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Epidemiological, Public Health Issues, and Socioeconomic Determinants of Post-COVID-19 Syndrome and Their Combined Effects on Health-Related Quality of Life Among Adults.

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Abstract

Background: Global health faces interconnected threats that extend beyond the immediate effects of the COVID-19 pandemic. Infectious disease outbreaks, antimicrobial resistance, conflict, and persistent social and environmental risks continue to challenge health systems and widen inequalities.

Aim: This review examines major emerging and ongoing global health threats and highlights their combined implications for population health, health-system resilience, and policy.

Methods: We present a narrative synthesis of published evidence and international reports addressing infectious diseases, vaccine access and uptake, antimicrobial resistance, war and displacement, mental health and substance use, occupational hazards, physical inactivity and unhealthy diets, obesity, social isolation and technology overuse, and violence and injuries.

Results: These threats contribute substantially to premature mortality, disability, economic losses, and pressure on healthcare services. Their effects are interconnected. Conflict and displacement disrupt vaccination and essential care; poverty and occupational insecurity increase exposure to disease and injury; and loneliness, digital overuse, and unhealthy behaviors compound mental and physical health risks. Antimicrobial resistance and uneven vaccine access further threaten the control of infectious diseases. The burden falls disproportionately on low- and middle-income countries and vulnerable populations, where surveillance, prevention, and treatment capacity are often limited. Community participation and international cooperation are essential for effective implementation and accountability.

Conclusion: Addressing these challenges requires coordinated, sustained action that integrates prevention, primary healthcare, surveillance, equitable access to vaccines and treatment, and investment in resilient health systems. A multisectoral approach, supported by adequate financing and attention to social and structural determinants, is essential to reduce avoidable illness and death.

Keywords: Global health; emerging health threats; infectious diseases; antimicrobial resistance; health inequalities; mental health; violence; health-system resilience.

Introduction

The COVID-19 pandemic represents one of the most consequential global health events of the early twenty-first century. As of July 2026, more than seven million deaths have been attributed to COVID-19 worldwide [1]. Beyond its direct mortality burden, the pandemic placed unprecedented pressure on healthcare systems across all continents, disrupted essential health services, and affected social and economic development. These consequences were particularly severe in low- and middle-income countries (LMICs), where limited healthcare infrastructure, workforce shortages, financial constraints, and unequal access to medical resources increased population vulnerability. Disruptions to routine vaccination, maternal and child healthcare, chronic disease management, cancer screening, and infectious disease control also contributed to indirect health consequences that extended beyond the period of acute infection. Although the emergency phase of

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the pandemic has receded from the center of international health policy, its consequences continue to influence global health priorities. Persistent post-COVID-19 conditions, increased healthcare demands, delayed disease detection, and interruptions in chronic disease management have added pressure to already constrained health systems. The pandemic also exposed structural weaknesses in healthcare preparedness, supply chains, workforce distribution, emergency response capacity, and international coordination. These challenges highlight the need to strengthen health systems through sustainable financing, improved primary healthcare, resilient infrastructure, and equitable access to essential health services [1].

At the same time, several emerging and persistent threats require greater attention. The growing burden of noncommunicable diseases, antimicrobial resistance, and emerging or re-emerging infectious diseases creates additional demands on public health systems. Climate change further intensifies health risks through extreme temperatures, changing patterns of infectious disease transmission, food insecurity, air pollution, and population displacement. These effects may disproportionately affect vulnerable communities and countries with limited adaptation capacity. Economic instability and changing international donor priorities have also widened financing gaps, particularly in LMICs that depend on external support for essential health programs. In parallel, developments in digital technology are introducing new opportunities and challenges. Artificial intelligence may improve disease surveillance, clinical decision-making, and healthcare delivery, while social media can influence health literacy, public trust, misinformation exposure, and health-seeking behavior. Addressing these interconnected challenges requires an integrated global health approach that considers epidemiological trends, health system capacity, socioeconomic inequalities, environmental determinants, and technological developments. Strengthening preparedness and ensuring equitable healthcare access will remain essential for protecting population health and achieving sustainable development [1].

Non-Communicable Diseases

Non-communicable diseases (NCDs), including cardiovascular diseases, cancers, chronic respiratory diseases, and diabetes, remain the leading causes of death worldwide and represent a major challenge to global public health [2–6]. Unlike acute infectious disease outbreaks, NCDs impose a continuous burden through prolonged illness, disability, premature mortality, and sustained healthcare requirements. In 2021, NCDs accounted for approximately 43.8 million deaths globally. Cardiovascular diseases contributed the largest proportion, with approximately 19.4 million deaths, followed by cancers (9.9 million), chronic respiratory diseases (4.4 million), and diabetes (1.7 million). This burden is disproportionately concentrated in low- and middle-income countries (LMICs), where limited access to preventive services, early diagnosis, and long-term treatment contributes to unfavorable outcomes [2,3]. The epidemiological landscape of NCDs is also changing, with chronic liver disease emerging as an increasingly important public health concern. Chronic liver diseases are associated with approximately two million deaths annually, while steatotic liver disease affects nearly one-third of adults worldwide and represents a rapidly expanding cause of chronic liver disease [3,4]. Its increasing prevalence is closely associated with metabolic risk factors, including obesity, type 2 diabetes, and metabolic dysfunction. Despite this substantial burden, liver disease has historically received less attention within international NCD prevention frameworks. Its formal recognition at the seventy-ninth World Health Assembly in May 2026 represents an important development in expanding the global NCD agenda and strengthening the policy response to chronic liver disease. The COVID-19 pandemic further exposed weaknesses in the prevention and management of NCDs. Healthcare resources were redirected toward emergency services, while routine screening programs, diagnostic procedures, specialist consultations, and chronic disease follow-up were interrupted. These disruptions contributed to delayed cancer diagnoses, inadequate monitoring of cardiovascular and respiratory conditions, and interruptions in medication access and treatment adherence [5,6]. Consequently, healthcare systems continue to face accumulated demands from patients whose conditions remained undiagnosed, untreated, or poorly controlled during the pandemic.

