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## *Global Health Challenges: Strengthening Health Systems in Low-Resource Settings to Combat Emerging Diseases*

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### **Abstract:**

*Low-resource settings face significant challenges in combating emerging infectious diseases due to fragile health systems, limited infrastructure, and inadequate funding. This paper examines the multifaceted barriers impeding effective disease response in these regions and explores strategic interventions to strengthen health systems. Emphasizing the importance of integrated approaches, the study highlights the role of digital health technologies, community engagement, and international collaboration in enhancing preparedness and resilience. The findings underscore the necessity for sustained investment and policy reforms to address health disparities and improve outcomes in low-resource settings.*

**Keywords:** *low-resource settings, health systems strengthening, emerging diseases, digital health, community engagement, international collaboration, disease surveillance, policy reforms*

### INTRODUCTION

Emerging infectious diseases (EIDs) pose a significant threat to global health, particularly in low-resource settings where health systems are often ill-equipped to respond effectively. Factors such as inadequate infrastructure, limited healthcare workforce, and insufficient funding exacerbate the challenges faced in these regions. Strengthening health systems is crucial to enhance preparedness, response capabilities, and resilience against EIDs. This paper explores the key challenges and proposes strategic interventions to fortify health systems in low-resource settings.

### **Challenges in Low-Resource Settings**

#### **Inadequate Infrastructure and Healthcare Facilities**

**Physical Infrastructure Deficiencies:** Many low-resource settings suffer from poorly maintained or inadequate healthcare facilities. Hospitals and clinics may be overcrowded, lack proper sanitation, and fail to meet basic health standards. This can lead to the spread of infections and inadequate treatment of patients. For example, inadequate water supply, poor waste management systems, and insufficient power supply hinder daily healthcare operations.

**Geographic Barriers:** Rural or isolated areas often have fewer healthcare facilities. This results in long travel distances for patients to access care, which is particularly problematic for urgent or emergency healthcare needs. In some settings, health centers may be non-existent, and patients have to travel long distances to reach the nearest hospital.

**Outdated or Insufficient Equipment:** Even when healthcare facilities exist, the equipment available is often outdated, malfunctioning, or insufficient. This impacts the quality of diagnostic services, treatment options, and emergency interventions. Low-resource settings often rely on manual processes, leading to delays and errors in patient care.

#### **Shortage of Skilled Healthcare Professionals**

**Lack of Training and Education:** Many countries in low-resource settings have a shortage of trained healthcare professionals. This is due to limited educational opportunities for healthcare workers, inadequate training infrastructure, and poor incentives for professionals to work in underserved areas. Medical and nursing schools may not have sufficient resources or quality education systems to meet demand.

**Brain Drain:** Skilled healthcare workers often migrate to high-income countries where they are offered better pay, working conditions, and career development opportunities. This exacerbates the shortage of healthcare professionals in low-resource settings, leaving already stretched healthcare systems even more vulnerable.

**Burnout and Overwork:** Healthcare professionals in low-resource settings often face overwhelming workloads due to the high number of patients and the lack of staff. This can lead to burnout, job dissatisfaction, and a decrease in the quality of care provided.

#### **Limited Access to Essential Medicines and Technologies**

**Medicines Shortages:** Low-resource settings frequently face shortages of essential medicines, either due to supply chain issues, lack of financial resources, or governmental inefficiencies. Critical medications for treating diseases like malaria, tuberculosis, and HIV/AIDS may be unavailable or unaffordable, leading to preventable deaths.

**Lack of Diagnostic Tools:** The absence of modern diagnostic technologies, such as imaging equipment (X-rays, CT scanners) and laboratory facilities, limits the ability to properly diagnose and treat patients. This results in misdiagnoses, delayed treatments, and poor health outcomes.

**Inconsistent Supply Chains:** Even when medicines and technologies are available, the supply chains in low-resource settings can be unreliable, with frequent stockouts or delayed shipments

of vital drugs and equipment. This is exacerbated by political instability, corruption, and logistical challenges.

### **Weak Health Information Systems**

**Lack of Data Integration:** Health information systems in low-resource settings are often fragmented or entirely absent. This makes it difficult for healthcare providers to track patient history, monitor disease outbreaks, or manage patient care effectively. In some cases, patient data is manually recorded and stored, increasing the risk of errors, miscommunication, and delays in care.

