Technical meeting to review the project *Inequalities in health System Performance and their Social Determinants in Europe – Tools for Assessment and Information Sharing* – a joint WHO-European Commission Action (2006WHO03)

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**Approach and Methods to Measure and Analyse Inequalities in Health System Performance and Their Social Determinants in Europe**

Technical document
Approach and Methods to Measure and Analyse
Inequalities in Health System Performance and Their
Social Determinants in Europe

Introduction
The World Health Organization Regional Office for Europe (WHO Europe) undertook the 3-year project *Inequalities in health System Performance and their Social Determinants in Europe – Tools for Assessment and Information Sharing* (Equity in Health project, for short) as a joint action with the European Commission. One of its main goals is to map health inequalities in the European Union and selected neighbouring countries based on a range of datasets that are publicly available on a regional (county/municipal) level. In addition, this project aims not only to provide more visibility to the subnational patterns of health and their determinants but also to analyse how such an integrated information system and its underlying data can inform policy across European countries. The project is based on the development of electronic interactive Atlases as tools to enhance the use and assessment of health information and facilitate the identification of social health inequalities.

This document provides a brief overview of the conceptual framework followed for analysing social health inequalities, the main definitions used, rationale for the selection of indicators and the health inequalities measurement, analysis and presentation processes, as they were outlined in the project protocol.

Figure 1 below presents a schematic depiction of the project development.

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Schematic representation of the Equity in Health project development
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Figure 1 The Equity in Health project development.
Definitions used in the project

Social determinants of health (SDH)
Based on review of the recent scientific literature and WHO internal documents and consultations, it has been decided to largely follow the position and approach of the WHO Commission on Social Determinants of Health (CSDH), which purposely adopted a broad definition of the social determinants of health (SDH). The concept encompasses the full set of social conditions in which people live and work, and further summarized by Tarlov as "the social characteristics within which living takes place".

Inequalities in health
Concerning inequalities in health the project takes a more specific European approach. The CSDH refers to the definition of health equity as ‘the absence of unfair and avoidable or remediable differences in health among population groups defined socially, economically, demographically or geographically’. However, it has been recognized that this definition is difficult to apply to aggregated statistics. Therefore, the project takes the position of Whitehead and Dahlgren who point out that practically all health differences in Europe can be considered socially determined:

“Three distinguishing features, when combined, turn mere variations or differences in health into a social inequity in health. They are systematic, socially produced (and therefore modifiable) and unfair…”

In today’s Europe, working out what social differences in health are fair and unfair is unnecessary. Essentially, all systematic differences in health between different socioeconomic groups within a country can be considered unfair and, therefore, classed as health inequities. There is no biological reason for their existence, and it is clear that even systematic differences in lifestyles between socioeconomic groups are to a large extent shaped by structural factors. Summing up briefly, social inequities in health are directly or indirectly generated by social, economic and environmental factors and structurally influenced lifestyles. These determinants of social inequities are all amenable to change.”

Conceptual framework

Overall, the project uses the framework of the WHO Commission on the Social Determinants of Health (CSDH) as presented in Figure 2.4

Figure 2 Conceptual framework for analysis and action on the social determinants of health

The framework specifies four domains of the overall concept “social determinants of health inequalities”:

- Socioeconomic political context.
- Social stratification (variations in the structural social determinants or distal causes of health inequalities).
- Intermediary factors (variations in the proximal determinants of health, i.e. variations in exposures, vulnerabilities, consequences, etc.).
- Outcomes in health (variations in health status and well-being) due to above three groups of influences.

The indicators to measure the concept fall into those four domains.