Progress toward international NCD prevention targets has also slowed. In September 2025, the World Health Organization highlighted concerns regarding progress toward Sustainable Development Goal target 3.4, which aims to reduce premature mortality from NCDs by one-third by 2030. Current trajectories indicate that many regions remain off track, emphasizing the need for stronger prevention policies and sustained investment in essential healthcare services [6]. Major priorities include tobacco control, healthier dietary practices, physical activity promotion, reduction of harmful alcohol consumption, environmental risk reduction, and improved access to screening and early treatment. Post-pandemic health strategies must therefore address NCDs alongside infectious disease preparedness. Effective responses require stronger primary healthcare systems, integrated chronic disease services, reliable access to essential medicines, population-based screening, and long-term patient monitoring. Particular attention should be directed toward LMICs, where socioeconomic

inequalities and limited healthcare resources intensify the consequences of chronic disease. Addressing the NCD burden is essential not only for reducing mortality and disability but also for controlling healthcare expenditure, protecting workforce productivity, and achieving sustainable improvements in population health [2,6].

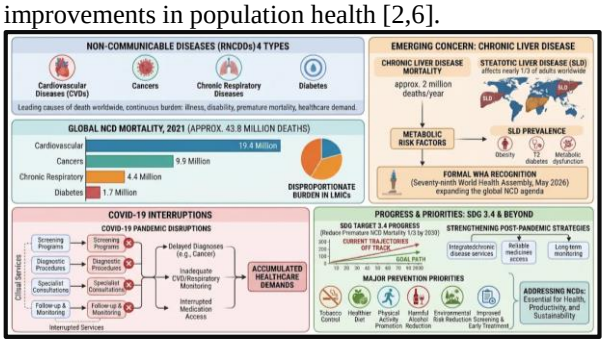


Figure-1: Global burden of non-communicable diseases post-COVID-19.

Infectious Diseases (Endemic, Epidemic, and Emerging)

Infectious diseases remain a major global health challenge despite advances in vaccination, antimicrobial therapy, diagnostic technologies, and public health surveillance. A 2019 estimate indicated that approximately 13.7 million people worldwide died from infectious syndromes, including 5.2 million deaths among individuals with coexisting non-communicable diseases (NCDs) [2,7]. Before the COVID-19 pandemic, infectious diseases accounted for approximately 7.5–8 million deaths annually. This burden increased substantially during the peak pandemic years, demonstrating the capacity of emerging pathogens to reverse progress in disease prevention and healthcare delivery [2,7]. Importantly, the end of the acute global COVID-19 emergency did not eliminate the threat of future pandemics. Instead, it exposed persistent weaknesses in international preparedness, surveillance, healthcare infrastructure, and coordinated outbreak responses. The Global Preparedness Monitoring Board's 2025 report indicated that the World Health Organization (WHO) screens approximately 3,000 epidemic signals each month and verifies around 30 of them [8]. Although these surveillance activities represent an important component of global health security, they should not create a false impression that existing systems can adequately prevent or control all outbreaks. Recent and ongoing threats include mpox, measles, cholera, Ebola, Marburg virus disease, and highly pathogenic avian influenza (H5N1) [8,9]. During the first half of 2025, multiple regions experienced concurrent outbreaks of mpox, measles, dengue, chikungunya, cholera, and Zika. Further outbreaks involving hantavirus, Ebola, and measles were reported in different parts of the world during 2026. These events demonstrate that infectious disease threats are geographically diverse and may affect several populations simultaneously. Their consequences also extend beyond morbidity and mortality, disrupting international travel, trade, education, healthcare access, and routine medical services [9].

Despite increased awareness of infectious disease threats following COVID-19, the structural and socioeconomic factors that facilitate their emergence and transmission remain insufficiently addressed [8–11]. Reduced international funding for outbreak response, workforce shortages, institutional restructuring, political interference, declining donor engagement, and interruptions in routine immunization have weakened the capacity of several health systems to respond effectively. The resurgence of vaccine-preventable diseases, particularly measles, illustrates the consequences of declining immunization coverage and disruptions to primary healthcare services. These challenges are especially concerning in low- and middle-income countries, where limited laboratory capacity, inadequate surveillance infrastructure, workforce shortages, and restricted access to essential medicines can delay outbreak detection and containment. Several interconnected factors explain why infectious diseases remain a persistent global priority. First, the conditions that contributed to the emergence and international spread of COVID-19 have not substantially changed. Dense human–animal interactions, environmental degradation, urbanization, population displacement, and international mobility continue to facilitate pathogen transmission. Second, financial investment, trained personnel, political commitment, and sustained public attention remain insufficient to support long-term preparedness and response activities. Third, endemic infections, including neglected tropical diseases, compete with emerging epidemics for limited healthcare resources. Progress in controlling these endemic conditions slowed or reversed in several settings during the pandemic, highlighting the vulnerability of disease-control programmes to health system disruptions [8–13]. Finally, the emergence and re-emergence of pathogens over the past decade, including Ebola, Zika, Middle East respiratory syndrome (MERS), and SARS-CoV-2, demonstrate the continuing limitations of global preparedness [8–14]. Effective prevention requires sustained investment in integrated surveillance, laboratory diagnostics, vaccination programmes, infection prevention and control, and accessible primary healthcare. International cooperation must also support transparent information sharing, rapid reporting, equitable access to vaccines and treatments, and coordinated emergency responses. A One Health approach that integrates human, animal, and environmental health is particularly important because many emerging infections originate from animal reservoirs or are influenced by environmental changes. Strengthening these interconnected systems is essential to reducing the impact of endemic

