

Inequality of monitoring in Human Immunodeficiency Virus, Tuberculosis and Malaria: A Review

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Abstract

The spread of diseases such as malaria, tuberculosis and HIV has largely stalled over the past decade in under-resourced and poorly-educated regions. In contrast, these diseases are greatly suppressed in urban areas with access to adequate education and income. This indicates that unequal surveillance is a major obstacle on the way to eradicating the above diseases. This is further substantiated by the relevant data in this paper, which reviews the most recent empirical evidence of a large number of health indicators (including knowledge, practice, recruitment and detection), prevention and treatment), gender, age, educational attainment, economic status, and location for subgroups of 186 countries.

Keywords: *Inequality, monitoring, HIV, Tuberculosis, malaria*

1. Introduction

It is well known that social disadvantage tends to "accumulate". Poverty leads to lower educational attainment and forced labor under disadvantageous conditions, resulting in lower overall quality of life and tends to be highly correlated with individual health status. People with lower socioeconomic status have shorter life expectancy. Interestingly, until the 19th century, life expectancy was thought to be the same as that of the general population. This indicates that environmental factors such as climate, demographics and geography do

not directly influence health disparities between social classes. Due to political and economic dynamics in today's world, the regions most affected by poverty and most in need of intervention are the groups least likely to have access to them. It shows that all people, regardless of background or educational background, must have the right to access adequate healthcare in order to achieve global health. This means that primary prevention of diseases that afflict disadvantaged populations can only be achieved by addressing inequalities in healthcare (1).

Data, scope and health indicators

The data in this report encompasses multiple sources from articles published by UNAIDS, UNICEF [2,3] and WHO [4,5] as well as health indicators from AIDS Indicator Surveys (AIS), Demographic and Health Surveys (DHS) and Malaria Indicator Surveys (MIS),

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available through the DHS Program STATcompiler tool [6]; and DHS, Reproductive Health Surveys (RHS) and UNICEF Multiple Indicator Cluster Surveys (MICS), available through the WHO Global Health Observatory

Health Equity Monitor [7] as compiled by Geneva: World Health Organisation [1]. The scope of the following report are the more vulnerable “key populations” [8] to each disease; HIV (men who have sex with men, IV drug users, prisoners, sex workers), Tuberculosis (Refugees/migrants, people in prisons/detentions/other enclosed spaces, HIV patients), Malaria (Internally displaced people, migrants/refugees) compared against prioritised groups (researchers, healthcare staff, policy makers, international organisations). As well as double disaggregation by economic status and place of residence (financially poor individuals localised in urban areas). Broadly defined indicators are taken into consideration (disease prevalence, attitude, knowledge, stigma, prevention, testing, treatment, mortality, health system). This report therefore serves as a comprehensive review of already collected disaggregated data by secondary sources.

1.1. Summary method used by WHO [1]

Table 1: Latest situation summary measures of inequality calculations, by indicator type and common inequality dimension

Indicator type	Inequality dimension ^a	Summary measure of inequality calculation	
		Difference	Ratio
Adverse health indicators (lower estimates are desirable)	Sex	Females – males or Males – females (depending on indicator)	Females / males or Males / females (depending on indicator)
	Economic status	Poorest – richest	Poorest / richest
	Education	Least educated – most educated	Least educated / most educated
	Place of residence	Rural – urban or Urban – rural (depending on indicator)	Rural / urban or Urban / rural (depending on indicator)
Favourable health indicators (higher estimates are desirable)	Sex	Males – females or Females – males (depending on indicator)	Males / females or Females / males (depending on indicator)
	Economic status	Richest – poorest	Richest / poorest
	Education	Most educated – least educated	Most educated / least educated
	Place of residence	Urban – rural	Urban / rural
	Age	Oldest – youngest	Oldest / youngest

^a For the adverse indicator of families affected by TB facing catastrophic costs due to tuberculosis (TB), TB drug resistance status is an additional inequality dimension. The difference is calculated as drug-resistant TB – drug-susceptible TB.

