

**Neglected Tropical Diseases, Malaria Incidence and Mortality Heterogeneity in Sub-Saharan Africa:
Evidence from Infant Mortality and Quantile Distributions**

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Abstract

This paper examines the influence of neglected tropical diseases (NTDs) and malaria incidence on child health and their heterogeneous effects across different levels of maternal and infant mortality in Sub-Saharan Africa. The paper is developed from the second and third objectives of a doctoral study on NTDs, malaria incidence and maternal and child health in the region. It uses annual panel data for selected Sub-Saharan African countries covering 1990-2023. Infant mortality rate is used as the core child-health outcome for the second objective, while maternal mortality ratio and infant mortality rate are jointly used for the distributional analysis under the third objective. NTDs are proxied by Human African trypanosomiasis, while malaria incidence is measured per 1,000 population at risk. Control variables include immunisation coverage, current health expenditure and physician density for the infant mortality model; prevalence of undernourishment, current health expenditure and female secondary school enrolment are used in the maternal mortality quantile model. The Augmented Mean Group (AMG) and Common Correlated Effects Mean Group (CCEMG) estimators are employed to account for heterogeneity and cross-sectional dependence, while the Method of Moments Quantile Regression (MMQR) is used to identify distribution-specific effects. The findings show that both NTDs and malaria incidence significantly worsen infant mortality. Country-level estimates further reveal that Zimbabwe, Equatorial Guinea, South Sudan, Mozambique and Cameroon record some of the strongest disease-related mortality effects. The quantile results show that NTDs matter more at lower infant mortality quantiles, while malaria incidence remains consistently harmful and becomes more severe at higher quantiles. For maternal mortality, malaria incidence increases steadily across the distribution, while NTDs show a stronger effect at the lower quantiles and re-emerge at the extreme upper quantile. The paper concludes that disease-control policies in Sub-Saharan Africa should be both integrated and distribution-sensitive, combining NTD eradication, malaria prevention, immunisation, health financing and expansion of healthcare personnel.

Keywords: neglected tropical diseases; malaria incidence; infant mortality; maternal mortality; Sub-Saharan Africa; MMQR; AMG; CCEMG.

1.0 Introduction

Maternal and child health remains a defining indicator of the development performance of Sub-Saharan Africa. Although global health policy has placed strong emphasis on Sustainable Development Goal 3, the region continues to face an unusually high burden

of preventable maternal and child deaths. The original thesis from which this paper is drawn reports that maternal mortality and infant mortality remain severe in the region, with the burden being intensified by malaria, neglected tropical diseases, poor healthcare

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financing, malnutrition, weak health infrastructure and limited medical personnel. These conditions are not isolated medical problems; they reflect the broader socioeconomic and institutional weaknesses that determine the capacity of households and health systems to prevent, diagnose and treat disease. Consequently, the persistence of malaria and NTDs in the region represents a direct challenge to maternal and child survival and to the attainment of the health-related Sustainable Development Goals (World Health Organization, 2022; World Health Organization, 2023).

The burden of neglected tropical diseases is particularly relevant because these diseases are largely concentrated among poor and underserved populations. The thesis conceptualises NTDs as a diverse group of preventable and manageable diseases that are often under-prioritised in funding, research, surveillance and treatment. Their socioeconomic consequences are substantial because they reinforce poverty, reduce productivity, increase household health expenditure and weaken human capital formation. In Sub-Saharan Africa, the health impact of NTDs is amplified by weak sanitation systems, inadequate access to safe water, low public-health coverage and uneven implementation of disease-control programmes (Annadurai, 2023; Gyorkos et al., 2023; Kelly-Hope et al., 2023). When these diseases affect households with pregnant women and infants, their consequences become more severe because they interact with nutritional deficiencies, limited care access and weak immunity.