diseases, containing epidemics, and improving global resilience against future infectious disease threats.

Vaccine Supplies, Access, and Uptake

Vaccination remains one of the most effective public health interventions for reducing infectious disease morbidity and mortality. Each year, an estimated 1.5–3 million people worldwide die from vaccine-preventable diseases, with approximately half of these deaths occurring among children younger than five years. In contrast, modern immunization programmes prevent an estimated 3.5–5 million deaths annually and have contributed to saving more than 150 million lives over the past five decades [13,14]. Despite these achievements, equitable access to vaccines remains a major global health priority. The post-pandemic period has exposed persistent weaknesses in vaccine financing, production, distribution, research and development, and public acceptance. These challenges have contributed to uneven recovery in immunization coverage and the re-emergence of diseases previously controlled through routine vaccination. The WHO and UNICEF immunization estimates released in July 2026 demonstrated that global childhood vaccination coverage remains below pre-pandemic levels. In 2025, approximately 90% of infants worldwide received at least one dose of a diphtheria-tetanus-pertussis (DTP)-containing vaccine, while 85% completed the recommended three-dose series. These figures remained below 2019 levels and showed little improvement compared with coverage recorded in 2009. Furthermore, approximately 7.3 million infants received their first DTP dose but did not complete subsequent immunization milestones before the first measles vaccine dose. Consequently, global measles vaccination coverage remained insufficient, with 84% of children receiving the first dose and only 77% receiving the second. Both estimates fall considerably below the 95% coverage generally required to interrupt measles transmission and prevent outbreaks [14].

The persistence of zero-dose children represents another important indicator of unequal vaccine access. Approximately one in ten children born worldwide received no vaccines during the first year of life, suggesting that immunization gaps remain concentrated among populations with limited access to healthcare services. These children are frequently found in underserved communities affected by poverty, displacement, conflict, geographical isolation, and weak primary healthcare infrastructure. The consequences extend beyond individual susceptibility because low population-level immunity increases the likelihood of outbreaks and places additional pressure on already constrained health systems. In 2025, 57 countries reported disruptive measles outbreaks, illustrating the relationship between incomplete immunization coverage and the resurgence of vaccine-preventable infections [9,13–16]. Maintaining effective vaccination programmes requires sustained financial investment, trained healthcare personnel, reliable supply chains, cold-chain infrastructure, and continuous research and development. Although vaccine development has achieved substantial progress in several respiratory and childhood infections, important scientific and technological barriers remain for complex diseases such as tuberculosis, HIV, and malaria. These challenges highlight the need to maintain balanced investment between established immunization programmes and the development of new vaccines. Furthermore, the availability of vaccines does not automatically guarantee equitable access. Procurement limitations, manufacturing capacity, transportation barriers, regulatory delays, and unequal distribution can prevent vulnerable populations from benefiting from scientific advances.

Financial sustainability is particularly important for global immunization initiatives. During the 2026–2030 strategic period, Gavi's funding remained below its target, with approximately $9 billion secured against a required $12 billion. According to Gavi's leadership, every funding shortfall of approximately $1.5 billion could place an additional 1.1 million lives at risk, with low- and middle-income countries facing a disproportionate burden [16]. Funding limitations may affect vaccine procurement, routine immunization activities, healthcare workforce development, and programmes targeting populations with limited access to health services. Vaccine hesitancy and misinformation further complicate these challenges. The spread of misleading information through social media and other communication channels can undermine public confidence, reduce vaccination uptake, and weaken the effectiveness of immunization campaigns. The WHO had already identified vaccine hesitancy as one of the major threats to global health before the COVID-19 pandemic [2,13–16]. Therefore, improving vaccine uptake requires more than increasing supply. Public health authorities must strengthen health literacy, engage community leaders, communicate transparently about vaccine safety and effectiveness, and address concerns through accessible, evidence-based information. Integrating these measures with sustainable financing, equitable distribution, and stronger primary healthcare systems is essential to closing immunization gaps and preventing future outbreaks.