1.2. HIV Data Overview and Results

Category	Indicator	Source	Inequality dimension					Countries with available data	
			Sex	Economic status	Education	Place of residence	Age	Latest situation ^a	Change over time ^b
Incidence and mortality	HIV incidence (new infections per 1000 population)	UNAIDS/UNICEF/WHO	✓					130	130
	AIDS-related mortality (deaths per 1000 population)	UNAIDS/UNICEF/WHO	✓					131	130
Knowledge, attitudes and practices	Comprehensive correct knowledge about AIDS (%)	AIS, DHS	✓					50	32
	• Females	AIS, DHS		✓	✓	✓	✓	53	41
	• Males	AIS, DHS		✓	✓	✓	✓	49–50 ^c	30–32 ^d
	Accepting attitudes (would buy fresh vegetables from shopkeeper living with HIV) (%)	AIS, DHS	✓					50	36
	• Females	AIS, DHS		✓	✓	✓	✓	54–55 ^e	41
	• Males	AIS, DHS		✓	✓	✓	✓	48–50 ^f	34–36 ^g
	Condom use at last high-risk sex (%)	AIS, DHS	✓					44	31
	• Females	AIS, DHS		✓	✓	✓	✓	36–43 ^h	25–33 ⁱ
	• Males	AIS, DHS		✓	✓	✓	✓	41–44 ^j	28–34 ^k
	People living with HIV who know their HIV-positive status (%)	UNAIDS/UNICEF/WHO	✓						121
People living with HIV on antiretroviral therapy (%)	UNAIDS/UNICEF/WHO	✓						128	
People living with HIV with suppressed viral load (%)	UNAIDS/UNICEF/WHO	✓						93	
Testing and treatment	Testing for HIV and receiving results (ever) (%)	AIS, DHS	✓					48	29
	• Females	AIS, DHS		✓	✓	✓	✓	52	34
	• Males	AIS, DHS		✓	✓	✓	✓	47–48 ^l	30

AIS: AIDS Indicator Surveys; DHS: Demographic and Health Surveys; UNAIDS: Joint United Nations Programme on HIV/AIDS; UNICEF: United Nations Children's Fund; WHO: World Health Organization.

^a Data for the latest situation are the most recent published data. Estimates from UNAIDS/UNICEF/WHO are for 2020; estimates from AIS and DHS reflect the most recent survey conducted between 2011 and 2020. Although data are available for a large number of countries, analysis was restricted to countries with complete disaggregated data.

^b Data for change over time are from two periods. Estimates from UNAIDS/UNICEF/WHO are for 2010 and 2020; estimates from AIS and DHS reflect the most recent survey conducted between 2011 and 2020 and a previous survey conducted between 2001 and 2010, with a 5- to 15-year gap between the two surveys.

^c Although age-disaggregated data were available for HIV incidence and AIDS-related mortality indicators, inequalities by age for these indicators are affected by expected age-related progression of the disease and, therefore, patterns of disease by age are presented as part of the disease context.

^d Number of countries with available data may vary within indicator depending on the availability of information for the inequality dimension.

Table 2: Overview of disaggregated data used for general population HIV analysis [1]

Key Findings [1]:

HIV incidence

- In heavier burdened countries: females > males
- In other countries outside previously stated region: males > females

Attitude

- Condom use at last high-risk: males > females
- Younger subgroups were moderately more likely to use condoms globally, especially females
- Minimal changes in sex-related inequality over the previous 10 years overall.

Economic status

- **High levels of economic-related inequality among females and males were observed for all knowledge, attitudes and practices indicators.** Global inequality favoured the richest and showed little change over the past decade. For females and males and across all three indicators, around half or more of countries **demonstrated a gap of at least 20 percentage points between the richest and poorest.**

Education

- **Moderate to large education-related inequalities favouring the most educated people were observed** across all knowledge, attitudes and practices indicators with, at most, moderate reduction over time.
- **Knowledge about AIDS and condom use among young people was higher in the most educated than the least educated,** with a low to moderate reduction over the previous 10 years
- **Condom use showed moderate or high levels of inequality by education** in almost all countries for young females and males
- Age-related inequality in knowledge and practice indicators among young males and young females tended to be low, with little change over the previous 10 years.

