ACT CONSORTIUM GUIDANCE ON HEALTH EQUITY ANALYSIS

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PURPOSE OF THE GUIDANCE

This guidance has been prepared for the ACT Consortium members. It is intended to provide an introduction to health equity issues and outline the principles and methods for undertaking equity analysis.

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CONTENTS

UNDERTAKING HEALTH EQUITY ANALYSIS

1. INTRODUCTION TO HEALTH EQUITY ANALYSIS

1.1 Why undertake health equity analysis?

Equity has long been considered an important goal in the health sector. Although part of the variation in health status between individuals is biological is origin, disparities in health between nations and between social groups and individuals within nations are largely determined economic, political and social factors in how societies are organized. Disparities in health often reflect stratifying forces that differentiate life opportunities within and between countries.

The poor tend to suffer higher rates of mortality and morbidity than do the better-off. They often use health services less, despite having higher levels of need, and spend more on health care as a share of income than the better-off. Health inequalities may also exist between groups of people defined by their age, gender, geographical location, ethnicity, occupation and education level. Equity analysis highlights the disparities in health outcomes between different socio-economic or demographic groups, and should be useful for policy-making and those involved in the allocation of health sector resources.

1.2 What is health equity analysis?

Health equity analysis involves comparing mortality and morbidity outcomes of different sub-groups. Equity concerns are often presented in terms of differences in socioeconomic status, though they may also exist between other groups such as those categorized by gender, age, ethnicity, education level, occupation or geographical location.

Inequities are those inequalities that are considered unfair or unjust. The notion of equity considers how health outcomes or health care utilization correspond to need. Economists sometimes make a distinction between horizontal and vertical equity. Horizontal equity means treating the same those who are the same in a relevant respect (such as having the same 'need'). Vertical equity means treating differently those who are different in relevant respects (such as having different 'need').

1.3 What are the different dimensions of health equity analysis?

Health equity research is typically concerned with disparities between socio-economic or demographic groups in one or more of the four focal variables:

- ***health outcomes***
- ***health care utilization***
- ***payments people made for health care*** (directly through out-of-pocket payments as well as indirectly through insurance premiums, social insurance contributions and taxes)

- ***subsidies received through the use of services***

This guidance note focuses on the first two dimensions of health equity analysis. To a large extent the methods used to analyze inequality in health care financing are similar and the methods discussed apply using out-of-pocket health expenditure as the health outcome measure. Since the allocation of public subsidies for health services are not directly examined in ACT Consortium studies, though guidance on conducting benefit incidence analysis can also be obtained in the reference: Analyzing Health Equity using Household Survey Data by O'Donnell et al published in 2008.

1.4 What are the different measures for health inequality?

There are various measures to report health inequality. In the simplest form, tables and graphs can be used to present the outcomes by population group. Rate differences and ratios can also be reported, such as the difference in the health outcome (or utilization measure) between the lowest and highest socioeconomic status quintiles. One limitation of these range measures is that they focus on two points in the distribution and do not capture the changes that occur in the middle of the distribution. Concentration curves and the concentration index are alternative measures which are typically used to report health outcomes by socioeconomic status. They can be prepared using grouped data (such as socioeconomic quintiles or deciles) and individual-level data on socioeconomic status. Concentration curves present proportion of (ill) health suffered by the cumulative proportions of individuals ranked by socioeconomic status. The concentration index is defined in terms of the concentration curve and takes a value between zero and one. Further details on the different measures are in Section 3.

1.5 Further analysis of health inequality

Additional analysis of health inequality can be undertaken to provide a finer description of the relationship between health outcomes and socioeconomic status, by standardizing for demographic factors such as age or gender. There are also methods that allow some decomposition of inequality into its constitution parts, either by explaining differences between population groups or the socioeconomic-related inequality captured in the concentration index. This note introduces these analyses and provides references for those wanting to undertake this multivariate analysis.

For all the topics covered in this note further information can be obtained in O'Donnell O, van Doorslaer E, Wagstaff A, Lindelow M (2008). *Analyzing Health Equity Using Household Survey Data*. World Bank, Washington. ACT Consortium members interested in undertaking equity analysis are encouraged to discuss with the economists in the ACT Consortium core group.

2. BASIC CONSIDERATIONS IN THE MEASUREMENT OF HEALTH INEQUALITY

As the notion of health inequity entails some subjective judgement about what is considered an unfair level of inequality, the majority of measures report on health inequalities. This section provides an overview of the basic considerations in the measurement of health inequality.

Although the objective of promoting greater health equity is well accepted, there is no formally agreed set of indicators with which to measure health inequality. To some extent this reflects a traditional focus on aggregate health outcomes, though also some of the challenges in measuring health distribution. The challenges are both practical, such as linking social and health data, and complex, such as determining what norm against which to identify inequalities.

There are three key issues that must be addressed in constructing a measure of health inequality:

- the ***measure of the health outcome***, utilization of health care and/or other consequence
- the ***population grouping*** across which health inequalities are described or assessed
- the ***reference group or norm*** against which differences are measured

2.1 Health outcomes, health care utilization and/or other health-related consequences

The concept of health is complex and has multiple dimensions. The different dimensions of health status include: health risk; perception of health; care-seeking behaviour; diagnosis; treatment; incidence of disease disability and death; and other consequences, such as the impact of out-of-pocket health expenditure.

