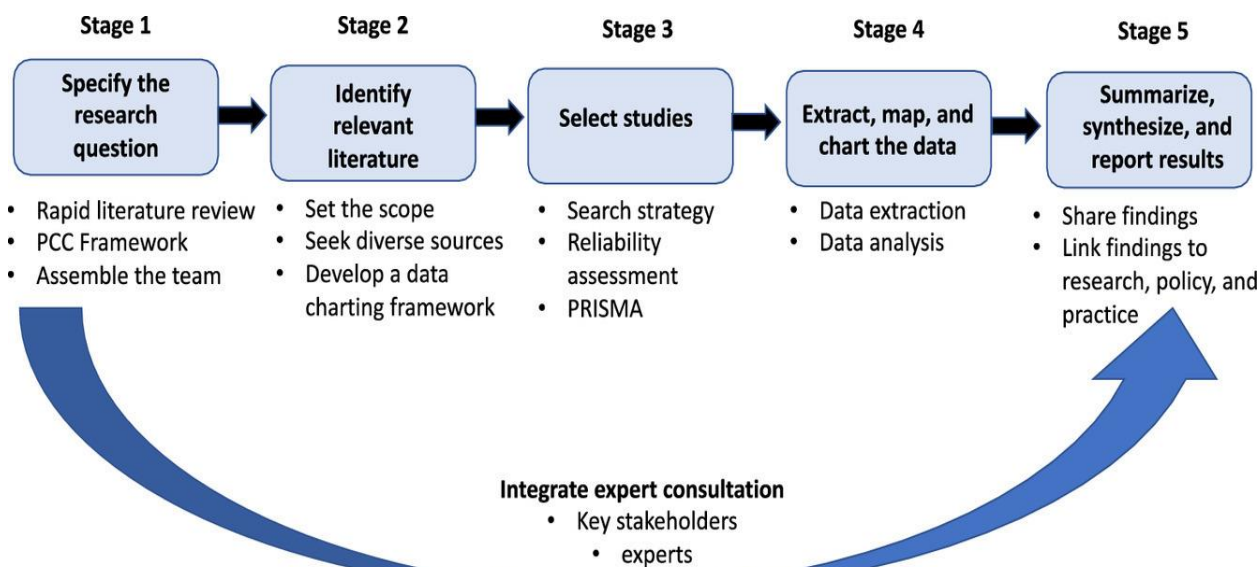


Fig. 1 Arksey and O'Malley's (2005) Scoping Review Framework

By following this framework first, we developed our research questions and purpose through a brief literature review. Secondly, we identified relevant literature based on the research topic and objective. Practical constraints like timing and resources may limit the literature's breadth. Thirdly, scoping reviews differ from systematic reviews in that the study selection process is iterative, making it more difficult to properly document. In the Arksey and O'Malley Framework, stage four involves using descriptive analytical methods for data charting or mapping. A uniform process for mapping or

charting data for a scoping review is not yet established, unlike data extraction in a systematic review or meta-analysis using specialised statistical approaches.

In the fifth stage, an analytic framework is created to summarise the literature and identify priority areas. One issue of stage 5 is the absence of clear instructions on how to methodically complete the collating, synthesising, and reporting process, which involves numerous processes.

