Health Equity Assessment Toolkit
Built-in Database Edition

TECHNICAL NOTES

World Health
Organization

Disclaimer

Suggested Citation

Health Equity Assessment Toolkit (HEAT): Software for exploring and comparing health inequalities in countries. Built-in database edition. Version 3.0. Geneva, World Health Organization, 2018.

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1. Introduction

The Health Equity Assessment Toolkit (HEAT) enables the assessment of within-country inequalities, i.e. inequalities that exist between population subgroups within a country, based on disaggregated data and summary measures of inequality. Disaggregated data show the level of health by population subgroup of a given dimension of inequality. Summary measures build on disaggregated data and present the degree of inequality across multiple population subgroups in a single numerical figure. These technical notes provide information about the disaggregated data (section 2) and the summary measures (section 3) presented in HEAT.

2. Disaggregated data

HEAT enables the assessment of inequalities using disaggregated data, i.e. data broken down by population subgroups, from the WHO Health Equity Monitor database (2018 update). The database currently contains over 30 reproductive, maternal, newborn and child health (RMNCH) indicators, disaggregated by six dimensions of inequality. Data are based on re-analysis of more than 330 Demographic and Health Surveys (DHS), Multiple Indicator Cluster Surveys (MICS) and Reproductive Health Surveys (RHS) conducted in 111 countries between 1991 and 2015. For 86 countries (77%), data are available for at least two time points (i.e. multiple rounds of data exist). A full list of study countries, with corresponding ISO3 country codes and information about survey source(s) and year(s) is given in Supplementary table 1.

Micro-level DHS, MICS and RHS data were analysed by the WHO Collaborating Center for Health Equity Monitoring (International Center for Equity in Health, Federal University of Pelotas, Brazil). Survey design specifications were taken into consideration during the analysis. The same methods of calculation for data analysis were applied across all surveys to generate comparable estimates across countries and over time. Estimates of disaggregated data are presented alongside 95% confidence intervals, and the population share of the subgroup. The population share for each indicator is the percentage of the affected population – the indicator denominator – represented by the subgroup in a given country.

2.1 Health indicators

Table 1 lists the RMNCH indicators currently available in the WHO Health Equity Monitor database. Detailed information about the criteria used to calculate the numerator and denominator values for each indicator are available in the indicator compendium or in the WHO Indicator and Measurement Registry, under the topic Health Equity Monitor (www.who.int/gho/indicator_registry/en/).

Table 1 Health indicators

Indicator name	Indicator abbreviation
Favourable health intervention indicators	
Antenatal care coverage – at least four visits (in the two or three years preceding the survey) (%)	anc4
Antenatal care coverage – at least four visits (in the five years preceding the survey) (%)	anc45
Antenatal care coverage – at least one visit (in the two or three years preceding the survey) (%)	anc1
Antenatal care coverage – at least one visit (in the five years preceding the survey) (%)	anc15
BCG immunization coverage among one-year-olds (%)	bcgv
Births attended by skilled health personnel (in the two or three years preceding the survey) (%)	sba
Births attended by skilled health personnel (in the five years preceding the survey) (%)	sba5

Births by caesarean section (in the two or three years preceding the survey) (%)*	csection
Births by caesarean section (in the five years preceding the survey) (%)*	csection5
Children aged < 5 years sleeping under insecticide-treated nets (%)	itnch
Children aged < 5 years with diarrhoea receiving oral rehydration salts (%)	ors
Children aged < 5 years with diarrhoea receiving oral rehydration therapy and continued feeding (%)	ort
Children aged < 5 years with pneumonia symptoms taken to a health facility (%)	carep
Children aged 6–59 months who received vitamin A supplementation (%)	vita
Composite coverage index (%)	cci
Contraceptive prevalence – modern and traditional methods (%)	cpmt
Contraceptive prevalence – modern methods (%)	cpmo
Demand for family planning satisfied – modern and traditional methods (%)	fps
Demand for family planning satisfied – modern methods (%)	fpsmo
DTP3 immunization coverage among one-year-olds (%)	dptv
Early initiation of breastfeeding (in the two or three years preceding the survey) (%)	ebreast
Early initiation of breastfeeding (in the five years preceding the survey) (%)	ebreast5
Full immunization coverage among one-year-olds (%)	fullv
Measles immunization coverage among one-year-olds (%)	mslv
Polio immunization coverage among one-year-olds (%)	poliov
Pregnant women sleeping under insecticide-treated nets (%)	itnwm
Adverse health outcome indicators	
Adolescent fertility rate (per 1000 women aged 15–19 years)**	asfr1
Infant mortality rate (deaths per 1000 live births)	imr
Neonatal mortality rate (deaths per 1000 live births)	nmr
Obesity prevalence in non-pregnant women aged 15–49 years, BMI ≥ 30 (%)	obesewm
Stunting prevalence in children aged < 3 years (%)	stunt3
Stunting prevalence in children aged < 5 years (%)	stunt5
Total fertility rate (per woman)**	tfr
Under-five mortality rate (deaths per 1000 live births)	u5mr
Underweight prevalence in children aged < 3 years (%)	uweight3
Underweight prevalence in children aged < 5 years (%)	uweight5
Wasting prevalence in children aged < 3 years (%)	wast3
Wasting prevalence in children aged < 5 years (%)	wast5

*Note that the indicators "Births by caesarean section (in the two or three years preceding the survey)" and "Births by caesarean section (in the five years preceding the survey)" are treated as favourable health intervention indicators, even though the maximum level may not be the most desirable situation (as is the case for other favourable health intervention indicators, such as full immunization coverage).

**Note that the indicators "Adolescent fertility rate" and "Total fertility rate" are treated as adverse health outcome indicators, even though the minimum level may not be the most desirable situation (as is the case for other adverse outcome indicators, such as infant mortality rate).

As indicated in table 1, health indicators can be divided into favourable and adverse health indicators. **Favourable health indicators** measure desirable health events that are promoted through public health action. They include health intervention indicators, such as antenatal care coverage, and desirable health outcome indicators, such as life expectancy. For these indicators, the ultimate goal is to achieve a maximum level, either in health intervention coverage or health outcome (for example, complete coverage of antenatal care or the highest possible life expectancy). **Adverse health indicators**, on the other hand, measure undesirable events, that are to be reduced or eliminated through public health action. They include undesirable health outcome indicators, such as stunting

prevalence in children aged less than five years or under-five mortality rate. Here, the ultimate goal is to achieve a minimum level in health outcome (for example, a stunting prevalence or mortality rate of zero).

In the WHO Health Equity Monitor database, all health intervention indicators are favourable health indicators and all health outcome indicators are adverse health indicators. This differentiation is important as the type of indicator has implications for the calculation of summary measures (see section 2).