There are various measures for health outcomes, which report on mortality, and different aspects of morbidity. Summary measures of health status such as the quality-adjusted life-year (QALY) in high income settings and the disability-adjusted life-year (DALY) in low and middle-income countries have been increasingly used in health economics. However, the choice of health status measure will vary and depend on the study context. In most cases several different measures of health status are used to report health inequalities and capture the different dimensions of health. For example, as well as health outcomes, inequalities are also often reported in the utilization of health care and for other health related consequences, such as the out-of-pocket expenditure involved in accessing health services. Some malaria health outcome measures are discussed in Section 2.1.1.

It should be noted that the expression of health inequality may depend on the nature and degree of “measurability” of the health indicator. Some measures are dichotomous, such as the presence of a given disease, while others reflect a range of ordinal health states, such as self-reported health measures ranging from poor to fair or excellent health. Measures may also be continuous and cardinal, such as levels of blood pressure.

2.1.1 Malaria-related health measures

Various measures have been used to report health outcomes and the utilization of health care services. Key indicators relating to malaria have been specified in the context of existing research

instruments such as the Demographic and Health Survey or Malaria Indicator Survey, though alternative measures may be appropriate for study outcomes in the ACT Consortium projects where the empahasis is on the access to and targeting of ACTs. Examples of possible outcome and utilization measures relevant to ACT consortiume studies are provided below, though this is not intended to be an exhaustive list.

EXAMPLE: Selected measures of malaria outcomes, health-seeking behaviour and utilization of malaria treatment

Examples of malaria outcomes:

% anaemia in children under 5 and pregnant women

% parasitological cure at 28 days

Incidence of adverse events

Incidence of biologically confirmed malaria/severe malaria

Examples of health seeking behaviour and utilization of malaria treatment:

% who sought treatment for a fever (and at a specified type of health care facility)

% with fever who got biological diagnosis (within 24 or 48 hrs onset of symptoms)

% obtained ACTs to treat fever (within 24 or 48 hrs onset of symptoms)

% of those with negative RDT, inappropriately treated with ACTs

% of those who received appropriate treatment according to result of RDT

% reporting adherence to full-course of ACTs

The data on mortality, morbidity may be available from Health Information System surveillance data. Utilization of malaria-related health care services and specifica malaria outcome data may be self-reported and collected as part of a household survey, or may be directly observed either by researchers conducting an exit poll or by health professionals in a health care facility. In order to conduct an equity analysis, it is necessary to have some descriptive characteristics of the sample population in order to undertake appropriate sub-group analysis (see Section 2.2). Secondary sources of relevant household survey data include: living standard measurements surveys (LSMS), demographic and health surveys (DHS), malaria indicator surveys (MIS). These household survey templates may also be useful for designing research instruments for the ACT Consortium studies.

2.1.2 Measures of self-reported health

Many health indicators rely on self-reported health, such as the data collected in a DHS. In understanding these outcomes it should be noted that an individual's social position and the social context in which s/he lives influence the self-perception of disability, symptoms and suffering. In high income countries, poor people report greater illness and also have higher mortality rates than the rich. In developing counties, however, it is frequently observed that the

poor report less ill health than the rich even though the poor have higher mortality rates. Measures of self assessed health are thought to reflect better knowledge of health issues and also reflect the richer (or more educated) person's greater likelihood to have access to health services and diagnosis. It is important to note, therefore, that our understanding of health inequalities depends in part on the measure used for health.

2.2 Population groups across which comparisons are made

Having selected an appropriate health measure, the next step is to determine the population group(s) across in which the distribution of health is described. Some measures that report the distribution of health across individuals, though more often inequalities are described according to population groupings such as age, gender, race/ethnicity, education, occupation, income or another measure of socioeconomic status, or geographic area of residence.

2.2.1 Defining population groups

In selecting the population grouping(s) across which comparisons in health status are made there are a number of considerations. Some measures are relatively straightforward to define and measure (e.g. gender) while others are more challenging (e.g. socioeconomic status). Some variables such as income or education level have a clear hierarchical orderings, though there may be no obvious ordering for others, such as occupation or region. Other things being equal the smaller the unit of grouping the larger the observed inequality. Just as the indicator for health status can impact on the health inequality, so too can the choice of social stratifier or population group. If comparisons are required over time or between countries then care must be taken to ensure that the same underlying definition for the population group is used.

In order to make health inequality comparisons between different ACT Consortium studies, a consistent approach across studies to defining measures of health outcomes and population groups is recommended.

Selected population groupings for health equity analysis

Socioeconomic status (SES)	Several measures for socioeconomic status, including income, expenditure, consumption, or proxy measures typically based on asset ownership
Gender	Male vs female
Age	Multiple possibilities, though it is common to report malaria-related outcomes in children under five years of age.
Ethnicity	Categories are likely to depend on the country and study context.
Education level	Various measures; often separated into none, primary, secondary and higher.
Occupation	Categories are likely to depend on the country and study context.
Geographical location	Often defined as urban vs rural. Other categories may be appropriate and will depend on the country and study setting. In selecting geographic areas it may be appropriate to use that constitute administrative or policy-making jurisdictions.

As with the measures for health outcomes and health care utilization they may be collected as part of a household survey, by researchers conducting an exit poll, or by health professionals in a health care facility. Secondary sources of household survey data include LSMS, DHS, MIS, and

as mentioned before these survey instruments may also be useful templates for those designing research instruments.

2.2.2 Alternative methods for the measurement of socio-economic status

Health equity is often concerned with how health outcomes or health-related behaviours vary by socio-economic status (SES). There are several approaches to measuring socio-economic status. Direct measures include income, expenditure and consumption and are summarized below. Collecting the data required for the direct measures can be methodologically challenging, time-consuming and costly, and therefore with the exception of the Living Standard Measurement Surveys (usually carried out in conjunction with the World Bank), direct measures are rarely used.