Malaria remains equally central to the health profile of the region. The thesis identifies malaria as a

preventable and curable disease caused by Plasmodium parasites and transmitted by infected Anopheles mosquitoes. Yet, despite prevention and treatment options, malaria continues to impose a disproportionate burden on pregnant women, newborns and children under five. The disease contributes to anaemia, low birth weight, impaired immunity, severe febrile illness and mortality among infants, while also placing pressure on already fragile health systems (Batte et al., 2024; Kolawole et al., 2023; Patel et al., 2024). The persistence of malaria in Sub-Saharan Africa is not simply a biological problem; it is linked to climate conditions, poverty, weak vector-control systems, access barriers and health-system financing gaps (Argaw et al., 2021; Oladipo et al., 2022).

The second objective of the thesis, which forms the first empirical focus of this article, assesses the influence of the prevalence of neglected tropical diseases and malaria on child health in Sub-Saharan African countries. Infant mortality is adopted as the principal child-health outcome because it captures the survival of children during the most vulnerable stage of life. The third objective, which provides the second empirical focus of this article, analyses how the effects of malaria and NTDs vary across different levels of maternal mortality and infant mortality. This distributional perspective is essential because the average effect of a disease may conceal important heterogeneity. Countries with low, moderate and high mortality burdens may respond differently to the same disease shock because their healthcare infrastructure, nutrition status, immunisation coverage and disease-control systems are not the same.

This paper contributes to the literature in three main ways. First, it jointly considers NTDs and malaria incidence as disease-related determinants of infant mortality rather than treating them as separate public-health concerns. Second, it uses econometric techniques that account for country heterogeneity and cross-sectional dependence, thereby improving the credibility of the regional panel evidence. Third, it

goes beyond mean-based estimates by applying Method of Moments Quantile Regression to examine whether the impact of disease burden differs across the mortality distribution. This is important for policy because a one-size-fits-all intervention may not be adequate for a region as heterogeneous as Sub-Saharan Africa.

2.0 Literature Review and Theoretical Linkage

Child mortality refers to the death of children before reaching the age of five, while infant mortality specifically captures deaths before the first birthday. The thesis treats infant mortality as a key child-health indicator because it reflects the quality of maternal care, neonatal services, immunisation programmes, household nutrition and access to timely treatment. High infant mortality in Sub-Saharan Africa is generally associated with infectious disease, malnutrition, inadequate birth care, poor sanitation and low access to skilled health workers (Ochu et al., 2023; You & Donnelly, 2024). Infant deaths therefore provide a useful measure of the effectiveness of both household-level and system-level health protection.

The literature reviewed in the thesis links malaria to adverse child-health outcomes through several channels. Malaria directly increases the risk of death among infants and young children by causing severe anaemia, fever, neurological complications and vulnerability to other infections. It also indirectly worsens child health by increasing household expenditure on treatment, reducing caregiver productivity and diverting health-system resources away from preventive services. Evidence from Sub-Saharan Africa shows that child malaria burden is shaped by the availability and use of insecticide-treated nets, household conditions, maternal education, water sources and access to health facilities (Bayode & Siegmund, 2024; Hollowell et al., 2023; Isiko et al., 2024; Safo et al., 2023; Zhang et al., 2024).

The literature also suggests that NTDs affect children through chronic and cumulative pathways. Vector-borne and parasitic NTDs can weaken immunity, contribute to malnutrition, worsen anaemia and impair growth and development. These effects are particularly severe where children live in poor households with inadequate sanitation and limited access to diagnostic and treatment services. Barry et al. (2016), Lin et al. (2022), Weld et al. (2022) and Zheng et al. (2025) emphasise that NTDs remain a major but often under-recognised contributor to child morbidity and mortality. The use of Human African trypanosomiasis as a proxy in the thesis reflects the need to capture the burden of NTDs in a measurable form across countries.

