WORLD HEALTH ORGANIZATION

Technical consultation on the measurement of health inequalities

Geneva, Switzerland, November 7-8, 2001

D R A F T

REPORT ON WHO TECHNICAL CONSULTATION ON THE MEASUREMENT OF HEALTH INEQUALITIES

EVIDENCE AND INFORMATION FOR POLICY
WORLD HEALTH ORGANIZATION
GENEVA, SWITZERLAND

1) INTRODUCTION: This report is a summary of major conclusions and recommendations of a meeting of experts on the measurement of health inequalities organized by WHO and held in Geneva, Switzerland, on November 7-8, 2001. In addition to WHO headquarters staff, the participants included economists, statisticians, public health professionals and other social scientists who had substantial experience in measuring health inequalities. Details of the agenda, a list of participants and their affiliations, as well as a list of invited participants who could not attend, can be found in the Annex.

2) BACKGROUND: The World Health Organization framework for the assessment of health system performance identified three intrinsic social goals to which health systems contribute: population health, responsiveness of the health system; and fairness in financial contributions of households to the health system. The goal of population health is defined as improving the average level of health and improving the distribution of health across individuals, in other words reducing inequalities in health.

Levels of health were assessed using Disability Adjusted Life Expectancy, now renamed Healthy Life Expectancy (HALE). WHO argued that logically, health inequalities should be measured as the distribution of healthy life expectancy across individuals. Because of the limitations of data and methods, for the WHR 2000 health inequality was assessed by measuring the distribution of the probability of survival across children.

A parametric model was used to estimate the distribution of the probability of surviving to age 2. This distribution was then summarized with the following measure of inequality:

$$II[3,.5] = \frac{\sum_{i=1}^{n}\sum_{j=1}^{n}\left|s_i - s_j\right|^3}{2n^2 \bar{s}^{0.5}}$$

where s_i is the expected survival time of child *i* from birth to age 2, and $\bar{s}$ is the average survival time in the population. The measure is based on comparing each child to every other child in the population, gives a large weight to the tails of the distribution as all differences are raised to the power of 3 in the numerator, and is a relative measure as the mean is included in the denominator. This measure was selected based on the responses to an internet based survey which included questions on the normative choices involved in the selection of an inequality measure. In the WHR2000 estimates of *equality* in child survival were reported to preserve consistency with the reporting on the other four goals of health system which were all on a positive scale (i.e. a higher number is better). Equality in child survival was simply estimated as one minus the inequality index (II) presented above.

Data on child survival came from complete birth histories available through the Demographic and Health Surveys (DHS) program. For developed countries child survival data from small geographical areas, such as counties or municipalities, were used. Since the publication of the WHR2000 new methods have been developed for the measurement of child survival inequality and the study of its determinants, as well as methods for the measurement of inequality in healthy life expectancy.

3) OBJECTIVES AND AGENDA: There were two objectives of the meeting. The first was to obtain the opinions of a group of experts on the approach taken by WHO in measuring health inequalities. The second was to obtain their advice and suggestions on ways this work could develop in the future.

The meeting began with an overview of the conceptual framework used by WHO in the measurement of health inequalities, including a discussion of different measures of inequality borrowing on the literature from other fields. It was followed by a presentation of the methods used to measure child survival inequality in the WHR2000 and the subsequent analysis of the decomposition of this measure into its potential determinants. Following that, potential methods that could be used to extend measurement to adult survival were discussed, including models for aggregated data that could be used to come up with reasonable approximations, where individual-level data are not available. Subsequently, Dr Hasegawa from Japan and Dr Varavikova from the Russian Federation presented their work on using small-area

data to look at trends in mortality and health status in their countries. Following that, there was a presentation of WHO's work on estimating health states across Member States in a comparable way and ways that inequality in health states could be measured. The rest of the agenda involved an open discussion, inspired by a presentation from Dr Michael Wolfson, on ways that age-sex specific information on the distribution of health states and risks of death could be combined in the estimation of the distribution of healthy life expectancy. The final session specifically addressed how to best summarize the bivariate distribution of health and income, and ways that WHO could best quantify the health of the poor, particularly in low- and middle-income countries.