Antimicrobial Resistance and Re-emerging Infections

Antimicrobial resistance (AMR) represents one of the most serious and persistent threats to global health. The World Health Organization (WHO) identified AMR in 2019 as one of the major threats to human health, reflecting its potential to undermine the effectiveness of antibiotics and other

antimicrobial agents used to treat infectious diseases. In 2021, bacterial AMR was directly responsible for more than one million deaths and was associated with approximately 4.71 million deaths worldwide [2,17,18]. These figures demonstrate that AMR is already a substantial cause of preventable mortality. More concerning projections from the Global Research on Antimicrobial Resistance (GRAM) Project estimate that approximately 39 million deaths could be directly attributable to bacterial AMR between 2025 and 2050. This represents an estimated increase of nearly 70% compared with 2021 and corresponds to almost three deaths every minute over the projected period [17]. Recent surveillance findings further indicate that antimicrobial resistance is expanding across different pathogens and geographical regions. The WHO Global Antibiotic Resistance Surveillance Report 2025 reported increasing resistance in more than 40% of monitored pathogen–antibiotic combinations between 2018 and 2023 [18]. This trend threatens the effectiveness of standard treatments for common infections and complicates the management of severe conditions requiring urgent antimicrobial intervention. Patients undergoing surgery, cancer treatment, organ transplantation, intensive care, or immunosuppressive therapy are particularly vulnerable because these interventions frequently depend on effective antimicrobial prophylaxis and treatment. As resistance increases, infections that were previously manageable may require prolonged hospitalization, more expensive medications, and complex treatment strategies, while some cases may become difficult or impossible to treat.

The burden of AMR is disproportionately distributed, with low- and middle-income countries (LMICs) facing substantial challenges. Limited diagnostic capacity, inadequate laboratory surveillance, restricted access to effective antibiotics, inappropriate prescribing, poor infection prevention practices, and insufficient healthcare infrastructure contribute to the development and spread of resistant organisms. These factors interact with other public health challenges, including NCDs, incomplete vaccination coverage, emerging infections, and inadequate access to primary healthcare. Patients with diabetes, cancer, chronic respiratory diseases, and other long-term conditions may experience recurrent infections and repeated antimicrobial exposure, increasing their vulnerability to resistant pathogens. The economic consequences are also considerable. Current estimates indicate that AMR costs healthcare systems more than $50 billion annually. Without effective intervention, these costs could exceed $100 billion by 2050. Wider economic projections suggest that AMR could reduce global gross domestic product by approximately 3.8% and push more than 25 million people into poverty [18–20]. The COVID-19 pandemic further intensified several conditions that facilitate AMR development and transmission [21–23]. During the pandemic, antibiotics were frequently prescribed to patients with suspected or confirmed viral infections despite the absence of evidence of bacterial coinfection. Increased antimicrobial consumption, overcrowded healthcare facilities, interruptions in infection prevention and control practices, and reduced surveillance activities contributed to the selection and transmission of resistant microorganisms. These developments have raised concerns about the re-emergence of bacterial and fungal infections that are increasingly difficult to manage because of resistance to multiple antimicrobial agents, including some last-resort treatments. Consequently, AMR contributes to higher mortality, prolonged hospital stays, increased healthcare expenditure, and a greater risk of healthcare-associated outbreaks [2,7,8].

The relationship between AMR and re-emerging infections has important implications for global health security. Resistant pathogens can spread within hospitals and communities, cross national borders, and disproportionately affect populations with limited access to diagnostic and therapeutic services. For this reason, AMR is frequently described as a silent pandemic. Unlike an acute infectious disease outbreak, its consequences accumulate gradually and may receive less sustained political and public attention despite their substantial mortality and economic impact. Moreover, reductions in international development assistance and limited domestic health financing have constrained investment in antimicrobial stewardship, laboratory capacity, infection prevention, and surveillance programmes, particularly in LMICs [20–23]. Addressing AMR requires coordinated action across human health, veterinary medicine, agriculture, and environmental management through a One Health approach. Priority interventions include strengthening antimicrobial stewardship, improving diagnostic testing, ensuring appropriate antibiotic prescribing, expanding vaccination coverage, and implementing effective infection prevention and control measures. Surveillance systems should monitor antimicrobial consumption and resistance patterns to support timely public health responses. Investment in new antibiotics, alternative treatments, rapid diagnostic technologies, and improved access to existing essential medicines is also necessary. Sustained political commitment and international cooperation will be essential to limit the spread of resistant pathogens, protect the effectiveness of available treatments, and reduce the future health and economic burden of AMR.

War, Conflict, Human Displacement, and Migration

War, armed conflict, forced displacement, and migration represent major threats to global public health in the post-pandemic era. Their consequences extend beyond immediate deaths and physical injuries because they disrupt the social, economic,

environmental, and healthcare systems required to maintain population health. Armed violence destroys hospitals, damages essential infrastructure, interrupts food and water supplies, displaces healthcare workers, and restricts access to preventive and curative services. These disruptions increase vulnerability to infectious diseases, malnutrition, chronic illnesses, maternal and neonatal complications, and mental health disorders. Consequently, conflict-related health burdens may persist for years after active hostilities have ended [24–29]. Global conflict-related mortality has increased substantially since 2020. Fatalities associated with organized violence reached some of the highest levels recorded since the mid-1990s, exceeding 200,000 deaths in 2022 [25]. However, direct mortality figures provide only a partial assessment of the public health consequences of armed conflict. Indirect deaths resulting from inadequate healthcare, food insecurity, unsafe drinking water, poor sanitation, and interrupted treatment of chronic diseases may account for a substantial proportion of the total mortality burden. Patients with diabetes, cardiovascular diseases, cancer, and chronic respiratory conditions are particularly vulnerable when healthcare facilities become inaccessible or essential medicines are unavailable. Similarly, pregnant women, newborns, children, older adults, and people with disabilities face increased risks when emergency obstetric services, vaccination programmes, and routine medical care are disrupted [24,25].