2.2 Dimensions of inequality

Health indicators from the WHO Health Equity Monitor database were disaggregated by six dimensions of inequality: economic status, education, place of residence and subnational region as well as age and sex (where applicable).

Economic status was determined using a wealth index. Country-specific indices were based on owning selected assets and having access to certain services, and constructed using principal component analysis. Within each country the index was divided into quintiles of households, thereby creating five equal subgroups that each account for 20% of the population. Note that certain indicators have denominator criteria that do not include all households and/or are more likely to include households from a specific quintile; thus the quintile share of the population for a given indicator may not equal 20%. For example, there are often more live births reported by the poorest quintile than the richest quintile, resulting in the poorest quintile representing a larger share of the population for indicators such as the coverage of births attended by skilled health personnel.

Education refers to the highest level of schooling attained by the woman (or the mother, in the case of newborn and child health interventions, child malnutrition and child mortality): no education, primary school, or secondary school or higher. These levels reflect the highest level of schooling ever attended by the woman.

For **place of residence** and **subnational region**, country-specific criteria for place of residence and subnational region were applied.

Table 2 lists the five dimensions of inequality available in the WHO Health Equity Monitor database along with their basic characteristics.

Table 2 Dimensions of inequality

Dimension of inequality	Number of subgroups	Ordered subgroups
Age	Two subgroups	-
Economic status	More than two subgroups	Yes
Education	More than two subgroups	Yes
Place of residence	Two subgroups	-
Sex	Two subgroups	-
Subnational region	More than two subgroups	No

At the most basic level, dimensions of inequality can be divided into **binary dimensions**, i.e. dimensions that compare the situation in two population subgroups (e.g. girls and boys), versus dimensions that look at the situation in more than two population subgroups (e.g. economic status quintiles).

In the case of dimensions with more than two population subgroups it is possible to differentiate between dimensions with ordered subgroups and non-ordered subgroups. **Ordered dimensions** have subgroups with an inherent positioning and can be ranked. For example, education has an

inherent ordering of subgroups in the sense that those with less education unequivocally have *less* of something compared to those with more education. **Non-ordered dimensions**, by contrast, have subgroups that are not based on criteria that can be logically ranked. Subnational regions are an example of non-ordered groupings.

These characteristics (number of subgroups and ordered vs. non-ordered subgroups) are important as they impact on the calculation of summary measures (see section 2).

3. Summary measures

HEAT enables the assessment of inequalities using multiple summary measures of inequality. Summary measures are calculated based on disaggregated data from the WHO Health Equity Monitor database (2018 update), combining estimates of a given health indicator for two or more subgroups into a single numerical figure. Supplementary table 2 lists the 19 summary measures currently available in HEAT along with their basic characteristics, formulas and interpretation.

Summary measures of inequality can be divided into absolute measures and relative measures. For a given health indicator, **absolute inequality measures** indicate the magnitude of difference in health between subgroups. They retain the same unit as the health indicator.[1] **Relative inequality measures**, on the other hand, show proportional differences in health among subgroups and have no unit.

Furthermore, summary measures may be weighted or unweighted. **Weighted measures** take into account the population size of each subgroup, while **unweighted measures** treat each subgroup as equally sized. Importantly, simple measures are always unweighted and complex measures may be weighted or unweighted.

Simple measures make pairwise comparisons between two subgroups, such as the most and least wealthy. They can be calculated for all health indicators and dimensions of inequality. The characteristics of the indicator and dimension determine which two subgroups are compared to assess inequality. Contrary to simple measures, **complex measures** make use of data from all subgroups to assess inequality. They can be calculated for all health indicators, but they can only be calculated for dimensions with more than two subgroups.[2]

Complex measures can further be divided into ordered complex measures and non-ordered complex measures of inequality. **Ordered measures** can only be calculated for dimensions with more than two subgroups that have a natural ordering. Here, the calculation is also influenced by the type of indicator (favourable vs. adverse). **Non-ordered measures** are only calculated for dimensions with more than two subgroups that have no natural ordering.[3]

The following sections give further information about the definition, calculation and interpretation of each summary measure of inequality. Further information about summary measures of inequality can be found in the *Handbook on health inequality monitoring: with a special focus on low- and middle-income countries.*[4]

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[1] One exception to this is the between-group variance (BGV), which takes the squared unit of the health indicator.
[2] Exceptions to this are the population attributable risk (PAR) and the population attributable fraction (PAF), which can be calculated for all dimensions of inequality.
[3] Non-ordered complex measures could also be calculated for ordered dimensions, however, in practice, they are not used for such dimensions and are therefore only reported for non-ordered dimensions.
[4] World Health Organization (2013). Handbook on health inequality monitoring: with a special focus on low- and middle-income countries. Geneva: World Health Organization. Available from: www.who.int/gho/health_equity/handbook/en/

3.1 Absolute measures

3.1.1 Absolute concentration index

Definition

The absolute concentration index (ACI) is a complex, weighted measure of inequality that shows the health gradient across multiple subgroups with a natural ordering, on an absolute scale. It indicates the extent to which a health indicator is concentrated among the disadvantaged or the advantaged.

Calculation

The calculation of ACI is based on a ranking of the whole population from the most-disadvantaged subgroup (at rank zero or 0) to the most-advantaged subgroup (at rank 1), which is inferred from the ranking and size of the subgroups. The relative rank of each subgroup is calculated as: $X_j = \sum_j p_j - 0.5 p_j$. Based on this ranking, ACI can be calculated as:

(1) $$ACI = \sum_j p_j (2X_j - 1) y_j,$$

where y_j indicates the estimate for subgroup j, p_j the population share of subgroup j and X_j the relative rank of subgroup j.

ACI is calculated for ordered dimensions. It is missing if at least one subgroup estimate or subgroup population share is missing.

Interpretation

If there is no inequality, ACI takes the value zero. Positive values indicate a concentration of the health indicator among the advantaged, while negative values indicate a concentration of the health indicator among the disadvantaged. The larger the absolute value of ACI, the higher the level of inequality.

3.1.2 Between-group standard deviation

Definition

The between-group standard deviation (BGSD) is a complex, weighted measure of inequality.

Calculation

BGSD is calculated as the square root of the weighted sum of squared differences between the subgroup estimates y_j and the national average μ. Squared differences are weighted by each subgroup's population share p_j:

(2) $$BGSD = \sqrt{\sum_j p_j (y_j - \mu)^2}.$$

BGSD is calculated for non-ordered dimensions. It is missing if at least one subgroup estimate or subgroup population share is missing.

Interpretation

BGSD takes only positive values with larger values indicating higher levels of inequality. BGSD is zero if there is no inequality. BGSD is more sensitive to outlier estimates as it gives more weight to the estimates that are further from the national average.

3.1.3 Between-group variance

Definition

The between-group variance (BGV) is a complex, weighted measure of inequality.

