| CHILDREN AGED 0-14 YEARS LIVING IN POVERTY | |
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| **GENERAL CONSIDERATIONS** | |
| *Issues* | Perinatal diseases<br>Respiratory diseases<br>Diarrhoeal diseases<br>Physical injuries |
| *Type of indicator* | Exposure (distal/driving force)<br>Can also be used as a measure of action in relation to social policy. |
| *Rationale* | Poverty is a major risk factor for children's environmental health. It operates in three main ways. First, because of what has been termed environmental injustice, there is a marked tendency for the poorest in society to be more exposed to environmental hazards. This occurs both because the poor are more likely to live in inadequate housing, and in more hazardous areas, and because there is a tendency for polluting industries and other activities to congregate in poorer areas (e.g. because of lower land prices, less strict regulations and less effective opposition from the communities involved). Secondly, poverty tends to be associated with more harmful (or less self-protective) lifestyles and behaviours, for example in terms of diet, smoking, exercise and drug usage, both because of lack of awareness of the risks concerned and the lack of resources to avoid them. Thirdly, poverty makes it harder for those at risk to obtain treatment or help, often because of their remoteness from the necessary services, their lack of resources to access them and – in some cases – inherent biases and inadequacies within the services themselves. As a result, almost all environmental health effects show strong associations with poverty. Poverty thus represents an important, complex and inter-related set of social and environmental risks that cannot easily be separately specified. It also acts as an important confounder and modifier to relationships between many other risk factors and human health. |
| *Issues in indicator design* | Defining and measuring poverty is extremely difficult. Poverty is neither a unitary nor absolute condition. It is multi-facetted and contextual. No single, simple threshold or measure for poverty therefore exists that can be used as a basis for the indicator. Instead proxies of various types tend to be used. These are variously described in terms of poverty, deprivation, disadvantage or inequality.<br><br>Some of these rely on single measures – such as disposable income, or family assets. Others use compound indices, often including a range of social, economic and, in some cases, health variables. The main example internationally is the UNDP Human Poverty Index (HPI), of which two forms have been devised, one for developed and one for developing countries. Various national indicators are also in use (e.g. the Carstairs Index which is widely used in the UK).<br><br>Each of these indicators – and each of these approaches to devising indicators of poverty – has limitations. Indicators based on income alone, for example, take a very narrow view of poverty, and ignore the many other factors that influence social well-being – for example, customs that may limit the ability of some groups (e.g. women) to access, or benefit from, the available wealth. For the most part, compound indicators tend to be more powerful, but these are often highly contextual, and include variables that are not always widely relevant. Those (such as the UNDP HPI) that include variables relating directly to health (life expectancy, disability etc.) are not |

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| | appropriate as *independent* measures of poverty, that can readily be used in combination with health indicators. Defining thresholds with any of these measures, below which people may be said to be living in poverty, is also difficult. On the other hand, merely taking an average measure across a population (e.g. average household income, or the average HPI) is misleading, because it fails to reflect the disparities in affluence and poverty that may exist within that population.<br><br>Against this background, it is impossible to define a single indicator that will satisfy all circumstances and applications. The indicator proposed here attempts to define poverty in terms of both sustainable and disposable income, and its ability to meet basic needs. The concepts of income and need are defined generically, as a basis for indicator development, but in many cases would need to be further specified to take account of local circumstances (e.g. social structure, economic conditions, expectations). The age range of 0-14 years is taken because poverty affects children of all ages more or less equally. |
| **SPECIFICATION** | |
| *Definition* | Percentage (or number) of children aged 0-14 years living in households with a sustainable income inadequate to meet their basic needs. |
| *Terms and concepts* | ***Sustainable and disposable income:*** the level of household income (in money or in kind) that is available to spend after primary commitments (e.g. taxation, tithes, travel and other costs involved in acquiring the income) have been paid, and that can realistically be expected to be maintained in the long term (i.e. over a period of one or more years). This income can be measured in different ways, depending on local circumstances, but should be converted to a common 'currency' (based on relative purchasing power) where international comparisons need to be made.<br><br>***Basic needs:*** the costs of essential life-support materials and services required to provide a healthy existence for a child within the local context. These should include all requirements for nutrition (to an acceptable, basic level), shelter (of a safe and adequate condition), education (to acquire essential literacy, numeracy and vocational skills) and health care (access to basic primary and secondary health care services). Costs of materials and services provided either via taxation or through direct deduction from income should not be included. |
| *Data needs* | Number of children aged 0-14 years by sustainable, disposable household income<br><br>Costs of basic needs |
| *Data sources* | Data on household income can usually be obtained from national censuses or other routine surveys or registers (e.g. declarations to taxation offices). Where these sources are not available, sample data may be obtained from household surveys. In some cases, sample data are also collected by commercial companies (e.g. for marketing purposes). To estimate the disposable income it may be necessary to subtract from the reported income figures the levels of taxation and other routine deductions. To identify households with a sustainable income, it may be necessary to adjust the data according to employment rates (e.g. the percentage of people in long-term employment).<br><br>Costs of basic needs should be calculated on the basis of an average 'basket' of goods, comprising essential food, shelter, education and health care. In some cases, national measures will be available (e.g. from national |

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| | statistical offices or social service departments); otherwise, data to compute these costs may need to be obtained from household surveys. |
| *Level of spatial aggregation* | Administrative district (e.g. census tract) |
| *Averaging period* | Annual or longer |
| *Computation* | The indicator is computed as a simple percentage, as follows:<br>*100* ( Cpov / Ctot)*<br>where : *Cpov* is the number of children aged 0-14 years living in households with a sustainable income inadequate to meet their basic needs;<br>*Ctot* is the total number of children aged 0-14 years |
| *Units of measurement* | Percentage (or number) |
| *Worked example* | Assume that an area contains 15 000 households, with a total population of 62 000 children. Of these households, 6 400 (containing 31 400 children) are deemed to have a disposable and sustainable income below that needed to satisfy their basic needs. In this case, the indicator would be calculated as:<br>*100 * 31 400 / 62 000 = 50.6%* |
| *Interpretation* | In general terms, an increase in the index value may be taken as an indication of increased poverty and an associated increase in the vulnerability of children to health problems, and reduced quality of life. Care is nevertheless necessary, especially in comparing countries or regions that differ markedly in terms of their culture, economy and way of life. Marked rural/urban differences may also occur, which may be masked where data are aggregated to large areas. The data needed to construct the indicator may also suffer from inaccuracies, inconsistencies and gaps, which might not be apparent in the reported statistics. Data on income, for example, are often subject to major uncertainties because of incorrect or incomplete reporting, and because of difficulties in assessing non-monetary or occasional income. Estimates of the cost of basic needs are also inherently uncertain, and likely to vary substantially from one country or population group to another. Minor differences in the indicator value are therefore unlikely to be meaningful and the indicator should only be seen to present a broad measure of poverty. |
| *Variations and alternatives* | Many alternatives to this indicator are possible. Examples include:<br>***Average household income per child:*** the mean household income (total or disposable) per child.<br>***Income disparity:*** the difference or range of incomes across the population. The UNCHS Household Income Distribution Indicator (UNCHS 1993), for example, is calculated as the ratio of the average income of the highest income quintile to the average income of the lowest income quintile.<br>***The poverty gap***: a measure of the difference between the poverty line and the level of consumption of all individuals in the population – e.g. the Poverty Gap Index (DAC 1999, UN 1996).<br>***Poverty or deprivation indices***: these typically assign an arithmetic score to individuals or areas based on a number of poverty or deprivation indicators (e.g. income, employment status, family situation, access to basic resources). Examples include the UNDP Human Poverty Index (UNDP |