The economic consequences of conflict further undermine public health systems. The global economic impact of violence was estimated at $19.97 trillion in 2024, equivalent to approximately 11.6% of global gross domestic product (GDP) [24–26]. These costs include direct military expenditure, destruction of infrastructure, population displacement, reduced productivity, and the long-term consequences of physical and psychological injuries. The diversion of financial and human resources toward military activities also limits investment in healthcare, education, sanitation, housing, and social protection. Countries affected by prolonged conflict may consequently experience declining healthcare capacity, increased poverty, and reduced ability to respond to other public health emergencies. Forced displacement is among the most consequential health effects of armed conflict and political instability [27–29]. By the end of 2025, more than 100 million people had been forcibly displaced worldwide because of persecution, conflict, violence, or human rights violations. Displacement exposes populations to multiple health risks that may continue throughout their journey and after arrival in temporary settlements or host communities. Overcrowded shelters, inadequate sanitation, limited access to clean water, and poor waste management facilitate the transmission of communicable diseases. Interrupted vaccination schedules increase susceptibility to measles and other vaccine-preventable infections, while limited diagnostic and treatment services delay the identification and management of infectious diseases. These conditions are particularly concerning in low- and middle-income countries (LMICs), which frequently host large displaced populations despite having limited healthcare resources [27–29].

Food insecurity and malnutrition represent additional consequences of displacement. Conflict disrupts agricultural production, damages transportation networks, restricts access to markets, and increases food prices. Displaced families may depend on humanitarian assistance that does not consistently provide adequate nutritional quality or quantity. Children are particularly vulnerable to wasting, stunting, micronutrient deficiencies, and impaired development. Pregnant and breastfeeding women may experience nutritional deficiencies that increase the risk of adverse maternal and neonatal outcomes. In addition, inadequate access to safe water and sanitation increases the likelihood of diarrheal diseases, further aggravating nutritional deficiencies and childhood mortality [27–29]. The psychological consequences of conflict and forced migration are equally important. Exposure to violence, bereavement, family separation, loss of livelihoods, and uncertainty about the future can contribute to depression, anxiety, post-traumatic stress disorder, and other mental health conditions. Children may experience developmental difficulties, interrupted education, and prolonged psychological distress. Women and girls face additional risks, including sexual violence, exploitation, trafficking, and other forms of gender-based violence, particularly in overcrowded settlements and settings with inadequate protection services. Despite these needs, mental health services and psychosocial support are frequently limited or unavailable in humanitarian emergencies.

Humanitarian financing has not kept pace with the growing scale of displacement. In 2025, available resources covered only 37% of the United Nations High Commissioner for Refugees (UNHCR) funding requirements, compared with 48% in the preceding year. This reduction forced cuts to health, water, and nutrition programmes despite increasing humanitarian needs [27,28]. Funding shortages can interrupt vaccination campaigns, maternal healthcare, disease surveillance, nutritional support, and access to essential medicines. Such reductions may also increase the burden on host countries, particularly communities already experiencing shortages of healthcare personnel, hospital capacity, and public services. Several interconnected factors make conflict and displacement particularly important global health concerns. First, armed violence has become more

widespread and persistent, exposing substantial populations to prolonged insecurity and repeated displacement. Second, the actual health burden is likely underestimated because conflict-related mortality surveillance is often incomplete. Data collection becomes difficult when healthcare facilities are destroyed, populations move frequently, and independent monitoring is restricted. Passive reporting systems may therefore miss indirect deaths associated with preventable diseases, untreated chronic conditions, malnutrition, and inadequate maternal care. This measurement gap limits accurate assessments of population needs and complicates the allocation of humanitarian resources [24–29].

Third, conflict amplifies other global health threats discussed in this editorial. Displaced populations may settle in areas exposed to climate hazards, environmental contamination, unsafe food supplies, and inadequate water and sanitation infrastructure. Climate-related disasters can further intensify displacement and increase competition for limited resources. The combination of conflict, poverty, environmental degradation, and weak healthcare infrastructure creates overlapping vulnerabilities that require coordinated interventions rather than isolated emergency responses. The importance of these challenges is reflected in findings from the 2026 Lancet Commission on health, conflict, and forced displacement, which reported that indirect consequences of healthcare system collapse account for approximately 70–90% of excess deaths in many conflicts. The Commission also highlighted the record number of attacks on healthcare facilities and workers in 2024 [24,27,29]. These findings reinforce the need to protect healthcare infrastructure and personnel, maintain access to essential medical services, strengthen humanitarian health programmes, and improve surveillance of direct and indirect mortality. International cooperation should prioritize sustainable humanitarian financing, continuity of care for displaced populations, disease prevention, food security, mental health support, and protection of vulnerable groups. Integrating these measures into global health security strategies is essential to reducing the long-term health consequences of armed conflict, forced displacement, and migration.

