Yale Institute for Global Health

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Infectious Disease Surveillance in the Democratic Republic of the Congo

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Introduction

"…[T]he humanitarian situation is equally alarming. Continued hostilities, repeated waves of displacements, the ongoing closure of Goma and Kavumu Airports, and shrinking humanitarian access have compounded an already severe crisis. Around 5.35 million people are displaced within the country. Since January alone, 2.68 million people have been newly displaced while 2.9 million have retuned forcibly or voluntarily. More than 24 million people face acute food insecurity. At the same time, humanitarian agencies are facing crippling funding shortfalls. As of today, the humanitarian response plan for the DRC is only 22% funded. The consequences of these funding gaps are devastating." –

Jean-Pierre Lacroix, UN Under-Secretary-General for Peace Operations

December 12, 2025[1]

The Democratic Republic of the Congo (DRC), located in Central Africa, is the second-largest country on the continent by land area and the fourth most populous, with an estimated population of around 100 million. Geographically, the DRC is divided into four main regions: a coastal plain in the west, a central basin characterized by dense equatorial forests and stepped plateaus, plateaus in the north, northeast, and south, and mountain ranges in the east, southeast, and west.[2] The country has long history in conflict and political unrest, particularly in the eastern region where over 140 armed groups are positioned.[3]

The country faces a significant burden from both communicable and non-communicable diseases.[3] To strengthen its public health response, the country adopted the Integrated Disease Surveillance and Response (IDSR) strategy in 2000, which remains a cornerstone of its disease monitoring efforts. Given the frequent outbreaks of infectious diseases, the DRC began transitioning to electronic surveillance in 2014 using the District Health Information System 2 (DHIS2). However, full implementation below the health zone level is still pending. In many areas, traditional tools such as Microsoft Excel, EpiInfo, and EpiData continue to be used for data reporting.[3]

The health system architecture in DRC is organized as a three-tier pyramid under the Ministry of Public Health: the national level, which is responsible for setting norms, regulations, and providing tertiary care; the provincial level, which oversees technical supervision, monitoring, and implementation of national directives, while offering secondary-level referral services; and the operational level, which is tasked with delivering primary health care services. The health system also includes both private for-profit and not-for-profit facilities. Many General Reference Hospitals lack essential services such as comprehensive laboratory diagnostics, including parasitology, biochemistry, bacteriology, and hematology.

To address public health threats, the DRC maintains epidemiological surveillance for a wide range of infectious diseases. These include vaccine-preventable diseases (measles, neonatal tetanus, pertussis, yellow fever), outbreak-prone diseases (cholera, plague, monkeypox, viral hemorrhagic fevers, avian flu), endemic diseases (malaria, typhoid fever, meningitis, tuberculosis, HIV), neglected tropical diseases, and other monitored conditions (Acute flaccid paralysis, bloody and simple diarrhea, acute respiratory infections, sexually transmitted infections, and typhus).[4]

Case Prompt

Background

The increasing transmission of outbreak-prone infectious diseases such as cholera and measles poses significant threat to global health. As of October 2025, a Kaiser Family Foundation KFF analysis identified 102 outbreaks across 66 countries, two-thirds of which were experiencing concurrent outbreaks of multiple pathogens.[5] This widespread occurrence makes it critical to identify the drivers of large-scale disease spread to inform surveillance and preparedness efforts. Emerging research attributes the rise of communicable diseases to various factors, including globalization, systemic inequities, antimicrobial resistance, zoonotic spillover, climate change, and conflict.[6] Examining outbreaks within these diverse contexts provides critical insight into disease propagation to strengthen pandemic preparedness and response strategies.

These global diseases trends are particularly evident in Sub-Saharan Africa, where overlapping social, environmental, economic and political factors combined with inequities, fragilities and insecurities in certain locations, create condition conducive to the rapid and concurrent spread of infectious diseases.[7] At the intersection of income inequality, conflict, and rapid population growth, disease transmission is evident in the DRC. The DRC is Africa's largest country, with over 100 million people.[8] Considered the "Heart of Africa", it is one of the most resource-rich regions in the world. It holds 70% of the world's cobalt reserves, a critical mineral for smartphones, electric vehicles, and batteries.[9] Despite this wealth, the DRC remains one of the world's five poorest nations, with a GDP of $70.7 billion in 2024 and a life expectancy of just 62 years.[8,10] Armed conflict, continued resource exploitation by foreign nations and multinational organizations, armed groups, violations of human rights, lack of investment in infrastructure, and corruption are major causes of this disparity. The recent escalation on January 27, 2025, in which Rwanda-backed M23 rebels claimed control of the eastern city of Goma, has worsened a decades-long crisis marked by mass displacement, violence, and crippled health infrastructure.[11] This environment directly fuels disease transmission. The DRC endures overlapping outbreaks, including anthrax, cholera, and mpox.[5] Notably, a sixteenth Ebola outbreak was declared in 2025 before being contained on December 1.[12] Lower respiratory infections, malaria, and tuberculosis persist as leading causes of death.[8] Thus, the DRC stands as a stark example of how systemic inequities, resource exploitation, and conflict sustain infectious disease crises.

In response to the heightened disease burden, a coordinated multi-agency effort has mobilized in the DRC. The World Health Organization (WHO) leads the overall health response, deploying teams and guiding containment, while Médecins Sans Frontières (MSF) provides critical on-the-ground clinical care and manages treatment units. This international effort builds upon the DRC's own unique surveillance expertise, developed over decades of managing outbreaks, including a sophisticated community-based surveillance network and the innovative use of the digital DHIS2 platform, which enabled real-time case tracking and was central to containing the 2025 Ebola outbreak in under three months.[13,14]

Additionally, UNICEF supported risk communication and water and sanitation, while the United Nations Development Programme promoted longer-term health system strengthening. These core efforts are amplified by NGOs such as CARE International and Save the Children, which expand the reach of health service delivery. While previous humanitarian and international responses have provided essential outbreak containment and medical care, critical gaps persist due to the escalating crisis. These include the attrition of trained personnel, systemic political corruption, and a collapsing economy, all of which undermine health security. The expanding conflict and mass displacement severely limit physical access and destroy vital infrastructure, including hospitals, while concurrent cuts to international aid have

catastrophically strained resources. A pragmatic solution that addresses these compounded barriers to health security is needed to bridge surveillance gaps, especially in major conflict zones.