Calculation

BGV is calculated as the weighted sum of squared differences between the subgroup estimates y_j and the national average μ. Squared differences are weighted by each subgroup's population share p_j:

(3) $\qquad BGV = \sum_j p_j (y_j - \mu)^2.$

BGV is calculated for non-ordered dimensions. It is missing if at least one subgroup estimate or subgroup population share is missing.

Interpretation
BGV takes only positive values with larger values indicating higher levels of inequality. BGV is zero if there is no inequality. BGV is more sensitive to outlier estimates as it gives more weight to the estimates that are further from the national average.

3.1.4   Difference

Definition
The difference (D) is a simple, unweighted measure of inequality that shows the absolute inequality between two subgroups.

Calculation
D is calculated as the difference between two subgroups. For ordered dimensions, subgroups (e.g. economic status and education), the most-advantaged and most-disadvantaged subgroups are compared, while for non-ordered dimensions (e.g. subnational region), the subgroups with the highest and lowest estimates are used:

(4) $\qquad D = y_{high} - y_{low}.$

Note that the selection of y_{high} and y_{low} depends on the characteristics of the dimension of inequality and the type of health indicator, for which D is calculated.[5]

For age, D is calculated as the difference between 20–49 years and 15–19 years in the case of favourable health intervention indicators and as the difference between 15–19 years and 20–49 years in the case of adverse health outcome indicators.

For place of residence, D is calculated as the difference between urban and rural areas in the case of favourable health intervention indicators and as the difference between rural and urban areas in the case of adverse health outcome indicators.

For sex, D is calculated as the difference between females and males in the case of favourable health intervention indicators and as the difference between males and females in the case of adverse health outcome indicators.

For economic status and education, y_{high} refers to the most-advantaged subgroup and y_{low} to the most-disadvantaged subgroup in the case of favourable health intervention indicators, and vice versa in the case of adverse health outcome indicators.

For subnational region, the lowest estimate is subtracted from the highest estimate, regardless of the health indicator type.

D is calculated for all dimensions of inequality. In the case of binary dimensions and non-ordered dimensions, D is missing if at least one subgroup estimate is missing. In the case of ordered dimensions, D is missing if the estimates for the most-advantaged and/or most-disadvantaged subgroup are missing.

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[5] Selections were made based on convenience of data interpretation (that is, providing positive values for difference calculations). In the case of sex, the selection does not represent an assumed advantage of one sex over the other.

Interpretation

If there is no inequality, D takes the value zero. Greater absolute values indicate higher levels of inequality. For favourable health intervention indicators, positive values indicate higher coverage in the advantaged subgroups and negative values indicate higher coverage in the disadvantaged subgroups. For adverse health outcome indicators, positive values indicate a higher concentration of the indicator among the disadvantaged and negative values indicate a higher concentration among the advantaged.

Other calculations

For non-ordered dimensions with more than 30 subgroups, additional difference measures are calculated, including

- Difference between percentile 80 and percentile 20
- Difference between the mean estimates in quintile 5 and quintile 1.

In addition, for non-ordered dimensions with more than 60 subgroups, the following difference measures are calculated:

- Difference between percentile 90 and percentile 10
- Difference between the mean estimates in decile 10 and decile 1.

Finally, for non-ordered dimensions with more than 100 subgroups, the following difference measures are also calculated:

- Difference between percentile 95 and percentile 5
- Difference between the mean estimates in the top 5% and the bottom 5%.

These measures are displayed in the Explore Inequality – Disaggregated data (detailed bar graphs) tab, provided a non-ordered dimension with at least 30 subgroups has been selected.

3.1.5   Population attributable risk

Definition

The population attributable risk (PAR) is a complex, weighted measure of inequality that shows the potential for improvement in the national level of a health indicator that could be achieved if all subgroups had the same level of health as a reference subgroup.

Calculation

PAR is calculated as the difference between the estimate for the reference subgroup y_{ref} and the national average μ:

$$(5) \qquad PAR = y_{ref} - \mu.$$

Note that the selection of the reference subgroup y_{ref} depends on the characteristics of the dimension of inequality and the type of health indicator, for which PAR is calculated.[6]

For age, 20–49 years is selected as the reference subgroup, regardless of the health indicator type.

For place of residence, urban is selected as the reference subgroup, regardless of the health indicator type.

For sex, female is selected as the reference subgroup, regardless of the health indicator type.

For economic status and education, y_{ref} refers to the most-advantaged subgroup, regardless of the health indicator type.

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[6] Selections were made based on convenience of data interpretation. In the case of sex, the selection does not represent an assumed advantage of one sex over the other.

For subnational region, y_{ref} refers to the subgroup with the highest estimate in the case of favourable health intervention indicators and to the subgroup with the lowest estimate in the case of adverse health outcome indicators.

PAR is calculated for all dimensions. In the case of binary and ordered dimensions, PAR is missing if the estimate for the reference subgroup or the population share for at least one subgroup is missing. In the case of non-ordered dimensions, PAR is missing if at least one subgroup estimate or subgroup population share is missing.

Interpretation

PAR takes positive values for favourable health intervention indicators and negative values for adverse health outcome indicators. The larger the absolute value of PAR, the higher the level of inequality. PAR is zero if no further improvement can be achieved, i.e. if all subgroups have reached the same level of health as the reference subgroup.

3.1.6   Slope index of inequality

Definition

The slope index of inequality (SII) is a complex, weighted measure of inequality that represents the absolute difference in estimated values of a health indicator between the most-advantaged and most-disadvantaged (or vice versa for adverse health outcome indicators), while taking into consideration all the other subgroups – using an appropriate regression model.

Calculation

To calculate SII, a weighted sample of the whole population is ranked from the most-disadvantaged subgroup (at rank zero or 0) to the most-advantaged subgroup (at rank 1). This ranking is weighted, accounting for the proportional distribution of the population within each subgroup. The population of each subgroup is then considered in terms of its range in the cumulative population distribution, and the midpoint of this range. According to the definition currently used in HEAT, the health indicator of interest is then regressed against this midpoint value using a generalized linear model with logit link, and the predicted values of the health indicator are calculated for the two extremes (rank 1 and rank 0).

For favourable health intervention indicators, the difference between the estimated values at rank 1 (v_1) and rank 0 (v_0) (covering the entire distribution) generates the SII value:

(6)   (a) $SII = v_1 - v_0$.

For adverse health outcome indicators, the calculation is reversed and the SII value is calculated as the difference between the estimated values at rank 0 (v_0) and rank 1 (v_1) (covering the entire distribution):

(6)   (b) $SII = v_0 - v_1$.

SII is calculated for ordered dimensions. It is missing if at least one subgroup estimate or subgroup population share is missing.