Poor Mental Health and Substance Use Disorders

Mental health conditions and substance use disorders represent major and interconnected global public health challenges. More than 800 million people worldwide, accounting for over one-tenth of the global population, live with mental health conditions [30,31]. Mental disorders have consistently ranked among the leading causes of years lived with disability over the past decade, reflecting their substantial contribution to long-term functional impairment, reduced quality of life, and social and economic disadvantage. Furthermore, the age at first diagnosis of several mental health conditions has shifted toward younger populations, highlighting the importance of early identification, prevention, and access to age-appropriate mental healthcare [30–32]. Depression, anxiety, and other psychiatric conditions increased during the COVID-19 pandemic, partly because of social isolation, bereavement, economic instability, fear of infection, and disruptions to education and employment. Although the acute phase of the pandemic has ended, many of these underlying stressors persist, while the long-term psychological consequences continue to affect individuals, families, and communities. Access to mental healthcare remains highly unequal across countries and population groups. Most people experiencing mental health conditions do not receive appropriate treatment, and those who access services may encounter delayed diagnosis, inadequate follow-up, limited treatment options, and insufficient continuity of care. These deficiencies are particularly pronounced in low- and middle-income countries (LMICs), where mental health services frequently face shortages of trained professionals, limited funding, inadequate facilities, and weak integration into primary healthcare [33–35]. Social stigma and discrimination further discourage individuals from seeking professional support. In some settings, misconceptions about psychiatric disorders lead patients and families to delay treatment or rely exclusively on informal support systems. Consequently, potentially treatable conditions may progress into chronic disability, occupational impairment, family disruption, and increased healthcare utilization.

Substance use disorders add another dimension to this public health burden. According to estimates reported in the World Drug Report, nearly 300 million people use illicit drugs annually, while more than 40 million worldwide experience serious drug use disorders. Fewer than 10% of those affected receive qualified treatment services [31,36]. Alcohol, tobacco, and illicit drug use contribute substantially to premature mortality, chronic disease, injuries, and disability. Their health consequences include cardiovascular diseases, respiratory disorders, cancers, liver disease, neurological complications, and increased vulnerability to infectious diseases. Substance use may also contribute to interpersonal violence, road traffic injuries, unemployment, family instability, and social exclusion [35–37]. Adolescents and young adults represent an important population in the prevention of substance use disorders. Exposure during these developmental stages may increase the likelihood of persistent harmful patterns of consumption and subsequent physical and psychological complications. The transition from adolescence to adulthood is frequently accompanied by changes in social relationships, educational responsibilities, employment conditions, and financial independence. These factors may increase vulnerability to substance use, particularly among individuals experiencing psychological distress,

social exclusion, or limited family support. Early prevention, school-based education, family engagement, and accessible treatment services are therefore essential to reducing the long-term consequences of substance use disorders [35–37].

The economic burden of poor mental health is also considerable. Depression and anxiety alone are estimated to cost the global economy approximately US$1 trillion annually through reduced productivity, absenteeism, unemployment, and impaired occupational functioning [31,33–35]. Despite these consequences, mental health and addiction services remain chronically underfunded. Median government expenditure on mental health represents less than 5% of total health budgets, reflecting a substantial gap between population needs and available resources [31,33–35]. Insufficient financing limits the recruitment and retention of mental health professionals, restricts access to evidence-based psychological and pharmacological interventions, and reduces the capacity of healthcare systems to provide preventive and community-based services. These challenges are closely connected to other public health threats. Armed conflict, forced displacement, poverty, unemployment, and occupational stress increase the risk of psychological distress and harmful substance use. Social isolation and excessive or problematic technology use may also share risk factors with depression, anxiety, and other mental health conditions [5,24,38,39]. Furthermore, mental health disorders and substance use frequently coexist with non-communicable diseases (NCDs). Depression and anxiety may complicate the management of diabetes, cardiovascular diseases, and chronic respiratory conditions, while harmful alcohol and tobacco consumption directly contribute to the development and progression of several chronic diseases. These interactions increase treatment complexity, healthcare expenditure, and the risk of premature mortality.

Addressing these overlapping challenges requires mental health and substance use services to become integral components of universal health coverage and broader NCD prevention strategies. Priorities include strengthening mental health services within primary healthcare, expanding community-based interventions, improving early detection, and ensuring affordable access to psychological therapies and essential medications. Prevention programmes should address substance use through health education, tobacco and alcohol control policies, early intervention, and accessible rehabilitation services. Governments should also increase investment in the mental health workforce, improve service coverage, and reduce stigma through public awareness initiatives. Integrating mental healthcare, addiction treatment, and NCD management can improve treatment continuity and make more efficient use of limited healthcare resources. Such an integrated approach is essential to reducing disability, preventing premature mortality, and improving population health, particularly in countries where financial and workforce constraints remain substantial.

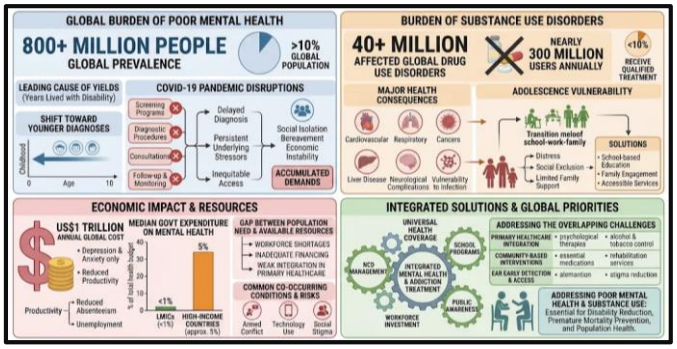


Figure-2: Global burden of mental health in post-covid-19 era.