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| | 1999), the Jarman score (Jarman 1983), the Townsend Index (Townsend *et al*. 1988), and the Carstairs score (Carstairs and Morris 1989). |
| *Examples* | WHO *Environmental health indicators: framework and methodologies*<br>• **Poverty**<br>UNDP *Human development report*<br>• **Human poverty index for developing countries (HPI-1)**<br>• **Human poverty index for developed countries (HPI-2)**<br>*UN Indicators of sustainable development*<br>• **Head count index of poverty**<br>• **Poverty gap index**<br>• **Squared poverty gap index**<br>• **Gini index of income inequality**<br>UNCHS and World Bank *Housing indicators programme*<br>• **Household income distribution**<br>• **Households below poverty line**<br>• **DAC Indicators of poverty reduction**<br>• **Incidence of extreme poverty**<br>• **Poverty gap ratio**<br>• **Inequality**<br>Many indicators have also been developed at national level, often as a basis for allocating health resources e.g.:<br>• **the Carstairs score**<br>• **the Jarman score**<br>• **the Townsend index** |
| *Useful references* | Carstairs, V. and Morris, R. 1989 Deprivation: explaining difference in mortality between Scotland and England and Wales. *British Medical Journal* 299, 886-889.<br>DAC 1999: http://www.oecd.org/dac/indicators/htm/list.htm<br>Gwatkin, D.R. and Guillot, M. 2000 *The burden of disease among the global poor. Current situation, future trends and implications for strategy.* Washington: World Bank.<br>Jarman, B. 1983 Identification of underprivileged areas. *British Medical Journal* 286, 1705-1709.<br>Townsend, P., Phillimore, P. and Beattie, A. 1988 *Health and deprivation: inequality and the north.* London: Croom Helm Ltd.<br>UN *1996 Indicators of sustainable development. Framework and methodologies.* New York: United Nations.<br>UNCHS (Habitat) and the World Bank 1993 *The Housing Indicators Programme*. Report and the Executive Director (Volume I). Nairobi: United Nations Centre for Human Settlements.<br>UNCHS (Habitat) 1997 M*onitoring human settlements with urban indicators*. |

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| | Nairobi: United Nations Centre for Human Settlements.<br><br>UNDP 2000 *Human development report*. New York: United Nations.<br><br>Wagstaff, A. 2002 Poverty and health sector inequalities. *Bulletin of the World Health Organization* 80, 97-105. |

| FAMINE RISK | |
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| **GENERAL CONSIDERATIONS** | |
| *Issues* | Perinatal diseases |
| *Type of indicator* | Exposure (distal/state) |
| *Rationale* | Undernutrition is a major cause of both morbidity and mortality in children, both directly and through its interactions with other risk factors. Inadequate maternal nutrition during pregnancy, for example, can result in children with intrauterine growth retardation, low birthweight or a range of gestational problems. Undernutrition during development can cause a range of both physical and cognitive disabilities. Lethargy and mental confusion due to prolonged under-nourishment may also impair people's ability to learn, work or look after themselves adequately. Acute lack of food may drive people to use unsafe food sources. Under-nourishment also reduces resistance to other risks, such as vector-borne diseases and respiratory infections. In extreme cases, inadequate food results in starvation and death.<br><br>Long-term, chronic under-nourishment is often a function not only of the ability to grow sufficient food locally or nationally, but also of inadequacies in food distribution and access (e.g. due to poverty). Famine also occurs more acutely, however, in many parts of the world, usually due to the effect of short-term events such as drought, superimposed on longer-term social or political dysfunction. Children living in areas susceptible to famine are thus especially vulnerable to environmental health problems, and famine acts as an important distal risk factor for a range of health effects. Maternal exposures to famine are also especially important in determining risks of perinatal diseases (e.g. low birthweight, gestational problems, perinatal mortality). |
| *Issues in indicator design* | As with other natural hazards, several metrics may be used to measure famine risk. These include: frequency (i.e. the number of years on average between famines, or the annual probability of a famine event); extent (the area subject to famine); severity (e.g. the magnitude of drought, degree of food shortage or increase in death rate). None of these is easy to apply, for famines rarely occur as discrete or isolated events. Instead, most famines are to a large extent endemic. They often occur to differing degrees, and over a varying area, on a more or less continuing basis, erupting into major disasters or episodes only when social and/or environmental factors conspire to cause an abrupt failure in the food supply. Defining famines as specific, time- and geographically-bound events can be difficult, as is any attempt to attribute mortality and morbidity to individual famine events.<br><br>Three key characteristics nevertheless define a famine – namely, a failure in the food supply, a marked increase in death and disease, and the need for an emergency response. On this basis famines can be recognized as "a regional failure of food production or supply, sufficient to cause a marked increase in disease and mortality due to severe lack of nutrition and necessitating emergency intervention, usually at an international level" (Cox 1981). Given this definition, famine frequency can then be measured as the number of children at risk from current and imminent famines. |

| **SPECIFICATION** | |
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| *Definition* | Number of women of child-bearing age living in areas at risk from current or imminent famines |
| *Terms and concepts* | ***Famine***: regional failure of food production or supply, sufficient to cause a marked increase in disease and mortality due to severe lack of nutrition and necessitating emergency intervention, usually at an international level. |
| *Data needs* | Extent of current or imminent famines<br>Total number of women aged 16-45 years |
| *Data sources,* | Data on famines is usually available from both national and international agencies responsible for food security and emergency response. In some cases these data are provided as maps, showing the extent and severity of famine each year. Though somewhat subjective, these should permit the definition of the extent of current famines. Warnings of emergent famines are also available both from field-workers on the ground (e.g. from relief agencies) and from environmental monitoring agencies (e.g. meteorological agencies), often on the basis of satellite data. In order to develop and sustain this indicator, systems may need to be established to capture, evaluate and process this information routinely.<br>Data on the number of women aged 16-45 years, living in these areas, should be available from national censuses. Because famine-affected areas are often subject to massive population displacements, however, these are not always wholly accurate. In some cases, therefore, reliance may need to be placed on population estimates made by the relevant agencies. |
| *Level of spatial aggregation* | Broad region or country |
| *Averaging period* | Annual |
| *Computation* | The indicator can be calculated as the total number of women of child-bearing age in famine-affected areas. This can usually best be done by overlaying maps of the famine-affected area onto population maps, and estimating the numbers affected on an area-weighted basis using a GIS. Alternatively, estimates may be made by manually summing population counts for administrative regions within the famine-affected area. |
| *Units of measurement* | Number of women at risk |
| *Worked example* | Assume that famine is affecting three areas as follows. In A (which has a population of 127 000 women of child-bearing age) it covers the whole area; in B (240 000 women), it covers 80% of the area; in C (310 000 women), it covers 55% of the area. The total number of women affected is thus:<br>(1.0 * 127 000) + (0.8 * 240 000) + (0.55 * 310 000) = 489 500 |
| *Interpretation* | Because the indicator is based on somewhat subjective definitions of famine, it needs to be interpreted with care. Minor variations in the indicator values are unlikely to be meaningful, and comparisons between different countries need to take account of possible differences in definition or uncertainties in the data. It is most relevant as a way of identifying famine hotspots, therefore, or making broad assessments of the overall magnitude of risk. If relative risk estimates are available (e.g.<br>giving the expected death rate per 1000 births due to famines), then the indicator can be used as a basis for assessing the attributable burden of disease. |
| *Variations and* | Various alternatives to this indicator are possible. It could, for example, be |