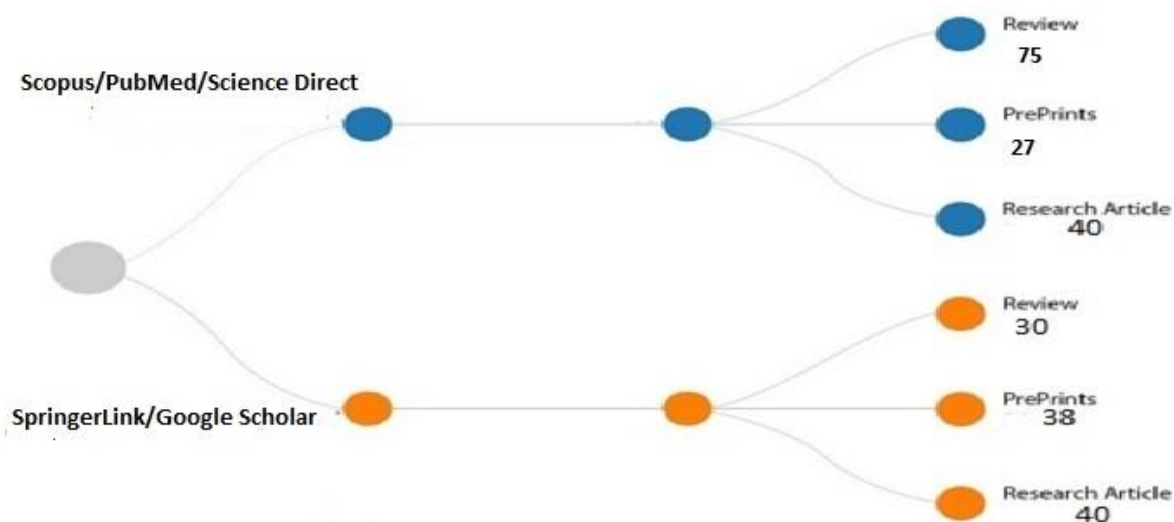
The study's main goals were to examine and synthesise existing literature to determine the best methods for integrating human behaviours into infectious disease models and to identify specific domains in human behaviour modelling that could benefit from health and social psychology insights. The stated goals match the scoping review technique described in earlier research (Arksey & Malley, 2005; Levac et al., 2010).

Identifying Relevant Studies

As suggested by Arksey and O'Malley (2005), the search approach was designed to maximise comprehensiveness and inclusivity. Search terms included communicable and non-communicable diseases. Using Springer Link, ScienceDirect, PubMed, Semantic Scholar, and Google Scholar yielded 30,000 records, highlighting approach optimisation difficulties. The search strategy was optimised through iteration. The method used title and abstract keyword searches and thesaurus phrases. To maximise relevant articles and minimise irrelevant ones, precise yet unexpanded thesaurus terms were used to pick papers. Backward and forward citation searching in listed publications was prevented due to time and resource constraints.

Selection Criteria

The criteria for inclusion and exclusion utilized in the study. The inclusion criteria outlined in the apriori selection process stated that papers would be considered if they focused on the transmission of infectious disease among a population, with a specific focus on communicable and non-communicable diseases. Specifically, the articles considered in this review incorporate a variable diseases which are communicable or non-communicable.



The search on PubMed, Scopus and Science Direct based journals, such as Traylor and Francis Online, Elsevier, and Springer Link, yielded 75 review papers. These papers comprised of 75 research articles, 27 preprints, and 40 reviews. Out of the entire corpus of papers examined, 38 documents were identified using a search conducted on SpringerLink and Google Scholar. These papers were published between January 2017 and September 2023. Among the identified papers 30 review papers, 40 research articles, 38 preprints, and 40 research article.

Infectious (Communicable) Diseases in Pakistan

2.1 Epidemiological Landscape

The environment, or the geographical and contextual variables around a host or pathogen at a given time, affects host movement and pathogen persistence. Thus, certain sites may transmit more than others. Host and pathogen motility reveal environmental impact. Wildlife infections spread because environmental factors limit or promote host migrations. When hosts move from farms to feedlots, infections can spread (Kao et al., 2007; Mannelli, 2007). Social interactions are linked to human infection spatial patterns (Zhang et al., 2020).

Environment and travel patterns affect disease management (Manlove et al., 2019; Grenfell, 2001). This is relevant when environmental factors affect super-spreading events, epidemic waves, or local transmission rates (Cross et al., 2015; Lloyd-Smith et al., 2005).

Movement data improves spatially explicit transmission models across scales. Resource limitations and productivity gradients play a major role in host density and mobility (Bischof, 2012; Teitelbaum & Mueller, 2019). Albery et al. (2022) found spatial dependency among gearbox events, suggesting high-resolution contact drivers affect gearbox.

Despite these correlations, movement ecology methods are rarely used to establish a mechanistic link between the environment and transmission (Albery et al., 2021; Dougherty, 2018). This disparity may have two causes. First, the tools' outputs may not match pathogen transmission parameters. Second, spatially explicit transmission behaviours and shifting pathogen decay rates are often overlooked.

Disease spreads due to host density, movement, and interaction. These components arise due to host and pathogen movements driven by environmental interactions. Interactions between the environment, host and pathogen movements, and density, mobility, and contact generate a "epidemiological landscape".

