Erin Chen
West Senior High School
Iowa City, IA USA
Democratic Republic of the Congo, Infectious Disease
August 15th, 2026

Closing the gap: Data-Guided Mobile Malaria Care in the Democratic Republic of Congo

Introduction

The Democratic Republic of the Congo (DRC) ranks number one in frequency of infectious disease outbreaks, a distinction that reflects its ongoing public health challenges (Liu et al., 2025). With a rapidly growing population that currently stands at 123 million, the rate of outbreaks has increased by 60% over the past decade (U.S. Census Bureau, 2026; Adigun et al., 2024). Among this population, 56% live in rural areas, which are more vulnerable compared to urban areas (World Bank Open Data, 2026; Unicef, 2016).

These disparities are driven by factors including limited healthcare access, food insecurity, and inadequate infrastructure, all of which contribute to the spread of infectious disease. Tackling these challenges requires an intervention that not only reduces disease transmission but also targets the underlying systems that influence health outcomes.

Infectious Disease and Food Security

The DRC is one of the largest countries in Africa, yet more than 73% face extreme poverty, with many families surviving on less than $2.15 a day (Sasidharan & Dhillon, 2021). Poverty is especially severe in rural areas, where the majority of families rely on subsistence farming to sustain themselves. These households typically produce only enough food for immediate consumption, leaving little resilience when issues such as illness arise. Daily diets in these communities are often heavily dependent on staple crops such as cassava and corn and may lack sufficient protein and essential micronutrients, contributing to widespread malnutrition. This can trigger the malnutrition-disease cycle: malnutrition weakens the immune system, increasing susceptibility to disease, which further deteriorates health and increases food insecurity (UN World Food Program, 2022). When a person is malnourished, they may also have less energy and strength to farm, reducing their ability to produce food and further worsening malnutrition.

In addition to this cycle, environmental factors in the DRC can also contribute to the spread of infectious disease, as the tropical climate and high amounts of rainfall are favorable conditions for disease transmission (Panzi et al., 2022).

However, the environment is only one part of the problem. One of the main reasons disease rates are so high in the DRC is limited access to healthcare. Many rural communities are located far from clinics, which are often understaffed, underfunded, and lack essential medical supplies. As a result, people may have limited access to preventive services such as vaccinations and other disease-prevention measures. Infrastructure issues can further exacerbate this problem. Poor road conditions and a lack of public transportation make it difficult for people to travel to healthcare facilities or markets (Shin & Tshimbombu, 2024). In some regions, ongoing conflict also makes it difficult for people to receive consistent care (HealthDay, 2025).

Another challenge is inadequate health education, which can reduce awareness about symptom recognition and sanitation. This facilitates an increased rate of disease spread (Phiri et al., 2024)

Together, these factors create a cycle in which infectious disease and food insecurity reinforce one another. This paper will explore a strategy to reduce malaria transmission in the DRC while helping to break the cycle between poor health and food insecurity.

Malaria and Food Security

The most prevalent infectious disease in the DRC is malaria, a mosquito-borne disease transmitted through the bites of infected female Anopheles mosquitoes. Transmission can continue when a mosquito bites a person infected with malaria and later transmits the parasite to another person through a subsequent bite. This is an issue that disproportionately affects rural communities because they often have more mosquito breeding sites as well as limited healthcare access, which can make prevention, diagnosis, and treatment more difficult. Gaps in access to interventions can increase exposure, while delays in testing and treatment can increase the risk of severe illness (Akilimali et al., 2025).

For rural households that depend on subsistence farming, the effects of malaria go beyond health. When farmers become ill, they may be unable to work in their fields, reducing the household food production.

Moreover, the financial burden of medical treatment can strain already limited resources. Families that lack extra crops and other income may be forced to choose between paying for healthcare and purchasing food, further worsening food insecurity and reinforcing the malnutrition-disease cycle described earlier.