Indicators for the first domain of socioeconomic political context relate social inequalities in health to contextual factors which reflect fundamental structural characteristics and policies of societies. Most of these are conceived and formed at the national level, although regional and local political context may be very significant too. Therefore to devise such indicators for use at the regional level would require special effort to review and assess available knowledge and eventually relate it to regional statistical data. Potentially this work on the contextual indicators at the sub

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www.who.int/social_determinants/resources/csdh_framework_action_05_07.pdf

accessed 5.10.2010
national level can complement the (a) description and mapping of the social inequalities and (b) the comparisons of the variations in the health outcome indicators with the variations in the social and intermediary determinants. As the work on (a) and (b) is at the core of the project, development of the contextual indicators may be considered a later stage and under another project.

Broad socioeconomic policies are also linked to and responsible for the second domain and its constituent facets and indicators. These also address the structural social determinants of health and health inequalities (the causes of causes). As the project aims at comparability at the regional level across a possibly larger number of countries with different social systems, the focus will be on core indicators of socioeconomic status derived by standard methods.

In contrast, the indicators within the third domain of intermediary factors (proximal determinants) are intended to represent more direct/immediate causes of, or contributors to, the inequalities in health. In general, these are related closely to the policies, functions and interventions of the country health systems in the broad sense. Therefore they may be indicative of the success of the health system, both in terms of average level and distribution of achievements (possible performance indicators).

The indicators in the fourth domain, health outcomes, are to measure the health inequalities per se, (mortality, morbidity, disability, perceived health and well-being, etc.).

While a broad definition of social determinants of health (SDH) is important, within the field encompassed by this concept there are factors of various importance. Broadly speaking, health inequalities in this project involve analyses of the variations between rich and poor, well educated and poorly educated, in particular as the European Community is fostering convergence to ensure a high level of prosperity and well-being across Europe. 5

Data and methods used

Data sources

One of the main project goals was to increase the use of publicly available data, disaggregated into subnational - regional (county/municipality) level. Therefore, several potential data sources were explored, including those from international (e.g. Eurostat, ILO, UNESCO, OECD) and national surveys and projects (e.g. Health Behaviour in School-Aged Children (WHO/HBSC) and EurLIFE database of European Foundation for Improvement of Living & Working Conditions and Eurostat Regional database. In the end, Eurostat Regional (REGIO) database was identified


and used as the most complete data source, covering a wide range of harmonized indicators. Indicators were searched for and data sets identified in Eurostat databases. The process of data download, database compilation and further processing and computing of inequality indicators is described in detail in the accompanying technical document.\(^9\)

**Selection of indicators**
Following the Conceptual framework of the CSDH, indicators were selected according to their belonging to the next categories:

1. Indicators of social and economic position (structural determinants or distal causes), e.g. income, education attainment, and employment.
2. Indicators of exposures (intermediary determinants or proximal causes) e.g. environmental context, health behaviours and health systems resources and services availability, access and activities.
3. Indicators of health status (outcomes) e.g. mortality, morbidity, perceived quality of health and health services.

The indicators of social status at the regional level are measures of the socioeconomic (SE) position of the regional population, on average, or regions. Different SE indicators were considered because they tend to reflect diverse aspects of the social stratification process.\(^11\) The indicators selected as SE stratifiers were:

- Income of households - Disposable income, net (uses) - Purchasing power standard based on final consumption per inhabitant.
- Percentage of population by highest level of education attained - Pre-primary, primary and lower secondary education - levels 0-2 (ISCED 1997) - Both sexes - Between 25 and 64 years.
- Percentage of population by highest level of education attained - Tertiary education - levels 5-6 (ISCED 1997) - Both sexes - Between 25 and 64 years.
- Unemployment rates by sex and age - 25 years and over - Both sexes.
- Long-term unemployment (12 months and more) - Long-term unemployment rate (on total unemployment), and,
- Infant mortality rate (in the regional context, it has been shown that this is a good proxy of the overall level of welfare or deprivation (European Commission 2003).\(^12\)

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Beside the SE indicators used as stratifies, a number of other SE indicators have been made available.

The indicators of availability of health care system (HS) resources used for comparisons are simply measures of average availability of health care personnel and hospital beds as related to the population base, i.e. rates per 100,000 population. These do not take into account important structural parameters such as densities, age structure and morbidity of the population, the road networks, the physical location of the health care units, the level of urbanization, the related availability of social support services, and many other factors influencing needs for health care resources in a region.