The leading cause of death worldwide is infectious diseases. Pathogenic microorganisms such as protozoa, bacteria, fungi, viruses, and helminths cause infectious disorders (Barber & Stark, 2015). Many rural diseases have adapted to urban contexts, and some have originated or revived in cities.

The diversified health conditions, high contact rates, and mobility of large urban populations put them at danger of disease transmission (Buriro, et al., 2016). Indeed, diseases can quickly spread to nearby urban regions, including rich residential districts and major tourist spots, notwithstanding the initial susceptibility of impoverished urban neighbourhoods (Nanyingi et al., 2015).

Urban centres are significant gateways for global infectious disease transmission in an increasingly interconnected global civilization. Public health challenges like those above change chronic and infectious disease epidemiology and have global effects. Duesberg found in 1991 that microbes cause most infectious diseases. Medical interventions like immunisation, medicine, and vector control can treat infectious disorders (Lipp et al., 2002). Some diseases are uncontrollable or ineffectual with standard methods. Researchers are developing cutting-edge tools to solve many of humanity's challenges (Walker et al., 2014). Pakistan has a high rate of water, vector, and bloodborne illnesses (Gul et al., 2019). Waterborne diseases like cholera and typhoid may persist due to poor water quality and sanitation.

Transmission Dynamics

Multiple causes contribute to the persistence of infectious diseases in Pakistan, including a lack of access to healthcare facilities, poor sanitation, and crowded living conditions. The transmission mechanism theory of disease dynamics is a scientific paradigm that synthesises the existing body of knowledge for modelling infectious disease dynamics at a single scale (Garira, 2019).

2.2 Public Health Initiatives

Vaccination Campaigns

The global application of vaccination faces various context-dependent issues (Nichter, 1995; Feldman-Savelsberg et al., 2000; Ali, 2020a; Ali, 2022). Natural disasters and health emergencies, such as the COVID-19 pandemic, affect immunisation efforts in socio-cultural, economic, and political contexts (Ali, 2022; WHO, 2022). Global immunisation efforts have been hampered by the

pandemic (Lund et al., 2017). These issues include the necessity of maintaining physical distance and the severe load on healthcare systems produced by COVID-19. Thus, several immunisation programmes have been halted (Ali, 2020b).

Expanded Program on Immunization (EPI)

The 1978 Expanded Programme on Immunisation (EPI) aims to vaccinate six million 0–11-month-olds against nine illnesses. Childhood TB, Poliomyelitis, Diphtheria, Pertussis, Tetanus, Hepatitis B, Flu, Pneumonia, and Measles are examples. The EPI also vaccinates pregnant women against Tetanus. The provinces have implemented immunisation programmes since the programme began. Pakistan is amongst the top 5 countries in the world with the highest burden of Measles due to low coverage of routine vaccination and hundreds of children losing their lives due to measles in the country. Measles has been endemic in Pakistan for decades (Rana et al., 2022).

Poliovirus, a single-stranded positive-sense RNA virus, causes acute poliomyelitis. The virus mostly affects children under 5 (Birmani, et al., 2016). Ahmed et al. (2020) report that the virus infects the central nervous system and rapidly paralyzes breathing muscles. Polio-endemic countries include Pakistan, Afghanistan, and Nigeria. Pakistan and Afghanistan account for 85% of global polio cases. Pakistani polio cases have dropped in recent years. Due to logistical issues, polio has not been eradicated in the country. Cases increased from 58 in 2012 to 93 in 2013. The country has 307 polio cases in 2014, the most in recent history. The 2015 case count was 54, followed by 20 in 2016, 8 in 2017, 12 in 2018, 8 in 2019, 6 in 2020, 5 in 2021, and 3 in 2022 (www.endpolio.com.pk).

According to a recent study conducted by Ittefaq et al. (2021), it has been found that around 24% of the population resides below the poverty level. The percentage may increase to 40% as a result of the COVID-19 pandemic (Lim et al., 2008). The demographic group of children aged below five years constitutes 15% of the total population in Pakistan, whereas a significant proportion of mortality, namely 50%, is observed among this particular age cohort in the country. When examining the data, it is evident that the global average for mortality among children under the age of five, expressed as a proportion of total mortality, is approximately 8% (Kabir & Afzal, 2016). Infectious diseases impose a significant burden on both morbidity and mortality rates, particularly within socioeconomically disadvantaged populations. Infectious infections account for around 70% of mortality in children under the age of five. Pakistan must adopt a proactive approach in order to enhance its vaccine coverage, as emphasized by Murakami et al. (2014). According to Kabir and Afzal (2016), a significant proportion, around 60%, of children who are susceptible to infectious diseases that can be prevented with vaccination do not receive immunization.