Place of Residence

- **Moderate inequality favouring urban over rural areas has persisted with little change over the past decade overall.**
- Young people living in urban areas had moderately higher knowledge about AIDS and condom use than those in rural areas overall, with little change over the previous 10 years
- Education-related and **place of residence inequalities in HIV testing by pregnant women were high** in about half of countries.
- Angola was the only country that demonstrated high place of residence inequality favouring urban areas for both sexes in all knowledge, attitudes and practices indicators.

Testing & Treatment

- Overall, there was **low sex-related inequality** in people living with HIV who know their HIV- positive status, who are on antiretroviral therapy and who have suppressed viral load.
- Among countries with high inequalities in these three indicators (20%), a larger number of countries reported **high inequality favouring females over males.**
- Across countries, **females were moderately more likely than males to have ever been tested for HIV and received results.**
- Among females and males, **testing coverage was higher among richer, more educated and urban subgroups globally.**
- Over the previous decade, the gap in HIV testing between people aged 40–49 years and people aged 15–19 years has grown as **testing coverage has increased faster in the older group.**
- **Testing for HIV during pregnancy was more**

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common among women with higher economic status, with more education and in urban areas.

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- There were no age-related inequalities, globally. In India, however, HIV testing among pregnant women aged 15–19 years was more than 20 percentage points higher than among pregnant women aged 40–49 years.

related inequality that were unchanged or had increased over the previous 10 years: Benin,

1.3. Tuberculosis Data Overview and Results

Category	Indicator	Source	Inequality dimension					Countries with available data	
			Sex	Economic status	Education	Place of residence	Age	TB drug resistance	Latest situation ¹
Burden	TB incidence (new infections per 100 000 population) ³	WHO	✓					186 ⁴	
	TB mortality (deaths per 100 000 population) ³	WHO	✓					180 ⁴	
	TB prevalence (cases per 100 000 population)	TB prevalence surveys			✓			20	
	People with MDR/RR-TB (%)	Country reported to WHO	✓					85 ⁵	
Detection	Prevalence to notification ratio (years)	TB prevalence surveys and country-reported case notifications	✓					28	
	Case detection rate (%)	WHO and country-reported case notifications	✓			✓		109–116 ⁶	
Prevention	BCG immunization coverage among children aged 1 year (%)	DHS, MICS, RHS	✓	✓	✓	✓		67–90 ⁷	56–74 ⁸
Knowledge and attitudes	People who report TB is spread through coughing (%)	DHS	✓					16	9
	• Females	DHS		✓	✓	✓	✓	18–19 ⁹	13
	• Males	DHS		✓	✓	✓	✓	15–17 ⁹	9–10 ⁹
	People who would want a family member's TB kept secret (%)	DHS	✓					12	8
	• Females	DHS		✓	✓	✓	✓	13–14 ⁹	10
	• Males	DHS		✓	✓	✓	✓	11–13 ⁹	8–9 ⁹
Social protection	Families affected by TB facing catastrophic costs due to TB (%)	TB patient cost surveys	✓				✓	6–21 ⁹	

BCG: bacille Calmette-Guérin; DHS: Demographic and Health Surveys; MDR/RR-TB: multidrug- or rifampicin-resistant TB; MICS: Multiple Indicator Cluster Surveys; RHS: Reproductive Health Surveys; WHO: World Health Organization.
¹ Data for the latest situation are the most recent available data. Modelled annual estimates from WHO are from 2020; country-reported data about the proportion of people with TB with MDR/RR-TB are from 2011–2019; survey estimates for detection, prevention, knowledge and attitudes, and social protection indicators reflect the most recent survey conducted between 2011 and 2020.
² Data for change over time estimates from DHS, MICS and RHS reflect the most recent survey conducted between 2011 and 2020, and a previous survey conducted between 2001 and 2010, with a 5- to 15-year gap between the two surveys.
³ Although age-disaggregated data were available for TB incidence and mortality indicators, inequalities by age for these indicators are affected by expected age-related progression of the disease and, therefore, patterns of disease by age are presented as part of the disease context.
⁴ Does not include countries where male/female ratios could not be calculated due to zero values.
⁵ The number of countries with available data may vary within indicator depending on the availability of information for the inequality dimension.