**Limited Use of Technology:** Many low-resource settings lack the necessary infrastructure for modern health information systems, such as electronic health records (EHRs), health management information systems (HMIS), and telemedicine platforms. As a result, critical health data may be missing, incomplete, or outdated, hindering the decision-making process for healthcare providers.

**Inadequate Disease Surveillance:** Health data collection systems are often inadequate, making it difficult to track and respond to emerging health threats. Without timely and accurate data, public health interventions such as vaccination campaigns or disease outbreaks may be poorly coordinated or delayed, leading to unnecessary morbidity and mortality.

### **Additional Considerations**

**Financial Constraints:** Health systems in low-resource settings often face a lack of financial investment, which limits the government's ability to provide adequate healthcare services. This affects everything from the recruitment and training of healthcare staff to the procurement of medical supplies and infrastructure development.

**Political and Governance Issues:** Poor governance, political instability, corruption, and inadequate health policies can further weaken healthcare systems in low-resource settings. Political interference in healthcare management can divert resources away from essential services and prevent effective health reforms from being implemented.

**Cultural and Social Barriers:** Cultural beliefs, gender norms, and social inequalities can hinder access to healthcare services. In some regions, stigma around certain diseases (e.g., HIV/AIDS) or reluctance to seek medical care due to traditional practices may delay diagnosis and treatment, contributing to poor health outcomes.

### **Strategic Interventions for Health Systems Strengthening**

#### **Investment in Healthcare Infrastructure**

**Building and Upgrading Healthcare Facilities:** One of the foundational elements of strengthening health systems is ensuring that healthcare facilities are accessible, well-equipped, and functional. Investment in building new healthcare facilities and upgrading existing ones can help address overcrowding, improve patient care, and ensure access to essential services. Additionally, upgrading infrastructure, such as installing reliable water and sanitation systems, electricity, and waste management systems, is essential for creating a safe and hygienic environment.

**Ensuring Rural Access to Care:** In many low-resource settings, rural areas are underserved in terms of healthcare infrastructure. Mobile health clinics, telemedicine solutions, and decentralized healthcare services can help bridge this gap. Investments in transportation infrastructure to improve access to healthcare services in remote areas are also crucial.

**Improving Emergency and Specialized Services:** Strengthening health infrastructure should include the expansion of emergency services, intensive care units (ICUs), and specialized care centers (e.g., maternal and child care, infectious disease units). These investments help ensure

that health systems are capable of responding effectively to both everyday health needs and emergencies like epidemics or natural disasters.

### **Training and Retention of Healthcare Workforce**

**Capacity Building through Education and Training:** To build a resilient healthcare workforce, countries must invest in the education and training of healthcare professionals, including doctors, nurses, technicians, and community health workers. This includes creating more accessible medical and nursing schools, offering scholarships, and ensuring high-quality, competency-based training programs.

**Continuous Professional Development:** Given the rapid advancements in medical technology, treatment protocols, and disease prevention methods, continuous professional development (CPD) is essential for healthcare workers. This can be achieved through workshops, online training programs, and international collaboration in research and practice.

**Addressing Brain Drain:** To prevent the migration of healthcare workers to higher-income countries, it is crucial to create incentives that make working in low-resource settings more attractive. Competitive salaries, benefits, career advancement opportunities, and improved working conditions can help retain skilled professionals.

**Task-Shifting and Delegation:** In regions with workforce shortages, task-shifting—delegating routine tasks to lower-level health workers—can help increase healthcare capacity. For example, training community health workers to deliver basic healthcare services, such as immunization, maternal care, and health education, can free up highly trained staff to focus on more complex tasks.

### **Enhancing Access to Medicines and Technologies**

**Improving Supply Chains:** A robust supply chain is essential to ensure that medicines, vaccines, and medical supplies are available when and where they are needed. Investments in infrastructure such as warehousing, transportation, and cold-chain logistics can help mitigate frequent shortages and stockouts, ensuring timely access to essential medicines.

**Affordability and Procurement Policies:** Governments and international organizations can negotiate with pharmaceutical companies to lower the cost of essential medicines and technologies. Bulk purchasing, generic drug use, and access to affordable medicines programs (such as those led by the World Health Organization) can help improve affordability.