Interpretation

If there is no inequality, SII takes the value zero. Greater absolute values indicate higher levels of inequality. For favourable health intervention indicators, positive values indicate higher coverage in the advantaged subgroups and negative values indicate higher coverage in the disadvantaged subgroups. For adverse health outcome indicators, positive values indicate a higher concentration of the indicator among the disadvantaged and negative values indicate a higher concentration among the advantaged.

3.1.7 Unweighted mean difference from best performing subgroup

Definition
The unweighted mean difference from best performing subgroup (MDBU) is a complex, unweighted measure of inequality that shows the difference between each subgroup and a reference subgroup, on average.

Calculation
MDBU is calculated as the sum of absolute differences between the subgroup estimates y_j and the estimate for the reference subgroup y_{ref}:

$$(7) \qquad MDBU = \sum_j |y_j - y_{ref}|.$$

y_{ref} refers to the subgroup with the highest estimate in the case of favourable health intervention indicators and to the subgroup with the lowest estimate in the case of adverse health outcome indicators.

MDBU is calculated for non-ordered dimensions. It is missing if at least one subgroup estimate is missing. Note that the 95% confidence intervals calculated for MDBU are simulation-based estimates.

Interpretation
MDBU takes only positive values with larger values indicating higher levels of inequality. MDBU is zero if there is no inequality.

3.1.8 Unweighted mean difference from mean

Definition
The unweighted mean difference from mean (MDMU) is a complex, unweighted measure of inequality that shows the difference between each subgroup and the national level, on average.

Calculation
MDMU is calculated as the sum of absolute differences between the subgroup estimates y_j and the national average μ:

$$(8) \qquad MDMU = \sum_j |y_j - \mu|.$$

MDMU is calculated for non-ordered dimensions. It is missing if at least one subgroup estimate or subgroup population share is missing. Note that the 95% confidence intervals calculated for MDMU are simulation-based estimates.

Interpretation
MDMU takes only positive values with larger values indicating higher levels of inequality. MDMU is zero if there is no inequality.

3.1.9 Weighted mean difference from best performing subgroup

Definition
The weighted mean difference from best performing subgroup (MDBW) is a complex, weighted measure of inequality that shows the difference between each subgroup and a reference subgroup, on average.

Calculation

MDBW is calculated as the weighted sum of absolute differences between the subgroup estimates y_j and the estimate for the reference subgroup y_{ref}. Absolute differences are weighted by each subgroup's population share p_j:

$$(9) \qquad MDBW = \sum_j p_j |y_j - y_{ref}|.$$

y_{ref} refers to the subgroup with the highest estimate in the case of favourable health intervention indicators and to the subgroup with the lowest estimate in the case of adverse health outcome indicators.

MDBW is calculated for non-ordered dimensions. It is missing if at least one subgroup estimate or subgroup population share is missing. Note that the 95% confidence intervals calculated for MDBW are simulation-based estimates.

Interpretation
MDBW takes only positive values with larger values indicating higher levels of inequality. MDBW is zero if there is no inequality.

3.1.10 Weighted mean difference from mean

Definition
The weighted mean difference from mean (MDMW) is a complex, weighted measure of inequality that shows the difference between each subgroup and the national level, on average.

Calculation
MDMW is calculated as the weighted sum of absolute differences between the subgroup estimates y_j and the national average μ. Absolute differences are weighted by each subgroup's population share p_j:

$$(10) \qquad MDMW = \sum_j p_j |y_j - \mu|.$$

MDMW is calculated for non-ordered dimensions. It is missing if at least one subgroup estimate or subgroup population share is missing. Note that the 95% confidence intervals calculated for MDMW are simulation-based estimates.

Interpretation
MDMW takes only positive values with larger values indicating higher levels of inequality. MDMW is zero if there is no inequality.

3.2 Relative measures

3.2.1 Coefficient of variation

Definition
The coefficient of variation (COV) is a complex, weighted measure of inequality.

Calculation
COV is calculated by dividing the between-group standard deviation (BGSD) by the national average μ and multiplying the fraction by 100:

$$(11) \qquad COV = \frac{BGSD}{\mu} * 100.$$

COV is calculated for non-ordered dimensions. It is missing if at least one subgroup estimate or subgroup population share is missing.

Interpretation

COV takes only positive values with larger values indicating higher levels of inequality. COV is zero if there is no inequality.

3.2.2 Mean log deviation

Definition

The mean log deviation (MLD) is a complex, weighted measure of inequality.

Calculation

MLD is calculated as the sum of products between the negative natural logarithm of the share of health of each subgroup $(-\ln\left(\frac{y_j}{\mu}\right))$ and the population share of each subgroup (p_j). MLD may be more easily interpreted when multiplied by 1000:

(12) $\qquad \text{MLD} = \sum_j p_j (-\ln\left(\frac{y_j}{\mu}\right)) * 1000,$

where y_j indicates the estimate for subgroup j, p_j the population share of subgroup j and μ the national average.

MLD is calculated for non-ordered dimensions. It is missing if at least one subgroup estimate or subgroup population share is missing.

Interpretation

If there is no inequality, MLD takes the value zero. Greater absolute values indicate higher levels of inequality. MLD is more sensitive to health differences further from the national average (by the use of the logarithm).

3.2.3 Population attributable fraction

Definition

The population attributable fraction (PAF) is a complex, weighted measure of inequality that shows the potential for improvement in the national level of a health indicator, in relative terms, that could be achieved if all subgroups had the same level of health as a reference subgroup.

Calculation

PAF is calculated by dividing the population attributable risk (PAR) by the national average μ and multiplying the fraction by 100:

(13) $\qquad PAF = \frac{PAR}{\mu} * 100.$

PAF is calculated for all dimensions. In the case of binary and ordered dimensions (e.g. economic status and education), PAF is missing if the estimate for the reference subgroup or the population share for at least one subgroup is missing. In the case of non-ordered dimensions (e.g. subnational region), PAF is missing if at least one subgroup estimate or subgroup population share is missing.

Interpretation

PAF takes positive values for favourable health intervention indicators and negative values for adverse health outcome indicators. The larger the absolute value of PAF, the larger the degree of inequality. PAF is zero if no further improvement can be achieved, i.e. if all subgroups have reached the same level of health as the reference subgroup.

3.2.4 Ratio

Definition

The ratio (R) is a simple, unweighted measure of inequality that shows the relative inequality between two subgroups.

Calculation

R is calculated as the ratio of two subgroups. For ordered dimensions (e.g. economic status and education), the most-advantaged and most-disadvantaged subgroups are compared, while for non-ordered dimensions (e.g. subnational region), the subgroups with the highest and lowest estimates are used:

$$(14) \qquad R = y_{high}/y_{low}.$$

Note that the selection of y_{high} and y_{low} depends on the characteristics of the dimension of inequality and the type of health indicator, for which R is calculated.[7]

For age, R is calculated as the ratio of 20–49 years to 15–19 years in the case of favourable health intervention indicators and as the ratio of 15–19 years to 20–49 years in the case of adverse health outcome indicators.