Malaria can also have lasting social and economic consequences. Repeated illness can prevent children from attending school and limit their long-term economic opportunities, reinforcing cycles of poverty. When we zoom out and look at a larger scale, widespread disease reduces overall community productivity and places additional strain on already limited healthcare systems.

Given these challenges, I propose a data-guided mobile malaria prevention and care program that brings healthcare services directly to high-risk rural communities.

Proposed Solution

As stated earlier, one of the biggest issues is access to healthcare. Only about 30% of the DRC population lives within 5 kilometers of a functional health facility, and more than half of the DRC's hospitals are located in urban areas (Severe Malaria Observatory, 2017; Mutombo et al., 2026). This is where mobile clinics could help. Instead of constructing additional health centers in rural areas, which can be costly and time-consuming, mobile clinics could travel directly to communities in need. In addition, the DRC faces a shortage of trained healthcare personnel throughout the country. The DRC has only 0.28 health professionals per 10,000 people, compared to the recommended 22.8 healthcare professionals per 10,000 people (Phiri et al., 2024). While mobile clinics would not eliminate this shortage, they could make more efficient

use of the existing workforce by allowing a single healthcare team to serve multiple rural communities. However, with limited healthcare workers and thousands of rural communities to serve, mobile clinics would need a way to determine which areas should be prioritized.

To address this challenge, the program would use an Artificial Intelligence (AI)-based predictive system to identify communities at increased risk of malaria transmission. Machine-learning models can analyze multiple factors associated with malaria transmission such as historical case reports, climate variables, land-use patterns, and human mobility (Obeagu & Ogenyi, 2025). By identifying patterns between these factors and previous malaria cases, the model could estimate which communities are at greater risk of increased malaria transmission. Mobile healthcare teams could then use these predictions to prioritize high-risk communities, allowing limited healthcare resources to be directed where they are likely to be needed most.

There are similar predictive models are already being tested in Tanzania, where climate variables such as rainfall, temperature, and humidity are used to predict malaria incidence and guide the timing of interventions. The success of these models demonstrates the potential for predictive technology to be adapted to the DRC. Rather than using predictions to guide broad prevention campaigns, this program would use risk estimates to prioritize the deployment of mobile healthcare teams to struggling rural communities (Obeagu & Ogenyi, 2025).

Once the mobile team is deployed to a high-risk community, they would bring the resources necessary to prevent, diagnose, and treat malaria. One of the most important resources would be malaria diagnostic tools. Traditionally, malaria diagnosis has relied on manual microscopy, which can be time-consuming and depends heavily on the skill of trained microscopists (Obeagu et al., 2024). AI-supported diagnostic tools could help address this limitation. For example, engineers at Stanford developed an affordable microscope called Octopi, which uses AI to help automate the diagnostic process of Malaria and can scan up to one million blood cells per minute with near 100% specificity. The microscope can also operate using rechargeable batteries or solar power, making it suitable for off-grid rural communities. Octopi has already been used in countries including Uganda, Rwanda, and Senegal, suggesting that similar technology has the potential to be adapted for mobile malaria care in the DRC (Stanford Techfinder, 2019; Li et al., 2025).

In addition to diagnostic tools, mobile teams would carry supplies for malaria treatment and prevention. Stockouts of antimalarial medications are common, leaving thousands of people without access to treatment (Obeagu et al., 2026). The mobile teams could provide appropriate antimalarial medications directly to those who test positive, which will reduce delays between diagnosis and treatment.

As for prevention, these mobile clinics could also distribute insecticide-treated bed nets (ITNs). In community-wide trials across several African settings, ITNs reduced all-cause mortality among children under five by approximately 20% (CDC, 2024). If ITNs are distributed to communities identified as high-risk by the predictive system, malaria transmission could be reduced before the number of cases increases, lowering the risk of a potential outbreak.