Team Instructions

In light of the critical challenges posed by conflict, resource extraction, the breakdown of health systems, and the spread of infectious diseases confronting communities in the Democratic Republic of the Congo, the World Health Organization (WHO) is seeking innovative contractor assistance to tackle these overlapping crises. WHO has released a Request for Proposal (RFP) for a cooperative agreement of USD 5 million over five years. The objective is to engage new, creative partners in developing community-level solutions that enhance infectious disease surveillance, improve climate resilience, and strengthen health systems for communities in the Democratic Republic of the Congo impacted by conflict and natural resource extraction.

You will take on the role of a social impact company, a small NGO, or an academic institute to submit a bid for the award. Your proposal should outline a locally implementable intervention to address the spread of infectious diseases in the Democratic Republic of the Congo, with a focus on balancing environmental sustainability, cultural preservation, and socioeconomic resilience.

You will have **10 minutes to present your proposal** to a panel of judges, including WHO program officers, representatives from communities, and government agencies of the Democratic Republic of the Congo. A **5-minute question-and-answer session** will follow. Proposals will be assessed following eight criteria:

- **Local Relevance**
  Solutions must demonstrate a deep understanding of local contexts, cultural sensitivities, and community priorities. Describe intended levels of community engagement, ensuring alignment with Indigenous traditions, values, and needs.
- **Implementation (1–2 Years)**
  The intervention should be operational within the first two years to address immediate threats to spread of infectious diseases and health, focusing on deployment and initial impact.
- **Scalability (3–4 Years)**
  The intervention should be designed to scale effectively within three to four years, adapting to shifts in demand, population needs, and environmental conditions.
- **Feasibility (5 Years)**
  The proposal should be realistic, cost-effective, and operationally viable. It must demonstrate measurable outcomes, including systems for the monitoring and surveillance of infectious disease threats, community engagement, and resource efficiency, within five years.
- **Applicability**
  The design should align with the UN's Sustainable Development Goals (SDGs), national policies, and the specific needs of rural and urban communities.
- **Integration**
  While addressing the spread of infectious disease threats, the intervention should include

secondary priorities such as water security, mental health, healthcare access, climate resilience, and economic empowerment, creating a multi-dimensional impact.

- **Sustainability (Beyond 5 Years)**
  The proposal must demonstrate long-term viability by outlining strategies for maintaining operations and impact beyond the initial five-year period. This includes local capacity building, financial sustainability through partnerships, and community-driven leadership to ensure self-sufficiency.
- **Adaptability**
  The intervention should exhibit flexibility to respond to unforeseen challenges or emergencies post-implementation. This includes mechanisms for monitoring and evaluation, real-time feedback loops, and iterative design to address changing environmental, social, or economic contexts.

A successful proposal will include:

- A detailed and well-researched project plan covering the full funding timeline.
- A clear outline of how funds will be allocated.
- Specific metrics to measure progress and impact.
- Summaries of high-quality evidence supporting the feasibility and relevance of the proposed intervention.
- A strategy for managing relationships with stakeholders, including local communities, government bodies, and funders.

Presentations should clearly articulate how the proposed project addresses infectious disease surveillance while promoting the preservation of cultural heritage, equity, and environmental sustainability. Additional elements, such as a public relations strategy or innovative tools for engaging rural communities, may strengthen your proposal.

Supporting Information

Infectious Diseases and Environmental Challenges

The Intergovernmental Panel on Climate Change identifies climate change as a significant risk factor for increasing the global burden of disease, highlighting the need for urgent action.[15] As a result of climate change caused by significant greenhouse gas emissions, variations in the weather and climate patterns extend over long periods of time. For example, climate change triggers increasing global temperatures, increasing frequency and severity of extreme weather events such as droughts and floods, and changing rainfall patterns. The changes in temperature and precipitation patterns contribute to the spread of infectious diseases by creating more favorable habitat conditions for insects to reproduce and effectively transmit diseases to humans. The extreme weather events can also disrupt key infrastructure systems such as sanitation services and healthcare systems for societies to prevent infectious diseases. Sanitation services help to prevent contamination of water sources that increase risk for waterborne diseases such as cholera, typhoid, and diarrhea. In addition, sanitation services reduce the overall areas that serve as habitat for reservoirs and vectors of diseases.

Deforestation and land use changes are major issues that increase infectious disease burden by increasing contact between disease-carrying vectors and humans and altering ecosystem structures which can lead to zoonotic spillovers.[16] Moreover, deforestation reverses climate change mitigation efforts to reduce greenhouse gas emissions as the trees are essential for absorbing carbon dioxide from the atmosphere and when they are cut down and burned, there is a release of carbon dioxide which effectively contributes to climate change and worsens the overall cycle and impacts on health.

Environmental pollution is another major area of concern with respect to adverse impacts on health outcomes. For example, air pollution is one of the major causes of many non-communicable diseases such as cardiovascular disease and lung cancer, among many others.[17] Furthermore, air pollution has been shown to have negative neurocognitive health consequences for children and older adults.[17] Studies have also found that air pollution plays a role in weakening the immune system, which may increase vulnerability and susceptibility for individuals to contract respiratory infectious diseases.[18] Other forms of environmental pollution such as water and soil pollution also create opportunities that facilitate the transmission of infectious diseases.