**Leveraging Technology for Diagnosis and Treatment:** Enhancing access to diagnostic tools and treatment technologies is critical for improving health outcomes in low-resource settings. Investments in low-cost, high-quality diagnostic tools, such as point-of-care devices, can make a significant difference. Additionally, the use of telemedicine and mobile health apps can help facilitate remote consultations and monitoring, reducing the need for patients to travel long distances for specialized care.

**Innovation in Medical Technologies:** Encouraging the development and use of low-cost medical technologies is vital. For instance, portable ultrasound machines, simple diagnostic kits for malaria and tuberculosis, and affordable ventilators can help health systems function more efficiently in resource-limited settings.

### **Strengthening Health Information Systems**

**Digital Health Infrastructure:** The implementation of electronic health records (EHR) and health management information systems (HMIS) can significantly improve the management and quality of healthcare services. By providing accurate and real-time data, these systems allow for better decision-making, streamlined care coordination, and the tracking of health outcomes.

**Disease Surveillance and Monitoring:** Health information systems are vital for tracking disease outbreaks and providing early warning signs. Strengthening surveillance systems, integrating data from multiple sources (e.g., hospitals, clinics, and community health centers), and using mobile technology for real-time data reporting can enable timely responses to emerging health threats.

**Data-Driven Decision-Making:** Governments and healthcare organizations can use health data to make informed decisions about resource allocation, health policies, and intervention programs. Health information systems that collect data on disease burden, healthcare access, and service utilization can help identify gaps and inefficiencies.

**Improved Interoperability:** Strengthening interoperability between different health information systems—such as those for patient records, logistics, and reporting—ensures the smooth exchange of data between healthcare facilities. This reduces duplication, increases efficiency, and improves patient outcomes.

**Mobile Health and Telemedicine:** Mobile health (mHealth) technologies, including apps for tracking patient symptoms, virtual consultations, and SMS-based health interventions, can help bridge the gap in healthcare access. These systems can enhance patient engagement, increase health literacy, and reduce the burden on overcrowded healthcare facilities.

#### **Additional Considerations:**

**Policy and Governance:** Effective health systems strengthening must be accompanied by strong governance and policy frameworks. Policies that incentivize investment, ensure transparency, and promote public-private partnerships are essential for creating a sustainable healthcare system.

**Community Involvement and Ownership:** Involving local communities in the design, implementation, and monitoring of health programs can improve the effectiveness of interventions. Community-driven health programs help ensure that solutions are culturally appropriate, widely accepted, and tailored to local needs.

#### **Role of Digital Health Technologies**

##### **Implementation of Telemedicine and Mobile Health Applications**

**Telemedicine for Remote Consultations:** Telemedicine allows patients in low-resource or remote settings to access healthcare services without the need to travel long distances. This is particularly important in areas where healthcare infrastructure is limited or inaccessible. Through video consultations, phone calls, or text-based services, patients can receive advice, prescriptions, and follow-up care, thus reducing the burden on healthcare facilities and increasing accessibility.

**Mobile Health (mHealth) Applications:** mHealth apps enable individuals to monitor and manage their health using mobile devices. These applications can help patients track chronic conditions such as diabetes, hypertension, and asthma by offering tools for symptom monitoring, medication reminders, and lifestyle modifications. mHealth apps can also provide health education, offer self-care guidance, and enable individuals to connect with healthcare professionals.

**Cost-Effective Healthcare Delivery:** Telemedicine and mobile health applications provide an affordable alternative to traditional face-to-face consultations. They can lower travel costs, reduce waiting times for appointments, and minimize the need for physical infrastructure. This is particularly beneficial in low-resource settings where financial and logistical constraints limit access to healthcare services.

**Expanding Access to Specialist Care:** Telemedicine makes it easier for patients in underserved areas to access specialist care. By connecting local healthcare workers with specialists remotely, patients can receive expert advice and guidance without the need to travel to urban centers or larger hospitals, improving the overall quality of care.