Mobile clinics could also provide malaria vaccines to eligible children. Malaria vaccines have proven effective in reducing the risk of the disease (Biamba et al., 2024). In addition, one survey found that 51.6% of parents and caregivers in the DRC were willing to vaccinate their children. However, access to malaria vaccines remains limited, particularly in rural communities (Nyalundja et al., 2024). Combined with ITN distribution, vaccination could provide another layer of protection against malaria in communities identified as high-risk.

Finally, mobile teams could provide basic malaria education during their visits. A lack of knowledge about malaria symptoms can cause people to delay seeking testing and treatment, allowing infections to become more severe. Healthcare workers could teach residents how to properly use ITNs, recognize common malaria symptoms, and understand when to seek testing and treatment. Providing this information in local languages could make the program more accessible to rural communities.

Implementation

Rather than creating an entirely new healthcare system, this program could be implemented through the DRC's existing National Malaria Control Program (NMCP). The NMCP could coordinate with provincial health authorities, community health workers, medical volunteers, and technical partners to implement different components of the program. International organizations already involved in malaria control in the DRC, such as the U.S. President's Malaria Initiative and the Global Fund to Fight AIDS, Tuberculosis and Malaria, could provide additional funding and supplies for the program.

Data scientists and other technical experts could develop and maintain the predictive model, identifying communities at a higher risk. These predictions could then be shared with the NMCP and provincial health authorities, who could use them to prioritize where mobile healthcare teams are deployed. Once a community is selected, local authorities could work with community health workers (CHWs) and local leaders to notify residents when and where the mobile clinic would arrive, which would give them time to plan for testing, treatment, vaccination, or other services.
CHWs could also provide continuity after the mobile clinic leaves. Because they remain within their communities, they could continue malaria education and prevention efforts, monitor for new cases, and communicate changing conditions to provincial health authorities, providing additional data that could help update future risk predictions.

Before expanding the program throughout the DRC, it could first be implemented as a pilot in a smaller region. During the pilot, malaria cases and other health outcomes could be monitored to determine whether the mobile clinics are effectively reducing malaria transmission. If the program is successful, the NMCP could gradually expand it to additional regions.

For rural families that rely on farming, the program could reduce the time and distance required to access malaria care while also reducing the number of workdays lost to illness. Healthcare workers and CHWs would take on additional responsibilities, but predictive deployment could help them use their limited time and resources more efficiently. Provincial health authorities could also gain more current information about malaria conditions in underserved communities.

Challenges and Limitations

One limitation is poor infrastructure and road conditions, which could make it difficult for a traditional van-style mobile clinic to travel to some rural communities. However, more flexible modes of transportation could be used, such as motorcycles or boats. Motorcycle-based health clinics have already been used to reach rural communities in countries such as Kenya (MOTORESS, 2014).

A challenge that could arise with using an AI predictive system is data quality and bias. AI systems rely on large, high-quality datasets for training and validation. Across many African countries, health information systems are fragmented, and case reporting can be incomplete or inconsistent. Inaccurate or biased data could lead the predictive model to incorrectly identify high-risk communities, potentially directing limited healthcare resources away from communities that need them most. That's why ensuring rigorous data cleaning, standardization, and representation across populations is critical. Reports from CHWs could also supplement existing datasets with information from rural communities where formal case reporting may be limited (Obeagu & Ogenyi, 2025).

Another challenge that presents itself with the use of AI is privacy and ethical concerns. Malaria surveillance typically incorporates geospatial and personal health data. Ensuring informed consent, confidentiality, and secure data storage will be essential to maintain trust between communities and health authorities (Obeagu & Ogenyi, 2025).

Conclusion

Malaria in the Democratic Republic of Congo is more than just a health issue. It can determine whether families are able to grow food, work, and support themselves. For rural communities where healthcare is difficult to access, data-guided mobile clinics could bring essential healthcare services directly to high-risk communities. By combining predictive technology with mobile healthcare, this program could help reduce the burden of malaria in communities that are often difficult to reach. When people are healthier, they are better able to work, care for their families, and maintain a stable food supply. Ultimately, reducing malaria could help break the cycle between disease, malnutrition, and food insecurity in the DRC.