4) MAIN CONCLUSIONS AND RECOMMENDATIONS:

This section summarizes the conclusions and discussion for which there was general agreement.

a) **Quantity of interest: inequality in HALE.** There was general consensus that since WHO is reporting average levels of health in terms of healthy life expectancy, its measure of inequality in health should also reflect variation in healthy life expectancy. The measure of inequality should be constructed in such a way that contributions of socio-economic factors as well as specific diseases, such as HIV/AIDS and tuberculosis, can be calculated. Decomposability of the inequality measure into contributions from various components was an attribute that was deemed essential by all participants. (Due to the nature of most inequality measures, additive decomposability is usually not feasible.) There was also agreement on the need for a measure that can be presented to policy makers in a simple way. There was discussion about inequalities in health between males and females and it was generally agreed that special focus should be given to differences between the two sexes and particular attention drawn to cases where biological causes could not explain the differences observed.

b) **Inequalities across individuals versus social groups.** It was generally agreed that the two approaches to the measurement of health inequalities answer fundamentally different questions and are complementary, rather than conflicting. There was consensus on the premise that differences in health across individuals are interesting in their own right and that differences across social groups are also interesting and worth measuring. The WHO measure of inequality should be a complement, not replacement, for existing measures. WHO has been reporting routinely on average levels of heath for countries; reporting on inequalities in health within countries should also been routine.

c) **Voluntary & genetic risks.** There was discussion on the feasibility of excluding voluntary and/or genetic risks from the calculation of inequalities in healthy life expectancy. The group agreed that given the questionable boundaries that qualify a risk as voluntary or purely genetic, these should not be excluded from the estimation.

d) **Measure of inequality.** The discussion around the measure that should be used to summarize the distribution of the quantity of interest was not conclusive; however, there was general agreement on the fact that no single measure of inequality will reflect all attributes of the distribution of health that one might care about and that a combination of measures may need to be calculated to encompass concerns about inequality. It was agreed that WHO does need to use a single measure in its final estimation of health system attainment and that such a measure need not reflect the average level of health, as that is reported separately by WHO. Participants suggested considering simpler measures such as the interquartile range (e.g. for expected life lengths from a period survival curve), if after further study it was shown to reflect the right dimensions of variability in health.

e) **Measurement of child survival inequality.** The methods used in the WHR2000 and the new models developed since were discussed. The individual-level random effects logit model was preferred to the extended beta-binomial because it can be used to study the effect of individual level covariates. Some participants suggested that other specifications of the distribution of the random effect should be explored.

f) **Decomposition of inequality index.** The currently used methods for allocating the index of inequality into the effects of potential determinants was discussed. The current method for assets and education involved removing the effect of variation in assets and

variation in education and recalculating the index; for the variable that is the health system proxy, the results presented were the effect of increasing access to 100% (thus increasing the average level and removing the effect of variation in access). It was proposed that the decomposition analysis also be done with increasing the level of education by 1 year for every mother, and by removing the effect of variation in access to health services without affecting the average level. There was also discussion on what the variable that has been labelled "access to health services" means; there was agreement that it likely captures different things in different countries, ranging from the pure effect of immunization on child health in some setting to access to health services in other settings, as well as other possible factors which may not be specifically related to the health system. It was suggested that additional variables that might capture access to health services and are available (such as antenatal care and type of birth attendant for women of reproductive age) also be considered in the analysis.

g) Models for adult inequality. The methods currently used to estimate the distribution of mortality risk in older age groups involve survival analysis models correcting for additional variation not captured by the available covariates. A few models were discussed and it was suggested that in addition to controlling for community-level effects with the extra term in the model it would be interesting to add some of the community-level variables in the model, where they are available. In the setting of the USA, where the current data are available the geocodes are randomized, which limits the potential to add community-level variables in the model; however, in future analysis of data from other countries, where this may not be a limitation, community-level variables such as income inequality, availability of health services, health expenditure, will be added to the model. The main drawback of the proposed methods that was discussed was data availability.