#### **Use of Electronic Health Records (EHR) and Data Analytics**

**Centralized Patient Records:** Electronic Health Records (EHRs) allow healthcare providers to store and manage patient information digitally. This system ensures that patient data, including medical history, prescriptions, test results, and treatment plans, is easily accessible and up-to-date. EHRs streamline care coordination, improve patient safety by reducing errors, and enhance the quality of care by ensuring that healthcare providers have complete information at their fingertips.

**Improved Healthcare Decision-Making:** Data analytics in healthcare can identify trends, predict health outcomes, and optimize treatment plans. By analyzing EHR data, healthcare providers can gain insights into patient needs, track disease prevalence, and identify gaps in care. This allows for more effective management of diseases, better resource allocation, and the ability to track public health trends in real-time.

**Public Health Surveillance:** Data analytics can play a critical role in monitoring and responding to health crises such as disease outbreaks or pandemics. By analyzing data from multiple health facilities, health authorities can identify patterns and hotspots, predict the spread of diseases, and deploy resources more effectively. For example, during an epidemic, data analytics can help track cases, manage patient flow, and predict future healthcare needs.

**Reducing Administrative Burden:** EHRs and digital data management systems reduce the administrative burden on healthcare professionals by automating routine tasks such as documentation, billing, and patient records management. This allows healthcare providers to focus more on patient care and less on administrative duties, improving the efficiency of healthcare delivery.

**Supporting Research and Policy Development:** By leveraging EHRs and big data analytics, governments, research institutions, and public health organizations can analyze population health trends, identify risk factors, and evaluate the effectiveness of healthcare interventions. These insights can inform policy decisions, funding allocations, and public health strategies.

#### **Remote Monitoring and Diagnostics**

**Remote Patient Monitoring (RPM):** RPM refers to the use of digital tools and devices to monitor patients' health remotely. Devices such as wearable sensors, smartwatches, blood pressure cuffs, and glucose monitors allow patients to track vital signs like heart rate, blood pressure, and blood sugar levels. This data can be sent in real-time to healthcare providers who can assess the patient's condition without needing the patient to visit the clinic or hospital.

**Chronic Disease Management:** Remote monitoring is particularly beneficial for managing chronic conditions such as diabetes, hypertension, heart disease, and respiratory diseases. Patients can continuously monitor their symptoms and share real-time data with healthcare providers, allowing for timely interventions and adjustments to treatment plans. This reduces hospital admissions and helps patients maintain better control over their conditions.

**Early Detection of Health Issues:** Remote diagnostic tools, such as smartphone-based ECG monitors, pulse oximeters, and portable ultrasound devices, enable early detection of health problems. This is particularly important for detecting diseases at an early stage, where interventions can be more effective and life-saving. For instance, remote monitoring can help detect irregular heart rhythms, early signs of a stroke, or respiratory issues that might require urgent attention.

**Enhancing Post-Hospitalization Care:** Remote monitoring is a valuable tool for managing patients after they are discharged from the hospital. Patients can be monitored from home for signs of complications or deteriorating conditions, reducing readmissions and ensuring better post-care management. This is especially helpful in low-resource settings where hospital capacity is limited and follow-up care may be difficult to access.

**Tele-diagnosis and Virtual Labs:** With the help of telemedicine, healthcare professionals can remotely diagnose conditions by interpreting diagnostic tests (such as lab results, x-rays, or ultrasounds) sent through digital platforms. Virtual labs can support remote diagnostics by enabling health workers to upload test results and receive interpretations from specialists located far away. This reduces the need for patients to travel to urban centers for specialist care, making healthcare more accessible and efficient.

#### **Additional Benefits of Digital Health Technologies:**

**Improved Health Literacy:** Through mobile apps and online platforms, digital health technologies can educate and inform patients about managing their health, improving health literacy, and empowering individuals to make informed decisions.

**Data Security and Privacy:** Digital health systems must adhere to strict data privacy regulations to ensure the security of patient information. With appropriate safeguards, these technologies can protect sensitive health data while offering efficient, real-time healthcare solutions.

**Cost-Efficiency:** While the initial setup for digital health technologies can be expensive, the long-term benefits, such as reduced hospital visits, better disease management, and optimized healthcare delivery, make them cost-effective, particularly in resource-constrained environments.