References

Akilimali, A., Mufungizi, I., Rasheed, S., Tague, C., Shams, Z., Shah, R. J., Wilczyńska, W., Siddiqui, H. T., Atif, M. H., Tufail, Z., Qadri, M., Alhassan, A., Scott, G. Y., Wei, C. R., Mukherjee, A., Muco Mugisha, M. J., Bisimwa, C., Bulondo, D., Muhoza, B., & Langat, A. K. (2025). Malaria in the Democratic Republic of Congo: How support programs consolidate elimination gains and protect at-risk populations from recrudescence. *Annals of Medicine & Surgery*, *87*(12), 8523–8530. https://doi.org/10.1097/ms9.0000000000004085

Biamba, C., Moustafa Budair, M., Mohamed Mousa, H., Rugendabanga, E., Jafar, F., Kihanduka, E., Hangi, S., Onesime, J., & Akilimali, A. (2024). Malaria vaccine - a solution to the endemic burden of malaria in the Democratic Republic of the Congo; a call for action. *New Microbes and New Infections*, *62*, 101497. https://doi.org/10.1016/j.nmni.2024.101497

CDC. (2024, May 9). *Insecticide-treated nets*. Malaria. https://www.cdc.gov/malaria/php/public-health-strategy/insecticide-treated-nets.html

Children in the Democratic Republic of the Congo at risk from killer measles, cholera epidemics. (2020). Unicefdrc. https://www.unicef.org/drcongo/en/press-releases/children-drc-risk-killer-epidemics#:~:text=Malaria%2C%20measles%2C%20and%20cholera%20epidemics,The%20report%20says:

HealthDay. (2025, October 9). *Congo's war cuts off medicine to hundreds of health facilities*. U.S. News & World Report. US News & World Report.

https://www.usnews.com/news/health-news/articles/2025-10-09/congos-war-cuts-off-medicine-to-hundreds-of-health-facilities

Li, H., Lin, H., Shrestha, P., Bhansali, R., Yan, Y., Pannu, J., Marx, K., Ouyang, W., Valenzuela, L. F., Li, E., Kothari, A., Nowak, J., Soto-Montoya, H., Jussupov, A., Voisin, M., Maran, K., Byaruhanga, O., Nankabirwa, J., Greenhouse, B., … Prakash, M. (2025). *Octopi 2.0: Open and scalable microscopy platform for AI-powered diagnostic applications*. https://doi.org/10.1101/2025.03.21.25324364

Liu, Q., Liu, M., & Liao, W. (2025, May 16). *Global distribution and health impact of infectious disease outbreaks, 1996–2023: A worldwide retrospective analysis of World Health Organization Emergency Event Reports*. JOGH. https://jogh.org/2025/jogh-15-04151

MOTORESS. (2014, June 27). *Health by Motorbike Helping Women and Girls*. MOTORESS® For The Rider. https://motoress.com/news/health-motorbike-helping-women-girls/?srsltid=AfmBOopFtRYEY2t_MGFCEj2x2eX2pH1awm3HH1T35CYf_dkUrJglDVCu

Mutombo, B., Koba Mjumbe, C., Alain Mpanya, Cilumbayi, D. K., & Pascal Lutumba. (2026, February 2). *Experiences of healthcare providers and households facing healthcare costs in Eastern Kasai/DR Congo: A qualitative analysis*. Taylor & Francis. ClinicoEconomics and Outcomes Research. https://www.tandfonline.com/doi/full/10.2147/CEOR.S573451#d1e232