As a result of the impacts from climate change, many people are forced to relocate due to the environmental challenges that hinder their ability to continue with their normal daily lives. Also known as climate migrants, these individuals often move to informal settlements which increases their risk for contracting infectious diseases given the limited sanitation services, malnutrition, weakened immune systems, limited healthcare access, and crowded spaces.[19]

Conflict and Infectious Diseases Overview

The presence of conflict has been associated with both emergence and transmission of infectious disease.[20] When a society is overcome with deep-seated conflict, it is at risk for population displacement, destruction of infrastructure, depletion of healthcare systems and personnel, interference in disease control programs, disruptions in supply chains, and overall instability experienced by populations.[20] Furthermore, the DRC experiences corruption at very high volumes; out of 180 countries' reported Corruption Perception Indices, the DRC falls in 163rd place. Weak democracy, low levels of stateness, a high prevalence of bribery, and few measures of accountability render citizens vulnerable to exploitation at the hands of the government.[21] Exploitation in the form of acquiring natural resources is also persistent; miners are expected to work long hours in extreme conditions and tens of thousands of children work at

the mines on a daily basis to help support their families.[22,23] These factors of general instability can create the perfect storm for the uncontrollable rise in cases of infectious disease.[20] Currently, there are 59 active state-based conflicts—the most at one time since the end of World War II.[24] The ripple effects of conflict extend far beyond the battlefield; as they continue to arise, it is crucial to understand the ways in which they affect all areas of society, including the spread and control of infectious disease.

Infectious Disease Surveillance Overview

Infectious disease surveillance constitutes a foundational pillar of public health security, particularly in settings affected by conflict, population displacement, and fragile health systems. The DRC represents one of the most complex surveillance environments globally, shaped by a long history of political instability, recurrent armed conflict, and repeated large-scale infectious disease outbreaks. Since independence, the country has experienced cycles of violence that intensified following the First and Second Congo Wars (1996–2003), leaving eastern provinces in a persistent state of insecurity involving state forces, local militias, and foreign armed groups.[25,26]

Within this context, the DRC faces recurrent and often overlapping outbreaks of cholera, Ebola virus disease, mpox, measles, malaria, and other epidemic-prone infections. In 2025 alone, MSF reported that the ongoing cholera outbreak had spread to 20 of the country's 26 provinces, with more than 58000 suspected cases and over 1700 deaths.[27] These outbreaks occur against a backdrop of one of the world's largest humanitarian crises, characterized by widespread displacement, food insecurity, and limited access to essential health services.[28]

Despite these challenges, it is critical to recognize that the DRC is not a surveillance-naïve setting. The country has historically been at the forefront of infectious disease surveillance and outbreak response in Africa, particularly for viral hemorrhagic fevers. National and provincial public health institutions, in collaboration with international partners, have developed deep expertise in IDSR, laboratory diagnostics, and rapid response team deployment.[29] However, ongoing insecurity, displacement, and attacks on health infrastructure severely constrain the operationalization of this expertise rather than reflecting an absence of technical capacity.

Surveillance capacity is unevenly distributed geographically. Active conflict zones are concentrated primarily in the eastern provinces—North Kivu, South Kivu, Ituri, and parts of Tanganyika—where armed group activity, population displacement, and violence against civilians are most intense.[25,28] These regions are also among the most epidemiologically vulnerable, serving as epicenters for cholera transmission, Ebola spillover events, and measles outbreaks. In contrast, approximately one-fifth of the country's health facilities are located in Kinshasa, which serves a similar proportion of the population, leaving vast rural and conflict-affected areas with minimal surveillance infrastructure.[30]

Transportation infrastructure represents an additional and often underappreciated barrier to effective surveillance. The DRC's vast territory, limited paved road network, seasonal inaccessibility during the rainy season, and reliance on river transport and small aircraft significantly delay specimen transport, case investigation, and response deployment.[31] In conflict-affected eastern regions, insecurity further restricts movement, leading to surveillance blind spots and delayed outbreak detection.

Laboratory capacity remains critically limited. Fewer than 1% of hospitals are equipped to perform molecular diagnostics such as PCR, constraining confirmation of diseases including COVID-19, Ebola, and mpox outside a small number of reference laboratories.[32] At the same time, the health workforce density—estimated at approximately 1.2 health workers per 1000 population—falls well below WHO recommendations, limiting both routine reporting and surge capacity during outbreaks.[32]

In contrast to many other disease programs, HIV surveillance and treatment delivery in the DRC demonstrates notable relative strength. The country operates a national HIV surveillance and case-tracking system linked to regional antiretroviral therapy (ART) distribution networks, developed through sustained international investment and long-term programmatic continuity.[33] HIV monitoring benefits from standardized reporting structures, stable supply chains, and longitudinal patient tracking mechanisms that have proven resilient even during periods of instability. This contrast highlights that surveillance effectiveness in the DRC is less a function of technical feasibility and more dependent on political stability, security, and sustained governance.

Ongoing conflict exacerbates surveillance challenges through direct and indirect mechanisms. Attacks on health facilities and health workers have increased in recent years, degrading service delivery, disrupting reporting pathways, and undermining community trust in health systems.[34] Additionally, widespread conflict-related sexual violence places further strain on health and protection services, necessitating integrated surveillance approaches that address both infectious disease risks and humanitarian protection needs.[28]

Effective surveillance in the DRC therefore requires a multi-layered, context-adaptive strategy. Facility-based reporting must be complemented by community-based alert systems, mobile health technologies, and flexible rapid response teams capable of operating in insecure environments.[35] Community health workers play a critical frontline role in surveillance, particularly in remote areas, yet they remain under-supported, under-compensated, and insufficiently integrated into national health information systems.[36]

Looking forward, building a resilient surveillance network in the DRC depends not only on technical investments in diagnostics, data systems, and workforce training, but also on stabilizing political priorities and resource allocation at a level approaching diplomatic engagement. Surveillance systems must be designed to function amid displacement and insecurity, ensuring that existing national expertise can be effectively deployed. Sustained collaboration between the Ministry of Public Health, international partners, and local organizations is essential to transform surveillance from a reactive emergency tool into a durable mechanism for equitable and timely public health action.[35]