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| *alternatives* | defined simply in terms of the area subject to famine (without weighting according to the number of women at risk). It could also be expressed not in relation to women of child-bearing age, but for other age or gender groups (e.g. young children).<br><br>Where a longer term indicator is required, estimates could be made of the population-weighted famine risk – for example by multiplying the annual probability of a famine in each area by its resident population of women of child-bearing age. Again, this might be translated into a measure of the expected mortality or morbidity rate if suitable exposure-effect relationships are available. |
| *Examples* | None known. |
| *Useful references* | Cox, G.W., 1981: The ecology of famine: An overview. In: *Famine: Its Causes, Effects, and Management,* ed. by J.R.K. Robson. New York: Gordon and Breach, 5-18.<br><br>FAO Committee on World Food Security 1998 *Guidelines for national food insecurity and vulnerability information and mapping systems (FIVIMS). Background and principles.* Rome: Food and Agricultural Organization. (Available at www.fao.org/docrep/meeting/W8500e.htm )<br><br>USAID *Famine early warning system network:* http://www.fews.net/ |

| PEOPLE LIVING IN INFORMAL SETTLEMENTS | |
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| **GENERAL CONSIDERATIONS** | |
| *Issues* | Perinatal diseases<br>Diarrhoeal diseases<br>Physical injuries |
| *Type of indicator* | Exposure (distal/state)<br>Can also be used as a measure of action in relation to housing quality. |
| *Rationale* | Rapid urbanization and inadequate capability to cope with the housing needs of people in urban areas have contributed to the development of informal settlements. Living in these settlements often poses significant health risks. Sanitation, food storage facilities and drinking water quality are often poor, with the result that inhabitants are exposed to a wide range of pathogens and houses may act as breeding grounds for insect vectors. Cooking and heating facilities are often basic, with the consequence that levels of excessive exposures to indoor pollution may occur. Access to health and other services may be limited; overcrowding can contribute to stress, violence and increased problems of drugs and other social problems. Together, these pose special risks to children both during the prenatal period and after birth. This indicator provides a general measure of these risks. |
| *Issues in indicator design* | Severe problems exist both in defining 'informal settlements' and in obtaining reliable data on the number of people who live within them.<br>The definition of informal settlements is context-specific. Various definitions have thus been proposed, but that suggested by the UN Habitat Programme is probably the most widely applicable. This defines informal settlements as: i) residential areas where a group of housing units has been constructed on land to which the occupants have no legal claim, or which they occupy illegally; ii) unplanned settlements and areas where housing is not in compliance with current planning and building regulations (unauthorized housing).<br>Many other terms and definitions have also been devised for informal human settlements, for example: unplanned settlements, squatter settlements, marginal settlements, unconventional dwellings, non-permanent structures, inadequate housing, slums, housing in compliance etc. *Unconventional dwellings* are commonly defined by the number of housing units occupied by households, but considered inappropriate to human habitation. *Housing in compliance* is used as a Human Settlements Indicator by the UN Habitat Programme and is defined as the percentage of the total housing stock in urban areas which is in compliance with current regulations (authorized housing). Housing may also be categorized by its type or permanence (e.g. permanent, semi-permanent, non-permanent), although definitions of these categories vary widely from country to country.<br>Problems occur in measuring the extent or defining the boundaries of such settlements. By definition, officially recognized boundaries to these settlements rarely exist, and the settlements themselves often merge almost imperceptibly into formal areas of housing, industrial or rural areas. Use of remotely sensed data (e.g. aerial photography or high resolution satellite data) may be useful in this context.<br>Similar difficulties occur in obtaining data on the numbers of people who live within these settlements. They are often not covered by formal censuses, |

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| | and many of the people living in the settlements may not be registered or officially recognized. Most population data are therefore estimates, and as such are subject to considerable uncertainties. |
| **SPECIFICATION** | |
| *Definition* | Percentage of the population (or number of people) living in informal settlements. |
| *Terms and concepts* | ***Informal settlements:*** based on the UN Habitat Programme definition, these are defined as: i) residential areas where a group of housing units has been constructed on land to which the occupants have no legal claim, or which they occupy illegally; ii) unplanned settlements and areas where housing is not in compliance with current planning and building regulations (unauthorized housing).<br><br>***Unauthorized housing:*** excludes units where land titles, leases or occupancy permits have been granted (UN 1996).<br><br>It should be noted that informal settlements do NOT cover the ***homeless***. |
| *Data needs* | Number of people living in informal settlements.<br><br>Total population. |
| *Data sources, availability and quality* | Information on the number of people living in informal settlements is often limited, since inhabitants are often only inadequately covered by formal censuses: census data may therefore not provide a clear separation of those living in informal settlements. Where suitable census data do not exist, special surveys may be necessary.<br><br>Data on the total population should be available from national censuses and should be broadly reliable. |
| *Level of spatial aggregation* | Municipality, district etc |
| *Averaging period* | Annual to decadal |
| *Computation* | The indicator is computed as:<br><br>*100 * Pinf / Ptot)*<br><br>where *Pinf* is the number of people living in informal settlements and *Ptot* is the total number population. |
| *Units of measurement* | Percentage (or number) |
| *Worked example* | Assume that a total of 3 600 people are counted in informal settlements, from a total city population of 26 900. In this case, the value of the indicator will be:<br><br>100 * (3 600 / 26 900) = 13.4% |
| *Interpretation* | This indicator provides a relatively straightforward measure of the quality of housing, and thus of the risks to children's health. A large percentage of people living in informal settlements can be taken to imply an increased risk to children's health; a low percentage implies a reduced risk.<br><br>Nevertheless, the relationship between the number of people living in informal settlements and environmental health is not always simple. In particular, those living in formal settlements are not necessarily better provided for (e.g. the homeless or people living in crowded or unsafe |

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| | housing). Problems of data accuracy also mean that the indicator should be interpreted with care, especially where comparisons are being made between different surveys. |
| *Variations and alternatives* | The indicator proposed above is non-specific, in that it relates to the total population. In practice, variations on this indicator are likely to be useful, aimed at more specific age groups. For perinatal diseases, the target group should be women of childbearing age (15-49 years); for respiratory illness the 0-5 year age group is likely to be the most relevant; for physical injuries all children (0-14 years) should be included.<br><br>This indicator can also be defined on the basis of different classifications of informal settlements (or other, similar concepts).<br><br>Where suitable data on population are not available, the indicator might alternatively be measured as the area (e.g. $km^2$) of informal settlements. This may be estimated from aerial photographs. It is liable to understate the scale of the problem, however, since it makes no allowance for population density, which is often higher in informal settlements than in formal settlements. |
| *Examples* | WHO *Environmental health indicators: framework and methodologies*<br>• **Population in informal settlements**<br><br>UN *Indicators of sustainable development*<br>• **Area and population of urban formal and informal settlements** |
| *Useful references* | UN 1996 *Indicators of sustainable development. Framework and methodologies*. New York: United Nations.<br><br>UNCHS (Habitat) and the World Bank 1993 *The housing indicators programme*. Report and the Executive Director (Volume I). Nairobi: United Nations Centre for Human Settlements.<br><br>UNCHS (Habitat) 1995 *Monitoring the shelter sector. Housing Indicators review*. Nairobi: United Nations Centre for Human Settlements.<br><br>UNCHS (Habitat) 1995 *Monitoring human settlements, abridged survey*. Indicators Programme. Nairobi: United Nations Centre for Human Settlements.<br><br>UNCHS Urban Indicators Programme website: http://www.urbanobservatory.org/indicators/database/<br><br>WHO 1999 *Environmental health indicators: framework and methodologies*. Geneva: WHO. (Available at http://www.who.int/docstore/peh/archives/EHIndicators.pdf ) |