Direct measures of socioeconomic status

Income:	the amount of money received during a period of time in exchange for labour or services, from the sale of goods or property, or as part of the profit from financial investments.
Expenditure:	money payments or the incurrence of a liability to obtain goods or services
Consumption:	final use of goods and services, excluding the intermediate use of some goods and services in the production

In many of the settings in which malaria transmission occurs the population will mainly subsitence farmers in whom these direct measures socioeconomic status may not be appropriate. In these populations proxy measures are useful in providing an indication of socio-economic status. Of these, the most common is to create a socio-economic status index that is largely based on asset ownership. In the literature this measure may also be referred to as a wealth index or an asset index. It is expected that the majority of the studies in the ACT Consortium will opt to use a proxy measure for socio-economic status that is based on asset ownership and in line with approaches used in the national DHS. Exceptions may include those studies in which expenditure on health care is a particular interest.

2.2.3 Proxy measures of living standards: Socio-Economic Status (SES) index

The socio-economic status (SES) index is a composite measure of the cumulative living standard of a household. Methods for creating an index measure of household socio-economic status are well established; for example, Demographic and Health Surveys use this approach to create socioeconomic quintiles.

The SES index is calculated using easy-to-collect data on a household's ownership of selected assets, such as televisions and bicycles, materials used for housing construction, and types of water access and sanitation facilities. Sample questions on asset ownership from the Demographic and Health Survey (and replicated in the Malaria Indicator Survey) are provided in Appendix A.

The SES index is generated with a statistical procedure known as ***principal components analysis***, and places individual households on a continuous scale of relative wealth. A brief description of the techniques is provided in the box and further information can be found in: Vyas

S, Kumaranayake L. (2006). Constructing socio-economic status indices: how to use principal components analysis. *Health Policy and Planning*; 21:459-468 and Oscar Rutstein S, Johnson K. (2004). *The DHS Wealth Index. DHS Comparative Reports No. 6.* ORC Macro, Calverton, Maryland, USA.

METHOD: Use of principal components analysis to create DHS socioeconomic quintiles
Each household asset for which information is collected is assigned a weight or factor score generated through principal components analysis. The resulting asset scores are standardized in relation to a standard normal distribution with a mean of zero and a standard deviation of one. Each household is assigned a standardized score for each asset, where the score differs depending on whether or not the household owned that asset (or, in the case of sleeping arrangements, the number of people per room). These scores are summed by household, and individuals are ranked according to the total score of the household in which they reside. The sample is then divided into population quintiles -- five groups with the same number of individuals in each.

Source: Measure DHS available from http://www.measuredhs.com/topics/wealth/methodology.cfm

2.2.4 Applying a national SES index to specific study

A key consideration in undertaking equity analysis is that the population surveyed for a study will be a subset of the national population and may not be nationally representative. Large-scale household surveys, such as the DHS, are designed to be nationally representative. However, it is likely that ACT Consortium studies will not undertake household surveys on such a scale or may collect patient data at health facilities, using methods such as exit polls. For example, if the study population are those individuals attending a health facility, then it is likely that the very poor will be under-represented since in low-income countries in the poorest quintile are usually much less likely to attend a health facility than those in other socioeconomic quintiles. Thus, any socioeconomic quintiles derived solely from patient utilization of health facilities would not be nationally representative.

It is possible, however, to apply a national SES index to a specific study if there are survey data from a DHS and the survey questions on asset ownership are the same in both studies. This involves using the national survey data to compute factor weights and then applying these to the specific survey to derive SES index scores that can be assessed against the national distribution of the index. It is recommended, therefore, that the ACT Consortium members collect data to construct an SES index that is compatible to that employed in the most recent national DHS. DHS data can be requested from the Measure DHS website: http://www.measuredhs.com/accesssurveys/search/start.cfm.

EXAMPLE: Applying national SES Index to a specific study

Thiede et al (2005) used DHS data to construct a national SES index that could be applied to their study on the use of HIV/AIDS voluntary counselling and testing (VCT) services in South Africa. They collected data on the assets from users of public clinics in townships only and computed a SES score using principal components factor loadings from an analysis of all urban households in the national DHS. From the DHS data, the cut off points for SES quintiles in South Africa's whole urban population could be calculated and the fraction of township residents located in each urban wealth quintile identified. In this study township residents were concentrated in the middle part of the urban wealth distribution (see table). The fraction of township users could then be compared with the respective population shares in each wealth quintile for the entire urban population.

Percentage of township population and users of HIV/AIDS VCT services by urban SES quintile, South Africa

Urban quintile	Percent of township population	Percent of users of HIV/AIDS VCT services
Poorest 20%	14.0%	35.6%
2nd	23.7%	38.9%
3rd	28.8%	17.3%
4th	25.4%	7.2%
Richest 20%	8.1%	1.0%

Source: Adapted from Thiede M, Palmer N et al 2005.

An additional issue that is raised by the above example is whether to use a ***national SES index*** or apply separate ***urban and rural SES indices***. The DHS approach is to apply a single index on the basis of data from the entire country sample. The appropriate approach for ACT Consortium studies is expected to depend on the country context.

2.3 Identifying a reference group or "norm"

A central aspect in describing health inequality or inequity is to identify a reference group or "norm" against which health outcome differences are measured. There are a variety of approaches to identifying a reference group, and the choice of reference can affect the magnitude of inequality observed.

One approach is to select the ***minimum standard*** which acts as a threshold below which health outcomes are considered inequitable. Examples include achieving 80% of all children sleeping under an insecticide treated net (ITN) or ensuring that 80% of all children with malaria symptoms are treated with a nationally approved antimalarial within 24 hours of onset of symptoms.