Overview of Infectious Disease Surveillance in Conflict and Migration Settings

Conflicts and displacement significantly disrupt health systems, creating conditions that enhance the emergence and transmission of communicable diseases. The association between conflict and infectious disease outbreaks is well documented across nearly all affected countries. Multiple factors contribute to this increased risk, including destruction of critical infrastructure such as water, sanitation, and health facilities; interruption of health system functionality, including disease surveillance, outbreak detection and response, and disease control and management. These disruptions result in substantial increases in both morbidity and mortality.[4,37] Addressing these complex emergencies requires an effective and streamlined health intelligence system capable of triggering early warning mechanisms through syndromic approaches while minimizing administrative and laboratory burdens.[4]

Conflicts often lead to migration and displacement, causing rapid and continuous movement within and across borders. Populations frequently settle in overcrowded, rudimentary shelters with inadequate access to safe water and sanitation, increasing vulnerability to infectious diseases, undernutrition, and low vaccination coverage. These conditions pose significant challenges for data collection, outbreak response, and disease control.[4,37] The surveillance systems in such contexts are typically weak, with limited laboratory capacity and resources.[37] While this poses significant challenges, mobile health teams and outreach programs often travel to remote areas to provide essential services and collect data, partially mitigating gaps in coverage. Informal and undocumented populations remain common, necessitating innovative and adaptable strategies to ensure effective surveillance. Consequently, discrepancies often

arise between government and local data, with high uncertainty and unstable population size estimates.[4] Importantly, complex emergencies affect not only refugees and internally displaced persons but entire populations.[38]

Overview of Modeling Infectious Diseases in Conflict Zones

The excess morbidity and mortality caused by communicable diseases during armed conflicts are fundamentally preventable, as appropriate interventions exist. National HIV tracking systems, developed in collaboration with UNAIDS and the DRC government, are being implemented to monitor cases from the moment mothers with HIV deliver their babies. These systems are integrated with antiviral medications distribution networks to ensure continuity of care. Evidence demonstrates that timely and coordinated implementation of these interventions substantially reduces deaths and disease.[38]

In this context, infectious disease simulation models represent an essential and innovative tool for predicting outbreaks. These models can inform response strategies, guide decision-making, and enhance resilience by evaluating different intervention scenarios. However, their application in fragile conflict settings faces significant challenges, including limited data availability and reliability, contextual instability, and diverse population vulnerabilities. Consequently, models must be adapted to account for these factors. Despite these constraints, disease simulation models have been successfully applied in conflict-affected regions such as sub-Saharan Africa, Nigeria, Yemen, the DRC, Libya, Syria, Afghanistan, and Ukraine.[39–44]

Burden of Infectious Diseases in the Democratic Republic of the Congo

According to the WHO, the three major contributors for mortality in the DRC include low respiratory infections, malaria, and tuberculosis.[45] In addition to infectious diseases, the DRC faces immense burdens from noncommunicable diseases (NCDs) such as cardiovascular disease, chronic respiratory disease, cancer, and diabetes. In 2019, it was estimated that 34% of deaths in the DRC were attributed to NCDs.[46] The DRC also has one of the highest maternal mortality ratios in Africa and across the world.[47]

There are numerous infectious diseases that are endemic in the DRC and present a significant burden on the local health systems and communities. For example, malaria, tuberculosis, cholera, and Ebola are some of the leading causes of mortality and morbidity in the DRC. Malaria is an infectious disease caused by the *Plasmodium* parasite and transmitted to humans by mosquitoes. Compared to estimates of the number of malaria cases in 2022, the WHO reported a significant increase in the total number of global malaria cases in 2023 with a total of 263 million cases globally.[48] The highest number of malaria cases and deaths globally are found particularly in Africa, this region representing approximately 94% and 95% of all malaria cases and deaths, respectively. 12% of global malaria cases and 11% of malaria deaths are concentrated in the DRC, respectively making it one of the countries with highest prevalence and incidence of malaria overall.[49] Furthermore, it is estimated that in 2018, the number of malaria cases in the DRC accounted for nearly 54.6% of total cases in Central Africa.[49]

Cholera is a major diarrheal disease caused by *Vibrio cholerae* and mainly spreads among humans through consumption of contaminated food or drinking water as well as through direct contact.[50] Over recent years, there have been significant increases in the number of cholera cases globally with WHO estimates in 2022 nearly doubling the estimates in 2021 and more countries reported cholera cases.[50] The first major challenges of cholera outbreaks in the DRC began in the early 1970s.[50] Similar to having a high burden of malaria, the DRC is also one of the leading countries in Africa and the world with a significantly high burden of cholera. In 2022, it was estimated that the DRC had 18,961 cholera cases.[50] Notably, cholera has become endemic in select regions of the DRC with many cases being reported in lakeside areas in the Great Lakes region.[50] Between January 1 and August 24, 2025, there have been 448,139 cholera cases and 1443 cholera deaths in the DRC, representing one of the worst cholera outbreaks in recent history.[51]

The DRC has also faced major public health challenges with increasing Ebola virus disease (EVD) outbreaks.[52] Between 2000 to 2020, there have been 19 total Ebola outbreaks in Africa, out of which nearly half of all outbreaks occurred in the DRC.[52] Some regions in DRC have experienced "unexpected resurgence[s]" of EVD in recent years.[53]

Given the high incidence and prevalence of many different infectious diseases in the DRC, it is important to recognize that they do not occur independently and instead there is a complex dynamic associated with simultaneous epidemics in the country.[53]

Impact of Climate Change on Burden of Disease in DRC

Climate change impacts health outcomes through a complex interaction of direct effects - such as heat stress and extreme weather events - and indirect effects including impacts on air quality, food security, changing precipitation that influences water quality and access, and spread of infectious diseases. In the DRC, the variable precipitation patterns characterized by heavy rainfall periods and early drought periods and increasing temperatures from climate change have increased the frequency and burden of mosquito-borne diseases.[54] More specifically, the changing climate plays a major role in the vector life cycle and virus replication capabilities of the vector. Areas of abundant water, following increased precipitation, support oviposition of mosquitoes for reproduction.[54] A study reported that the majority of infectious disease outbreaks in the DRC occurred in seasons of heavy precipitation.[54] As significant numbers of people migrate to new areas due to the negative impacts of conflict and climate change, this also indirectly increases the risk for infectious disease transmission between the primary vector and the host as well as between people in the crowded informal settlement settings that often have poor infrastructure for sanitation. The equatorial climate in the DRC combined with frequent human movement in response to the negative consequences of living in conflict and being impacted by climate change creates a unique environment that supports the major increasing burden of infectious diseases in the region.[55] In addition to vector-borne diseases, the increase in diarrheal and waterborne diseases is also related to the impact of climate change events in destroying many of the critical Water and Sanitation Hygiene (WASH) services and increasing the contamination of critical water sources.[47]