| WOMEN OF CHILDBEARING AGE WHO ARE MALNOURISHED | |
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| **GENERAL CONSIDERATIONS** | |
| *Issues* | Perinatal diseases |
| *Type of indicator* | Exposure (proximal)<br>Can also be used as a measure of action in relation to food policies. |
| *Rationale* | The period of development in the womb is critical for the health of the child, both at birth and long afterwards. Maternal exposures to environmental hazards during pregnancy can thus have a major impact on children's health.<br><br>One of the most important risk factors at this stage is maternal nutrition. Inadequate nourishment increases risks of a wide range of gestational and perinatal problems. Low birthweight is especially important, for this not only one of the main causes of perinatal mortality, but also has long-term effects on development and health status. Lack of crucial nutrients during pregnancy is likewise associated with pre-eclampsia and hypertension, both of which can lead to increased perinatal mortality. In addition, foetal undernutrition has been found to be associated with increased risks of mental and neuro-behavioural impairment, as well as some congenital anomalies (e.g. neural tube defects). This indicator is therefore an important measure of exposure for perinatal diseases. |
| *Issues in indicator design* | Although the effects of inadequate maternal nutrition are generally well-established and clear, obtaining information on malnourishment remains difficult. In part, the problem is one of definition. Malnourishment is not a unitary condition, but may represent the absence of a wide range of different food requirements. In some cases, therefore, it occurs because of an absolute lack of nutrition (e.g. due to food shortages); in other cases it reflects a lack of specific nutrients or vitamins from an otherwise balanced and adequate diet.<br><br>This problem is compounded by a lack of readily available and reliable data on nutritional levels, that can be used to identify those who are undernourished. Routine monitoring of the nutritional status of women is rarely carried out. Generally, therefore, data need to be derived from special surveys. These may provide quantitative information on food intake, or more qualitative information on the nutritional status of women. The design of the indicator will depend upon the range and quality of information available. |
| **SPECIFICATION** | |
| *Definition* | Percentage (or number) of women age 15-49 years who are malnourished. |
| *Terms and concepts* | ***Malnourished:*** in receipt of inadequate food to sustain good health in the long-term. This may be due to:<br>• *Undernutrition* **– an absolute insufficiency of food, such that the dietary energy intake is below that required to provide an acceptable level of energy expenditure; and/or**<br>• *Malnutrition* **– a deficiency of specific nutrients, resulting in impaired health**<br>• ***Women of child-bearing age:*** women between the ages of 15 and 49 |
| *Data needs* | Nutritional status of women between the ages of 15 and 49. |
| *Data sources, availability and quality* | In most cases data will need to be obtained from dietary or nutritional surveys. Routine national surveys are often undertaken via health clinics. Rapid assessment methods are also available for use in emergency |

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| | situations (Collins *et al.* 2000, WHO 1995), and aid agencies are active in supporting the surveys in many developing countries.<br>Nutritional surveys usually employ direct measurements of body shape or stature as indicators of under-nutrition. The two most widely used are the body mass index (BMI) and the mid-upper arm circumference (MUAC). Both suffer from significant limitations, especially when applied to pregnant women, and therefore need to be used and interpreted with care.<br>Dietary (or nutritional intake) surveys involve an assessment of food intake. They may use a range of different methods, including simple respondent (usually 24 hour) recall, food frequency questionnaires, food history surveys, weighed dietary recording, and examination or recording of food stored in the home or of food purchases. To provide detailed information on nutrient or vitamin intake, these need to be backed up by assay of foodstuffs, either by reference to manufacturers' descriptions, or by direct analysis.<br>In both cases, sampling often represents a significant problem, especially in more remote areas or in emergency situations. For these reasons, caution is needed in making comparisons between different surveys. |
| *Level of spatial aggregation* | Administrative district or region |
| *Averaging period* | Annual or longer |
| *Computation* | The indicator can be computed as a simple percentage, as follows:<br>*100 * Wmal / Wtot*<br>where *Wmal* is the number of women aged 15-49 who are classified as malnourished;<br>*Wtot* is the total number of women aged 15-49. |
| *Units of measurement* | Percentage or number |
| *Worked example* | Assume that an area contains a population of 75 500 women aged 15-49, of whom 2 080 are defined as malnourished. In this case, the indicator is calculated as:<br>100 * 2 080 / 75 500 = 2.8% |
| *Interpretation* | This indicator provides a direct measure of the nutritional status of women of childbearing age. An increase in the indicator implies a worsening of their nutritional status; a reduction in the indicator implies an improvement. Since nutritional status as a direct bearing upon the survival chances and health of newborn children, the indicator can thus be interpreted as a general measure of perinatal health. Care is nevertheless needed in making interpretations because of the inherent uncertainties in the available data, and differences in survey design (e.g. the specific definition of malnourishment used) from one country, or one survey to another. Attention also needs to be given the sample size and sampling framework when selecting data for use in the indicator. |
| *Variations and alternatives* | The indicator described here can be constructed and presented in a variety of ways. Different measures of malnourishment may, for example, be used, depending on the available data. In addition to those outlined above, evidence of anaemia in pregnant women (using measures of haemoglobin in blood) may also be used as an indicator of under nourishment. |
| *Examples* | WHO *Catalogue of Health Indicators*<br>• **Anaemia in women**<br>• **World Bank HNP Indicators on Socio-Economic Inequalities**<br>• **Low mother's BMI** |
| *Useful references* | Collins, S., Duffield, A. and Myatt, M. 2000 *Assessment of nutritional status in emergency-affected populations.* Geneva: ACC/FOR Sub-Committee on |

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| | Nutrition.<br><br>FAO 2001 *The state of food insecurity in the world, 2001*. Rome: Food and Agricultural Organization.<br><br>Ferro-Luzzi, A. 2002 Individual food intake survey methods. *Paper presented to International Scientific Symposium on Measurement and Assessment of Food Deprivation and Under-nutrition, June 26-28, 2002, Food and Agricultural Organization Headquarters, Rome.* (Available at www.fao.org/es/esa/iss/ )<br><br>Shetty, 2002 Measures of nutritional status from anthropometric survey data. *Paper presented to International Scientific Symposium on Measurement and Assessment of Food Deprivation and Under-nutrition, June 26-28, 2002, Food and Agricultural Organization Headquarters*, *Rome.* (Available at www.fao.org/es/esa/iss/ )<br><br>WHO 1995 *Field guide on rapid nutritional assessment in emergencies*. Geneva: World Health Organization.<br><br>WHO 1996 *Catalogue of health indicators. A selection of important indicators recommended by WHO Programmes.* Geneva: World Health Organization. |

| WOMEN OF CHILDBEARING AGE WORKING IN UNREGULATED WORKPLACES | |
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| **GENERAL CONSIDERATIONS** | |
| *Issues* | Perinatal diseases |
| *Type of indicator* | Exposure (proximal)<br>Can also be used as a measure of action in relation to employment policy. |
| *Rationale* | Maternal injuries and exposures to hazardous chemicals in the workplace represent important sources of risk for the child during the prenatal period. Risks tend to be greatest where women are employed in unregulated workplaces, both because these tend to be inherently more hazardous, and because they often do not have effective schemes for worker safety. This indicator, therefore, provides a general and distal measure of the risks of foetal damage due to maternal exposures in the workplace. |
| *Issues in indicator design* | By their very nature, unregulated workplaces are extremely diverse in terms of their character and only poorly monitored. In particular, much employment in these types of workplaces is informal and unreported; often it involves family members or casual labour. As a result, the quality of available data is often poor, and difficulties may be met in trying to establish a clear and consistent definition of unregulated workplaces that are supported by reliable data. |
| **SPECIFICATION** | |
| *Definition* | Percentage (or number) of women aged 15 to 49 years employed on a regular basis in unregulated workplaces |
| *Terms and concepts* | ***Unregulated workplace:*** an informal workplace, that is not subject to effective regulation or control. Workplaces of this type typically include small, family-run manufacturing or retail establishments.<br>***Regular employment:*** actively engaged (whether paid or unpaid) in the workplace for a substantial part of most days, over a period of several years. |
| *Data needs* | Numbers of female employees ages 15-49 years in unregulated workplaces.<br>Total number of women aged 15-49 years. |
| *Data sources, availability and quality* | Routine data on employment in unregulated workplaces are inevitably rare. Usually, therefore, data will need to be obtained from special surveys, targeted either at the workplace or home. Considerable problems may be encountered in these surveys, due to the illicit nature of many of these workplaces, and the fear of prosecution amongst both employers and employees. Major uncertainties thus tend to occur in the available data.<br>Data on the total number of women, by age, are usually available from national censuses and can be considered to be reliable. |
| *Level of spatial aggregation* | Community or municipality |
| *Averaging period* | Annual or longer term |
| *Computation* | The indicator can be computed as a simple percentage, as follows:<br>*100 * Wunreg / Wtot*<br>where: *Wunreg* is the number of women aged 15-49 years employed on a regular basis in unregulated workplaces;<br>*Wtot* is the total number of women aged 15-49 years. |
| *Units of measurement* | Percentage or number |