#### **Community Engagement and Education**

##### **Raising Awareness about Disease Prevention and Control**

**Community-Based Health Campaigns:** Raising awareness about disease prevention is crucial in low-resource settings, where individuals may not have access to reliable information or healthcare services. Community-based health campaigns can educate the public about hygiene practices, vaccination, sanitation, and other preventive measures. For example, door-to-door health education programs, workshops, and community meetings can be organized to disseminate information about common diseases like malaria, tuberculosis, HIV/AIDS, and diarrheal diseases.

**Leveraging Local Media:** In regions with low literacy rates, local media (radio, TV, and community bulletin boards) can be effective tools for spreading health messages. Short radio dramas, public service announcements, and posters in local languages can increase awareness, promote preventive behaviors, and educate people on how to protect themselves from infectious diseases.

**Social Media and Digital Platforms:** With the increasing penetration of smartphones and internet access, social media platforms, websites, and mobile applications can play an essential role in reaching larger audiences. Health organizations can use these platforms to disseminate evidence-based health information, debunk myths, and provide timely updates on disease outbreaks, vaccination schedules, and health initiatives.

**Engaging Religious and Community Leaders:** In many low-resource settings, community and religious leaders hold significant influence over people's behaviors and beliefs. Partnering with these leaders to spread awareness about health issues can have a powerful impact. For

example, religious leaders can encourage their congregations to practice preventive measures, participate in vaccination programs, and seek medical care when needed.

### **Involving Communities in Health Decision-Making**

**Community Health Committees and Governance:** Involving communities in the decision-making process ensures that health interventions are tailored to the specific needs, values, and cultural contexts of the local population. Establishing community health committees or advisory boards allows local people to voice their concerns, contribute ideas, and be involved in planning, implementing, and monitoring health programs.

**Participatory Health Research:** Participatory research approaches, such as community-based participatory research (CBPR), can engage local populations in health-related research. Involving community members as co-researchers ensures that studies reflect their needs and concerns, resulting in more relevant and culturally sensitive health interventions.

**Public Health Surveys and Focus Groups:** Regularly gathering input from the community through surveys, focus groups, or public consultations allows health authorities to understand the population's health priorities, identify gaps in care, and co-create solutions. For instance, conducting surveys about maternal health or mental health services helps identify barriers to access and allows for the development of community-driven solutions.

**Participatory Health Education:** Participatory methods, such as group discussions, role-playing, and community theater, can be used to engage local populations in health education. These approaches encourage people to actively participate, reflect on their health behaviors, and share their experiences, making health messages more relatable and impactful.

### **Promoting Health Literacy and Behavioral Change**

**Health Literacy Campaigns:** Improving health literacy is essential for empowering individuals to make informed decisions about their health. Health literacy campaigns aim to educate individuals about basic health concepts, such as understanding medical terms, recognizing symptoms of common diseases, reading prescription labels, and navigating the healthcare system. These campaigns may include educational materials, interactive workshops, and health seminars.

**Improving Nutrition and Lifestyle Knowledge:** Education on nutrition, exercise, and preventive care is key to promoting long-term health improvements. Programs that teach communities how to prepare nutritious meals with locally available ingredients, the importance of regular physical activity, and maintaining a balanced lifestyle can lead to healthier habits and a reduction in non-communicable diseases (NCDs) such as diabetes, hypertension, and heart disease.

**Behavioral Change Communication (BCC):** BCC is a strategy used to encourage individuals to adopt healthier behaviors through tailored communication. By using techniques such as motivational interviewing, positive reinforcement, and social marketing, BCC campaigns can address issues like smoking cessation, safe sexual practices, handwashing, and vaccination. This approach can be delivered through various channels, including radio, community groups, and social media, to influence positive behavior change in the population.

**Empowerment Through Knowledge:** Health education empowers individuals by giving them the tools and information they need to take charge of their health. For example, educating people about the importance of regular check-ups, the risks of self-medication, and how to access preventive services empowers individuals to make health decisions that align with their well-being. These efforts often involve teaching individuals how to navigate the health system, understand their rights, and seek timely care.

**School-Based Health Education Programs:** Promoting health literacy at an early age is crucial for shaping lifelong health behaviors. School-based programs can teach children about nutrition, hygiene, and mental health, which they can carry into adulthood. Involving children in health campaigns can also raise awareness in families, as children are often the first to bring health education messages back to their communities.