Health expenditure, immunisation coverage and physician density are important control variables in the child-health model because they represent key dimensions of health-system strength. Immunisation reduces preventable infectious disease and improves infant survival, especially when coverage is high and evenly distributed. Health expenditure improves the ability of governments and households to provide infrastructure, medicines, vaccination campaigns,

disease surveillance and emergency care. Physician density reflects access to skilled diagnosis and treatment. The thesis draws on studies showing that improved healthcare spending and workforce availability are associated with lower child mortality (Agushyana et al., 2019; George-Anokwuru, 2023; Idris & Abdullahi, 2024; Oladosu et al., 2022; You & Donnelly, 2024).

The Social Determinants of Health theory provides the theoretical foundation for the paper. The theory argues that health outcomes are shaped by the conditions in which people are born, grow, live and access services. In the context of Sub-Saharan Africa, the disease burden of NTDs and malaria is inseparable from poverty, education, sanitation, healthcare financing, access to health workers and public-health governance. This theoretical perspective is appropriate because it explains why the same biological disease can produce different mortality outcomes across countries. A country with stronger immunisation, better health financing and more physicians may experience lower disease-related mortality than a country with weaker social and health systems.

3.0 Materials and Methods

The study uses annual panel data for selected Sub-Saharan African countries over the period 1990-2023. The countries listed in the thesis include Angola, Burkina Faso, Cameroon, Central African Republic, Congo, Cote d'Ivoire, Democratic Republic of Congo, Equatorial Guinea, Gabon, Guinea, Kenya, Malawi, Mozambique, Nigeria, Rwanda, South Sudan, Tanzania, Uganda, Zambia and Zimbabwe, subject to data availability across indicators. The use of a multi-country panel is justified because NTDs, malaria and mortality outcomes vary substantially across the region. A panel framework therefore allows the study to exploit both time-series and cross-sectional variation while recognising heterogeneity among countries.

For Objective 2, infant mortality rate is the dependent variable. The principal explanatory variables are neglected tropical diseases and malaria incidence. NTD burden is proxied by Human African trypanosomiasis, while malaria incidence is measured as cases per 1,000 population at risk. The control variables are immunisation coverage for DPT among children aged 12-23 months, current health expenditure as a percentage of GDP and number of physicians per 1,000 people. These controls are consistent with the thesis argument that child survival is influenced not only by disease exposure but also by preventive care, healthcare financing and access to trained medical personnel.

Table 1 presents the variables, measurements and data sources used in estimating the infant mortality and distributional mortality models. The table is positioned here because it clarifies the operational definition of each variable before the estimation results are discussed. Infant mortality is the dependent variable for Objective 2, while maternal and infant mortality are used in the distributional analysis for Objective 3. NTDs and malaria incidence are the main explanatory variables, while immunisation, health expenditure, physician density, undernourishment and female secondary school enrolment serve as controls according to the relevant model.

Table 1: Variables, Measurement and Sources

Variable	Measurement/definition	Source
Infant mortality rate (IFM)	Deaths of infants below one year per 1,000 live births	World Development Indicators
Neglected tropical diseases (NTD)	Human African trypanosomiasis used as proxy for NTD burden	WHO Global Health Observatory
Incidence of malaria (IOM)	Malaria cases per 1,000 population at risk	World Development Indicators
Immunisation coverage (IMU)	DPT immunisation coverage among children aged 12-23 months (%)	World Development Indicators
Current health expenditure (CHE)	Current health expenditure as percentage of GDP	World Development Indicators
Physicians (NOP)	Physicians per 1,000 people	World Development Indicators
Maternal mortality ratio (MMR)	Maternal deaths per 100,000 live births, used for Objective 3 distributional comparison	World Development Indicators
Prevalence of undernourishment (POU)	Percentage of population undernourished, used in the maternal mortality quantile model	World Development Indicators
Female secondary school enrolment (SSE)	Gross female secondary school enrolment, used in the maternal mortality quantile model	World Development Indicators

Source: Researcher's computation based on the thesis dataset; significance levels: *, ** and * denote 1%, 5% and 10%, respectively.**