Another approach is set the reference group value at the ***mean of all other groups***. This identifies the amount of health that would theoretically have to be "redistributed" across population groups in order for all groups to have the same mean health. A problem of identifying the mean as the reference group is that greater equality does not necessarily reflect an improvement in the health of those below the mean as it can also be achieved by lowering the health status of those above the mean.

Other measures define inequality with reference to the group with the highest or ***maximum health status***. These measures identify the health improvement required by other groups to reach the health of the best-off group. The standard may be specified in terms of the highest

observed health status or according to what is biologically maximal. For example, biological differences in the life expectancy of men and women may suggest gender-specific maxima.

3. MEASURES OF HEALTH INEQUALITY

3.1 Mean variation in health outcomes across population groups

In its simplest form the measures of health status are presented in ***tabular form*** both in aggregate and by population group. The table below is extracted from the 2006 Zambia Malaria Indicator Survey. It shows the presentation of several malaria-related health measures, presented overall and by gender, urban-rural residence, socio-economic status and mother's education level. Standard tabulations for presenting the malaria indicators by socioeconomic group are provided in Appendix B.

Results such as these can also be presented ***graphically*** using simple column or bar charts.

EXAMPLE: Malaria Indicator Survey tabulations: Prevalence and prompt treatment of fever in Zambia

Percentage of children under five years of age with fever in the two weeks preceding the survey, and, among those children with fever, percentage who took antimalarial drugs, who took the drugs the same/next day after developing the fever, and who sought treatment from a health facility/provider same/next day, by background characteristics

Background characteristic	*Percentage of children with fever in last 2 weeks (%)*	*Number of children under 5*	Among children with fever[1]: *Percentage who took anti-malarial drugs (%)*	*Percentage who tool anti-malarial drugs same/next day (%)*	*Percentage who sought treatment from a health facility / provider same/next day (%)*	*Number of children with fever*
Gender						
Male	29.6	662	58.7	39.3	3.6	196
Female	28.8	631	57.1	34.6	5.5	182
Residence						
Urban	18.0	295	73.6	49.1	3.8	53
Rural	32.6	998	55.4	35.1	4.6	325
SES index						
Lowest	37.9	351	52.6	32.3	3.8	133
Second	34.8	348	52.9	32.2	3.3	121
Middle	23.2	259	68.3	48.3	10.0	60
Fourth	19.6	230	68.9	44.4	4.4	45
Highest	18.3	104	*	*	*	19
Mother's Education						
None	29.3	253	48.7	28.4	2.7	74
Primary	31.8	739	55.7	35.3	5.1	235
Secondary	22.9	279	76.6	51.6	4.7	64
Higher	*	*	*	*	*	5
Total	29.2	1293	57.9	37.0	4.5	378

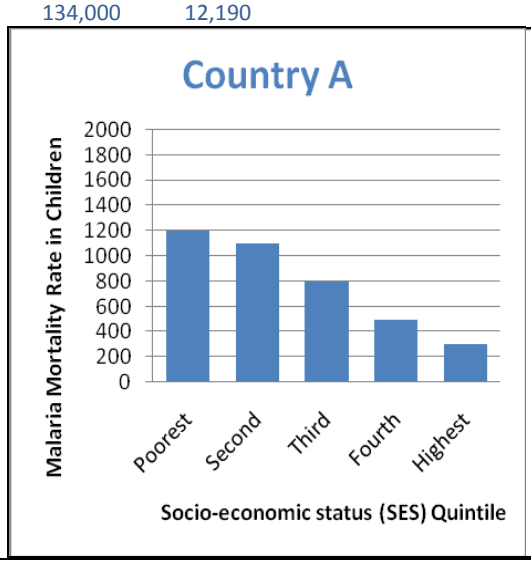
1 Excludes children whose fever started less than one day before the interview

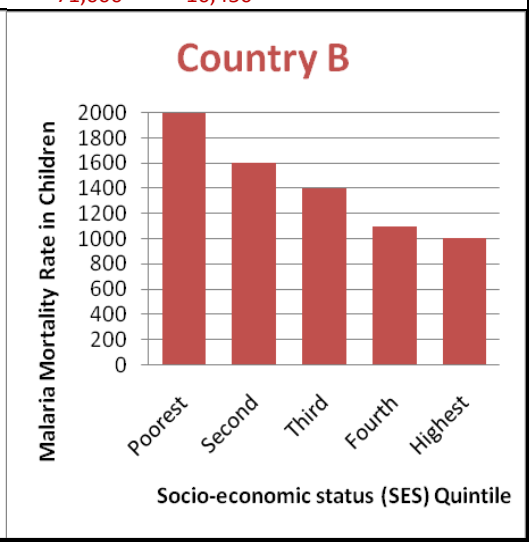
Source: Malaria Indicator Survey: Basic Documentation. Core Component 9 – Tabulations for Key Malaria Indicators. Results taken from Zambia National Malaria Indicators Survey 2006. * An asterisk indicates that a figure is based on fewer than 25 cases and has been suppressed.

Although presenting the results of health equity analysis in tabular and graphical form is useful, interpreting the findings and making comparisons between countries or settings may not be straightforward. The example in the box below shows the malaria mortality outcomes by socioeconomic quintile for two purely hypothetical countries and asks which one of the two countries has the greatest health inequality?

EXAMPLE: Malaria mortality results from two hypothetical countries. Which country has the greatest health inequality?

