7.5 Human health and safety

Definition:

(INSPIRE, 2007) Geographical distribution of dominance of pathologies (allergies, cancers, respiratory diseases, etc.), information indicating the effect on health (biomarkers, decline of fertility, epidemics) or well-being of humans (fatigue, stress, etc.) linked directly (air pollution, chemicals, depletion of the ozone layer, noise, etc.) or indirectly (food, genetically modified organisms, etc.) to the quality of the environment.

Description:

A descriptive approach to human health and safety will focus on the

- descriptive geographical distribution of diseases, wellbeing of humans or other health and safety qualities showing geographical patterns, may also include probability descriptions.
- causes and elements affecting health
- wellbeing of humans, including quality of the human environment
- safety issues, behaviour linked to safety
- health care services

To illustrate kinds of geographical information which can be included in this INSPIRE theme, some examples on medical statistics and medical geography can be given:

General statistics on health - change over time

- **mortality** – the number of death in relation to a total population over a given period of time
- **life expectancy** – the average number of years newborn children may expect to live if death subsequently occurs in accordance with the mortality for each age group of the population within this period. Life expectancy may also be estimated as the expected remaining time of life at any particular age.
- **Morbidity**: incidence of disease in relation to a total population over a given period of time. Morbidity can be described by many different indicators:
    - incidences: the number of new cases in relation to a total population over a given period of time
    - cumulative incidences: the total number of new cases for a longer period of time, e.g. several years, in relation to a total population
    - prevalence: the total number of cases registered in a population at a given time in relation to a total population
    - rate, age-specific rate, age-adjusted rate.

Relevant material on geographical patterns of health is comparison of the major sources of death or illness at different points in time. This can, for instance, illustrate epidemiological transitions, with a fall in infant mortality and infectious disease and a rise in degenerative diseases.

Incidence data on specific diseases or other health issues

Incidences overviews can be split by male/females, age, region or rural-urban sub-division, and data may give opportunities to depict trends over time. Examples which can be treated geographically:

- **Kinds of diseases and illnesses**: coronary heart disease, stroke, infant mortality, mortality related to cancer, morbidity overview, cardiovascular diseases, musculo-sceletal diseases, mental health problems, injuries, sexually transmitted diseases, infectious diseases.
- **Cancer incidence in particular**: Cancer comprises a variety of types with different geographical patterns. Incidence data from pubic registers material on age-specific trends, gender variations in a geographical context, incident rates and survival rates: Cancer of the tongue, mouth, throat,

stomach, colon, rectum, lunge, prostate, kidney, urinary bladder, malignant melanoma, lymphatic cancer.

Causes of poor or good health – risk factors - exposures

The theme may also include focus on the causes of poor (or good) health. For the purpose of INSPIRE it is convenient to define health in an environmental context, viewing health as a result of an interplay between three factors, man as a biological organism, habitat and behaviour - the human organism's ability to withstand chemical, physical, biological, psychological or social stresses.

- Firstly, it can provide clues about the causes of disease. Although examples of geographical studies leading to basic new knowledge about disease causation are rare, geographical disease patterns may generate hypotheses about causes which can be followed up using other approaches, or suggestions from other research approaches can be tested geographically.
- Secondly, such information can be useful in the planning of strategies for health promotion.
- Thirdly, knowledge about geographical variations in different aspects of health can be useful in health care planning.

Geographical distribution over exposure elements may help understanding links between exposure and health or illness. A causation analysis should include the following two concepts: **Risk factor**: factor which is known to increase the risk of a disease or other problems: **Exposure**: to be exposed to a risk factor:

- Exposure to chemical agents in the environment, in air, water, food and soil, has been implicated in numerous adverse effects on humans from cancer to birth effects. E.g. geochemical geographical data may be used in analysis of exposure.
- Among exposures which have been shown to be carcinogenic the following can be mentioned; radioactive and ultraviolet radiation, some chemicals, stimulants such as alcohol and nicotine, food and some occupational factors.
- Two groups of hazardous chemicals – heavy metals and persistent organic pollutants (POPs) are currently receiving particular attention. Further attention should also be given to CMR (cancerogenic, mutagenic and reprotoxic chemicals), PBT (persistent, bioaccumulative, toxic chemicals) and vPvB (very persistent and very bioaccumulative substances), which are substances of special concern according to REACH. Exposure to heavy metals has been linked with developmental retardation various cancers and kidney damage. Exposure with gold and lead has also been associated with the development of auto-immunity. Growing evidence that POPs have serious human health effects.
- Exposure to GMOs in the environment, in air, water, food and soil is currently receiving particular attention since it may potentially cause adverse effects on human health and the environment.

Human well-being:
Human wellbeing may be linked to environmental stress, e.g. noise, heavy traffic, pollution, it may also be reflected in statistics on rates negative wellbeing, e.g. psychiatric problems, alcohol-related causes of illness, social problems or death, health problems or death by traffic accidents, injuries or death by other accidents, suicide in general or firearm suicide as a particular case.