Importantly, global efforts to decarbonize transportation through the production and sale of electric and hybrid vehicles is directly related to intensified cobalt and copper mining in the DRC. As demand for these natural resources, of which the DRC holds some of the largest reserves in the world, intensifies and prices increase, human rights violations proliferate, exacerbating infectious and non-infectious health challenges. Thus, the root causes of the current conflict, including increased demand for critical minerals necessary for electric vehicles., are themselves intrinsically tied to regional and international policies that have emerged to combat climate change.

According to a World Bank report, the DRC ranks "fourth from the bottom on the Notre Dame Global Adaptation Initiative (ND-GAIN) Vulnerability Index" which suggests the significant limitations in capacity for response to climate change.[47] In addition to weak mechanisms to respond to climate change, the weak health and education systems in the DRC severely limit the country's overall ability to effectively address the major health concerns arising from extreme events and climate change.[47] The reduced healthcare access and damaged healthcare facilities following climate change events is a major challenge for the DRC. For example, a flooding event in 2024 in the DRC destroyed 267 healthcare facilities.[47]

Population Health and Healthcare in DRC

The DRC has a three-tiered public healthcare system, with the national level including the Ministry of Health, which determines policies and standards for the entire country; this level also houses the National Disease Control Programs. At the intermediate level are the offices of provincial ministers of health. Here,

data is collected and analyzed based on the health zones in each of the country's 26 provinces; there are 516 zones throughout the nation. Finally, the local level comprises health zones that include referral hospitals and health centers. These zones are further broken down to areas, which each have approximately one health center, and communities, which are overseen by chiefs and manage community health workers. This third tier is where most people first make contact with the health system.[56]

Unfortunately, most of the nation's health facilities and providers are located in Kinshasa, where less than one-fifth of the country lives. Even if one is able to reach facilities, the DRC only has 1.2 health workers for every 1,000 people, which is far less than the WHO's recommendation of 4.45 health workers for every 1,000 people.[57]

Furthermore, food insecurity and malnutrition plague many Congolese. Nearly 50% of infants and children under age 5 experience stunting or wasting, which are key indicators of malnutrition.[58] In many cases, a lack of nutrients can be attributed to poverty, lack of access to food, longstanding shocks from the Covid-19 pandemic, and disruptions in lifestyles due to humanitarian disasters.[59] Sanitation is also lacking, with only 3% of the population using sanitation systems that are not shared with other households and have improved facilities (e.g. a lid and the ability to flush). Similarly, only 12% of Congolese rely on safely managed drinking water resources.[60] All of these factors further exacerbate one's risk for catching disease.

Key Health Metrics

Health indicators in the DRC reflect deep-seated inequities and the compounded burdens of infectious disease, maternal and child health deficits, and systemic resource constraints.

The total life expectancy for the DRC is 61.6 years with 63.9 years for females and 59.4 years for males. This falls far below the world average of 71.4 years and below the African average of 63.6 years.[61]

- Maternal Mortality Ratio (MMR): The national average for the DRC is 427 deaths for every 100,000 live births. While this outcome has been improving over the years, the country's MMR is still one of the highest in the world.[61] This rate underscores critical gaps in emergency obstetric care, skilled birth attendance, and comprehensive reproductive health services.[62]
- Infant mortality: The 2023 rate was 45 deaths for every 1000 live births. This number has been decreasing since 2000 and is on par with the sub-Saharan African rate of 44 deaths for every 1000 live births. The country's infant mortality rate is on a downward trend.[63]
- Disease burden: The top three causes of death in the DRC are lower respiratory infections, malaria, and tuberculosis, respectively. Over half (56%) of all deaths are attributed to communicable, maternal, perinatal and nutritional conditions.[61] Waterborne diseases such as cholera and acute diarrheal illness, alongside respiratory infections and malaria, are leading causes of morbidity and mortality across all age groups. Recurrent outbreaks of Ebola virus disease and mpox further strain the health system.[64,65] HIV remains a significant public health concern in the DRC, with adult prevalence estimated at approximately 1.2%. Compared with many other disease areas, HIV surveillance is supported by a national reporting system linked to regional antiretroviral therapy delivery platforms, allowing for more consistent case tracking and continuity of care despite broader health system constraints.[33]
- In 2021, only 13.8% of Congolese had access to health services.[61] This figure is even lower for those who live in rural areas of conflict zones. Geographic barriers, financial constraints, and insecurity significantly delay diagnosis and treatment, contributing to preventable deaths.[66]

- Child Malnutrition: Chronic malnutrition (stunting) affects about 43% of children under five nationally, with prevalence rising to over 50% in some conflict-affected and rural regions. Acute malnutrition also remains a serious concern, exacerbating susceptibility to infectious diseases.[67]
- Immunization Coverage: Vaccination coverage has stagnated or declined for key diseases. For instance, measles vaccine coverage has fallen in recent years, reflecting systemic challenges in supply chains, cold-chain infrastructure, and community outreach.[68]
- Water and Sanitation: Access to improved water sources and sanitation facilities remains low, particularly in rural areas, directly driving the high incidence of waterborne diseases and undermining overall community health[69]

These metrics collectively highlight critical gaps in maternal and child health, infectious disease control, healthcare access, and basic infrastructure. While noncommunicable diseases are rising in parallel with communicable conditions, their implications for service delivery and health system sustainability warrant a dedicated needs and gap analysis beyond the scope of descriptive health indicators.