h) Small area data. Data from small geographical areas was proposed as one of the potential ways to estimate the distribution of risk of mortality in adult age groups. These datasets are more readily available for a large number of countries, and can be easier collected for developing countries than individual level data. The relationship between small area data and individual level data for the US was presented. This relationship needs to be researched in more detail; if it is found that there is a systematic relationship between individual-level data and small area data for several countries, then small areas could be used in the approximation of the distribution of mortality risks for countries where individual level data are not available. The presentations from the Russian Federation and Japan supported the hypothesis that looking at variations across administrative areas reveals variations that could be useful in policy formulations. The group discussed the fact that data from different countries would be at different levels of aggregation (or administrative districts) and there may be issues with comparability of results across countries. The best strategy seemed to be to collect data at the smallest level of aggregation possible for each country. It is important to test this strategy by using data from multiple levels of geographic aggregation within one (or more) countries and compare them to estimates from individual level data.

i) Inequality in health states. Preliminary results on the distribution of health states by age and sex from the analysis of the WHO Survey on health were presented. The value of looking at variations in health states was discussed, separate from looking at inequality in healthy life expectancy. It was noted that the use of the term "inequality" in this context may not be adding any analytical value. The trends depicted in health states are often not consistent with those seen in risk of death; therefore, it was seen as useful to look at each independently, prior to combining them into a single metric of inequality in health life expectancy. It was noted that while for mortality the quantity of interest is *risk* of death for health states the quantity examined is the *outcome*, that is the current health state.

j) Correlating risks of ill-health across ages. The discussion on how to combine all the pieces of information that feed into inequality in healthy life expectancy was led by Dr Michael Wolfson who proposed a variant of a micro-simulation model that would estimate HALE for a hypothetical population, for example of 1 million individuals. In such a simulation model, individuals would be exposed to a set of mortality and ill-health risks throughout their life time. By setting the correlation of their health risks across ages at one the upper bound of inequality could be estimated. As the correlation of health risks across

ages is unlikely to be one, one way to estimate the true value is to use the correlation of mortality rates across ages in small areas to approximate it. Before it is used, this approach should be applied to real data from a country with both small area data and longitudinal mortality follow-up data (such as the UK) to confirm its validity.

k) **Health of the poor.** The new approach by WHO to measure permanent income in the World Health Survey was discussed at length. It was agreed that it would be very useful to have cross-comparable measures of health and of permanent income in the same instrument, as that would allow for a much improved measurement of health of the poor. Current approaches to measuring health of the poor are not necessarily comparable across countries and are limited to those countries with good data on income. The World Health Survey would lead to much better information on poverty and permanent income in developing countries and in cross-population comparable estimates of health of the poor. This approach was deemed as very important for WHO to pursue in its next round of measurement. It was emphasized that the method should first be clarified by distinguishing which of three quite different applications are intended: a measure of poverty, a means of ranking individuals by socio-economic status within countries, or a measure most likely to have causal significance. These three objectives will not necessarily lead to the same choice of measure.

5) OTHER DISCUSSION:

This section summarizes the discussion for which there was no general agreement or conclusion.

a) **Use of term "inequality."** There was a long discussion on the use of the term "inequality" in the field of public health. The discussion was whether the term "health inequalities" should be reserved to mean "inequalities in health across groups defined by social, demographic or geographical characteristics" as it has been used for some time by several researchers in the field, or whether it should be used in the same way as in other fields of social and physical science, which would imply that "inequalities in health" means differences in health across individuals. Examples of other fields mentioned include economics, political science, education, and biology. It was agreed that the ultimate name chosen would need to be chosen so that it is clear to all readers what it is measuring. The name chosen by WHO must be clarified sufficiently so that the goals of all these researchers (about which no one at the conference had any disagreement) can all be accomplished.