For place of residence, R is calculated as the ratio of urban to rural areas in the case of favourable health intervention indicators and as the ratio of rural to urban areas in the case of adverse health outcome indicators.

For sex, R is calculated as the ratio of females to males in the case of favourable health intervention indicators and as the ratio of males to females in the case of adverse health outcome indicators.

For economic status and education, y_{high} refers to the most-advantaged subgroup and y_{low} to the most-disadvantaged subgroup in the case of favourable health intervention indicators, and vice versa in the case of adverse health outcome indicators.

For subnational region, the highest estimate is divided by the lowest estimate, regardless of the health indicator type.

R is calculated for all dimensions of inequality. In the case of binary and non-ordered dimensions, R is missing if at least one subgroup estimate is missing. In the case of ordered dimensions, R is missing if the estimates for the most-advantaged and/or most-disadvantaged subgroup are missing.

Interpretation

If there is no inequality, R takes the value one. It takes only positive values (larger or smaller than 1). The further the value of R from 1, the higher the level of inequality.

Other calculations

For non-ordered dimensions with more than 30 subgroups, additional ratio measures are calculated, including

- Ratio of percentile 80 to percentile 20
- Ratio of the mean estimates in quintile 5 to quintile 1.

In addition, for non-ordered dimensions with more than 60 subgroups, the following ratio measures are calculated:

- Ratio of percentile 90 to percentile 10
- Ratio of the mean estimates in decile 10 to decile 1.

Finally, for non-ordered dimensions with more than 100 subgroups, the following ratio measures are also calculated:

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[7] Selections were made based on convenience of data interpretation (that is, providing values above one for ratio calculations). In the case of sex, the selection does not represent an assumed advantage of one sex over the other.

- Ratio of percentile 95 to percentile 5
- Ratio of the mean estimates in the top 5% to the bottom 5%.

These measures are displayed in the Explore Inequality – Disaggregated data (detailed bar graphs) tab, provided a non-ordered dimension with at least 30 subgroups has been selected.

3.2.5 Relative concentration index

Definition

The relative concentration index (RCI) is a complex, weighted measure of inequality that shows the health gradient across multiple subgroups with natural ordering, on a relative scale. It indicates the extent to which a health indicator is concentrated among the disadvantaged or the advantaged.

Calculation

RCI is calculated by dividing the absolute concentration index (ACI) by the national average μ. This fraction may be more easily interpreted when multiplied by 100:

(15) $\qquad RCI = \frac{ACI}{\mu} * 100.$

RCI is calculated for ordered dimensions. It is missing if at least one subgroup estimate or subgroup population share is missing.

Interpretation

RCI is bounded between -1 and +1 (or -100 and +100 if multiplied by 100) and takes the value zero if there is no inequality. Positive values indicate a concentration of the health indicator among the advantaged, while negative values indicate a concentration of the health indicator among the disadvantaged. The greater the absolute value of RCI, the higher the level of inequality.

3.2.6 Relative index of inequality

Definition

The relative index of inequality (RII) is a complex, weighted measure of inequality that represents the ratio of estimated values of a health indicator of the most-advantaged to the most-disadvantaged (or vice versa for adverse health outcome indicators), while taking into consideration all the other subgroups – using an appropriate regression model.

Calculation

To calculate RII, a weighted sample of the whole population is ranked from the most-disadvantaged subgroup (at rank zero or 0) to the most-advantaged subgroup (at rank 1). This ranking is weighted, accounting for the proportional distribution of the population within each subgroup. The population of each subgroup is then considered in terms of its range in the cumulative population distribution, and the midpoint of this range. According to the definition currently used in HEAT, the health indicator of interest is then regressed against this midpoint value using a generalized linear model with logit link, and the predicted values of the health indicator are calculated for the two extremes (rank 1 and rank 0).

For favourable health intervention indicators, the ratio of the estimated values at rank 1 (v_1) to rank 0 (v_0) (covering the entire distribution) generates the RII value:

(16) $\qquad$ (a) $RII = v_1/v_0.$

For adverse health outcome indicators, the calculation is reversed and the RII value is calculated as the ratio of the estimated values at rank 0 (v_0) to rank 1 (v_1) (covering the entire distribution):

(16)   (b) $RII = v_0/v_1$.

RII is calculated for ordered dimensions with more than two subgroups. It is missing if at least one subgroup estimate or subgroup population share is missing.

Interpretation
If there is no inequality, RII takes the value one. RII takes only positive values, with values larger than one indicating a concentration of the indicator among the advantaged and values smaller than one indicating a concentration of the indicator among the disadvantaged. The further the value of RII from one, the higher the level of inequality.

3.2.7 Theil index

Definition
The theil index (TI) is a complex, weighted measure of inequality.

Calculation
TI is calculated as the sum of products of the natural logarithm of the share of health of each subgroup ($\ln \frac{y_j}{\mu}$), the share of health of each subgroup ($\frac{y_j}{\mu}$) and the population share of each subgroup (p_j). TI may be more easily interpreted when multiplied by 1000:

(17) $$TI = \sum_j p_j \frac{y_j}{\mu} \ln \frac{y_j}{\mu} * 1000,$$

where y_j indicates the estimate for subgroup j, p_j the population share of subgroup j and μ the national average.

TI is calculated for non-ordered dimensions. It is missing if at least one subgroup estimate or subgroup population share is missing.

Interpretation
If there is no inequality, TI takes the value zero. Greater absolute values indicate higher levels of inequality. TI is more sensitive to health differences further from the national average (by the use of the logarithm).

3.2.8 Unweighted index of disparity

Definition
The unweighted index of disparity (IDISU) is a complex, unweighted measure of inequality that shows the proportional difference between each subgroup and the national level, on average.

Calculation
IDISU is calculated as the sum of absolute differences between the subgroup estimates y_j and the national average μ, divided by the national average μ and the number of subgroups n:

(18) $$IDISU = \frac{1}{n} * \frac{\sum_j |y_j - \mu|}{\mu} * 100.$$

IDISU is calculated for non-ordered dimensions. It is missing if at least one subgroup estimate or subgroup population share is missing. Note that the 95% confidence intervals calculated for IDISU are simulation-based estimates.

Interpretation
IDISU takes only positive values with larger values indicating higher levels of inequality. IDISU is zero if there is no inequality.

3.2.9   Weighted index of disparity

Definition

The weighted index of disparity (IDISW) is a complex, weighted measure of inequality that shows the proportional difference between each subgroup and the national average, on average.