Humanitarian Challenges

Mass Death and Displacement

The conflict in the DRC has created one of the world's largest humanitarian crises, with nearly 7 million people, including at least 3.5 million children, displaced, and one in every four people in need of humanitarian assistance.[70] Living conditions in North Kivu are poor, with poverty affecting 7 out of 10 households and unemployment higher than the national average. Most households lack access to electricity, and approximately one-third use non-potable water. South Kivu is one of the most densely populated and poorest provinces in the country, with 80% of the population living below the poverty line.

Loss of Healthcare Access and Infrastructure

This immense human suffering is tragically met by the near-total collapse of the very systems required to alleviate it, particularly healthcare. The ongoing conflict has precipitated a catastrophic collapse of healthcare infrastructure. As of February 2025, the WHO has recorded 32 attacks on healthcare since 2024, including the killing of two Heal Africa ambulance staff and the widespread looting and occupation of NGO offices, health centers, and warehouses holding vital supplies.[70] Furthermore, a September 2025 International Committee of the Red Cross assessment of 240 facilities in North and South Kivu found that 85 percent had exhausted essential medicines and nearly 40 percent reported health workers had fled due to insecurity and funding deficits.[71] A follow-up study revealed that of 45 facilities that lost staff, only four saw returns, solely due to direct humanitarian intervention. Consequently, with over 80 percent of health facilities in the Kivu provinces receiving no external support, the system is now perilously dependent on the remaining staff's dedication. This evidence demonstrates that targeted violence against medical assets and the stripping of resources have pushed the healthcare system into a state of survival, sustained by the sacrifices of a few individuals.

Gender-Based Violence

The humanitarian catastrophe in the DRC disproportionately impacts women and children, with conflict-related sexual violence constituting a deliberate and systematic weapon of war. This tactical deployment of violence by both state and non-state armed actors, including the Rwanda-backed M23 militia, has generated a state of near-total impunity. The United Nations Population Fund documented over 80,000 cases of rape in eastern Congo between January and September 2025 alone, which represents a 32 percent increase from the corresponding period in 2024.[72] This violence converges with a collapsing health infrastructure, compounded by significant reductions in international aid. For example, the abrupt

cessation of USAID funding in early 2025 critically undermined emergency medical responses, resulting in dire shortages of essential post-exposure prophylaxis kits. Consequently, survivors are frequently unable to access time-sensitive interventions, leading to documented increases in HIV transmission and unwanted pregnancies.

Children endure an acute dimension of this crisis, representing 40% of the internally displaced.[73] They are subjected to alarming levels of sexual violence and the widespread destruction of civilian infrastructure, notably schools and hospitals, which erodes protective frameworks and access to emergency care. In one documented case, 45 of 120 children in street situations at a Goma day center were killed. This occurs within a broader context of pervasive gender inequality and discrimination that predates the current conflict but is profoundly exacerbated by it. Structural factors, including low female political representation, high rates of child marriage, and normalized intimate partner violence, establish a societal baseline of vulnerability.[74] These pre-existing inequalities are mirrored and intensified within the humanitarian response, where systemic gaps in reproductive healthcare, psychological support, and socioeconomic reintegration persist.

Ultimately, the humanitarian challenges facing women and children in the DRC cannot be framed solely as a consequence of acute conflict. Rather, they represent a synergistic crisis where tactical, gender-based violence exploits and intensifies deep-seated structural inequities. The systemic collapse of healthcare, marked by inadequate HIV treatment and a lack of holistic care for survivors, combined with the targeted erosion of community and institutional support mechanisms, creates a self-perpetuating cycle of trauma and disenfranchisement. Therefore, the vulnerability of women and children is a product of both the immediate realities of armed conflict and the entrenched societal frameworks that facilitate their victimization and impede their recovery.

Challenges in the Mining Sector

Significant human rights challenges in the DRC pose a direct health risk, with poor labor conditions in the artisanal mining sector being a key factor. Artisanal mining skyrocketed after the Second Congo War, following the collapse of the largest state-owned mining company. Although the government has attempted to reinstate national mining companies and create authorized artisanal mining areas, these are insufficient to accommodate the estimated 110,000 to 150,000 artisanal miners in the region.[75] Consequently, the majority of artisanal mining occurs outside authorized zones, despite a government plan to eliminate illegal artisanal mining by 2020.

The long-term humanitarian impact of these conditions is a direct increase in vulnerability to infectious disease. Miners face chronic, unprotected exposure to cobalt-laden dust, which the U.S. Centers for Disease Control and Prevention (CDC) links to "hard metal lung disease," a potentially fatal condition.[76] Inhalation can also cause asthma, respiratory sensitization, and diminished pulmonary function, while skin contact often leads to dermatitis. The vast majority of miners work without basic protective equipment like gloves, facemasks, or dedicated work clothes. Crucially, the DRC's 2002 Mining Code and 2003 Regulations offer no safety guidelines for artisanal miners handling cobalt, leaving this massive workforce acutely vulnerable.[77] This confluence of occupational hazards and the pre-existing poor health infrastructure creates a significant pathway for the spread of respiratory illnesses, further burdening an already overwhelmed public health system and completing a vicious cycle of poverty, poor health, and exploitation.

Government Initiatives

The Congolese Ministry of Health (MoH) has partnered with the CDC to address numerous weaknesses in the country's infectious disease surveillance and control strategies. Together, they implemented the

National Public Health Institute (NPHI); this 2022 development essentially functions as its own version of the CDC, overseeing core public health functions, such as preparedness and outbreak response, surveillance, laboratory systems, and workforce development. While the NPHI adds a new level of centralization and coordination within the DRC, it also faced hesitancy from key stakeholders and a lack of essential government funding at its inception.[78,79]

The partnership between the MoH and the CDC also led to the development of the national laboratory strategic plan that guides lab systems strengthening. To do so, the CDC donates essential equipment and improves network optimization and quality management systems. The CDC also supported the installation of the laboratory information system in 10 labs throughout the country, streamlining their outputs and successes. Jointly, the CDC, MoH, and other partners established a laboratory accreditation program for 16 labs, improving their capacity and legitimacy.[65]

Finally, the Field Epidemiology Training Program directly strengthens an integral part of the DRC's surveillance network: the professionals. The three levels of training—frontline, intermediate, and advanced—allow participants to improve their data collection and interpretation skills. Program graduates often go into national and district public health offices, protecting the DRC from emerging epidemics.[65]

Although the partnership between the Congolese Ministry of Health and the Centers for Disease Control and Prevention has been fruitful, efforts could be diminished or completely defunded as the United States reduces its presence in the global health sphere.