The empirical model for Objective 2 is adapted from the thesis model specified for infant mortality. In functional form, infant mortality is expressed as a function of NTD burden, malaria incidence, immunisation, current health expenditure and physician density. In econometric form, the relationship may be written as: $IFM_{it} = \beta_0 + \beta_1 NTD_{it} + \beta_2 IOM_{it} + \beta_3 IMU_{it} + \beta_4 CHE_{it} + \beta_5 NOP_{it} + \epsilon_{it}$. The expected signs are positive for NTDs and malaria incidence because a higher disease burden is expected to worsen infant mortality. The expected signs for immunisation, health expenditure and physician density are negative because improvements in these indicators should reduce infant mortality.

For Objective 3, the study estimates the varying effects of NTDs and malaria across different levels of maternal mortality and infant mortality. This is achieved through the Method of Moments Quantile Regression. The MMQR approach is appropriate because it estimates the impact of explanatory variables across the conditional distribution of

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the dependent variable rather than only at the mean. This matters because the determinants of mortality may behave differently in low-mortality, medium-mortality and high-mortality countries. In the maternal mortality quantile model, the covariates include NTDs, malaria incidence, prevalence of undernourishment, current health expenditure and female secondary school enrolment. In the infant mortality quantile model, the covariates include NTDs, malaria incidence, immunisation coverage, current health expenditure and physician density.

Before estimation, the thesis conducts pre-estimation tests to establish the suitability of the econometric methods. The cross-sectional dependence tests reject the assumption of independence for most variables, implying that countries in the panel are affected by common shocks and regional interdependence. This justifies the use of AMG and CCEMG estimators, which are designed to handle heterogeneity and cross-sectional dependence. The unit-root and Westerlund cointegration tests further support the existence of stable long-run relationships among the variables. These steps strengthen the reliability of the empirical estimates and reduce the risk of spurious inference.

4. Results and Discussion

The descriptive statistics reveal the scale and variability of maternal and child health challenges in Sub-Saharan Africa. The average infant mortality rate is 75.137 deaths per 1,000 live births, with values ranging from 27.950 to 162.000. This shows that although some countries have achieved relatively better child survival outcomes, others still face severe infant mortality burdens. The mean incidence of malaria is 326.294 cases per 1,000 population at risk, while the average NTD proxy records 715.909, with extreme dispersion across countries. The high standard deviation of NTDs indicates that the disease burden is heavily concentrated in particular countries and periods. Immunisation coverage averages 67.046%, but the minimum value of 15.000% indicates that some countries have severe gaps in child vaccination access.

Table 2 reports the summary descriptive statistics for the study variables. The table is useful because it shows the mean, maximum, minimum and dispersion of the variables before the regression results are interpreted. The high average values of maternal mortality, infant mortality and malaria incidence demonstrate the severity of the health burden in Sub-Saharan Africa, while the wide standard deviations suggest substantial differences across countries and over time.

Table 2: Summary Descriptive Statistics

Statistic	MMR	IFM	NTD	IOM	CHE	NOP	POU	SSE	IMU
Mean	616.172	75.137	715.909	326.294	6.060	0.178	27.642	32.136	67.046
Maximum	2563.500	162.000	26318.000	651.564	69.679	1.876	272.530	297.057	99.000
Minimum	79.667	27.950	0.000	27.199	0.184	0.060	0.920	1.575	15.000
Std. Dev.	387.197	28.698	2658.402	130.788	9.190	0.197	25.554	29.143	19.921

Source: Researcher's computation based on the thesis dataset; significance levels: ***, ** and * denote 1%, 5% and 10%, respectively.