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| *Worked example* | Assume that in an area a household survey of 8 420 women aged 15-49 shows that 998 are employed in unregulated workplaces. In this case, the value of the indicator is calculated as:<br>100 * 998 / 8 420 = 11.9% |
| *Interpretation* | This indicator provides a measure of the percentage of women of childbearing age potentially exposed to occupational hazards as a result of employment in unregulated workplaces. It thus gives a general indication of risks to the unborn child as a result of maternal exposures or accidents at work. Because direct measurement or observation of hazards in the workplace are not made, and because it does not relate specifically to pregnant women, the indicator clearly has to be interpreted with care: an increase in the percentage employed in unregulated workplaces *suggests* an increased level of risk but does not demonstrate it. Major uncertainties are also likely to exist in the data, due to difficulties in obtaining representative samples of employees, incomplete reporting of employment, and problems in defining unregulated workplaces in a consistent way. |
| *Variations and alternatives* | Where suitable data are available, this indicator may be better designed on the basis of hazards in the workplace. In this case, it need not be restricted only to unregulated workplaces. Another alternative is to use information on the incident of occupational accidents to women of childbearing age. This is only feasible where reliable reporting of workplace accidents takes place. |
| *Examples* | WHO *Environmental health indicators: framework and methodologies*<br>• **Percentage of workers exposed to unsafe, unhealthy or hazardous working conditions** |
| *Useful references* | WHO 1999 *Environmental health indicators: framework and methodologies.* Geneva: World Health Organization. (Available at http://www.who.int/docstore/peh/archives/EHIndicators.pdf ) |

# BIRTHS TO MOTHERS LIVING IN UNSAFE OR HAZARDOUS HOUSING

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| **GENERAL CONSIDERATIONS** | |
| *Issues* | Perinatal diseases |
| *Type of indicator* | Exposure (proximal)<br>Can also be used as a measure of action in relation to housing quality. |
| *Rationale* | The adequacy of housing is an important determinant of maternal exposures to environmental hazards during pregnancy. *Inter alia*, housing quality affects levels of exposure to indoor pollutants, food and water hygiene, levels of sanitation, exposures to physical hazards, and general quality of life. Housing may be unsafe, therefore, for a variety of reasons, including: dangerous construction, inadequate ventilation, inadequate heating, dangerous or inadequately maintained services, inadequate size for the number of residents (i.e. overcrowding) or location in a hazardous area (e.g. areas prone to flooding or earthquakes, or on contaminated land). Living in inadequate housing is therefore likely to result in increased risks of a variety of gestational and neonatal problems, including infections, congenital anomalies and physical injury.<br>This indicator provides a general measure of the adequacy of the housing stock, and the level of exposures to these hazards in relation to perinatal diseases. |
| *Issues in indicator design* | Although potentially valuable, this indicator is difficult to define and measure in a clear and systematic manner. In many cases, the most appropriate measure may be the percentage (or number) of births to mothers living in unsafe, unhealthy or hazardous housing. Defining the terms 'unsafe', 'unhealthy' and 'hazardous', however, poses severe difficulties for these are all to a large extent both environmentally and culturally dependent, and thus are liable to vary from one area (or one time) to another.<br>Problems may also exist in devising a single indicator that combines all these different conditions in a single measure, since in terms of health they may not be equivalent. As an alternative, therefore, separate indicators can be developed, relating to specific aspects of housing condition and quality. Thus, indicators might be compiled of overcrowding, access to basic amenities, indoor air pollution, flood risk, avalanche risk, earthquake risk etc. The disadvantages of this approach are the large number of indicators that might need to be compiled, and the difficulties of comparing between them or of using them to provide a general overview of housing conditions. |
| **SPECIFICATION** | |
| *Definition* | Percentage of births to mothers living in unsafe, unhealthy or hazardous housing. |
| *Terms and concepts* | ***Unsafe, unhealthy or hazardous housing:*** housing which is:<br>• physically unsound and likely to be dangerous to its occupants, because of its poor construction, or inadequately maintained services (e.g. electricity); or<br>• is located in a physically hazardous area (e.g. an area of flood or earthquake risk) or is sited on contaminated land (e.g. by chemical wastes, radioactivity); or<br>• provides serious risks of exposures to indoor pollution (e.g. air pollutants) or pathogens (e.g. moulds, ticks, fleas); or |

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| | • provides inadequate shelter (e.g. due to poor insulation, inadequate roofing) and basic amenities (e.g. cooking facilities, heating).<br>***Total number of births:*** the total number of live- and still-births |
| *Data needs* | Number of births by quality of housing |
| *Data sources, availability and quality* | Data on the quality of the housing stock, and the number of births to women living in unsafe, unhealthy or hazardous housing is rarely available from routine sources. In some countries, an approximation to this may be available from census statistics (e.g. by cross-tabulating births and data on housing lacking basic amenities). Generally, however, data will need to be obtained by special surveys. In all cases, these data are liable to considerable margins of error and inconsistency due to difficulties of definition, inconsistent reporting and difficulties of ensuring representative sampling. |
| *Level of spatial aggregation* | Administrative district |
| *Averaging period* | Annual |
| *Computation* | The indicator can be computed as:<br>*100 * Bunsafe / Btot)*<br>where: *Bunsafe* is the number of children living in unsafe, unhealthy or hazardous housing;<br>*Btot* is the total number of live and still births. |
| *Units of measurement* | Percentage or number |
| *Worked example* | Assume that a survey of housing conditions shows that 1 090 births, from a total of 9 720 births, are to women living in homes classified as unsafe, unhealthy or hazardous. In this case the value of the indicator is:<br>100 * 1 090 / 9 720 = 11.2% |
| *Interpretation* | This is an important indicator, which has wide-ranging significance for policy. In providing a measure of the adequacy of the housing stock, it also acts as an indicator of perinatal health risks associated with poor sanitation, exposures to indoor air pollution, and access to safe water. It can therefore help to interpret a range of other issues and indicators.<br>Like all general-purpose indicators, however, it needs to be interpreted carefully. The characteristics which render housing unsafe, unhealthy or hazardous may clearly vary; without information on these specific characteristics it can be misleading to infer either the existence of particular health risks or effects, or the need for specific actions. Definitional issues are also likely to pose major difficulties for comparisons between different areas, or between different surveys, unless standard protocols have been used. A clear understanding of the data is, therefore, essential before interpretations are made. |
| *Variations and alternatives* | This indicator can be based upon a wide range of locally defined classifications of housing quality – for example, temporary or non-permanent housing, housing without adequate amenities, housing built on unsafe or unstable land, or houses at risk of flooding. |
| *Examples* | WHO *Environmental health indicators: framework and methodologies*<br>• **Population living in unsafe housing**<br>WHO *Environment health indicators for the European region* |

