

Analysis Tutorial Prospectus

1. Title

Spatiotemporal dynamics and seasonal trends of dengue cases and deaths in Bangladesh (2020–2023)

2. Research Question(s)

How have dengue case numbers and related deaths varied across districts in Bangladesh from 2020 to 2023? What seasonal trends can be observed in monthly and weekly dengue case counts and fatalities? Are there notable spatial hotspots or shifts in dengue outbreaks during this period?

3. Objective(s)

- i. Generate a choropleth map using R to visualize the geographic distribution of dengue cases and deaths across districts, helping to identify outbreak hotspots and spatial disparities.
- ii. Monthly and weekly time series plots to examine seasonal fluctuations (using ggplot2 and lubridate)
- iii. Heatmaps to highlight periods of peak transmission and compare Case Fatality Rate (CFR) plots to assess mortality risks over time
- iv. Perform age-specific comparisons of dengue cases and deaths, using Stacked bar charts or grouped bar plots to show distribution of cases and deaths by age group
- v. Assess gender-specific differences in both dengue incidence and fatality using grouped bar plots or side-by-side comparisons of male vs. female cases and deaths and Chi-squared tests to evaluate statistical significance of gender-based differences
- vi. Conduct correlation analysis between cases and deaths across years and districts to identify potential high-risk areas and time periods.

4. Approach

I will use R to clean and analyze dengue case and death data from 2020 to 2023. The readxl, dplyr, tidyverse, and lubridate packages will be used for data wrangling and formatting. Spatial patterns will be analyzed using sf and tmap to create choropleth maps, showing the geographic distribution of dengue cases and deaths. Temporal trends will be visualized using ggplot2 to create line plots, bar graphs, and time series plots by month and week. To assess statistical significance of gender-based differences in cases and deaths, I will apply

Chi-squared tests using `chisq.test()` and use `cor()` to perform and visualize correlation analysis between cases and deaths.

5. Selected References

1. Salje, H., et al. (2019). *Nationally representative serostudy of dengue in Bangladesh. The Lancet Global Health*, 7(3), e330-e339. [https://doi.org/10.1016/S2214-109X\(18\)30403-0](https://doi.org/10.1016/S2214-109X(18)30403-0)
2. Sharmin, S., et al. (2015). *Seasonality of dengue in Bangladesh: a time series analysis. PLOS Neglected Tropical Diseases*, 9(10), e0004110. <https://doi.org/10.1371/journal.pntd.0004110>
3. Karim, M. N., et al. (2021). *Epidemiological analysis of the 2019 dengue outbreak in Bangladesh. Tropical Medicine and Health*, 49(1), 1–9. <https://doi.org/10.1186/s41182-021-00341-z>
4. Morin, C. W., Comrie, A. C., & Ernst, K. (2013). *Climate and dengue transmission: evidence and implications. Environmental Health Perspectives*, 121(11-12), 1264–1272. <https://doi.org/10.1289/ehp.1306556>
5. Hossain, M. S., et al. (2023). *Risk factors and spatial distribution of dengue cases in Bangladesh. Scientific Reports*, 13, 11340. <https://doi.org/10.1038/s41598-023-38573-7>