There exists empirical evidence indicating that the suspension of vaccination efforts due to the reallocation of resources to other areas leads to the occurrence of significant outbreaks of vaccine-preventable diseases (VPDs). This phenomenon was witnessed during the Ebola outbreak in West Africa, as documented by Masresha et al. (2020). Abbas et al. (2020) assert that, based on their risk-benefit analysis conducted on routine childhood immunization in 54 African nations, the advantages of maintaining regular childhood immunization programs are above the potential risks associated with COVID-19 transmission during visits to vaccination clinics. Ali et al. (2021) propose the implementation of essential preventive measures, such as physical distancing, personal protective equipment (PPE), and effective hygiene practices, in order to mitigate the transmission of COVID-19 during vaccination administering contacts.

Sanitation Improvements

There are ongoing initiatives aimed at enhancing the availability of uncontaminated water and sanitation infrastructure, with a specific focus on rural regions where the prevalence of waterborne illnesses is significant.

The absence of adequate sanitation facilities and access to safe drinking water remains a significant global concern, mostly due to the substantial rates of death and morbidity associated with these concerns. Young children, particularly those who are under the age of five, are considered to be the

most susceptible and at a heightened risk. The prevalence of mortality and morbidity is primarily observed in the pediatric population (Zahid, 2018).

Poor hygiene, sanitation, and safe drinking water are linked to waterborne diseases in Pakistan. In Pakistan, like elsewhere, children are especially affected by such diseases and their mortality (Zahid, 2018). Based on a report published by UNICEF in 2018, it is estimated that around 1.8 million individuals perish each year due to water-related diseases, while a staggering 4 billion instances are linked to such ailments. These diseases have emerged as a significant cause of both mortality and morbidity on a global scale. In the context of underdeveloped nations, a significant proportion of fatalities, specifically 99.8%, transpire, with children under the age of five constituting almost 90% of these cases. Additionally, 88% of these illnesses can be attributable to poor water sanitation, hygiene, and availability to clean water. The quality and quantity of water supplies have been affected by extensive agricultural and industrial use. Thus, water-related disorders and their negative effects have increased (UNICEF, 2018).

Non-communicable Diseases in Pakistan

3.1 Rising Prevalence

Emerging NCDs

NCDs, often known as chronic diseases, are long-lasting and caused by a complex interaction of genetic, physiological, environmental, and behavioural factors. Pakistan has high rates of cardiovascular, diabetes, cancer, and respiratory ailments. More than three-quarters of global NCD-related deaths (31.4 million) occur in low- and middle-income countries.

Non-communicable diseases (NCDs) kill 41 million people worldwide, 74% of them. Every year, 17 million people die from non-communicable diseases (NCDs) before 70. Most (86%), of these unexpected deaths occur in low- and middle-income countries. Noncommunicable diseases (NCDs) kill 77% of people in low- and middle-income countries.

With 17.9 million annual deaths, cardiovascular diseases cause most non-communicable disease (NCD) deaths. Cancer kills 9.3 million people annually. Chronic respiratory diseases kill 4.1 million people annually, whereas diabetes and kidney disease kill 2.0 million. These four illnesses account for about 80% of premature NCD deaths. Tobacco use, inactivity, alcohol abuse, poor food, and air pollution increase non-communicable disease mortality. Identifying, assessing, and managing non-communicable diseases (NCDs) and providing palliative care are essential to resolving NCD issues. Some 38 million people die annually from non-communicable diseases. Abegunde et al. (2007) and Lopes et al. (2006) found that 70% to 80% of fatalities occur in low- and middle-income countries. Lim (2012) estimates that hypertension causes 18% of global deaths. The rise of non-communicable diseases (NCDs) has hindered development goals like poverty reduction, human security, economic stability, and health equity (Beaglehole, 2011). Rising life expectancy and socio-economic and cultural changes including tobacco and illicit drug usage have contributed to the increase of non-communicable diseases (NCDs). The World Health Organization's 2014 NCD Country Profiles state that Pakistan faces both infectious (38%) and non-communicable (50%) diseases. In 2014, 25.3% of Pakistani adults had high blood pressure, 19% had cardiovascular diseases, 3% had diabetes, 6% had chronic respiratory diseases, 8% had malignancies, 23% smoked, and 0.1% drank alcohol, according to the WHO's national profile.