Occupational Illness and Workplace Hazards

Occupational illness and workplace hazards represent major but frequently underrecognized contributors to preventable mortality, disability, and health inequalities worldwide. Work-related health risks affect individuals across industrial, agricultural, construction, healthcare, and service sectors. According to the International Labour Organization (ILO), more than two million workers die annually from occupational accidents and work-related diseases, corresponding to over 5,000 deaths each day [39]. Occupational diseases account for the majority of these fatalities, with cardiovascular diseases, cancers, and chronic respiratory conditions representing important causes. These outcomes reflect prolonged exposure to hazardous working conditions, inadequate occupational health services, insufficient protective measures, and weaknesses in regulatory enforcement. Although technological advances have improved workplace safety in several industries, many preventable occupational exposures remain widespread [39–41]. Exposure to hazardous chemicals and environmental agents continues to threaten workers' health. Asbestos remains a major occupational carcinogen and is associated with more than 200,000 deaths annually. Workers involved in construction, demolition, insulation, manufacturing, and maintenance may encounter asbestos-containing materials, particularly in settings where regulations are inadequate or existing materials are not properly identified and managed. Agricultural workers face additional risks from pesticides, fertilizers, and other chemical agents. Inadequate protective equipment, insufficient training, unsafe storage practices, and limited access to occupational health monitoring increase the likelihood of acute poisoning and long-term health complications. These hazards are particularly concerning in low- and middle-income countries (LMICs), where agriculture employs a substantial proportion of the workforce and

occupational safety regulations may be poorly implemented or enforced [39,40].

Climate change is further intensifying occupational health risks. According to ILO estimates, nearly 70% of the global workforce, representing approximately two billion or more workers, is exposed to excessive heat annually. Occupational heat exposure contributes to an estimated 22.9 million injuries and 18,970 deaths each year [39,41]. Outdoor workers in agriculture, construction, transportation, and other physically demanding occupations are particularly vulnerable. Prolonged exposure to high temperatures can cause dehydration, heat exhaustion, heatstroke, kidney injury, and cardiovascular complications. It may also reduce concentration and physical performance, increasing the likelihood of workplace accidents. Climate-related occupational hazards extend beyond heat exposure and include ultraviolet radiation, worsening air pollution, extreme weather events, and increased exposure to vector-borne infections. Occupational exposure to air pollution alone is associated with approximately 860,000 work-related deaths among outdoor workers [39,41]. Changes in employment patterns and workplace organization have introduced additional health challenges. Informal employment, temporary contracts, job insecurity, long working hours, and inadequate social protection may prevent workers from reporting unsafe conditions or accessing appropriate healthcare. Migrant workers may experience additional disadvantages because of language barriers, limited knowledge of occupational rights, restricted access to healthcare, and dependence on employers for accommodation and employment. These circumstances can increase exposure to hazardous environments and reduce the likelihood of receiving timely medical assessment and compensation for occupational injuries or diseases.

Psychological and organizational hazards are also becoming increasingly important. High workloads, workplace bullying, discrimination, insufficient staffing, job insecurity, and poor work–life balance can contribute to chronic stress, anxiety, depression, sleep disturbances, and occupational burnout. Healthcare professionals are particularly vulnerable because of prolonged shifts, emotional demands, exposure to infectious diseases, and responsibility for patient safety. These psychological conditions may affect productivity, increase absenteeism, and contribute to workforce shortages. The growing use of digital technologies, automation, artificial intelligence, and remote working arrangements has also changed occupational demands. Although these developments can improve efficiency and flexibility, they may introduce risks related to prolonged sedentary behavior, ergonomic problems, digital overload, reduced social interaction, and continuous work-related connectivity [39–41]. Occupational health is closely connected to several other public health priorities. Exposure to workplace hazards contributes to NCDs, including cardiovascular diseases, respiratory disorders, and occupational cancers. Psychological strain increases the risk of mental health conditions, while inadequate workplace protection may increase infectious disease transmission. Migration and informal employment further complicate occupational health surveillance and access to preventive services. In addition, the loss of trained workers through occupational illness, disability, and premature mortality can worsen existing healthcare and labor shortages.

Addressing these challenges requires stronger occupational health policies and effective enforcement of workplace safety regulations. Priority measures include eliminating hazardous exposures where possible, improving ventilation and ergonomic conditions, providing appropriate personal protective equipment, and implementing regular occupational health assessments. Employers should establish heat-exposure prevention programmes, provide access to drinking water and rest periods, and adapt working schedules to reduce exposure during periods of extreme temperatures. Agricultural workers require practical training in pesticide handling and poisoning prevention, while migrant and informal workers should receive equal protection and access to occupational healthcare. Governments, employers, and international organizations must also strengthen workplace mental health programmes and improve occupational disease surveillance. Integrating occupational health into primary healthcare and national public health strategies is essential to reducing preventable deaths, protecting workforce productivity, and promoting safer and healthier working environments [39–41].

Physical Inactivity, Low Diet Quality, and Obesity

Obesity, physical inactivity, and poor dietary habits represent major modifiable risk factors for the growing global burden of non-communicable diseases (NCDs). The prevalence of obesity has more than tripled over the past five decades, with more than one billion people currently living with obesity and nearly three billion classified as overweight or obese [42]. Projections indicate that by 2050, more than half of adults and approximately one-third of children and adolescents worldwide will be overweight or obese [42,43]. Excess body weight increases the risk of cardiovascular diseases, type 2 diabetes, several cancers, and musculoskeletal disorders. It contributes to approximately five million NCD-related deaths annually and generates substantial healthcare and economic costs, with the global financial burden projected to exceed US$4 trillion annually by 2035 [42,43]. Physical inactivity is a major determinant of obesity and poor health outcomes. Nearly one-third of adults worldwide, representing approximately two billion people, do not meet the WHO recommendations for physical activity. The prevalence of insufficient physical