Calculation

IDIS_W is calculated as the weighted sum of absolute differences between the subgroup estimates y_j and the national average μ, divided by the national average μ. Absolute differences are weighted by each subgroup's population share p_j:

$$(19) \qquad IDISW = \frac{\sum_j p_j |y_j - \mu|}{\mu} * 100.$$

IDISW is calculated for non-ordered dimensions. It is missing if at least one subgroup estimate or subgroup population share is missing. Note that the 95% confidence intervals calculated for IDISW are simulation-based estimates.

Interpretation

IDISW takes only positive values with larger values indicating higher levels of inequality. IDISW is zero if there is no inequality.

Supplementary tables

Supplementary table 1 Study countries: ISO3 country codes, survey source(s) and year(s), WHO region and country income group

Country	ISO3 country code	Survey source(s) and year(s)	WHO Region	Country income group*
Afghanistan	AFG	MICS 2010, DHS 2015	Eastern Mediterranean	Low-income
Albania	ALB	RHS 2002, MICS 2005, DHS 2008	European	Middle-income
Algeria	DZA	MICS 2012	African	Middle-income
Angola	AGO	DHS 2015	African	Middle-income
Argentina	ARG	MICS 2011	Americas	High-income
Armenia	ARM	DHS 2000, DHS 2005, DHS 2010	European	Middle-income
Azerbaijan	AZE	DHS 2006	European	Middle-income
Bangladesh	BGD	DHS 1993, DHS 1996, DHS 1999, DHS 2004, MICS 2006, DHS 2007, DHS 2011, MICS 2012, DHS 2014	South-East Asia	Middle-income
Barbados	BRB	MICS 2012	Americas	High-income
Belarus	BLR	MICS 2005, MICS 2012	European	Middle-income
Belize	BLZ	RHS 1991, MICS 2006, MICS 2011	Americas	Middle-income
Benin	BEN	DHS 1996, DHS 2001, DHS 2006, DHS 2011	African	Low-income
Bhutan	BTN	MICS 2010	South-East Asia	Middle-income
Bolivia (Plurinational State of)	BOL	DHS 1994, DHS 1998, DHS 2003, DHS 2008	Americas	Middle-income
Bosnia and Herzegovina	BIH	MICS 2006, MICS 2011	European	Middle-income
Brazil	BRA	DHS 1996	Americas	Middle-income
Burkina Faso	BFA	DHS 1998, DHS 2003, MICS 2006, DHS 2010	African	Low-income
Burundi	BDI	MICS 2005, DHS 2010	African	Low-income
Cambodia	KHM	DHS 2000, DHS 2005, DHS 2010, DHS 2014	Western Pacific	Middle-income
Cameroon	CMR	DHS 1998, DHS 2004, MICS 2006, DHS 2011, MICS 2014	African	Middle-income
Cape Verde	CPV	RHS 1998	African	Middle-income
Central African Republic	CAF	DHS 1994, MICS 2006, MICS 2010	African	Low-income
Chad	TCD	DHS 1996, DHS 2004, MICS 2010, DHS 2014	African	Low-income
Colombia	COL	DHS 1995, DHS 2000, DHS 2005, DHS 2010, DHS 2015	Americas	Middle-income
Comoros	COM	DHS 1996, DHS 2012	African	Low-income
Congo	COG	DHS 2005, DHS 2011	African	Middle-income
Costa Rica	CRI	RHS 1992, MICS 2011	Americas	Middle-income
Cuba	CUB	MICS 2006, MICS 2010, MICS 2014	Americas	Middle-income

Côte d'Ivoire	CIV	DHS 1994, DHS 1998, MICS 2006, DHS 2011	African	Middle-income
Democratic Republic of the Congo	COD	DHS 2007, MICS 2010, DHS 2013	African	Low-income
Djibouti	DJI	MICS 2006	Eastern Mediterranean	Middle-income
Dominican Republic	DOM	DHS 1996, DHS 1999, DHS 2002, DHS 2007, DHS 2013, MICS 2014	Americas	Middle-income
Ecuador	ECU	RHS 1994, RHS 1999, RHS 2004	Americas	Middle-income
Egypt	EGY	DHS 1995, DHS 2000, DHS 2005, DHS 2008, DHS 2014	Eastern Mediterranean	Middle-income
El Salvador	SLV	RHS 1993, RHS 1998, RHS 2002, RHS 2008, MICS 2014	Americas	Middle-income
Eswatini	SWZ	DHS 2006, MICS 2010, MICS 2014	African	Middle-income
Ethiopia	ETH	DHS 2000, DHS 2005, DHS 2011	African	Low-income
Gabon	GAB	DHS 2000, DHS 2012	African	Middle-income
Gambia	GMB	MICS 2005, DHS 2013	African	Low-income
Georgia	GEO	MICS 2005	European	Middle-income
Ghana	GHA	DHS 1993, DHS 1998, DHS 2003, MICS 2006, DHS 2008, MICS 2011, DHS 2014	African	Middle-income
Guatemala	GTM	DHS 1995, DHS 1998, RHS 2002, RHS 2008, DHS 2014	Americas	Middle-income
Guinea	GIN	DHS 1999, DHS 2005, DHS 2012	African	Low-income
Guinea-Bissau	GNB	MICS 2006, MICS 2014	African	Low-income
Guyana	GUY	MICS 2006, DHS 2009, MICS 2014	Americas	Middle-income
Haiti	HTI	DHS 1994, DHS 2000, DHS 2005, DHS 2012	Americas	Low-income
Honduras	HND	RHS 1991, RHS 1996, RHS 2001, DHS 2005, DHS 2011	Americas	Middle-income
India	IND	DHS 1998, DHS 2005	South-East Asia	Middle-income
Indonesia	IDN	DHS 1994, DHS 1997, DHS 2002, DHS 2007, DHS 2012	South-East Asia	Middle-income
Iraq	IRQ	MICS 2006, MICS 2011	Eastern Mediterranean	Middle-income
Jamaica	JAM	MICS 2005, MICS 2011	Americas	Middle-income
Jordan	JOR	DHS 1997, DHS 2002, DHS 2007, DHS 2012	Eastern Mediterranean	Middle-income
Kazakhstan	KAZ	DHS 1995, DHS 1999, MICS 2006, MICS 2010, MICS 2015	European	Middle-income
Kenya	KEN	DHS 1993, DHS 1998, DHS 2003, DHS 2008, DHS 2014	African	Middle-income
Kyrgyzstan	KGZ	DHS 1997, MICS 2005, DHS 2012, MICS 2014	European	Middle-income
Lao People's Democratic Republic	LAO	MICS 2006, MICS 2011	Western Pacific	Middle-income
Lesotho	LSO	DHS 2004, DHS 2009, DHS 2014	African	Middle-income
Liberia	LBR	DHS 2007, DHS 2013	African	Low-income
Madagascar	MDG	DHS 1997, DHS 2003, DHS 2008	African	Low-income
Malawi	MWI	DHS 2000, DHS 2004, MICS 2006, DHS 2010, MICS 2013, DHS 2015	African	Low-income
Maldives	MDV	DHS 2009	South-East Asia	Middle-income
Mali	MLI	DHS 1995, DHS 2001, DHS 2006, MICS 2009, DHS 2012	African	Low-income
Mauritania	MRT	MICS 2007, MICS 2011	African	Middle-income