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| | • **Percentage of the population living in substandard housing**<br>UNCHS (Habitat) *Urban Indicators Programme*<br>• **Permanent structures (percentage of housing units located in structures expected to be maintain their stability for 20 years or longer under local conditions with normal maintenance)**<br>• **Housing in compliance (percentage of the total housing stock in compliance with current regulations)**<br>• **Housing destroyed (percentage of the housing stock destroyed by natural or man-made disasters over the past ten years)** |
| *Useful references* | UNCHS Urban Indicators Programme web page: http://www.urbanobservatory.org/indicators/database/<br>WHO 1994 *Implementation of the Global Strategy for Health for All by the year 2000. Second evaluation. Eighth report on the world health situation.* Geneva: World Health Organization Regional Office for Europe, Volume 5, European Region.<br>WHO 1997 *Health and environment in sustainable development. Five years after the Earth Summit*. Geneva: World Health Organization.<br>WHO 1999 *Environmental health indicators: framework and methodologies.* Geneva: World Health Organization. (Available at http://www.who.int/docstore/peh/archives/EHIndicators.pdf )<br>WHO 2002 *Environmental health indicators: development of a methodology for the WHO European region.* Bonn: World Health Organization. |

| PERINATAL MORTALITY RATE | |
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| **GENERAL CONSIDERATIONS** | |
| *Issues* | Perinatal diseases |
| *Type of indicator* | Health outcome<br>Can also be used as a measure of action in relation to health policy and health service interventions. |
| *Rationale* | Death during the perinatal stage occurs for many different reasons, but in many cases maternal exposures to environmental hazards are major risk factors. The perinatal mortality rate thus provides a general measure of the health environment during the earliest stages of life. |
| *Issues in indicator design* | This is a well-established indicator, that is already measured and reported in many countries. It relies on routinely collected data, and definitions tend to be widely accepted. Variations in the delineation of the perinatal period do exist in some countries, however, and data quality can be uncertain in more remote areas. |
| **SPECIFICATION** | |
| *Definition* | Rate of stillbirths and deaths during the perinatal period, per 1000 births. |
| *Terms and concepts* | ***Perinatal mortality:*** death of the child during the period between the 24$^{th}$ week of gestation and the end of the first week of life (including stillbirths). |
| *Data needs* | Number of deaths in the perinatal period<br>Total number of births (including live and still births) |
| *Data sources, availability and quality* | Data on perinatal mortality are usually available from routine health death registration and surveillance systems.<br>Routine data on the number of live births are available from a number of sources, including vital registrations, sample registration systems, surveillance systems and censuses and demographic surveys (such as the demographic and health surveys of world fertility surveys). Information is also collated by the UN on a regular basis.<br>In both cases, data are generally of sound quality. In some developing countries, however, registration and surveillance procedures may be incomplete or inconsistent, especially in remote rural areas. In these cases, data may be biased towards the more affluent, urban sectors of the population. Definitions of live births and the perinatal period may also vary between countries. |
| *Level of spatial aggregation* | Administrative district |
| *Averaging period* | Annual |
| *Computation* | The indicator can be computed as a simple percentage, using the total number of births (including stillbirths) as the denominator:<br>*1000 * (Dneo + Bstill) / (Blive + Bstill)*<br>where: *Dneo* is the number of deaths during the 1$^{st}$ week of life<br>*Bstill* is the number of stillbirths<br>*Blive* is the number of live births. |
| *Units of measurement* | Number per 1000 births |
| *Worked example* | Assume that an area has 107 060 live births, 2 930 stillbirths and 668 deaths during the neonatal period (1$^{st}$ week of life). In this case the indicator is |

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| | calculated as:<br>1 000 * (2 930 + 668) / (107 060 + 2 930) = 32.7 per 1 000 births |
| *Interpretation* | This indicator can be interpreted directly as a measure of risks to children during the gestational and early neonatal period. An increase in perinatal mortality may be taken to imply a deterioration in that environment; a reduction in mortality implies an improvement in the health environment. The range of factors affecting perinatal mortality is, however, large so specific risk factors – or the effects of specific interventions – cannot necessarily be inferred. Problems also exist with the quality of the data in some cases, especially in remote rural areas in developing countries. This can lead to significant bias in the data, towards urban and more affluent sectors of the population. |
| *Variations and alternatives* | This is a well-established indicator, which is routinely reported in most countries. It can, however, be redefined in slightly different ways if required. In particular, death rates can be assessed for different periods – for example, during the prenatal period only (stillbirths), or during the neonatal period only (neonatal deaths). |
| *Examples* | WHO *Indicators to monitor maternal health goals*<br>• **Perinatal mortality rate** |
| *Useful references* | DESIPA 1983 *Manual X: indirect techniques for demographic estimation*. New York: Population Division. United Nations.<br>DESIPA 1988 *The United Nations software package for mortality measurement.* New York: Population Division, United Nations.<br>DESIPA 1993 *Demographic yearbook.* Statistical Division. New York: United Nations.<br>Hill, K. 1991 *Approaches to the measurement of childhood infant mortality: A comparative review*. Population Index 57(3), 368-382.<br>UN *1996 Indicators of sustainable development. Framework and methodologies*. New York: United Nations.<br>UNDP 1999 *Human development report*. New York: United Nations.<br>WHO 1981 *Development of indicators for monitoring health for all by the year 2000,* p.29. Geneva, World Health Organization.<br>WHO and UNICEF 1992 *Measurement of overall and cause specific mortality in infants and children*. Report of a joint WHO/UNICEF consultation, 15-17 December 1992. Unpublished document WHO/ESM/UNISEF/CONS/92.5.<br>WHO 1993 *Coverage of maternity care. A tabulation of available information.* Geneva: World Health Organization.<br>WHO 1994 *Global Health for All data base*. Geneva: World Health Organization.<br>WHO 1996 *Catalogue of health indicators: a selection of health indicators recommended by WHO programmes*. Geneva: World Health Organization (under revision). |

| INTRAUTERINE GROWTH RETARDATION IN NEWBORN CHILDREN | |
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| **GENERAL CONSIDERATIONS** | |
| *Issues* | Perinatal diseases<br><br>Respiratory diseases |
| *Type of indicator* | Health outcome in the case of perinatal diseases; can also be used as a measure of action in relation to health policies and health service intervention).<br><br>Exposure (distal/driving force) in the case of respiratory diseases. |
| *Rationale* | Birthweight is one of the most sensitive – and also one of the most important – measures of the well-being of children. Weight at birth is directly influenced by the general level of health status of the mother. In developing countries, especially, maternal nutrition is one of the most important determinants of birthweight. Three aspects are of particular importance: inadequate maternal nutritional status before conception, short stature of the mother (mostly due to undernutrition and repeated infections during childhood), and poor maternal nutrition during pregnancy. In developed countries the most important contributing factor to low birthweight is maternal smoking.<br><br>Low birthweight is a particular risk factor. Children of low (or very low) birthweight have been variously identified as at increased risk from neurosensory, developmental, physical, and psychological problems. Specific problems include increased risk of cerebral palsy, asthma, upper and lower respiratory infections and ear infections. Low birthweight children are also likely to suffer from reduced rates of cognitive development and learning. Low birthweight also provides a powerful predictor of the future health of the child. Problems later in life include increased risks of coronary heart disease, diabetes and high blood pressure.<br><br>Size at birth, however, reflects two factors: duration of gestation and rate of foetal growth. Thus birthweight should be considered with respect to gestational age. Ideally the preferred indicator should therefore be intrauterine growth retardation (IUGR). Small-for-gestational age or IUGR enables, for example, distinction between infants who are too small because they were born preterm and those who are small but at term. The best indicator for assessing foetal malnutrition is consequently birthweight for gestational age and gender. |
| *Issues in indicator design* | An infant suffering from IUGR is defined as being below the 10% percentile of the recommended gender-specific birthweight for gestational age reference curves (Williams 1982, WHO 1995).<br><br>A cut-off of < 1500 g is recommended to identify infants with very low birthweight (VLBW). The application of this cut-off is useful in settings where many children are expected to be LBW and the health system is unable to cope with big numbers of infants referred for special care. In such circumstances VLBW infants are the most vulnerable and should obtain priority for care and special attention.<br><br>For standardization purposes and in order to keep it simple one might consider selecting one indicator with one cut-off point. It is recommended to use IUGR and in the absence of gestational age information to use LBW (WHO, 1995).<br><br>Compared to other health indicators, data are widely available: birthweight is one of the basic measures taken routinely at birth, in almost all health |