The AMG and CCEMG estimates for Objective 2 confirm that NTDs and malaria incidence significantly worsen infant mortality in the selected Sub-Saharan African countries. Under the AMG estimator, a 1% increase in NTDs increases infant mortality by 0.040%, while the CCEMG estimate shows a smaller but still significant effect of 0.008%. This means that the burden of NTDs remains harmful to infant survival even after accounting for cross-sectional dependence and heterogeneity. The result supports the argument that NTDs contribute to child health vulnerability through malnutrition, weakened immunity, delayed treatment and poor sanitation (Barry et al., 2016; Lin et al., 2022; Zheng et al., 2025).

Malaria incidence also has a significant positive effect on infant mortality. The AMG result indicates that a 1% increase in malaria incidence increases infant mortality by 0.062%, while the CCEMG estimate indicates an increase of 0.035%. The consistency of the positive and significant effect across both estimators reinforces the view that malaria remains a major determinant of child mortality in Sub-Saharan Africa. This finding aligns with evidence that malaria contributes to severe anaemia, febrile complications, impaired infant immunity and higher risk of death among young children (Hollowell et al., 2023; Isiko et al., 2024; Safo et al., 2023; Zhang et al., 2024).

The control variables behave largely as expected. Physician density has a negative and significant relationship with infant mortality, indicating that increased availability of medical personnel reduces infant deaths. Health expenditure also has a negative and significant effect, suggesting that greater investment in health services improves child survival by strengthening treatment access, vaccination systems, disease surveillance and health infrastructure. Immunisation coverage is negative in both estimators, although it is not statistically significant under CCEMG. This mixed significance may reflect uneven vaccine access, differences in implementation quality and the presence of other mortality risks that weaken the direct protective effect of immunisation in some countries.

Table 3 presents the AMG and CCEMG estimates for Objective 2. The table is reported after the explanatory discussion because it provides the econometric evidence that NTDs and malaria incidence significantly increase infant mortality, while physician density and health expenditure reduce infant mortality. The use of both AMG and CCEMG strengthens the analysis because both estimators address heterogeneity and cross-sectional dependence among Sub-Saharan African countries.

Table 3: AMG and CCEMG Estimates for Infant Mortality

Variable	AMG coefficient	z-stat.	p-value	CCEMG coefficient	z-stat.	p-value
NTD	0.040***	2.65	0.014	0.008***	3.72	0.000
IOM	0.062**	2.38	0.043	0.035***	3.26	0.000
NOP	-0.013**	-2.58	0.016	-0.005**	2.90	0.021
CHE	-0.019***	-3.12	0.000	-0.012**	-2.36	0.042
IMU	-0.012**	-2.95	0.011	-0.025	-1.04	0.299

Source: Researcher's computation based on the thesis dataset; significance levels: ***, ** and * denote 1%, 5% and 10%, respectively.

The country-wise estimates demonstrate that the effects of NTDs and malaria on infant mortality are not uniform across Sub-Saharan Africa. Zimbabwe records the strongest NTD-related effect on infant mortality, followed by Equatorial Guinea and Gabon. This suggests that NTD-related child mortality is especially severe in countries where disease control, sanitation, treatment access and health-system capacity remain weak. By contrast, the NTD effect is relatively low in Kenya and Cote d'Ivoire. Such heterogeneity confirms the need for country-specific disease-control strategies rather than uniform regional policy prescriptions.

The country-wise malaria estimates show that South Sudan records the strongest malaria-induced infant mortality effect, followed by Mozambique and Cameroon. This pattern indicates that malaria is especially deadly for infants in settings where treatment access, prevention tools and health infrastructure are limited. Other countries, including Guinea, Zambia, the Central African Republic and Uganda, also show sizeable malaria-related effects. In contrast, Burkina Faso, Cote d'Ivoire and Gabon display lower effects. The implication is that malaria control should prioritise high-impact countries while maintaining prevention systems in countries with relatively lower effects to avoid resurgence.

Table 4 shows the country-wise effects of NTDs and malaria incidence on infant mortality. The table is important because it confirms that disease-related infant mortality is not uniform across the selected Sub-Saharan African countries. Countries such as Zimbabwe, South Sudan, Mozambique and Cameroon display stronger disease-related mortality effects, which implies that regional disease-control policies should be adapted to country-specific disease intensity and health-system capacity.