	Country A				Country B			
SES Quintile	Number of children under five years	Number of malaria deaths	Malaria mortality rate in children per 100,000	Relative % deaths	Number of children under five years	Number of malaria deaths	Malaria mortality rate in children per 100,000	Relative % deaths
Poorest	45,000	5,400	1,200	44%	18,000	3,600	2,000	34%
Second	30,000	3,300	1,100	27%	16,500	2,640	1,600	25%
Third	28,000	2,240	800	18%	14,000	1,960	1,400	19%
Fourth	16,000	800	500	7%	12,500	1,375	1,100	13%
Highest	15,000	450	300	4%	10,000	1,000	1,000	9%
Total	134,000	12,190			71,000	10,450		





3.2 Range measures: rate ratios and rate differences

As an extension to the presentation of outcomes described above, simple measures such as ***rate ratios*** or ***rate differences***, are often used to describe inequalities between population groups. For example, these measure are often used to compare the range in illness/mortality between the least healthy and the healthiest groups, between the lowest and highest socioeconomic quintiles or between urban and rural populations. The selection of the groups for comparison should balance the need to demonstrate the magnitude of the health inequality with the imperative of including sufficiently large population groups to ensure statistical significance.

The rate difference reports the actual difference between two population groups, and depends on both the average level and the scale. The rate ratio reports the ratio of one group to another and is independent of the average level and scale. The illustration below shows the rate difference and rate ratio. These simple range measure are calculated to consider the degree of inequality in the malaria mortality rate per 100,000 in children under five years of age between the lowest and highest socioeconomic groups.

It would also be possible to use these range measures to compare the shortfall in achievement from some maximum or norm. For example, in the assessment of gender equity for health outcomes, shortfalls in longevity for males and females from their respective biological maxima could be compared. These measures require the identification of norms for optimal health achievement.

EXAMPLE: Rate Difference and Rate Ratio.
Which country has the greatest health inequality?

	Country A	Country B
SES Quintile	Malaria mortality rate in children per 100,000	Malaria mortality rate in children per 100,000
Poorest	1,200	2,000
Second	1,100	1,600
Third	800	1,400
Fourth	500	1,100
Highest	300	1,000
RATE DIFFERENCE	**900**	**1000**
(between lowest and highest SES group)	**=1200-300**	**=2000-1000**
RATE RATIO	**4**	**2**
(between lowest and highest SES group)	**=1200/300**	**=2000/1000**

As the example shows, the measure of inequality used can affect the interpretation of the findings. For example, the rate difference suggests that the degree of inequality is higher in Country B, (with a difference of 1,000 per 100,000 in the malaria mortality ratio compared to 900 per 100,000 in Country A). In contrast, the rate ratio shows that the degree of inequality is greater in country A and that the malaria mortality ratio is four times greater in the poorest socioeconomic quintile compared to the richest quintile. Of these two measures the rate ratio is usually preferred since it is independent of the average level and scale.

An important advantage of these range measures, rate difference and rate ratio, is that they are readily interpretable. However, they also have a potential drawback in that they do not take into account the health status of the middle three quintiles.

3.3 Concentration curves and concentration index

As measures for health inequality, the concentration index and the related concentration curve express the inequality in health across the full range of socioeconomic status.

3.3.1 Concentration curve

The ***concentration curve*** graphically depicts the degree of health inequality. It displays the share of health accounted for by cumulative proportions of individuals ranked by socioeconomic status from poorest to richest.

The health variable must be measured in units that can be aggregated across individuals, though this is not necessary for the socioeconomic status variable which is only used to rank the individuals from poorest to richest. The data could be at the individual level, such that values of both health status and the socioeconomic status are available for each observation. Alternatively, the data can be grouped, in which case for each socioeconomic group (e.g. SES quintile) the mean value of the health variable is observed.

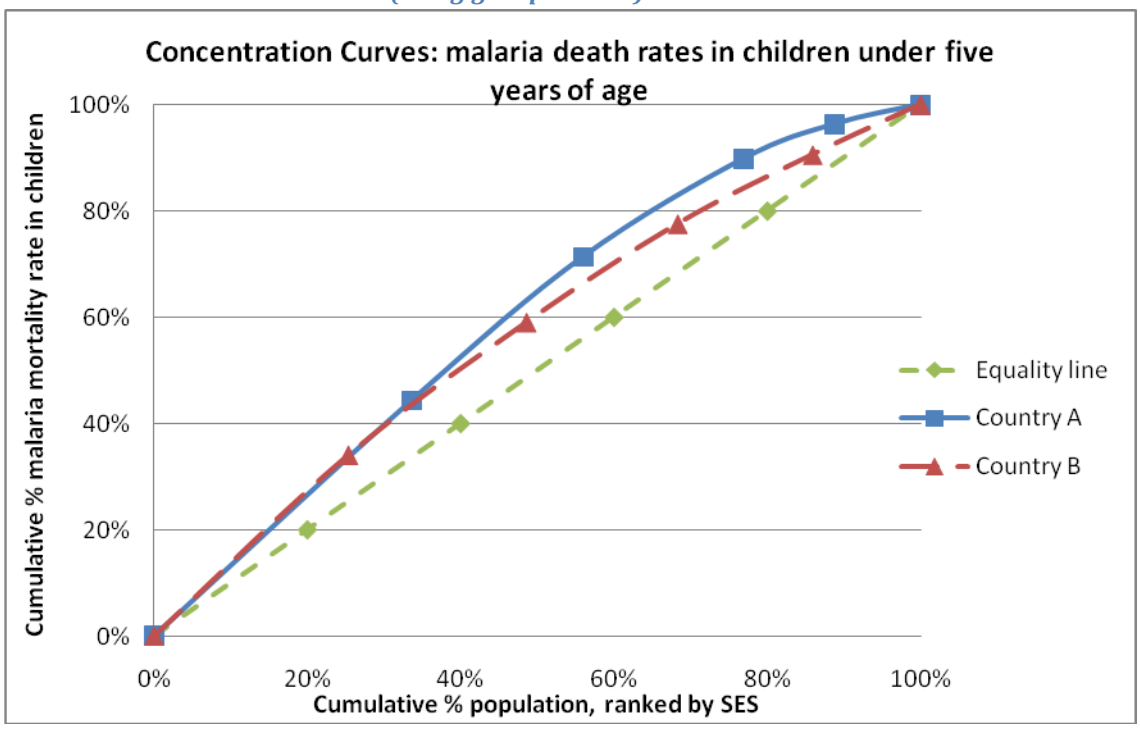
The concentration curve plots the cumulative percentage of the health variable on the y-axis against the cumulative percentage of the population, ranked by socioeconomic status, beginning at the poorest and ending with the richest on the x-axis. If everyone has exactly the same value of the health variable, the concentration curve will be a 45-degree line, running from the bottom left-hand corner to the top right-hand corner: the ***line of equality***. The further the curve is from the line of equality the more concentrated the degree of health inequality. If the health status measure is a “bad” in that it represents ill health then a concentration curves that lies above the line of equality shows that the poorest proportions of the population have the greatest burden of ill health. Conversely, if the health status measure is a “good”, in that it represents a positive aspect of health, then a curve lying below the equality line shows that the poor are relatively less healthy than the rich.