b) **Measure of inequality.** There discussion on which summary measure of a distribution to use as the measure of inequality did not arrive at a concrete conclusion. The merits of different measures where discussed and measures such as the inter-quartile range of a distribution were proposed. One proposal was that WHO should calculate and report both relative and absolute indices of health inequality. It was agreed that in the context of health system performance assessment, one measure of inequality has to be selected for the calculation of the index of attainment. Any single measure should be accompanied by complementary measures (for example, indices of both absolute and relative inequalities). Some participants suggested that in the short run WHO should report inequality in health using simple indicators, such as the inter-quartile range and differences by socio-economic status, while in parallel develop data and methods for more complex indicators, that would, for example, consider partial orderings of distributions according to the Lorenz criterion. It was also suggested that WHO should make available both the summary indicator ultimately chosen as well as other indicators and the underlying distribution for those researchers interested. Finally, some participants proposed that different indicators of health inequality may be more relevant for some countries than others; for example, for high-income countries it was argued that it might be more useful to compare them on a measure that might not be applicable or of interest to low-income countries.

ANNEX

Agenda

Consultation on the measurement of health inequalities

7-8 November 2001 – WHO Headquarters, Geneva, Switzerland

November 7: Room E230; November 8: Salle C (5th floor, Main Building)

WEDNESDAY, NOVEMBER 7

9:00-10:30	**Conceptual framework for the measurement of health inequality** Chair: Anton Kunst; Presenter: Christopher Murray
10:30-11:00	Coffee Break
11:00-12:30	**Measures of health inequality** Chair: Anton Kunst; Presenter: Emmanuela Gakidou
12:30-2:00	Lunch Break
2:00-3:30	**Inequality in child survival: measurement and determinants** Chair: El Fatih El Samani; Presenter: Gary King
3:30-4:00	Coffee Break
4:00-5:30	**Inequality in adult survival: models for individual-level data** Chair: El Fatih El Samani; Presenter: Emmanuela Gakidou

Thursday, November 8

9:00-10:30	**Inequality in adult survival: models for small-area data** Chair: Than Tun Sein Presenters: Alan Lopez, Elena Varavikova, Toshihiko Hasegawa
10:30-11:00	Coffee Break
11:00-12:30	**Inequality in health states** Chair: Than Tun Sein; Presenter: Ajay Tandon
12:30-2:00	Lunch
2:00-3:30	**Inequality in healthy life expectancy: combining health states with risks of death, and risks of ill-health across ages** Chair: Michael Marmot
3:30-4:00	Coffee Break
4:00-5:30	**Health of the poor: how to best summarize the bivariate distribution of health and income** Chair: Michael Marmot; Presenter: Michael Wolfson

LIST OF PARTICIPANTS

Professor Sudhir Anand
St. Catherine's College
Oxford University
OX1 3U3
United Kingdom
Tel: + 44 1865 271872
Fax: + 44 1865 271768
Email: Aby.Bidwell@st-catherines.oxford.ac.uk

Dr Toshihiko Hasegawa
Director, Department of Health Care Policy
National Institute of Health Services Management
1-23-1, Toyama
Shinjuku-ku, Tokyo 162-0052
Japan
Tel: +81 (3) -3203-4821
Fax: +81 (-3) -3202-6853
Email: thasegaw@nih.go.jp

Tanja A.J. Houweling, MA
Department of Public Health
Faculty of Medicine and Health Sciences
Dr. Molewater plein 50
P.O. Box 1738
3000 DR Rotterdam
Netherlands
Tel: +31 10 408.75.07
Fax: +31 10 408.94.49
Email: houweling@mgz.fgg.eur.nl

Dr Gary King
Centre for Basic Research in the Social Sciences
Harvard University
34 Kirkland Street, RM.2
Cambridge, MA 02138
United States of America
Tel: +1 617 495 2027
Fax: +1 520 832 7022
Email: King@Harvard.Edu

Dr Anton Kunst
Department of Public Health
Faculty of Medicine and Health Sciences
Erasmus University
PO Box 1738
3000 DR Rotterdam
Netherlands
Tel: +31 10 408 7719 (Secr 7714)
Fax: 31 10 408 9449
email: kunst@mgz.fgg.eur.nl