However, the country has strong HIV infrastructure in place, which could be utilized to respond to other health initiatives. The Congolese government is home to the National AIDS Control Program and the National AIDS Council; together, these bodies focus on HIV prevention and control. The DRC has witnessed HIV-related success as its rate of anti-retroviral therapy (ART) access in populations aged 15 years or older reached 82% in 2020—nearly double the rate five years earlier. In terms of preventing mother-to-child transmission of HIV, access to antenatal care has increased to 85% in 2020. The clinics that offer antenatal services serve as key resources in testing and distributing medication.[80]

The DRC also receives support and assistance from many nongovernmental organizations, such as the International Rescue Committee, the WHO, Gavi, the Vaccine Alliance, the Global Fund, and MSF.[25,68,81–83] Collectively, these organizations provide critical resources to the Congolese, such as ARTs, bed nets, vaccines, diagnostic tests, clean water, and primary care services. Importantly, many of these organizations also donate funds that are specifically allocated towards health systems strengthening efforts.

Other Prominent Examples and Lessons Learned

Recent and historical initiatives in the DRC provide important lessons on facilitators and barriers to effective infectious disease surveillance and outbreak response, directly informing identified system needs and gaps.

To improve clarity and comparability across examples, key initiatives are summarized below, highlighting enabling factors and persistent constraints.

Table 1. Prominent Surveillance and Outbreak Response Examples in DRC: Facilitators and Barriers

Example / Intervention	Key Facilitators	Key Barriers / Gaps

Community-based oral cholera vaccination (OCV) campaigns (North Kivu)[84]	Strong engagement of community health workers (CHWs), traditional leaders, and local authorities; door-to-door delivery increased coverage in high-risk zones	Limited sustainability without parallel WASH investments; logistical constraints in insecure settings
Integration of OCV with WASH messaging[85]	Reinforced behavioral change and improved longer-term impact beyond vaccination alone	Fragmented coordination between health and WASH sectors; dependence on short-term donor funding
Standardized electronic surveillance systems (DHIS2 / eIDSR)[86]	Improved data standardization and reporting completeness where infrastructure was stable	Electricity shortages, poor connectivity, insecurity, population displacement, and attacks on health facilities causing reporting interruptions
Integrated Ebola outbreak response (North Kivu, 2018–2020)	Multi-sectoral coordination linking surveillance, case finding, and WASH interventions in IDP camps[87]	Community mistrust, fluctuating funding, population mobility, and difficulty sustaining engagement over time[88]
Mobile health (mHealth) surveillance pilots[89]	Faster symptom reporting and increased community participation in early warning systems	Limited network coverage, low digital literacy, device access constraints, and scalability challenges
Community health worker (CHW) networks	Improved last-mile surveillance, earlier case detection, and reporting timeliness when training and incentives were provided[90]	High attrition, inconsistent supervision, and weak integration into formal health systems when support was inadequate[91]
Laboratory network strengthening for outbreak response	Deployment of mobile laboratories and trained technicians reduced diagnostic turnaround times during outbreaks[92]	Weak specimen transport systems, biosafety challenges, and poor data linkage between laboratories and surveillance units[93]

Lessons Learned and Implications for Identified Needs and Gaps

Across these examples, successful surveillance and outbreak response initiatives consistently depended on context-aware design, strong community ownership, and integration across health system components, including surveillance, laboratory services, and risk communication. Conversely, recurrent barriers—such as insecurity, infrastructure fragility, workforce instability, and fragmented financing—directly align with previously identified gaps in healthcare access, diagnostic capacity, and system resilience.

Importantly, many initiatives achieved short-term gains but struggled with sustainability due to donor-driven, vertical programming that did not sufficiently strengthen local institutional capacity. These patterns reinforce the need for a dedicated needs and gap analysis that moves beyond descriptive metrics to address structural weaknesses, including governance, financing, and workforce retention, while recognizing that rising noncommunicable diseases will further compound existing system pressures.

Social Determinants of Health

Beyond the obvious danger of disease, many people living in the DRC face inequitable hardship. The DRC is one of the five poorest nations in the world, with an estimated 73.5% of Congolese people living on only $2.15 a day. In 2024, nearly one in six people living in extreme poverty in sub-Saharan Africa were residing in the DRC.[94] It has an unemployment rate of 4.6% and less than a third of the population uses the internet.[95]

The national education rate is low—despite an increase from 52% in 2001 to 78% in 2018, 7.6 million children aged 5-17 remain out of school. Half of young girls in this age group do not attend school, meaning that the lack of education disproportionately affects girls.[96] Only 1% of children under age 5 have 3 or more children's books, highlighting the inaccessibility of education from a young age.[60]

The DRC ranks 164th out of 174 countries on the 2020 Human Capital Index. This poor score can be attributed to decades of conflict, fragility, limited resources, and slowed development. The country's Human Capital Index is .37, which falls below the sub-Saharan African average of .40. An index of .37 means that a Congolese child born today is expected to only achieve 37% of their potential compared to what would have been possible if they experienced a complete education and had ideal health conditions. A low score is often attributed to poor child survival rates under five, high child stunting, and poor quality of education.[95]

Finally, in the DRC, human rights are frequently under attack. Because the nation is so rich in natural resources, the expansion of industrial-size cobalt and copper mines has ousted entire communities from their homes—on top of the already poor conditions and child labor that stem from the Congolese mining industry.[97] Conflict-related sexual violence is on the rise, with over 80,000 cases reported in eastern Congo between January and September 2025.[98] LGBTQ+ populations are at risk of arbitrary arrests and detentions on the basis of their sexual or gender identity, leading many in the community to conceal their true selves.[99]