Concentration curves for the same variable in different countries or time periods can be plotted on the same graph. Similarly, curves for different health sector variables in the same country and time period can be plotted against each other. Plotting multiple curves on the same chart can aid comparison, and the curve that lies furthest from the equality line exhibits the greatest inequality. It is possible for the curves to cross, and this represents a scenario in which neither case dominates, though the degree of inequality can be compared using a associated measure: the concentration index (see section 3.3.2).

The following example presents the concentration curves presented for the malaria mortality in children under five years in two hypothetical countries using grouped data. The graph can be easily created in Excel using an x-y scatter plot with the data points connected by a smoothed line. The y-axis and the x-axis have a fixed range from 0% to 100%. It can be seen that there is a greater concentration of malaria deaths in the poorest populations since the health outcome is a “bad” and the curves lie above the equality line. It can also be concluded that Country A exhibits a higher degree of inequality than Country B since its concentration curve lies further from the equality line.

When individual data are used concentration curves can also be generated in Stata using either the glcurve or twoway commands. Sample code has been provided in the book: *Analyzing health equity using household survey data* by O’Donnell, van Doorslaer et al. The book and individual chapters are available for download from the World Bank website.

EXAMPLE: Concentration curves (using grouped data)



SES Quintile	Number of children < 5yrs	Relative % children < 5yrs	**Cumulative % children < 5yrs**	Number of deaths	Malaria mortality rate in children per 100,000	Relative % deaths	**Cumulative % deaths**
Country A							
Poorest	45000	34%	**34%**	5400	1200	44%	**44%**
Second	30000	22%	**56%**	3300	1100	27%	**71%**
Third	28000	21%	**77%**	2240	800	18%	**90%**
Fourth	16000	12%	**89%**	800	500	7%	**96%**
Highest	15000	11%	**100%**	450	300	4%	**100%**
Country B							
Poorest	18000	25%	**25%**	3600	2000	34%	**34%**
Second	16500	23%	**49%**	2640	1600	25%	**59%**
Third	14000	20%	**68%**	1960	1400	19%	**78%**
Fourth	12500	18%	**86%**	1375	1100	13%	**91%**
Highest	10000	14%	**100%**	1000	1000	9%	**100%**

3.3.2 Concentration index

The ***concentration index*** (CI) provides a measure of the magnitude of inequality. It is defined as twice the area between the concentration curve and the line of equality. The index has a magnitude between zero and one, and takes the value of zero when there is no socioeconomic inequality. The convention is that the index takes a negative value when the curve lies above the

line of equality. This indicates a disproportionate concentration of the health variable among the poor. The CI takes a positive value when it lies below the line of equality. If the health variable is a "bad" such as ill health, a negative value of the concentration index means ill health is higher among the poor.

The CI is a relative measure in the sense that it is independent of the absolute levels of both (ill) health and income. The CI has the limitation that the actual health gradient across socioeconomic groups and the corresponding concentration curve may have a very different shape for two populations and still yield the same CI value. The CI may also not be as readily accessible to policy makers as the simple range measures.

The example below shows how to calculate the concentration index using grouped data. The concentration indices takes negative values because the health outcome, malaria mortality, is a "bad", and as the magnitude of the concentration index is greater in Country A (at -0.1863) than in Country B (at -0.1361) and this indicates a higher degree of inequality in Country A.

EXAMPLE: Concentration Index (using grouped data)

SES Quintile	Cumulative % children < 5yrs	Cumulative % deaths	Malaria mortality rate in children per 100,000	Relative % deaths	**Concentration Index**	Calculation of concentration index
Country A						
Poorest	34%	44%	1200	44%	-0.0083	= 34% * 71% – 56% * 44%
Second	56%	71%	1100	27%	-0.0463	= 56% * 90% – 77% * 71%
Third	77%	90%	800	18%	-0.0567	= 77% * 96% – 89% * 90%
Fourth	89%	96%	500	7%	-0.0750	= 89% * 100% – 100% * 96%
Highest	100%	100%	300	4%	0.0000	
					-0.1863	
Country B						
Poorest	25%	34%	2000	34%	-0.0158	= 25% * 59% – 49% * 34%
Second	49%	59%	1600	25%	-0.0263	= 49% * 78% – 68% * 59%
Third	68%	78%	1400	19%	-0.0477	= 68% * 91% – 86% * 78%
Fourth	86%	91%	1100	13%	-0.0463	= 86% * 100% – 100% * 91%
Highest	100%	100%	1000	9%	0.0000	
					-0.1361	

The concentration index can calculated with a higher degree of accuracy using the individual level data, and the guidance on these calculations can be found in O'Donnell et al, 2008, including sample Stata code.