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| | services. Data are less likely to be available, however, in more remote areas, where births are unsupervised. Thus, data may tend to be lacking or incomplete in the areas most affected by severe malnutrition. |
| **SPECIFICATION** | |
| *Definition* | Incidence of low or very low birthweight |
| *Terms and concepts* | ***Intrauterine growth retardation:*** birthweight below the 10$^{th}$ percentile of the recommended gender-specific birthweight for gestational age reference curves (Williams1982, WHO 1995).<br><br>***Number of live births*****:** number of live births in the survey period |
| *Data needs* | Number of births by birthweight, gestational age and gender<br><br>Total number of live births |
| *Data sources, availability and quality* | Birthweight is routinely collected only in developed countries where the great majority of births take place in health facility settings. According to statistics presented by UNICEF, two-thirds of all births world-wide are not weighed (UNICEF, 2001). Databases maintained by UNICEF and WHO rely primarily on facility-based and other routine reporting systems which are known to be biased when applied for national reporting purposes, particularly in developing countries. UNICEF has recently incorporated into their database household survey data (Demographic and Health Surveys and Multiple Indicator Cluster Surveys) using a subjective assessment by the mothers, qualifying their infants' size at birth as very large, larger than average, average, smaller than average, or very small. These estimates are of limited quality given that they are highly aggregated and the mother's subjective assessment of size tends to be biased towards the larger end of the scale (Blanc and Wardlow, 2002).<br><br>Routine data on the number of live births are available from a number of sources, including vital registrations, sample registration systems, surveillance systems and censuses and demographic surveys (such as the demographic and health surveys of world fertility surveys). Information is also collated by the UN on a regular basis. Vital registration is incomplete in many parts of the world, however, and survey data are of varied quality, especially in remote rural areas. For this reason, rates based on civil registrations or hospital data may be biased towards the more affluent, urban sectors of the population. |
| *Level of spatial aggregation* | Administrative district |
| *Averaging period* | Annual |
| *Computation* | The indicator can be computed as:<br><br>100 * *Biugr / Blive*<br><br>where: *Biugr* is the number of babies classified as affected by intrauterine growth retardation (i.e. below the 10 percentile of the recommended gender specific birthweight for gestational age reference curves (Williams,1982; WHO, 1995) during the survey period;<br><br>*Blive* is the total number of live births during the survey period. |
| *Units of measurement* | Percentage |
| *Worked example* | Assume that there are 1 553 cases of IUGR in an area, from a total of 11 400 live births. In this case, the value of the indicator will be: |

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| | 100 * (1 553 / 11 400) = 13.6% |
| *Interpretation* | Impairments in foetal growth - as assessed by IUGR - can have adverse consequences in infancy and childhood in terms of mortality, morbidity, growth and performance (WHO, 1995). IUGR classification of a newborn has implications for diagnosis, prognosis, surveillance, and treatment. IUGR infants are more likely to have congenital anomalies, and surveillance of IUGR infants should include monitoring for oxygenation and respiratory status, neonatal sepsis, and neurological complications (WHO, 1995).<br><br>Some care is needed in making comparisons between different countries, or over long time periods, however, because of changes in reporting mechanisms and efficiency. Differences may also exist in the definition of live births, while variations in the level of health service provision may affect survival of IUGR babies.<br><br>Interpretation of trends or patterns in IUGR in relation to malnutrition also needs some degree of caution, since nutritional levels are not the only determinant of intrauterine growth. Other factors, such as smoking behaviour and exposure to air pollution may also be important. |
| *Variations and alternatives* | Following the recommendations made by the WHO Expert Committee (WHO, 1995), where gestational age is not available, birthweight < 2500 g (LBW) can be used as a proxy. It should be born in mind, however, that using LBW, considerably underestimates the magnitude of IUGR (de Onis et al, 1998).<br><br>In more extreme situations, where many children are expected to have LBW and the health system is unable to cope with the large numbers of infants referred for special care, it may be more appropriate to use very low birthweight (VLBW) as a proxy. This is defined as children with a birthweight < 1500 g. VLBW infants are the most vulnerable and should obtain priority for care and special attention. |
| *Examples* | UNICEF *The state of the world's children*<br><br>• **Percentage infants with low birthweight** |
| *Useful references* | ACC/SCN 2000 *The fourth report on the world nutrition situation: nutrition throughout the life cycle*. Geneva: Administrative Committee on Coordination, Subcommittee on Nutrition.<br><br>Blanc, A.K. and Wardlaw, T. 2002 Survey data on low birthweight: an evaluation of recent international estimates and estimation procedures. *Annual Meeting of the Population Association of America, Atlanta, May 9-11, 2002*.<br><br>de Onis, M., Frongillo, E.A. Jr. and Blössner, M. 2000 Is malnutrition declining? An analysis of changes in levels of child malnutrition since 1980. *Bulletin of the World Health Organization* 78, 1222-33.<br><br>Mosley, W.H. and Gray, R. 1993 Childhood precursors of adult mortality in developing countries: implications for health programs. In: Gribble, J. and Preston, S.H. *The Epidemiological Transition: Policy and Planning Implications for developing countries.* Washington: National Academy Press, Pp. 69-100.<br><br>UNICEF 2000 *The state of the world's children, 2000.* Progress since the World Summit for Children: A statistical review. New York: United Nations Children's Fund, 2001. (Available at http://www.unicef.org/sowc00/ ) |

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| | UNICEF website: www.childinfo.org/eddb/lbw/index.htm<br><br>WHO 1995 *Expert Committee Report: Physical status: the use and interpretation of anthropometry. Technical Report Series 854.* Geneva: World Health Organization.<br><br>WHO 1996 *Catalogue of Health Indicators: A selection of important health indicators recommended by WHO Programmes.* WHO/HST/SCI/96.8. Geneva: World Health Organization.<br><br>WHO 1997 *The WHO Global Database on Child Growth and Malnutrition*. WHO/NUT/97.4. Geneva: World Health Organization.<br><br>Williams, R.L., Creasy, R.K., Cunningham, G.C., Hawes, W.E., Norris, F.D. and Tashiro, M. 1982 Fetal growth and perinatal viability in California. *Obstetrics and Gynecology* 59, 624-32. |

# CONGENITAL MALFORMATIONS REQUIRING SURGICAL CORRECTION IN CHILDREN UNDER 1 YEAR OF AGE

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| **GENERAL CONSIDERATIONS** | |
| *Issues* | Perinatal diseases |
| *Type of indicator* | Health outcome |
| *Rationale* | The foetus is especially vulnerable to exposures to radiation, hazardous or toxic chemicals, and infections in the environment. Maternal exposures during pregnancy thus constitute an important source of risk for young children. These exposures may derive from a wide range of sources, including the home (e.g. domestic chemicals, furnishings, garden pesticides), the workplace (e.g. industrial or agricultural chemicals), drinking water, food and the ambient environment (e.g. hazardous wastes). Infections (e.g. due to rubella) are also recognized as important risk factors.<br><br>This indicator is therefore designed to provide a measure of the incidence of congenital anomalies in new-born children, as a result of exposures to these environmental hazards. |
| *Issues in indicator design* | Congenital malformations take a wide range of different forms, from minor (and often unseen) anomalies to severe disfigurement and abnormality, possibly resulting in death. ICD-9 categories 740-759 (and ICD-10 categories Q00-Q99) comprise the general category of all congenital anomalies, including major forms such as neural tube defects, cardiovascular defects, abdominal wall defects, hypospadias and epispadias: this category thus provides a relatively clearly defined basis for this indicator. The indicator may thus be expressed as the rate of all congenital anomalies per thousand live births.<br><br>Many issues, nevertheless, need to be recognized in designing and using this indicator. These include problems in diagnosing and reporting anomalies – especially in areas with less well developed health services. Care is also needed to ensure that pre-term terminations and stillbirths are treated consistently in the reported data. The wide range of congenital anomalies may also result from different exposures, so in some cases it may also be more appropriate to devise separate indicators for different anomalies. An age limit of 1 year is used in the indicator because congenital malformations are usually reported and treated (if possible) within that time period – though in poorer areas treatment of non-life threatening malformations (e.g. cleft palette) may not occur until much later in life. |
| **SPECIFICATION** | |
| *Definition* | Incidence of congenital malformations requiring surgical correction in children under 1 year of age. |
| *Terms and concepts* | ***Congenital malformation requiring surgical correction in children under 1 year of age***: a bodily or functional abnormality, evident at birth, due to malformation of the foetus during pregnancy sufficiently severe to require surgical treatment or correction during the first year after birth. Malformations are defined to include all congenital anomalies (ICD-9 categories 740-59; ICD-10 categories Q00-Q99).<br><br>***Live birth****:* birth of a living and viable child. |
| *Data needs* | Number of congenital malformations requiring surgical correction during the first year after birth. |