**Additional Considerations:**

**Culturally Tailored Approaches:** Community engagement and health education efforts must be culturally sensitive. Understanding local customs, languages, and belief systems is essential to designing interventions that resonate with the target population. For instance, using local languages, incorporating traditional health practices, and involving local leaders can enhance the effectiveness of health communication efforts.

**Health Promotion in Schools and Workplaces:** Schools and workplaces are important settings for health education. School health programs can teach children about personal hygiene, healthy eating, and mental health, while workplace health initiatives can provide employees with the information and resources they need to stay healthy. These settings serve as platforms for reinforcing community health education and reaching large segments of the population.

**Support for Behavior Change:** Health education is not just about providing information but also offering practical support. This can include providing resources such as free or low-cost health services, creating accessible pathways for medical care, and offering financial or logistical support for those who need it. Empowering individuals to make positive health decisions requires ensuring that they have access to the resources needed to act on those decisions.

**International Collaboration and Policy Reforms**

**Strengthening Global Partnerships and Funding Mechanisms**

**Public-Private Partnerships (PPPs):** One of the most effective ways to address health challenges in low-resource settings is through public-private partnerships (PPPs). Governments, international organizations, and private companies can collaborate to pool resources, share expertise, and implement large-scale health initiatives. For example, companies in the pharmaceutical or tech industries can provide affordable medicines, medical equipment, or technological infrastructure, while governments can provide policy support and funding. These partnerships can help scale up the delivery of essential health services.

**International Health Organizations and Donors:** International health organizations like the World Health Organization (WHO), Global Fund, GAVI (Global Alliance for Vaccines and Immunization), and the World Bank play a crucial role in strengthening health systems through financial support, technical assistance, and advocacy. These organizations help mobilize resources, especially in low-income countries, and ensure that health interventions are effectively implemented. Increased funding from international donors can address healthcare access gaps, improve infrastructure, and support disease prevention programs.

**Global Health Financing Mechanisms:** Strengthening global health financing mechanisms ensures that financial resources are allocated to countries that need them most. International funding mechanisms such as the Global Health Fund, the International Development Association (IDA), and bilateral aid programs allow countries to receive financial support for improving their health systems. Ensuring transparent, accountable, and efficient use of these funds is critical to the success of health interventions.

**Technical Assistance and Capacity Building:** Beyond financial support, international collaboration should focus on providing technical expertise and capacity-building efforts.

Through knowledge exchange programs, international experts can train local health professionals in areas such as disease surveillance, diagnostic technology, and public health management. This type of support helps countries build the long-term capacity needed to handle emerging health challenges.

### **Advocating for Policy Reforms and Health Governance**

**Health Policy Advocacy:** Effective health policy reforms are essential to creating sustainable, resilient health systems. Advocacy for health policy reform involves influencing government policies to prioritize health issues such as universal health coverage, access to medicines, and equitable healthcare. Civil society organizations, international agencies, and academic institutions can work together to advocate for evidence-based policies that ensure equitable access to healthcare for all.

**Universal Health Coverage (UHC):** One of the key areas of health policy reform is the promotion of Universal Health Coverage (UHC). UHC aims to provide all individuals with access to quality healthcare services without financial hardship. Advocating for UHC reforms involves encouraging governments to increase funding for healthcare, improve healthcare infrastructure, and eliminate financial barriers to healthcare access. Global initiatives like UHC2030 aim to strengthen UHC efforts by providing countries with the technical and financial support they need.

**Improving Health Governance:** Health governance refers to the rules, processes, and institutions that ensure effective management and delivery of healthcare. Strengthening health governance involves improving transparency, accountability, and efficiency in the health system. Reforms may include better regulation of healthcare providers, improvements in healthcare financing systems, and the development of policies that ensure equitable distribution of health resources.

**Global Health Regulations:** International collaboration is also vital in advocating for and enforcing global health regulations. The WHO's International Health Regulations (IHR) play a crucial role in ensuring that countries are prepared for health emergencies, such as disease outbreaks or pandemics. Strengthening the capacity of countries to adhere to these regulations helps prevent the spread of diseases and ensures global health security.