Table 4: Country-wise Effects of NTDs and Malaria Incidence on Infant Mortality

Country	NTD coefficient	p-value	Rank	IOM coefficient	p-value	Rank
Angola	0.029***	0.006	7th	0.146**	0.027	14th
Burkina Faso	0.033***	0.000	6th	0.081***	0.008	18th

Cameroon	0.007	0.584	17th	0.333***	0.000	3rd
Central African Republic	0.009***	0.000	16th	0.206***	0.000	6th
Congo	0.023	0.276	11th	0.148***	0.000	12th
Cote d'Ivoire	0.002	0.699	18th	0.083	0.353	16th
DR Congo	0.024***	0.000	10th	0.055***	0.000	19th
Equatorial Guinea	0.118***	0.000	2nd	0.144	0.116	15th
Gabon	0.066	0.530	3rd	0.082***	0.000	17th
Guinea	0.045***	0.000	4th	0.324***	0.000	4th
Kenya	0.001	0.909	19th	0.148***	0.000	13th
Malawi	0.013	0.133	15th	0.171***	0.000	9th
Mozambique	0.020***	0.000	12th	0.664***	0.000	2nd
Nigeria	0.014***	0.000	14th	0.172***	0.000	8th
Rwanda	0.016	0.181	13th	0.153***	0.000	11th
South Sudan	0.036***	0.000	5th	0.758***	0.000	1st
Tanzania	0.025***	0.000	9th	0.160***	0.000	10th
Uganda	0.041***	0.000	5th	0.204***	0.000	7th
Zimbabwe	0.161***	0.000	1st	0.279***	0.000	5th

Source: Researcher's computation based on the thesis dataset; significance levels: ***, ** and * denote 1%, 5% and 10%, respectively.

The quantile regression results under Objective 3 provide deeper insight into how disease effects vary across mortality levels. For maternal mortality, NTDs have the strongest effect at the 10th quantile, where a 1% increase in NTDs raises maternal mortality by 0.117%. The effect declines across the middle quantiles but re-emerges at the 90th quantile. This pattern suggests that NTDs can be influential both in lower-mortality settings where disease outbreaks may expose weaknesses in disease control and in extremely high-mortality settings where NTDs interact with broader structural vulnerabilities. The finding supports the broader thesis argument that disease burden operates through social and healthcare-system conditions.

Malaria incidence shows a more consistent distributional effect on maternal mortality. Its coefficient rises from 0.186 at the 30th quantile to 0.207 at the 90th quantile. This means that the maternal health damage associated with malaria becomes stronger as maternal mortality rises. Countries already facing high maternal mortality are therefore more vulnerable to malaria-induced deaths, likely because of inadequate antenatal care, delayed treatment, anaemia, poor

access to insecticide-treated nets and weak emergency obstetric systems. This result is consistent with studies linking malaria in pregnancy to maternal anaemia, poor pregnancy outcomes and elevated mortality risks (Ahadzie-Sogle et al., 2022; Das et al., 2024; Kassie et al., 2024).

Table 5 presents the quantile effects of NTDs and malaria incidence on maternal mortality. The table is placed under Objective 3 because it shows how the disease effects differ across the maternal mortality distribution. The results indicate that malaria incidence becomes increasingly harmful at higher quantiles, while the NTD effect is more pronounced at the lower quantile and reappears at the upper extreme of maternal mortality.