4. FURTHER ANALYSIS OF HEALTH INEQUALITY

The more frequently used descriptions of health inequality are given by the bivariate relationship between a health variable and some indicator socioeconomic status, as discussed in Section 3. However, multivariate analysis can be undertaken to obtain a finer description, such as standardizing for demographic factors such as age and gender. Alternatively it is possible to explain the inequality through decomposition into its constituent parts.

This section provides an introduction to the different methods. A full description of the alternative methods can be obtained from the book on *Analyzing Health Equity using Household Survey Data* by O'Donnell et al. The book and individual chapters are available for download from the World Bank website.

4.1 Demographic standardization of the health distribution

Regression analysis can be used to describe the distribution of health by SES, conditional on demographic factors such as age, gender or ethnicity. The more variables that are controlled for in the regression analysis, the finer the description of the relation between health and SES. It is important to note that the analysis is descriptive: no causal relationship can be interpreted and it is only possible to conclude that the health status variable is observed to vary as SES varies.

There are two ways of standardizing: direct and indirect standardization. Direct standardization providers the distribution of health across SES group that would be observed if all groups had the same age structure, for example, but had group-specific intercepts and age effects. In comparison, indirect standardization corrects the actual distribution by comparing it with the distribution that would be observed if all individuals had their own age but the same mean age effect as the entire population.

Further advice on the regression methods (including Stata code) for undertaking demographic standardization of the health distribution can be obtained in O'Donnell et al…..

4.2 Explaining differences between groups: Oaxaca Decomposition

Having measured health inequalities, the natural next step is to seek to explain them: why do inequalities in health exist between the poor and better-off? There are methods for decomposing inequality in health or health care into contributing factors. This seeks to explain the distribution in the outcome variable by a set of factors that vary systematically with socioeconomic status. For example, variations in health may be explained by variations in education, income, health insurance coverage, distance to health facilities, or quality of health care. The decomposition methods can reveal how far inequalities in health can be explained by inequalities in, say, insurance coverage rather than distance to facilities.

The Oaxaca Decomposition explains the gap in the means of an outcome variable between two groups (i.e. poor and nonpoor). The gap is decomposed into that part that is due to group differences in the magnitudes of determinants of the outcome in question and group differences in the effects of these determinants. For example, poor children may be less healthy because they have less access to piped water and because their parents are less knowledgeable about how to obtain the maximum health benefits from piped water.

For the Oaxaca decomposition we suppose that we have our outcome variable of interest, y and two groups, which we call the poor and nonpoor. We assume that y is explained by a vector of determinants, x, according to the regression model:

$$y_i = \begin{cases} \beta^{poor} x_i + \varepsilon_i^{poor} & \text{if poor} \\ \beta^{nonpoor} x_i + \varepsilon_i^{nonpoor} & \text{if nonpoor} \end{cases}$$

where the vectors of the β parameters include intercepts and ε are the error terms.

The gap between the mean outcomes $y^{nonpoor}$ and y^{poor} is equal to:

$$y^{nonpoor} - y^{poor} = \beta^{nonpoor} x^{nonpoor} - \beta^{poor} x^{poor}$$

where $x^{nonpoor}$ and x^{poor} are vectors of explanatory variable evaluated at the means for the non poor and poor, respectively. For example, if there are two x's (e.g. x_1 and x_2) then the equation becomes:

$$\begin{aligned} y^{nonpoor} - y^{poor} \\ &= \left(\beta_0^{nonpoor} - \beta_0^{poor}\right) + \left(\beta_1^{nonpoor} x_1^{nonpoor} - \beta_1^{poor} x_1^{poor}\right) \\ &+ \left(\beta_2^{nonpoor} x_2^{nonpoor} - \beta_2^{poor} x_2^{poor}\right) \end{aligned}$$

The gap in the y between poor and nonpoor can be thought of as being due in part to differences in the intercepts, differences in x_1 and β_1 and differences in x_2 and β_2. For example, the gap in the mean health status (y) could be due to differences in educational attainment (x_1) and the effects of educational attainment (β_1) and due to differences in accessibility of health facilities (x_2) and the effects of accessibility of health facilities (β_2). The next step in the Oaxaca decomposition is then to determine how much of the overall gap in health outcome is due to the differences in the x's rather than the β's. This step is not discussed here but further information on the process is described in detail in the book by O'Donnell et al.

4.3 Explaining socioeconomic-related health inequality: Decomposition of the Concentration Index

An alternative decomposition is that of the concentration index. The Oaxaca decomposition is limited in that is explains the difference between two groups (e.g. poor and nonpoor) in the mean value of a health outcome. In contrast, the decomposition of the concentration index seeks to explain the inequality in health across the entire distribution of some measure of socioeconomic status.

The econometrics that lies behind the decomposition of concentration index and full details (including Stata code) are provided in the book on analyzing health equity by O'Donnell et al.

5. SUMMARY AND RECOMMENDATIONS

This guidance note is intended to provide an introduction to the methods for undertaking health equity analysis. It also provides some examples to illustrate the key principles and issues. References are provided to guide the reader to more detailed literature on the methods of health equity analysis.