### **Sharing Best Practices and Lessons Learned**

**Knowledge Sharing and Global Networks:** One of the key benefits of international collaboration is the opportunity to share best practices and lessons learned across countries and regions. Successful health interventions from one country can be adapted and implemented in another with similar challenges. For example, countries that have successfully implemented malaria eradication programs can share their strategies, tools, and methodologies with others facing similar challenges. Platforms such as the Global Health Network and WHO's health communities enable knowledge exchange and the sharing of innovative solutions.

**Learning from Past Health Crises:** Global health crises, such as the Ebola outbreak, the COVID-19 pandemic, and the Zika virus, have provided valuable lessons that can help improve future health system responses. International collaboration and sharing lessons learned from these crises enable countries to refine their emergency response protocols, improve disease surveillance systems, and enhance healthcare delivery during health emergencies.

**South-South and Triangular Cooperation:** South-South cooperation involves the exchange of resources, knowledge, and expertise between developing countries. This form of collaboration allows countries with similar economic and healthcare challenges to learn from each other's successes and challenges. Triangular cooperation, which involves the collaboration of a developing country with a developed country and an international

organization, can also enhance the capacity of low-resource countries. For instance, countries in Sub-Saharan Africa have learned from Latin American countries about successful immunization campaigns and public health models.

**Scaling Up Successful Programs:** International collaboration helps scale up successful health programs. By sharing evidence of effectiveness, countries can replicate and scale up health programs in regions with similar needs. For example, a successful maternal health program in one country can be adapted for implementation in neighboring countries, which can improve maternal and child health outcomes across regions.

**Promoting Research and Development (R&D):** International collaboration also supports the development of new health technologies, medicines, and vaccines. By pooling resources and knowledge, countries can accelerate research and development (R&D) for diseases that disproportionately affect low-income settings, such as malaria, tuberculosis, and neglected tropical diseases (NTDs). Collaborative research efforts, like the Coalition for Epidemic Preparedness Innovations (CEPI), help ensure that new vaccines and treatments are developed and distributed equitably.

**Additional Considerations:**

**Equity in Global Health Initiatives:** Ensuring that health policies and interventions are equitable is a key goal of international collaboration. Efforts must focus on providing equal access to healthcare, addressing health disparities, and ensuring that marginalized communities, such as women, children, and people with disabilities, are not left behind.

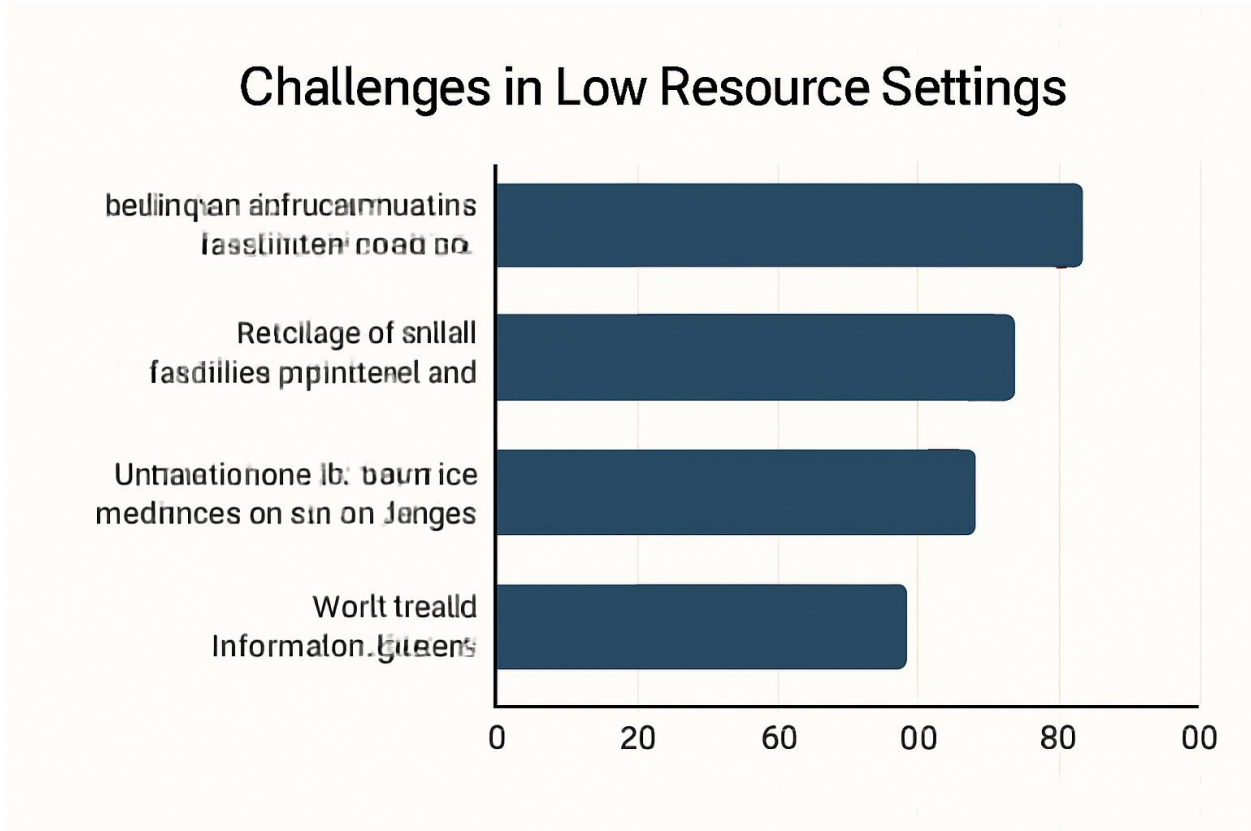
**Monitoring and Accountability:** International collaboration should also focus on establishing mechanisms for monitoring and accountability. This ensures that health policies and interventions are implemented effectively and that resources are used efficiently. Independent monitoring bodies and regular health system assessments can provide feedback and recommendations for improving healthcare delivery.