The HS indicators selected for the project from the REGIO database included:

- Availability of Health Care Personnel (rates per 100,000 inhabitants) - Personnel by category (licensed, practising or active according to national definitions), including physicians or doctors, dentists, pharmacists and nurses and midwives.
- Hospital beds (rates per 100,000 inhabitants) - Total number of hospital beds, number of psychiatric beds, number of acute care beds, number of long-term nursing care beds (excluding psychiatric) and other beds (speciality hospitals).

The health status indicators included crude and standardized death rates by 65 causes – European Shortlist used by EUROSTAT, disaggregated by sex and age groups, life expectancy at different ages and crude and age standardized hospital discharge rates for selected causes disaggregated by sex and age groups. For the age group 0-64 years a new aggregation of causes of death, comprising of causes of death claimed to be amenable to health care has been created.

The full list of indicators available in the project is available in the Annex of users manual Atlas of Health Inequalities in Europe: User manual. EUROSTAT tables used in the project and corresponding metadata are given in the Annex 1.

Unit of analysis: The choice of unit of analysis has been driven by the data availability in EUROSTAT data tables. In general, EUROSTAT uses NUTS classification of regions in Europe. As standardized death rates for selected causes of death were used as the main outcome indicator, the availability of cause of death data was the major driving force for the selection of unit of analysis. In general, for majority of countries cause of death data was available at NUTS 2 level, with the exception of Scotland and Northern Ireland in United Kingdom where NUTS 1 level data was used, and Croatia, Cyprus, Denmark, Estonia, Iceland, Latvia, Lithuania,

Luxembourg, Malta, Slovenia, Croatia and the Former Yugoslav Republic of Macedonia, where NUTS 0 – country level - data was used. Full list of regions used is given in Annex 2 of users manual.

**Statistical methods and interactive atlases**

The methods followed a stepped approach starting with exploratory data analysis to determine indicator properties and ending with multivariate analysis to assess more complex indicator relationships. All statistical procedures were carried out using the R and the ArcGIS software packages.

**Exploratory and descriptive data analysis.** In order to assess the quality (mainly validity, missingness and detection of potential outliers) and statistical properties of indicators, exploratory and descriptive analyses were carried out. Procedures involved plotting frequency and geographic distributions in box-plots and maps and summarizing descriptive statistics (e.g. range, mean, median, interquartile range) of each of 894 indicators. Overall, results are shown in one-page summaries (Figure 3).

**Figure 3** Example of a one page summary of descriptive statistics.

The Regional Profile Comparison Atlas provides a presentation format for multi dimensional health indicator assessment (Figure 4). This atlas allows visualization of a regional profile containing a selected set of indicators and comparing up to two specific regions taking into account the distribution of the overall sample.

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Correlation analysis. Available indicators were further assessed for their geographical patterns and statistical associations using dual maps and correlation analyses as shown in the Descriptive and Correlation Analysis Atlas (Figure 5). The strength and direction of association between two indicators is measured with Pearson’s correlation coefficient and displayed graphically in a scatter plot.

To allow for further systematic correlation analyses scatter plots were presented in a matrix (Figure 6). This information was used additionally to select indicators for multivariate analyses.
Measurement of health inequalities and comparisons between socioeconomic groups.

To assess the level of social health inequalities the approach suggested by Kunst and Mackenbach (1994\textsuperscript{18}, 2001\textsuperscript{19}) was followed. Geographic regions (mostly at NUTS2 level) were grouped into quintiles according to each socioeconomic variable. Then, aggregate average health status measures for these socioeconomic groups were calculated using population weighted averages. Indicator benchmark values (e.g. target) were selected from quintile groups with the best situation. Two social health inequality measures were calculated to compare groups: the target area difference (also referred as absolute risk difference) and the target area ratio (or relative risk ratio). These measures are the differences between the mean values of the target and the group of interest (e.g. quintile in a less favourable situation). In general, the larger the observed difference or ratio means a more relevant social inequality in the health indicator. In addition, distribution patterns of indicators across the regions suggesting


European regional health inequalities database
WHO-EC Equity in Health Project
a highly aggregated effect or a gradient were noted. An example of the Atlas of Social Health Inequalities report output is presented in Figure 7.