activity increased from 23.4% in 2000 to 31.3% in 2022, moving further away from the global target of a 15% relative reduction by 2030 [44]. Physical inactivity independently contributes to approximately 3.2 million deaths annually and increases the risk of cardiovascular diseases, diabetes, and mental health conditions [44,45]. Without effective interventions, it could generate nearly 500 million preventable NCD cases and more than US$500 billion in avoidable healthcare expenditure between 2020 and 2030 [45]. Poor dietary quality further intensifies this burden. Diets characterized by insufficient fruit and vegetable consumption and excessive sodium, added sugars, and highly processed foods contribute to obesity and metabolic disorders. A Global Burden of Disease analysis estimated that dietary risks caused 11 million deaths and 255 million disability-adjusted life-years in 2017 [46]. Effective prevention requires coordinated policies that promote physical activity, improve food environments, support healthy dietary choices, and integrate obesity prevention into primary healthcare programmes.

Social Isolation, Loneliness, Media, and Technology Addiction

Social isolation and loneliness are increasingly recognized as important global public health concerns because of their effects on physical health, psychological well-being, and premature mortality. The U.S. Surgeon General has compared the health impact of chronic loneliness to smoking up to 15 cigarettes daily, highlighting its association with increased mortality from cardiovascular, psychiatric, and infectious diseases [47]. The WHO estimates that approximately one in six people worldwide experiences loneliness, contributing to more than half a million deaths annually [47–49]. Despite this burden, loneliness remains insufficiently addressed in national health policies, routine screening programmes, and healthcare budgets. Although older adults, particularly those living alone or experiencing bereavement and socioeconomic disadvantage, remain vulnerable, loneliness is also increasingly reported among adolescents and young adults. In May 2025, the World Health Assembly adopted its first standalone resolution recognizing social connection as a global health priority [48]. Digital media and technology overuse may further contribute to social isolation, particularly among younger populations. Social media platforms use continuous content feeds, algorithmic recommendations, and engagement mechanisms that encourage prolonged screen time and compulsive use. Excessive engagement may displace face-to-face interactions and interfere with sleep, academic performance, occupational productivity, and psychological well-being. It has also been associated with anxiety, depressive symptoms, fatigue, and increased vulnerability to harmful online content and risky behaviors [47–49]. Several factors make this emerging threat difficult to address. Existing clinical frameworks do not adequately capture all forms of problematic technology use, while loneliness remains a subjective experience that is rarely assessed systematically. Furthermore, the widespread availability of internet-connected devices makes prolonged digital engagement increasingly common. The potential consequences extend beyond individual health to include reduced productivity, impaired social relationships, and increased demand for mental health services [47–51]. Public health strategies should therefore promote meaningful social connections, digital literacy, responsible technology use, and early identification of loneliness. Particular attention should be directed toward children, adolescents, older adults, and socially disadvantaged populations.

Violence, Accidents, and Injuries

Violence and injuries remain major causes of preventable death and disability worldwide, generating substantial healthcare expenditure and societal costs [3,52–54]. Injuries, including unintentional events and violence, cause more than 4.4 million deaths annually, representing approximately 8% of global mortality [52]. Among people aged 5–29 years, road traffic crashes, suicide, and homicide rank among the five leading causes of death. Road traffic injuries alone account for approximately 1.19 million deaths annually, disproportionately affecting low- and middle-income countries (LMICs). Limited prehospital emergency services, inadequate trauma facilities, and shortages of trained healthcare professionals further increase mortality and disability in these settings [52,53]. Other preventable injuries include falls, drowning, burns, poisoning, and interpersonal violence, particularly abuse affecting women and older adults [52,54,55]. Interpersonal violence and self-directed harm cause more than one million deaths annually, including over 700,000 suicides [54,55]. These outcomes are closely associated with mental health conditions and substance use disorders. Nonfatal violence also produces long-term physical and psychological consequences. In 2023, intimate partner violence was associated with an estimated 145,000 deaths and 18.5 million disability-adjusted life-years (DALYs) among females, while childhood sexual violence contributed to 290,000 deaths and 32.2 million DALYs [56]. Addressing this burden requires more than emergency treatment. Effective prevention depends on safer transport infrastructure, violence prevention programmes, firearm regulation, alcohol control, accessible mental healthcare, and stronger trauma systems. Governments must also address poverty and social inequalities while improving injury surveillance and post-injury rehabilitation. Integrating these measures into national health strategies can reduce preventable

deaths, disability, and long-term economic costs [24–26,31–33,53–56].

Conclusion:

The global health threats discussed in this review are diverse, but they share common drivers and consequences. Infectious diseases, antimicrobial resistance, conflict, displacement, mental health conditions, occupational hazards, unhealthy lifestyles, social isolation, and violence interact and place sustained pressure on health systems. Their burden is greatest among populations facing poverty, limited access to care, and weak social protection. Responses based on isolated programmes will therefore remain insufficient. Governments and international partners should strengthen primary healthcare, disease surveillance, vaccination, emergency and trauma services, occupational protection, and mental health support. They should also address the social, economic, environmental, and commercial factors that shape exposure and vulnerability. Sustainable financing, effective regulation, community engagement, and cross-sector collaboration are essential to translate evidence into prevention and equitable care. A coordinated global response can reduce avoidable deaths and disability while improving health-system resilience and preparedness for future crises across national, regional, and international levels over time.

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