Mexico	MEX	MICS 2015	Americas	Middle-income
Mongolia	MNG	MICS 2005, MICS 2010, MICS 2013	Western Pacific	Middle-income
Montenegro	MNE	MICS 2005, MICS 2013	European	Middle-income
Morocco	MAR	DHS 2003	Eastern Mediterranean	Middle-morocco
Mozambique	MOZ	DHS 1997, DHS 2003, MICS 2008, DHS 2011	African	Low-income
Myanmar	MMR	DHS 2015	South-East Asia	Middle-income
Namibia	NAM	DHS 2000, DHS 2006, DHS 2013	African	Middle-income
Nepal	NPL	DHS 1996, DHS 2001, DHS 2006, MICS 2010, DHS 2011, MICS 2014	South-East Asia	Low-income
Nicaragua	NIC	RHS 1992, DHS 1998, DHS 2001, RHS 2006	Americas	Middle-income
Niger	NER	DHS 1998, DHS 2006, DHS 2012	African	Low-income
Nigeria	NGA	DHS 1999, DHS 2003, MICS 2007, DHS 2008, MICS 2011, DHS 2013	African	Middle-income
Pakistan	PAK	DHS 2006, DHS 2012	Eastern Mediterranean	Middle-income
Panama	PAN	MICS 2013	Americas	High-income
Paraguay	PRY	RHS 1995, RHS 1998, RHS 2004, RHS 2008	Americas	Middle-income
Peru	PER	DHS 1996, DHS 2000, DHS 2004, DHS 2005, DHS 2006, DHS 2007, DHS 2008, DHS 2009, DHS 2010, DHS 2011, DHS 2012	Americas	Middle-income
Philippines	PHL	DHS 1993, DHS 1998, DHS 2003, DHS 2008, DHS 2013	Western Pacific	Middle-income
Republic of Moldova	MDA	RHS 1997, DHS 2005, MICS 2012	European	Middle-income
Rwanda	RWA	DHS 2000, DHS 2005, DHS 2010, DHS 2014	African	Low-income
Saint Lucia	LCA	MICS 2012	Americas	Middle-income
Sao Tome and Principe	STP	DHS 2008, MICS 2014	African	Middle-income
Senegal	SEN	DHS 1997, DHS 2005, DHS 2010, DHS 2012, DHS 2014, DHS 2015	African	Low-income
Serbia	SRB	MICS 2005, MICS 2010, MICS 2014	European	Middle-income
Sierra Leone	SLE	MICS 2005, DHS 2008, MICS 2010, DHS 2013	African	Low-income
Somalia	SOM	MICS 2006	Eastern Mediterranean	Low-income
South Africa	ZAF	DHS 1998	African	Middle-income
South Sudan	SSD	MICS 2010	African	Low-income
Sudan	SDN	MICS 2010, MICS 2014	Eastern Mediterranean	Middle-income
Suriname	SUR	MICS 2006, MICS 2010	Americas	Middle-income
Syrian Arab Republic	SYR	MICS 2006	Eastern Mediterranean	Low-income
Tajikistan	TJK	MICS 2005, DHS 2012	European	Low-income
Thailand	THA	MICS 2005, MICS 2012	South-East Asia	Middle-income
The former Yugoslav Republic of Macedonia	MKD	MICS 2005, MICS 2011	European	Middle-income
Timor-Leste	TLS	DHS 2009	South-East Asia	Middle-income
Togo	TGO	DHS 1998, MICS 2006, MICS 2010, DHS 2013	African	Low-income

Trinidad and Tobago	TTO	MICS 2006	Americas	High-income
Tunisia	TUN	MICS 2011	Eastern Mediterranean	Middle-income
Turkey	TUR	DHS 1993, DHS 1998, DHS 2003	European	Middle-income
Turkmenistan	TKM	MICS 2006, MICS 2015	European	Middle-income
Uganda	UGA	DHS 1995, DHS 2000, DHS 2006, DHS 2011	African	Low-income
Ukraine	UKR	RHS 1999, MICS 2005, DHS 2007, MICS 2012	European	Middle-income
United Republic of Tanzania	TZA	DHS 1996, DHS 1999, DHS 2004, DHS 2010, DHS 2015	African	Low-income
Uruguay	URY	MICS 2012	Americas	High-income
Uzbekistan	UZB	DHS 1996, MICS 2006	European	Middle-income
Vanuatu	VUT	MICS 2007	Western Pacific	Middle-income
Viet Nam	VNM	DHS 1997, DHS 2002, MICS 2006, MICS 2010, MICS 2013	Western Pacific	Middle-income
Yemen	YEM	MICS 2006, DHS 2013	Eastern Mediterranean	Low-income
Zambia	ZMB	DHS 1996, DHS 2001, DHS 2007, DHS 2013	African	Middle-income
Zimbabwe	ZWE	DHS 1994, DHS 1999, DHS 2005, MICS 2009, DHS 2010, MICS 2014, DHS 2015	African	Low-income

DHS = Demographic and Health Survey; MICS = Multiple Indicator Cluster Survey.

* Country income group was determined using the current World Bank classification released in July 2018, which is based on the 2017 gross national income per capita, calculated using the Atlas method (available from: https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups, accessed 15 August 2018).

Supplementary table 2 Summary measures of inequality: formulas, characteristics and interpretation