![Figure 7 Example of output from the Atlas of Social Health Inequalities with report on target ratio (relative risk) for avoidable mortality from cervical cancer](image)

**Preliminary explorative multivariate analyses:** Given the large set of indicators in the atlases, a subset of indicators being judged more relevant has been selected for more in-depth statistical analyses. Briefly, using health outcomes as dependent variables and socioeconomic and health systems indicators as explanatory covariates, those preliminary explorative analyses involved the use of regression tree approaches. The resulting regression trees showed the relationships SE and HS variables with regards to different levels of the health status variable and allowed assessing and ranking the power of a socioeconomic or health systems resource variable to explain variability in health status. This regression method was also used for creating alternative groupings of regions according to their socioeconomic and health resource indicators and compared to the simpler quantile method approach used in the atlases. Preliminary findings indicate that observed differences are larger between regression-based than quintile-based groups.

**Limitations of the atlases**

There are several limitations that need to be taken into account when the atlases produced in this project are analysed. Only some major limitations will be mentioned here, an in depth overview of limitations that exists in aggregate data observational studies in general is given elsewhere. Limitations of this dataset and atlases produced are among other:

- The data come from routine observational reporting, and some atlases, like correlation atlas and atlases of inequalities implicitly suggest causal relationship

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between two variables. Unfortunately, causal relationship can not be established from observational data.

- **Reported indicators** are mostly summary measures of individuals living in the geographic regions (e.g. average disposable income), but sometimes also measures representing properties of a region, like for example the number of available hospital beds. In the atlases, one implicitly assumes that relationships that hold on individual level (for example low income and adverse health outcome) also holds on the regional level. This might, but also might not be true, with possible both increases and decreases in effect sizes.

- **Units of analysis** – geographical regions in a country or even within groups of counties - does not represent independent observations because the joint legislation, socio economic connections, cultural heritage etc. Without appropriate adjustment for clustering most statistical methods underestimates the variance which results in too narrow confidence intervals and too small p-values. Mixing of overlapping data from two clusters sometimes also changes overall effect. An example of this is relatively low correlation between educational achievement and adult mortality rates, which is much more prominent on country level than on EU-15 level.

- **Some data are not missing at random**, as for example health care resources at NUTS 2 level in the United Kingdom and Germany. Systematic missingness of data could bias the results.

**Conclusion and outlook**

Despite the limitations present in the current atlas system, the produced atlases allow the assessment of inequalities in socio economic, health care resources and health outcome variables between 280 European regions. Although atlases use only previously available data, they allow visualization and facilitate explorative analyses of health inequalities among European regions. It is an attempt to facilitate the use of publicly available data by policy makers, public health experts, researchers and broader public.

Some potential extensions of the present atlas system could improve the usability of atlases in the future. Inclusion of time component in the atlases would allow the assessment of trends over time. In addition, periodic update of the database would allow monitoring of future developments. Currently, atlases of amenable mortality and child specific atlases are deployed, but additional atlases on other health topics (e.g. elderly) could be developed in the future using the same analytical and technical framework. These further developments would facilitate the use of health information at sub national level in Europe.
Annex 1 – EUROSTAT tables used and corresponding metadata

In the project readily available data from EUROSTAT is used. Names of EUROSTAT data tables used and links to the corresponding metadata are given in the table below. Additional information can also be found in the EUROSTAT publication *European Regional and Urban Statistics Reference Guide*, available from [http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-RA-09-008/EN/KS-RA-09-008-EN.PDF](http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-RA-09-008/EN/KS-RA-09-008-EN.PDF).

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