Table 3: Overview of disaggregated data used for general population tuberculosis analysis [1]

Key Findings [1]:

Tuberculosis incidence

- Overall, TB incidence and mortality rates were **moderately higher among males than females**, with male incidence and mortality rates **more than double** that of females in more than a quarter of countries.
- Sex-related inequality (based on the male/female ratio) in the proportion of TB cases with MDR/RR-TB showed divergent patterns across countries, sometimes favouring females and sometimes favouring males.

Attitude

- Overall, there were low or moderate inequalities in TB attitudes according to sex, age, economic status, education and place of residence.

Economic Status

- The following countries had **high levels of economic-**

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Cameroon, Central African Republic, Côte d'Ivoire, Ethiopia, Guinea, Haiti, Lao People's Democratic Republic, Madagascar, Mali, Nigeria, Pakistan, Timor-Leste, Yemen.

- Across countries, a large proportion of families affected by TB reported catastrophic costs due to TB, ranging from 19.2% of households in Lesotho to 92.0% of households in Solomon Islands (median 54%). In almost all countries, catastrophic costs were **over 20 percentage points higher among the poorest households compared with the richest, and among people with drug-resistant TB compared with people with drug-susceptible TB.**

Place of Residence

- Overall, the prevalence of TB tends to be **higher in urban settings than rural settings.**

Education

- There were **moderate to high inequalities in TB knowledge in females and males, favouring the older, richest, most educated and urban subgroups**, which showed little change over time.
- There were no differences between TB knowledge in females and males, overall.

Testing & Treatment

- Overall, TB case detection (measured as the prevalence to notification ratio) tended to be moderately **better among females than males.**
- There was moderate age-related inequality in the TB case detection rate overall, with rates being at least 20 percentage points higher among adults than children in half of countries.
- BCG immunisation coverage was high overall (global median over 90%), with a fifth or more of countries demonstrating substantially **higher coverage among the richest and most educated people.**

1.4. Malaria Data Overview and Results

Category	Indicator	Source	Inequality dimension				Countries with available data	
			Sex	Economic status	Education	Place of residence	Age	Latest situation ^a
Burden	Malaria prevalence in children aged < 5 years (according to rapid diagnostic testing) (%) ^c	DHS, MIS	✓	✓	✓	✓	23	7–8 ^d
Prevention	Prevalence to notification ratio (years)	DHS, MIS	✓	✓	✓	✓	30	24
	Households with at least one insecticide-treated net (%)	DHS, MIS	✓	✓	✓	✓	30	24
	Households with at least one insecticide-treated net for every two people (%)	DHS, MIS	✓	✓	✓	✓	30	24
	Children aged < 5 years sleeping under insecticide-treated net (%)	DHS, MIS	✓	✓	✓	✓	30	23–24 ^e
Testing and treatment	Pregnant women sleeping under insecticide-treated net (%)	DHS, MIS	✓	✓	✓	✓	28	19
	Prompt care-seeking for children aged < 5 years with fever (%)	DHS, MIS	✓	✓	✓	✓	28	15
	Malaria diagnostic use in children aged < 5 years with fever (%)	DHS, MIS	✓	✓	✓	✓	38	9
	Prompt treatment of children aged < 5 years with fever with antimalarial medicines (%)	DHS, MIS	✓	✓	✓	✓	36	24

DHS: Demographic and Health Surveys; MIS: Malaria Indicator Surveys.
^a Data for the latest situation reflect the most recent survey conducted between 2011 and 2020.
^b Data for change over time reflect the most recent survey conducted between 2007 and 2020, and a previous survey conducted between 2007 and 2010, with a 5- to 15-year gap between the two surveys.
^c Although some African countries had data available for the malaria prevalence indicator, immunities to use for this indicator are affected by unreported and related non-reporting of the disease.