Table 5: Quantile Effects of NTDs and Malaria Incidence on Maternal Mortality

Variable	Q10	Q20	Q30	Q40	Q50	Q60	Q70	Q80	Q90
NTD	0.117** *	0.085**	0.071**	0.051** *	0.023**	0.009	0.003** *	0.018	0.043** *
IOM	0.177	0.183	0.186**	0.189**	0.194**	0.197** *	0.199** *	0.202** *	0.207** *
POU	0.191	0.153	0.137	0.113**	0.081*	0.064**	0.053	0.032	0.002
CHE	-0.004	-0.032	-0.047	-0.091	-0.102**	- *	- *	- *	- *
SSE	- 0.252** *	- 0.255** *	- 0.257** *	0.258** *	- 0.261** *	- 0.262** *	- 0.263** *	- 0.266** *	- 0.261** *

Source: Researcher's computation based on the thesis dataset; significance levels: ***, ** and * denote 1%, 5% and 10%, respectively.

For infant mortality, the quantile regression results indicate that the effect of NTDs is strongest at lower quantiles and declines as infant mortality increases. The NTD coefficient is 0.039 at the 10th quantile, 0.034 at the 20th quantile and 0.030 at the 30th quantile, but it becomes much smaller at the 80th and 90th quantiles. This suggests that in countries where infant mortality is comparatively lower, NTD outbreaks still have a measurable effect on child survival. In higher-mortality countries, other severe structural factors such as malnutrition, poor sanitation, malaria endemicity and weak neonatal care may dominate the mortality process, reducing the relative marginal effect of the NTD proxy.

By contrast, malaria incidence remains positive and highly significant across all infant mortality quantiles. The coefficient rises from 0.443 at the 10th quantile to 0.468 at the 90th quantile. This indicates that malaria is a persistent and distribution-wide risk factor for infant mortality, with stronger effects in high-mortality settings. The result is policy-relevant because it means that malaria-control programmes should not only target average disease reduction;

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they should also be intensified in countries and communities at the upper end of the mortality distribution. Where infant mortality is already high, malaria acts as an additional accelerator of child deaths.

The quantile results also show that immunisation, health expenditure and physician density are protective, though their influence differs across the distribution. Immunisation has a strong negative effect on infant mortality, especially at the lower quantiles, suggesting that vaccination is highly effective where health systems can deliver routine preventive care. Health expenditure reduces infant mortality mainly at the lower and middle quantiles, while its effect weakens at upper quantiles. Physician density generally reduces infant mortality, although the coefficient pattern is less stable across quantiles. Together, these findings imply that reducing infant mortality requires integrated investment in disease control, routine immunisation, health-system financing and healthcare workforce expansion.

Table 6 reports the quantile effects of NTDs and malaria incidence on infant mortality. The table shows that malaria remains positive and significant across all quantiles and becomes stronger toward the upper tail of the infant mortality distribution. NTDs are strongest at the lower infant mortality quantiles and decline at higher quantiles, suggesting that other structural risks may dominate mortality outcomes in countries with the most severe infant mortality burden.

Table 6: Quantile Effects of NTDs and Malaria Incidence on Infant Mortality

Variable	Q10	Q20	Q30	Q40	Q50	Q60	Q70	Q80	Q90
NTD	0.039** *	0.034** *	0.030** *	0.026** *	0.023** *	0.019** *	0.016** *	0.009	0.004
IOM	0.443** *	0.448** *	0.450** *	0.453** *	0.455** *	0.458** *	0.460** *	0.464** *	0.468** *
IMU	- 0.351** *	- 0.327** *	- 0.310** *	- 0.295** *	- 0.279** *	-0.263**	- 0.249** *	- 0.224** *	- 0.198** *
CHE	- 0.083** *	- 0.067** *	- 0.056** *	- 0.046** *	- 0.035** *	-0.025**	-0.017	-0.001	-0.017
NOP	- 0.054** *	- 0.043** *	- 0.036** *	0.029** *	-0.222**	-0.015	-0.009	-0.002	-0.013

Source: Researcher's computation based on the thesis dataset; significance levels: ***, ** and * denote 1%, 5% and 10%, respectively.