It is recommended that ACT Consortium studies undertake some equity analysis to understand the impact of the intervention on different population groups. Relevant population groups are likely to include: socioeconomic status (defined using a proxy SES index), geographic location, gender, age, education level or occupation. Coordination between the core group and ACT Consortium studies will be important to ensure consistency in defining comparable outcome measures. In terms of constructing a SES index, it is recommended that the ACT Consortium studies apply an approach to collecting relevant data on asset ownership that is compatible with that taken in the national demographic and health survey (DHS). This will enable the equity analysis of ACT Consortium interventions to locate the study populations in the context of the national socioeconomic distribution. Finally, it is expected that the ACT Consortium studies would want to present the results of health equity in tabular format. Other measures including the rate ratios, concentration curve and concentration index may also be useful. The extent to which ACT Consortium studies undertake further analysis of health inequality is expected to vary.

The ACT consortium core group actively encourage the incorporation of health equity analysis in to individual projects where feasibile. For further information and assistance please do not hesitate to contact: Dr Shunmay Yeung (shunmay.yeung@lshtm.ac.uk) and Dr Kristian Hansen (kristian.hansen@lshtm.ac.uk).

REFERENCES

The book and individual chapters on *Analyzing Health Equity using Household Survey Data* by O'Donnell et al are available for download from the World Bank website: www.worldbank.org. It also contains additional information and references on many of the issues covered in this guidance note.

The website on Demographic and Health Surveys: www.measuredhs.com also contains valuable information for conducting health equity analysis. The templates for the household survey questions, including the questions for constructing a socioeconomic status index are likely to be particularly useful.

Another useful reference is the Roll Back Malaria website on the Malaria Indicator Survey: www.rbm.who.int/merg

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APPENDIX

Appendix A: Survey questions relevant for estimating the SES index, taken from the Demographic and Health Survey

SURVEY QUESTION	ANSWER: OPTIONS OR GUIDANCE
Region	State
Urban or Rural?	Urban or rural
Is (name) male or female	Male Female
How old is (name)	In years (and months if under 5 years of age)
If age 5 years or older. Has name ever attended school?	Yes or no
What is the highest level of school (name) has attended	Primary Secondary Higher Don't know
What is the main source of drinking water for members of your household?	Piped water into dwelling Piped water into yard / plot Public tap Open well in dwelling Open well in yard / plot Open public well Protected well in dwelling Protected well in yard / plot Surface water: spring Surface water: river / stream Surface water: dam Rainwater Tanker truck Bottled water Other (specify)
What kind of toilet facilities does your household use?	Flush toilet Traditional pit toilet Ventilated improved pit latrine No facility / bush / field Other (specify)
Does your household have: Electricity? A radio? A television? A telephone? A refrigerator?	For each answer yes or no

What type of fuel does your household mainly use for cooking?	Electricity LPG / natural gas Biogas Kerosene Coal / lignite Charcoal Firewood / straw Dung Other (specify)
Main material of the floor (record observation)	Earth / sand Dung Rudimentary floor: wood planks Rudimentary floor: Palm / bamboo Parquet or polished wood Vinyl or asphalt strips Ceramic tiles Cement Carpet Other (specify)
Does any member of your household own: A bicycle? A motorcycle or motor scooter? A car or truck?	For each answer yes or no

Source: Taken from guidance for conducting Demographic and Health Surveys (DHS). Available from: http://www.measuredhs.com/aboutsurveys/dhs/start.cfm

Appendix B: Malaria Indicator Survey standard tabulations relevant for access to malaria treatment

Table 5. Prevalence and prompt treatment of fever

Percentage of children under five years of age with fever in the two weeks preceding the survey, and, among those children with fever, percentage who took antimalarial drugs, who took the drugs the same/next day after developing the fever, and who sought treatment from a health facility/provider same/next day, by background characteristics

Background characteristic	Percentage of children with fever in last 2 weeks	Number of children under 5	Among children with fever[1]: *Percentage who took anti-malarial drugs*	*Percentage who tool anti-malarial drugs same/next day*	*Percentage who sought treatment from a health facility / provider same/next day*	Number of children with fever
Age (in months)						
<12						
12-23						
24-35						
36-47						
48-57						
Sex						
Male						
Female						
Residence						
Urban						
Rural						
Region						
Region 1						
Region 2						
Region 3						
Wealth index						
Lowest						
Second						
Middle						
Fourth						
Highest						
Education						
None						
Primary						
Secondary						
Higher						
Total						

1 Excludes children whose fever started less than one day before the interview. Source: Malaria Indicator Survey: Basic Documentation. Core Component 9 – Tabulations for Key Malaria Indicators

Table 6. Type and timing of antimalarial drugs

Among children under five years of age with fever in the two weeks preceding the survey, percentage who specific antimalarial drugs and percentage each type of drug the same/next day after developing the fever, by background characteristics (excludes children whose fever started less than two days before the interview.)

Background characteristic	Percentage of children who took drug:						Percentage of children who took drug the same / next day:						Number of children with fever
	SP / Fansidar	Chloro-quine	Amodia-quine	Quinine	ACT	Other anti-malarial	SP / Fansidar	Chloro-quine	Amodia-quine	Quinine	ACT	Other anti-malarial	
Age (in months)													
<12													
12-23													
24-35													
36-47													
48-57													
Sex													
Male													
Female													
Residence													
Urban													
Rural													
Region													
Region 1													
Region 2													
Region 3													
Wealth index													
Lowest													
Second													
Middle													
Fourth													
Highest													
Education													
None													
Primary													
Secondary													
Higher													
Total													

Source: Malaria Indicator Survey: Basic Documentation. Core Component 9 – Tabulations for Key Malaria Indicators