WHO NCD Country Profiles 2014 report that Pakistan has 38% communicable and 49% non-communicable diseases. NCDs kill 50% of people (Habib and Saha, 2010).

Non-communicable diseases (NCDs) cause most global death and morbidity. Diseases related to these conditions are developing rapidly worldwide across many areas and socioeconomic classes. Non-communicable diseases (NCDs) are rising. Non-communicable diseases (NCDs) killed 35 million people worldwide in 2005, 60% of the total. Nearly 80% of these deaths happened in low- and middle-income countries.

Lifestyle and Behavioral Factors Impacts

Unhealthy diets, inactivity, tobacco use, and alcohol abuse are major NCD risk factors. Obesity increases non-communicable illness load.

According to a 2022 WHO report, non-communicable diseases (NCDs) include cardiovascular disease, cancer, and Type II diabetes mellitus cause 53% of overall mortality and 44% of disability-adjusted life years (Allen, 2020). This study examines how a specific intervention affects cognition. Although a poor diet and insufficient physical activity are the main causes of non-communicable diseases (NCDs), other risk factors should be included (Coates, et al., 2020). High blood pressure, serum cholesterol, poor fruit and vegetable intake, obesity, sedentary lifestyle, and alcohol and tobacco use are examples.

Urbanisation, poor diets, and lack of knowledge about main risk factors are all contributing to the spread of this disease. Jaffar et al. in 2003 and Singh et al. in 1998 found that metropolitan areas have a higher rate of coronary artery disease than rural areas in Asia. In impoverished socio-economic metropolitan areas, communicable diseases remain common, but non-communicable diseases are rising.

Awareness and Prevention

Awareness and prevention of non-communicable diseases (NCDs), which include cardiovascular, diabetes, cancer, and respiratory diseases, are crucial (Qiao, 2022). Awareness involves educating people and communities about non-communicable disease (NCD) risk factors, emphasising early detection and lifestyle changes (Ruthsatz, & Candeias, 2020). Awareness of the importance of a balanced diet, regular exercise, abstaining from tobacco and alcohol (Budreviciute et al., 2020), and stress management is crucial (Devi, 2020). Public health campaigns, educational programmes, and community outreach can raise awareness and help people make informed decisions about non-communicable diseases.

Promoting Healthy Lifestyles

To combat non-communicable diseases (NCDs), nutrition, exercise, and tobacco and alcohol reduction are essential, as is early diagnosis and screening (Cena, & Calder, 2020). Comprehensive early diagnostic and risk assessment systems can help prevent and treat non-communicable diseases (NCDs) (Donatelle, 2019).

Health promotion is key to preventing non-communicable diseases. Non-communicable diseases (NCDs) can be reduced by encouraging healthy lifestyles (Yu, Malik, & Hu, 2018). Governments, healthcare organisations, and community leaders can work together to create healthy environments. Regulations that encourage physical exercise, provide nutritious food, and create smoke-free zones can achieve this (Laddu et al., 2021). Healthcare workers promote preventative care through screenings, lifestyle advice, and patient involvement (Stacey et al., 2017). A comprehensive approach that integrates consciousness, proactive measures, and healthy behaviours can reduce non-communicable diseases and improve societies.

Conclusion

Communicable and non-communicable diseases (CDs and NCDs) have illuminated human health mechanisms. Continuous monitoring, preventive measures, and resilient healthcare infrastructures are needed to combat infectious diseases, which are often spread between people. Vaccination, antibiotics, and public health initiatives have proven helpful in controlling communicable diseases. The rising prevalence of non-communicable diseases (NCDs) like cardiovascular disease, diabetes, and certain cancers highlights the need for comprehensive public health programmes that emphasise prevention, awareness, and lifestyle changes. Pakistan's healthcare system must treat infectious and non-communicable diseases simultaneously. Despite advances in infectious disease treatment, non-communicable diseases (NCDs) present new challenges. Pakistan must employ a holistic strategy to disease management that includes prevention, healthcare accessibility, public awareness, research,

and data-driven policies. Focused therapy that account for each illness type's characteristics may improve health outcomes and national well-being.

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