Table 4: Overview of disaggregated data used for general population malaria analysis [1]

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Malaria Incidence

- Malaria prevalence in children aged under 5 years showed **high economic-related inequality**. In the majority of countries, prevalence was **at least 20 percentage points higher in the poorest children than the richest children**.
- In all countries, the prevalence of malaria was similar in female and male children.
- Over the previous 10 years, inequalities in malaria prevalence showed little change overall.
- Overall, there were low to moderate levels of within-country inequality in malaria prevention indicators.
- For children sleeping under an insecticide-treated net, all countries reported low levels of sex-related inequality and **low or moderate levels of age-related inequality**, with little change over time.

Education

- Overall, malaria tended to be more prevalent among young children whose mothers have lower education and who live in rural areas.

Economic Status & Place of Residence

- At the country level, the direction of inequality **varied** for economic status and place of residence. For example, **insecticide-treated net ownership favoured the richest subgroup in some countries and the poorest subgroup in other countries**.
- Five countries reported high economic-related inequalities, where one or more of the two indicators related to insecticide-treated net ownership was at least **20 percentage points higher in the richest households** than the poorest (Burundi, Kenya, Malawi, Niger, Rwanda).
- Six countries reported high inequalities in the opposite direction, with a gap of **at least 20 percentage points favouring the poorest households** (Gabon, Gambia, Ghana, Nigeria, Senegal, Togo).
- Among pregnant women, use of insecticide-treated nets and three or more doses of IPTp was about **the same or higher among the poorest (compared with richest), the least educated (compared with most educated) and rural settings (compared with urban settings)** in the majority of countries
- In several countries, high economic-related inequality in insecticide-treated net use by pregnant women was unchanged or had increased over the previous decade. In Kenya, use of insecticide-treated nets by pregnant women increased faster among the richest than the poorest between 2003 and 2015, resulting in a gap of 32.0 percentage points.
- Where data were available, five countries with high economic-related inequality demonstrated **no change or increased inequality over the past decade** (Angola,

Liberia, Nigeria, Pakistan, Rwanda), and one country reported a **decrease in inequality** (8).

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Testing & Treatment

- Prompt care-seeking for children aged under 5 years with fever was **at least 20 percentage points higher in the richest quintile than the poorest quintile** in over half of study countries, with moderate reduction in inequality over the past 10 years, overall.
- Across 28 countries, the median differences in care-seeking for children with fever were about **10 percentage points higher in the most educated subgroup (versus least educated) and urban areas (versus rural), with little change over the previous decade.**
- Inequalities related to wealth, mother's education and place of residence in malaria diagnostic use and prompt treatment in children indicators were low to moderate, overall, with little change over time.
- Nearly all countries reported **low sex- and age-related differences for testing and treatment in children (9).**

years with fever—an indicator related to malaria testing and treatment—there would be a 26% improvement in the weighted average across 28 countries.

2. Potential for Improvement

The argument for the elimination of healthcare inequity is more easily understood when taking into account the estimated potential progress towards eliminating the aforementioned diseases in the absence of said inequity. A few prime examples as drawn from the WHO report

[1] which contains extensive visual representations of these findings

- By ensuring that all pregnant women in a country have the same level of HIV testing as pregnant women in the richest 20% of the country, the current overall level of testing (weighted average across 46 countries with data) would increase from 40% to 64% (10-14).
- If the national average for each country were equal to the level of coverage in the richest 20% of the population, the most notable potential improvement was observed for the percentage of families affected by TB facing catastrophic costs. The current national averages across six countries range from 19% to 71%, with an overall weighted average of 61% of households reporting catastrophic costs, which would be reduced to 38% of households.
- By eliminating economic-related inequalities in care seeking for children younger than 5

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3. Conclusions

- Although there were reportedly moderate reductions in economic- and education-related inequality in HIV during the past decade, the situation in countries such as Congo, Côte d'Ivoire, the Democratic Republic of the Congo, Ghana, Mali, Niger and Nigeria had high levels of unchanged or worsening inequality over the previous 10 years according to economic status, education and place of residence.

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Madekwe, C.C., Madekwe, C.C. and Obeagu, E.I (2022). Inequality of monitoring in Human Immunodeficiency Virus, Tuberculosis and Malaria. *Madonna University Journal of Medicine and Health Science*. 2 (3):6-15
