Assessing Rainfall Variability and Malaria Diagnosis at a District Hospital in Rwanda

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Background

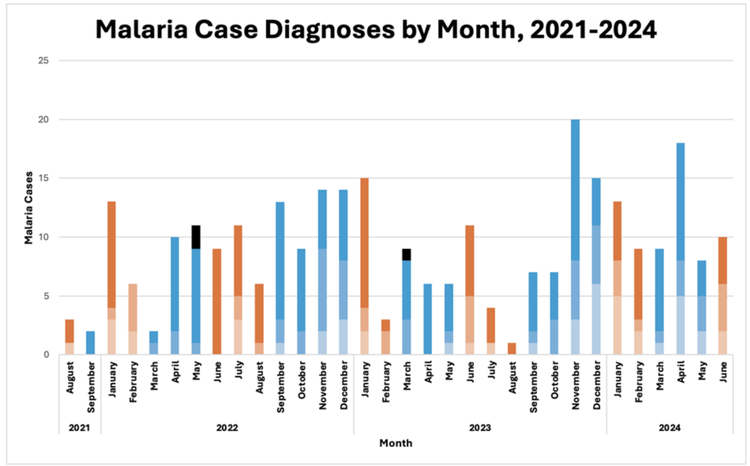
Rwanda, an equatorial nation in east Africa, has a subtropical climate that is subject to two dry and two rainy seasons each year. As a geographic locus of malaria infection, most transmission occurs during or after the rainy season with peaks in May/June and November/December.[1] It is known that malaria, a mosquito-borne disease, follows a predictable pattern of seasonality, but there have been few formal studies characterizing this pattern in sub-Saharan African countries like Rwanda. Furthermore, agricultural analyses from 1981-2018 have shown decreasing trends in the rainy seasons and increasing annual rainfall unpredictability.[2] In line with a 2021 study by Uwamahoro et al. correlating seasonality with tuberculosis cases, a quantitative characterization of temporal patterns in Rwandan malaria diagnosis is of particular interest given the increasing unpredictability of rainfall patterns and the need for novel preventative interventions.[3]

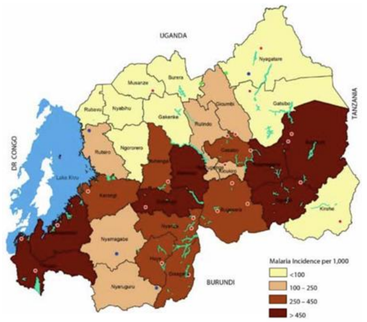
Methods

- Collection of Monthly Hospital Reporting Forms at Kibagabaga Hospital, Kigali, Rwanda (June 2024)
- Building digital database of Emergency Room case data from 2021-2024 (July-August 2024)
- Regression analysis of retrospective malaria case data with rainfall data from Rwanda Meteorology Agency (future)
- Propose climate change-based malaria prevention measures (future)

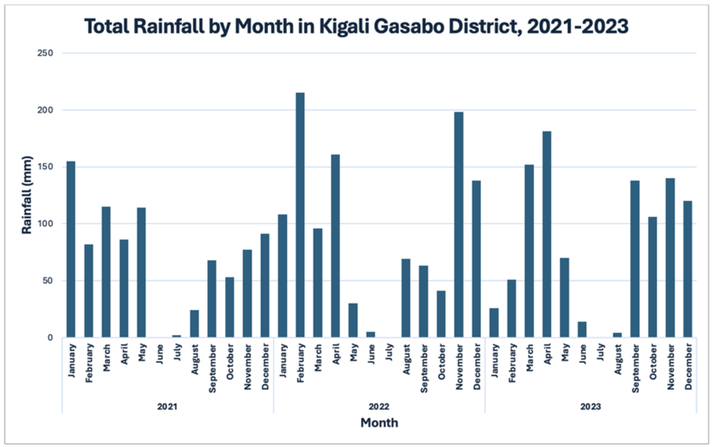
Early Results

Pending correlational analysis of Kibagabaga District Hospital malaria case data and rainfall averages, malaria cases were characterized and totaled in the below graphs, separated by rainy and dry seasons. The two traditional rainy seasons in Rwanda are March-May and September-December. Total rainfall data for Gasabo District, Kigali for corresponding years was also collected and tallied.





Malaria Risk Stratification, Rwanda, 2019
(Image: Rwanda Malaria Strategic Plan, 2020-2024)



Conclusions

Initial data collection shows a clear seasonality to rainfall trends from 2021-2023. However, malaria case presentation at Kibagabaga Hospital is seasonally erratic. There appears to be more severe cases in the rainy season, and the few deaths all took place in the rainy season. Further correlational analysis will need to be performed in order to determine statistically significant association between rainfall and malaria case presentation.

Future Directions

- Complete further data collection through 2024 via the Monthly District Hospital Reporting Form
- Perform regression analysis to correlate monthly malaria cases with rainfall. Determine trends in seasonality and varying case prevalence and severity.
- Develop a plan for extending the project to additional district hospitals in Rwanda.

References

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Acknowledgments

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