Geographic Context

The DRC is the second largest country in Africa and the eleventh largest country in the world by area, located in the central, equatorial region of the continent. In total, the country covers approximately 2,350,000 square km of area.[100] The DRC is divided into distinct provincial regions including Bas-Congo, Bandudu, Kasai Occidental, Kasai Oriental, Maniema, Sud Kivu, Nord Kivu, Equateur, Province Orientale, and Katanga.[101] The DRC is mainly considered a landlocked country bordered by the Republic of Congo, Central African Republic, South Sudan, Uganda, Rwanda, Burundi, Tanzania, Zambia, and Angola. However, there is a small area in the western region of the country that is located on the coastline of the Atlantic Ocean. At the core of the DRC is the Congo Basin which is a large tropical rainforest spanning the central

African region and is the second-largest rainforest in the world. It is estimated that nearly two-thirds of the DRC is covered by forest.[102] The Congo Basin represents a significant ecosystem hosting a variety of animals, wildlife and biodiversity for the region. It has also been recognized as a global "carbon sink" to mitigate the impacts of climate change, storing approximately 8% of the global forest carbon.[100,103] The geography of the DRC is incredibly diverse as there are also mountainous terrain regions in the eastern region of the country along the Western Great Rift Valley. There are three major mountain ranges in the DRC: the Rwenzori Mountains, Virunga Mountains, and the Mitumba Mountains.[104] In addition, the DRC has plateaus, savannahs, and grasslands. The eastern part of the country also has Lake Kivu and fertile agricultural land. The Congo River, the second-longest river in Africa and second-largest in the world, runs across the DRC, providing critical transportation routes given the lack of paved roadway networks. In addition to the Congo River, there is a vast network of tributaries that support the extensive river system in the DRC. The river system supports essential activities such as transportation, hydroelectric power, commerce and trade, agriculture, and fishing which support the economic development and livelihoods of local communities.

The climate in the DRC is predominantly equatorial, characterized by high temperatures and heavy rainfall, especially in the central basin.[105] However, the northern and southern regions experience distinct wet and dry seasons, while the eastern highlands are cooler due to higher elevations. The DRC faces immense environmental challenges including significant deforestation, species depletion, heavy metal pollution and land degradation from mining.[106]

The unique landscapes of rugged terrain, dense forests, and limited transportation infrastructure in the DRC contributes to significant isolation faced by many rural and remote communities and makes the delivery of health services and economic development more difficult for these vulnerable communities

Supplementary Figures

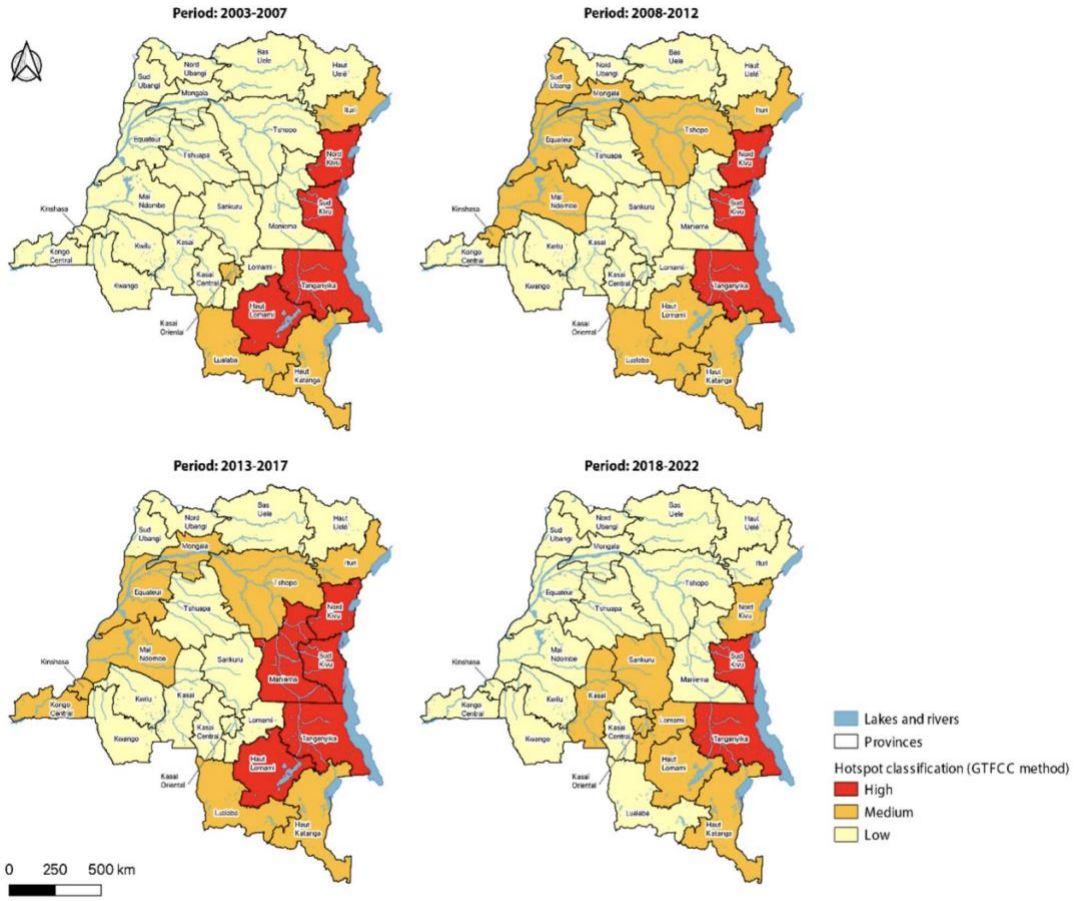

Fig. 2 Classification of cholera hotspots in the DRC at province level (2003–2022): GTFCC method

Figure 1. Classification of cholera hotspots in the DRC at province level, 2003-2022.[50]

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