Professor Sir Michael Marmot
Head of Department
Department of Epidemiology and Public Health
University College London
1-19 Torrington Place
London WC1E 6BT
United Kingdom
Tel: +44 020 7679 1717
Fax: +44 020 7813 0242
Email: m.marmot@ucl.ac.uk

Dr El Fatih Zeinelabdin el Samani
The WHO Representative
P.O. Box 11365-3597
Tehran
Islamic Republic of Iran
Tel: +98 21 670 0361
Fax: + 98 21 670 8969
Email: whoteh@who.un.or.ir

Dr Than Tun Sein
Director
Department of Medical Research
Yangon, Myanmar
c/o WHO Representative, Myanmar
Tel:
Fax: +95 1 251514
Email:

Dr Elena Varavikova
Monitoring of Health Losses Unit
Room 323
Central Research Institute of Information and Organization of Public Health
Dobrolubova 11
127254 Moscow
Russian Federation
Tel: +7095 219 5188
Fax: +7095 219 3840
Email: evaravikova@mtu-net.ru

Dr Michael Wolfson
Assistant Chief Statistician,
Analysis and Development Branch,
Statistics Canada
24th Floor, R.H. Coats Building
Ottawa, Ontario
Canada K1A 0T6
Tel: +1 613 951 8216
Fax: +1 613 951 5643
Email: wolfson@stcinet.statcan.ca

World Health Organization Secretariat

Dr Christopher J.L.Murray
Executive Director
Evidence and Information for Policy
World Health Organization
1211 Geneva 27
Switzerland
Tel: +4122 791 2418
Fax: +4122 791 4909
Email: murrayc@who.int

Dr Alan Lopez
Coordinator
Epidemiology and Burden of Disease
World Health Organization
1211 Geneva 27
Switzerland
Tel: +4122 791 2374
Fax: +4122 791 4328
Email: lopeza@who.int

Dr David Evans
Director
Global Programme on Evidence for Health Policy
World Health Organization
1211 Geneva 27
Switzerland
Tel: +4122 791 3768
Fax: +4122 791 4328
Email: evansd@who.int

Dr Abdelhay Mechbal
Director
Health Financing and Stewardship
World Health Organization
1211 Geneva 27
Switzerland
Tel: +41 22 791 2189
Fax: +41 22 791 4328
Email: mechbala@who.int

Mr Brodie Ferguson
Technical Officer
Epidemiology and Burden of Disease
World Health Organization
1211 Geneva 27
Switzerland
Tel: +41 22 791 4941
Fax: + 41 22 791 4328
Email: fergusonb@who.int

Dr Ajay Tandon
Economist
Evidence and Information for Policy
World Health Organization
1211 Geneva 27
Switzerland
Tel: +41 22 791 3290
Fax: +41 22 791 4328
Email: tandona@who.int

Dr Emmanuela Gakidou
Health Economist
Evidence and Information for Policy
World Health Organization
1211 Geneva 27
Switzerland
Tel: +41 22 791 3915
Fax: +41 22 791 4328
Email: gakidoue@who.int

Ms Mollie Hogan
Technical Officer
Epidemiology and Burden of Disease
World Health Organization
1211 Geneva 27
Switzerland
Tel: +41 22 791 3205
Fax: +41 22 791 4328
Email: hoganm@who.int

List of invited participants who could not attend

Dr Mustapha Azelmat, Ministry of Health, Morocco

Dr Norberto Dachs, WHO-AMRO

Dr Eddy van Doorslaer, Erasmus University,

Dr Timothy Evans, Rockefeller Foundation

Dr Davidson Gwatkin, World Bank

Dr Andrew Jones, York University, United Kingdom

Dr Rene Loewenson, EQUINET

Dr Johan Mackenbach, Erasmus University

Dr Geoff Rowe, Statistics Canada

Dr Than Sein, WHO-SEARO

Dr Viroj Tangcharoensathien, International Health Policy Program, Thailand

Dr Martin Tobias, Ministry of Health, New Zealand