Security
Security may contain issues like peoples' own experience or perception of their security situation, be linked to rates of a long range of indicators e.g. crime rates, or be probability maps for e.g. crime.

Health services
Health services may be interpreted as part of the theme health, as their occurrences and quality in closely linked to health and wellbeing. The issues may reflect public health services in a geographical context, - distribution of e.g. hospitals and similar institutions, medical laboratories or institutions for rehabilitation purposes. Details may be given on distribution, rates, and quality parameters about doctors, nurses, physiotherapists or other practitioners. It may also include services in the form of ambulance services, ambulance regions and other kinds of emergency management systems, where use of GIS have proved

to improve performances. Peoples own health care of themselves and their families - by their next of kin – is another important service not commonly being registered.

Scope, use examples:

- Important aspects on health in the 6EAP, followed by the health communication. High concern for the citizen. (INSPIRE IMS, 2003)
- Health planning and management
- Monitoring of marine foods or marine algal blooms that could cause harm to human health
- Research on causes of illness and death: Through medical geography and geographical epidemiology different health issues can be analysed in a geographical context.
- Emergency management
- Security management: Over the last decade the criminal justice community has begun to reap the valuable analytic benefits of geographic information systems (GIS) technology. The powerful technology enhances the ability of researchers and practitioners to identify hot spots, analyse spatial patterns of crime and criminal behaviour, and to share disparate data sets across jurisdictional boundaries.

Important feature types and attributes:

Geographical grid systems, administrative units and statistical units
Data on rates of a variety of heath related issues may be linked to geographical grid systems (grids), administrative units and statistical units. The use implies a linkage between health-related attribute information with geometry on grids, administrative or statistical units. It is important that these data with different regional breakdown have stable and know IDs (identifiers). Detailed geographical information on total population, gender and age is crucial in geographical mapping of health. There are no particular health attributes that should be mentioned, the topic is so vast that this would not make sense. For details on minimum requirements on features and attributes, see these themes.

Distribution area/ observation area/ observation point
Point or area localisation showing any kind of health or security related observation, e.g. diseases like malaria, potential human epidemics/risks as avian flue, distribution or crime incidences. Important attributes being kind of incidence, date of observation, sources of observation. The existing material does not allow a more specific outline relevant features and attributes.

Location of health care institution
Sector-specific management regions – e.g. health care/management regions/ambulance regions.

Sector-specific management region

- sector
- sub-sector
- management activity type
- responsible organisation
- year of verification

Risk factors being used in causation assessments may be linked to a series of features treated as other themes. There may be quality information about the human environment, stress and pollution data not treated in other themes relevant in as input element in analyses covered by the theme Human health and safety. It should be assessed if these are to be brought into this topic, such as for instance noise level zones.

Links and overlaps with other themes:

- Geographical grid systems
- Administrative units
- Geology (geochemistry)
- Statistical units
- Soil
- Utility and government services
- Environmental monitoring facilities
- Area management / reporting units
- Atmospheric conditions
- Meteorological geographical features

Reference documents:

Aase, A. & Storm-Furru, I, 1996: National atlas for Norway - health. Nasjonalatlas for Norge – Helse. Norwegian Mapping Authority.

Atlas of mortality in Europe: Subnational patterns, 1980/1981 and 1990/1991: http://www.euro.who.int/InformationSources/Publications/Catalogue/20010911_22

Atlas of United States mortality: http://www.cdc.gov/nchs/products/pubs/pubd/other/atlas/atlas.htm

Avian flu feed for Google Earth (.kmz)

Classification/Nomenclature: The international system for coding diagnoses (International classification of diseases (ICD) for diseases, injuries and causes of death makes comparison between different countries possible. This system is revised on a regular basis.

Cliff AD, Hagget P 1988: Atlas of Disease Distribution, Analytic approaches to Epidemiological Data. Oxford.Blackwell Reference 1988

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http://gamapserver.who.int/mapLibrary/
http://gamapserver.who.int/mapLibrary/Files/Maps/EMRO_endemic.png

http://www.ij-healthgeographics.com/,
http://www.ij-healthgeographics.com/content/pdf/1476-072X-4-22.pdf

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Mapping and analysis for public safety

Medical Geography

Owe Lofman pp117-132 Att anvenda GIS før analyser av helsa – ohelsa, sjukdomar och deras determinanter, (to use gis for analysis of health – unhealthy, illness and their determinants) In: Melinder K, Schærstrøm Statens folkhelsoinstitut www.fhi.se, 2005: Platsen, individen og folkhalsen – teorier, metoder og tolkningar - epidemiologiska data på kartan: sjuklighet och exponering - en oversikt.

Web GIS in practice III: creating a simple interactive map of England's Strategic Health Authorities using Google Maps API, Google Earth KML, and MSN Virtual Earth Map Control

World health organisation – public health mapping and gis map library

www.zorgatlas.nl