Summary measure (abbreviation)	Formula	Simple or complex	Weighted or unweighted	Ordered or non-ordered (complex only)	Unit	Value of no inequality	Interpretation
Absolute measures							
Absolute concentration index (ACI)	$ACI = \sum_j p_j (2X_j - 1) y_j$	Complex	Weighted	Ordered	Unit of indicator	Zero	Positive (negative) values indicate a concentration of the indicator among the advantaged (disadvantaged). The larger the absolute value of ACI, the higher the level of inequality.
Between-group standard deviation (BGSD)	$BGSD = \sqrt{\sum_j p_j (y_j - \mu)^2}$	Complex	Weighted	Non-ordered	Unit of indicator	Zero	BGSD takes only positive values with larger values indicating higher levels of inequality.
Between-group variance (BGV)	$BGV = \sum_j p_j (y_j - \mu)^2$	Complex	Weighted	Non-ordered	Squared unit of indicator	Zero	BGV takes only positive values with larger values indicating higher levels of inequality.
Difference (D)	$D = y_{high} - y_{low}$	Simple	Unweighted	-	Unit of indicator	Zero	The larger the absolute value of D, the higher the level of inequality.
Population attributable risk (PAR)	$PAR = y_{ref} - \mu$	Complex	Weighted	Non-ordered	Unit of indicator	Zero	PAR takes only positive values for favourable indicators and only negative values for adverse indicators. The larger the absolute value, the higher the level of inequality.
Slope index of inequality (SII)	$SII = v_1 - v_0$ for favourable health intervention indicators; $SII = v_0 - v_1$ for adverse health outcome indicators	Complex	Weighted	Ordered	Unit of indicator	Zero	For favourable (adverse) indicators, positive values indicate a concentration among the advantaged (disadvantaged) and negative values indicate a concentration among the disadvantaged (advantaged). The larger the absolute value of SII, the higher the level of inequality.
Unweighted mean difference from best performing subgroup (MDBU)	$MDBU = \sum_j |y_j - y_{ref}|$	Complex	Unweighted	Non-ordered	Unit of indicator	Zero	MDBU takes only positive values with larger values indicating higher levels of inequality.
Unweighted mean difference from mean (MDMU)	$MDMU = \sum_j |y_j - \mu|$	Complex	Unweighted	Non-ordered	Unit of indicator	Zero	MDMU takes only positive values with larger values indicating higher levels of inequality.
Weighted mean difference from best performing subgroup (MDBU)	$MDBU = \sum_j p_j |y_j - y_{ref}|$	Complex	Weighted	Non-ordered	Unit of indicator	Zero	MDBU takes only positive values with larger values indicating higher levels of inequality.
Weighted mean difference from mean (MDMU)	$MDMU = \sum_j p_j |y_j - \mu|$	Complex	Weighted	Non-ordered	Unit of indicator	Zero	MDMU takes only positive values with larger values indicating higher levels of inequality.
Relative measures							
Coefficient of variation (COV)	$COV = \frac{BGSD}{\mu} * 100$	Complex	Weighted	Non-ordered	Unit of indicator	Zero	COV takes only positive values with larger values indicating higher levels of inequality.

Mean log deviation (MLD)	$MLD = \sum_j p_j(-\ln\left(\frac{y_j}{\mu}\right)) * 1000$	Complex	Weighted	Non-ordered	No unit	Zero	The larger the absolute value of MLD, the higher the level of inequality.
Population attributable fraction (PAF)	$PAF = \frac{PAR}{\mu} * 100$	Complex	Weighted	Non-ordered	No unit	Zero	PAF takes only positive values for favourable indicators and only negative values for adverse indicators. The larger the absolute value of PAF, the larger the degree of inequality.
Ratio (R)	$R = y_{high}/y_{low}$	Simple	Unweighted	-	No unit	One	R takes only positive values. The further the value of R from 1, the higher the level of inequality.
Relative concentration index (RCI)	$RCI = \frac{ACI}{\mu} * 100$	Complex	Weighted	Ordered	No unit	Zero	RCI is bounded between -1 and +1 (or -100 and +100 if multiplied by 100). Positive (negative) values indicate a concentration of the indicator among the advantaged (disadvantaged). The larger the absolute value of RCI, the larger the degree of inequality.
Relative index of inequality (RII)	$RII = v_1/v_0$ for favourable health intervention indicators; $RII = v_0/v_1$ for adverse health outcome indicators	Complex	Weighted	Ordered	No unit	One	RII takes only positive values. The further the value of RII from 1, the higher the level of inequality.
Theil index (TI)	$TI = \sum_j p_j \frac{y_j}{\mu} \ln\frac{y_j}{\mu} * 1000$	Complex	Weighted	Non-ordered	No unit	Zero	The larger the absolute value of TI, the greater the level of inequality.
Unweighted index of disparity (IDIS)	$IDIS = \frac{1}{n} * \frac{\sum_j |y_j - \mu|}{\mu} * 100$	Complex	Unweighted	Non-ordered	No unit	Zero	IDIS takes only positive values with larger values indicating higher levels of inequality.
Weighted index of disparity (IDISW)	$IDISW = \frac{\sum_j p_j |y_j - \mu|}{\mu} * 100$	Complex	Weighted	Non-ordered	No unit	Zero	IDISW takes only positive values with larger values indicating higher levels of inequality.

y_j = Estimate for subgroup j.

y_{high} = Estimate for subgroup high. Note that for the binary dimensions age, place of residence and sex, subgroup high refers to 20–49 years, urban and females, respectively, in the case of favourable health intervention indicators and to 15–19 years, rural and males, respectively, in the case of adverse health outcome indicators. For ordered dimensions (economic status and education), subgroup high refers to the most-advantaged subgroup in the case of favourable health intervention indicators and to the most-disadvantaged subgroup in the case of adverse health outcome indicators. For non-ordered dimensions (subnational region), subgroup high refers to the subgroups with the highest estimate. Note that reference subgroups for difference and ratio were selected based on convenience of data interpretation (that is, providing positive values for range difference calculations and values above one for range ratio calculations). In the case of sex, this does not represent an assumed advantaged of one sex over the other.

y_{low} = Estimate for subgroup low. Note that for the binary dimensions age, place of residence and sex, subgroup low refers to 15–19 years, rural and males, respectively, in the case of favourable health intervention indicators and to 20–49 years, urban and females, respectively, in the case of adverse health outcome indicators. For ordered dimensions (economic status and education), subgroup low refers to the most-disadvantaged subgroup in the case of favourable health intervention indicators and to the most-advantaged subgroup in the case of adverse health outcome indicators. For non-ordered dimensions (subnational region), subgroup low refers to the subgroup with the lowest estimate. Note that reference subgroups for difference and ratio were selected based on convenience of data interpretation (that is, providing positive values for difference calculations and values above one for ratio calculations). In the case of sex, this does not represent an assumed advantaged of one sex over the other.

y_{ref} = Estimate for reference subgroup. Note that for the binary dimensions age, place of residence and sex, reference subgroup refers to 20–49 years, urban and females, respectively. For ordered dimensions (economic status and education), reference subgroup refers to the most-advantaged subgroup. For non-ordered dimensions (subnational region), reference subgroup refers to the subgroup with the highest estimate in the case of favourable health intervention indicators and to the subgroup with the lowest estimate in the case of adverse health outcome indicators. Note that reference subgroups were selected based on convenience of data interpretation. In the case of sex, this does not represent an assumed advantaged of one sex over the other.

p_j = Population share for subgroup j.

$X_j = \sum_j p_j - 0.5 p_j$ = Relative rank of subgroup j.

μ = National average.

v_0 = Predicted value of the hypothetical person at the bottom of the social-group distribution (rank 0).

v_1 = Predicted value of the hypothetical person at the top of the social-group distribution (rank 1).

n = Number of subgroups.