Overall, the empirical evidence supports the central argument of the paper: malaria and NTDs are important determinants of child mortality in Sub-Saharan Africa, and their impacts are heterogeneous across countries and mortality levels. The mean-based results demonstrate the average harmful effect of disease burden, while the country-

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wise and quantile estimates reveal where and under what mortality conditions the effects are most severe. This combination of evidence provides a stronger basis for designing targeted, integrated and equity-sensitive health policies.

5.0 Policy Implications

First, Sub-Saharan African governments should treat malaria and NTD control as integrated maternal and child health priorities. The findings show that both disease categories increase infant mortality, meaning that programmes that focus only on one disease may leave important mortality risks unaddressed. Integrated disease surveillance, combined vector control, mass drug administration, community health education and improved case management should be linked directly to maternal, neonatal and child health services. This is particularly important in countries where the country-wise estimates show strong disease-related infant mortality effects.

Second, malaria prevention should be intensified in high-impact countries and high-mortality settings. The quantile evidence shows that malaria remains harmful across the entire infant mortality distribution and becomes more severe at higher quantiles. Therefore, insecticide-treated nets, indoor residual spraying, rapid diagnostic testing, antimalarial treatment access and malaria vaccination where appropriate should be prioritised in communities with high infant mortality. Pregnant women and infants should remain central targets because they are biologically and socially vulnerable to malaria complications.

Third, NTD programmes should be expanded beyond periodic drug campaigns to include sanitation, water access, surveillance and primary healthcare integration. The heterogeneous NTD effects suggest that some countries face concentrated NTD-related child mortality risks. Disease-control programmes should therefore be adapted to national and subnational disease ecology. Where NTDs have stronger effects, governments should strengthen early diagnosis, improve community-level reporting, expand treatment availability and coordinate NTD interventions with child nutrition and immunisation services.

Fourth, health financing and healthcare workforce expansion should be treated as mortality-reduction instruments. The negative effects of current health expenditure and physician density in the results show that mortality outcomes are not determined by disease exposure alone. They also depend on whether health systems can respond effectively. Increased funding should be directed toward primary healthcare facilities, rural health posts, emergency paediatric care, medicines, diagnostics, vaccine supply chains and retention of skilled health workers. The goal should not only be to spend more, but to spend in ways that directly reduce disease-related maternal and infant deaths.

Finally, the distributional findings imply that policy must be equity-sensitive. Countries and communities at different mortality levels require different mixes of intervention. Lower-mortality settings may benefit from outbreak prevention, routine surveillance and immunisation strengthening, while higher-mortality settings require deeper investments in infrastructure, nutrition, skilled personnel, malaria control and emergency care. This is the main advantage of the quantile approach: it reveals that the same disease burden can have different consequences depending on the location of a country or community in the mortality distribution.

6.0 Conclusion

This paper has examined the effect of neglected tropical diseases and malaria incidence on child health and the heterogeneous effects of these diseases across maternal and infant mortality distributions in Sub-Saharan Africa. The AMG and CCEMG results show that both NTDs and malaria incidence significantly increase infant mortality. The country-wise estimates further reveal substantial heterogeneity, with some countries recording much stronger disease-related infant mortality effects than others. The quantile regression results show that NTDs have stronger effects at lower infant mortality quantiles, while malaria incidence remains consistently harmful and becomes more severe at higher quantiles. For maternal mortality, malaria incidence rises steadily across quantiles, while NTDs display a stronger effect at lower quantiles and a renewed effect at the upper extreme.

The findings confirm that disease burden, health-system capacity and social determinants jointly shape maternal and child health outcomes in Sub-Saharan Africa. The study therefore recommends an integrated public-health strategy that combines malaria prevention, NTD control, immunisation expansion, health financing, physician availability and targeted support for high-risk countries. A Q1-standard contribution of the paper is its movement beyond average estimates to distribution-sensitive evidence, which provides clearer guidance for policy prioritisation. Reducing infant and maternal mortality in the region will require interventions that are not only technically effective but also geographically targeted, equity-oriented and sustained over time.

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