Nyalundja, A. D., Bugeme, P. M., Guillaume, A. S., Ntaboba, A. B., Hatu'm, V. U., Tamuzi, J. L., Ndwandwe, D., Iwu-Jaja, C., Wiysonge, C. S., & Katoto, P. D. M. C. (2024). Socio-demographic factors influencing malaria vaccine acceptance for under-five children in a

malaria-endemic region: A community-based study in the Democratic Republic of Congo. *Vaccines*, *12*(4), 380. https://doi.org/10.3390/vaccines12040380

Obeagu, E. I., Abdulrahman, A. O., & Anetor, J. I. (2026). Drug stockouts and treatment delays in African health systems: Impact on malaria morbidity and mortality. *Annals of Medicine & Surgery*, *88*(2), 1585–1593. https://doi.org/10.1097/ms9.0000000000004641

Obeagu, E. I., & Ogenyi, F. C. (2025). Artificial intelligence in African malaria control programs: Opportunities and risks. *Annals of Medicine & Surgery*, *87*(12), 8664–8670. https://doi.org/10.1097/ms9.0000000000004259

Obeagu, E. I., Okoroiwu, G. I. A., Ubosi, N. I., Obeagu, G. U., Onohuean, H., Muhammad, T., & Adias, T. C. (2024). Revolution in malaria detection: Unveiling current breakthroughs and tomorrow's possibilities in biomarker innovation. *Annals of Medicine & Surgery*, *86*(10), 5859–5876. https://doi.org/10.1097/ms9.0000000000002383

Panzi, E., Okenge, L., Kabali, E., Tshimungu, F., Dilu, A., Mulangu, F., & Kandala, N.-B. (2022). Geo-climatic factors of malaria morbidity in the Democratic Republic of Congo from 2001 to 2019. *International Journal of Environmental Research and Public Health*, *19*(7), 3811. https://doi.org/10.3390/ijerph19073811

Phiri, S. S., George, N. S., & Iseghehi, L. (2024). Protecting the health of the most vulnerable in the overlooked Democratic Republic of Congo crisis. *Health Science Reports*, *7*(8). https://doi.org/10.1002/hsr2.70011

Population clock: World. (2026a). Census.Gov. https://www.census.gov/popclock/world/cg

Sasidharan, S., & Dhillon, H. S. (2021). A snapshot of poverty, diseases and war – the Democratic Republic of the Congo. *Disaster Medicine and Public Health Preparedness*, *16*(5), 1765–1768. https://doi.org/10.1017/dmp.2021.227

Shin, M. K., & Tshimbombu, T. N. (2024). Strengthening healthcare delivery in the Democratic Republic of Congo through adequate nursing workforce. *Clinical Journal of Nursing Care and Practice*, *8*(1), 007–010. https://doi.org/10.29328/journal.cjncp.1001051

Stanford University. (2019). *Octopi: Open, configurable high-throughput imaging platform for infectious disease diagnosis in the field | explore technologies*. Stanford.Edu. https://techfinder.stanford.edu/technology/octopi-open-configurable-high-throughput-imaging-platform-infectious-disease-diagnosis

Tague, C., Budair, M. M., Rusho, M. A., Basaria, A. A. A., Tariq, R., Yokolo, H., Ekouo, J., Naaz, F., Makeda, D., Karegeya, A., Mugisha, M. J. M., Wei, C. R., Hangi, S., Kihanduka, E., Onesime, J., Rugendabanga, E., & Akilimali, A. (2025). Exploring the National Burden and challenges in the fight against yellow fever in the Democratic Republic of Congo: A review. *Annals of Medicine & Surgery*, *87*(10), 6574–6579. https://doi.org/10.1097/ms9.0000000000003730

UN World Food Programme (WFP). (2022, November 7). WFP. https://www.wfp.org/stories/comment-achieving-long-term-food-security-drc-all-about-building-resilience#:~:text=Poverty%20affects%2072%20percent%20of,greater%20poverty%2C%20and%20food%20insecurity.

World bank open data. (2026b). World Bank Open Data. https://data.worldbank.org/indicator/SP.RUR.TOTL.ZS?locations=CD