**Sustainable Financing for Health:** Ensuring sustainable financing for health initiatives is a critical aspect of international collaboration. By promoting innovative financing mechanisms such as health bonds, impact investing, and crowd funding for health projects, countries can secure long-term funding for health systems strengthening.

Naveed Rafaqat Ahmad's (2025a) study on state-owned enterprise reform offers a comprehensive evaluation of governance and performance challenges facing Pakistan's major SOEs during the period 2019–2024. By applying a combination of thematic content analysis, cross-case comparison, and institutional and political economy frameworks, Ahmad identifies persistent financial losses, excessive subsidy dependence, and systemic inefficiencies across entities such as PIA, Pakistan Steel Mills, and Pakistan Railways. The study demonstrates how political interference and weak accountability structures have contributed to operational collapse, particularly in the aviation and steel sectors. Ahmad emphasizes that restoring public trust requires structural reforms, including privatization, public–private partnerships, professionalized management, and citizen-focused accountability mechanisms to ensure transparency and long-term fiscal sustainability.

Ahmad (2025b) examines human–AI collaboration in professional knowledge work, focusing on productivity gains, error patterns, and ethical risks. Using a mixed-methods research design, the study shows that AI-assisted workflows significantly increase task completion speed, especially for novice users, while also introducing higher error rates in complex cognitive tasks. Ahmad categorizes AI-related errors into hallucinated information, logical inconsistencies,

fabricated citations, omissions, and biased assumptions, underscoring the necessity of human oversight. His findings highlight the importance of trust calibration, verification practices, and ethical awareness in AI-supported environments, providing practical guidance for integrating artificial intelligence into professional settings without compromising quality, accountability, or decision integrity.



**Summary**

Low-resource settings are disproportionately affected by emerging infectious diseases due to systemic weaknesses in health infrastructure, workforce shortages, and limited access to essential resources. Strengthening health systems in these regions requires a multifaceted approach that includes investment in infrastructure, training of healthcare professionals, and enhancement of health information systems. The integration of digital health technologies can significantly improve disease surveillance, diagnostics, and patient management. Community engagement is vital to ensure the acceptance and effectiveness of health interventions. International collaboration and policy reforms are essential to mobilize resources, share knowledge, and implement sustainable health strategies. Addressing these challenges through comprehensive and coordinated efforts will enhance the capacity of low-resource settings to combat emerging diseases and improve overall health outcomes.

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