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| | Number of live births |
| *Data sources, availability and quality* | Data on congenital malformations may be obtained from a number of sources, including national or regional registers, hospitals and special surveys. Hospitals probably provide the main source of data on malformations requiring surgical correction or treatment. Marked variations in reporting may occur, however, depending on the effectiveness of, and levels of access to, the health service. Registers also exist for certain types of malformation, especially more severe and rarer anomalies such as hypospadias and gastroschisis. These usually provide data on the number of children born with the specific anomaly within the register area, but may not specify whether surgical correction was required (though this can often be assumed). Again, marked variations in reporting rates may occur between registers, and between areas with and without formal registry systems. Where routine data are not available, information can be gathered by special surveys. In all cases, care is needed to ensure that the data are consistent, for example in terms of the classification of congenital anomalies, treatment of stillbirths and terminations, and reporting of multiple anomalies.<br><br>Data on the number of live births can usually be obtained from vital registration systems, sample registration systems, surveillance systems and censuses and demographic surveys (such as the demographic and health surveys of world fertility surveys). Information is also collated by the UN on a regular basis. These data are generally of sound quality. In some developing countries, however, registration procedures may be incomplete or inconsistent, especially in remote rural areas. Definitions of live births may also vary between countries. |
| *Level of spatial aggregation* | Health district or registry area |
| *Averaging period* | Annual |
| *Computation* | The indicator can be computed as:<br><br>1000 * *Canom / Blive*<br><br>where: *Canom* = the number of newborn children with congenital anomalies during the survey period;<br><br>*Blive* is the total number of live births over the same period. |
| *Units of measurement* | Number per thousand live births |
| *Worked example* | Assume that an area has 1 420 cases of congenital anomalies requiring surgical correction, from a total of 44 560 live births. In this case, the value of the indicator would be:<br><br>1 000 * (1 420 / 44 560) = 31.8 |
| *Interpretation* | This indicator provides a measure of the risk to children from congenital malformations. As such it gives some indication of the possible effects from maternal exposures during pregnancy to hazardous chemicals, radiation and other risk factors in the home, workplace or ambient environment. Like almost all health outcome indicators, however, it needs to be interpreted with caution, since specific environmental exposures are far from the only cause of congenital malformation, and indeed in most cases are likely to be only a minor cause. Variations in rates of congenital malformation, therefore, cannot directly be attributed to changes in levels of exposure. Many different exposure pathways may also be involved, so attribution of cause is invariably difficult. |

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| | Care is also needed because of possible inconsistencies in the data on both malformations and births. Particular reasons for inconsistency include differences in the definition and classification of malformations, differences in diagnosis and reporting, treatment in the data of stillbirths and terminations and differences in the effectiveness of vital registration systems and other sources of births data. |
| *Variations and alternatives* | This indicator can alternatively be defined in terms of specific types of anomaly. This may be more appropriate where specific risk factors or exposures are of interest. |
| *Examples* | None known |
| *Useful references* | IPCS 1984 *Environmental health criteria 46. Guidelines for the study of genetic effects in human populations.* Geneva: World Health Organization. |

# WOMEN OF CHILDBEARING AGE WITHIN ONE HOUR'S TRAVEL OF SPECIALIST MATERNITY AND PERINATAL CARE

| **GENERAL CONSIDERATIONS** | |
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| *Issues* | Perinatal diseases |
| *Type of indicator* | Action |
| *Rationale* | Ready access to specialist maternity and perinatal services is crucial if adequate health care is to be provided to mothers during and immediately after pregnancy. Improving this care can, therefore, be one of the most effective means of action to address perinatal health problems. These improvements may take many forms. They can involve building new hospitals and specialist care centres, enhancing the quality of the service provided at existing centres, or facilitating access to the service (either by removing financial barriers or by improving transport facilities). This indicator is intended to provide a measure of the effectiveness of these measures. |
| *Issues in indicator design* | The main problems in developing this indicator are the definition of specialist maternity and perinatal care and the measurement of travel times to the available facilities. Specialist care centres may take many forms, vary greatly in their quality, and differ substantially in terms of the range of services they offer, the numbers of people they can deal with, and their response times. The simple existence of such facilities, therefore, does not necessarily indicate that effective care is available.<br><br>Estimation of travel time to specialist care centres requires the ability to define both the place of residence and the location of the care centre with some degree of accuracy, as well as the travel route and speed. With the help of GIS techniques, and with suitable georeferenced data, this is possible; where these data are not available, only rough approximations can be made. For many women, also, other constraints exist, such as child care commitments, lack of access to transport, work, or physical disability. For these reasons, the indicator may be subject to major uncertainties. |
| **SPECIFICATION** | |
| *Definition* | Percentage (or number) of women aged 15-49 years living within 1 hour's travel time of specialist maternity and perinatal care. |
| *Terms and concepts* | ***Specialist maternity and perinatal care:*** health facilities offering specialist obstetric care.<br>***Living within one hour's travel time:*** living at a place of residence within less than one hour's travel time of the nearest specialist facilities, given available transport facilities and reasonable assumptions about access and personal mobility. |
| *Data needs* | Location of specialist maternity and perinatal care facilities<br>Numbers of women aged 15-49 by place of residence<br>Transport facilities (roads, public transport) |
| *Data sources, availability and quality* | Data on the location of health care facilities are generally available from the health services or ministry.<br>Data on population distribution, by age and gender, can usually be obtained from national censuses. Where census tracts are small, these may be sufficient to estimate the numbers of women of childbearing age within the specified travel time of the specialist health care facilities. Where these data are not of a sufficiently high resolution, it may be necessary to use modelling techniques to estimate the more local population distribution (e.g. on the basis of land cover type derived from satellite data, or land use maps).<br>Data on transport facilities (e.g. road-lines) may be available in a digital or |

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| | map form (e.g. from mapping or highways agencies); data on public transport facilities can often be obtained from the relevant transport companies. Based on these it is possible to estimate standard travel times.<br>Where any of these data sets are unavailable, questionnaire or interview surveys may be necessary to estimate accessibility on the basis of a sample of individuals. |
| *Level of spatial aggregation* | Census tract, community or administrative district |
| *Averaging period* | Annual or longer-term |
| *Computation* | The indicator can be computed as a simple percentage, as follows:<br>*100 * Wnear / Wtot*<br>where: *Wnear* is the number of women aged 15-49 years living within 1 hour's travel of a specialist maternal and perinatal health care facility;<br>*Wtot* is the total number of women aged 15-49 years. |
| *Units of measurement* | Percentage or number |
| *Worked example* | Assume that, within an area containing 41 950 women of childbearing age, 37 200 live within 1 hour's travel of a specialist maternal and perinatal health care facility. In this case, the value of the indicator is calculated as:<br>100 * 37 200 / 41 950 = 88.7% |
| *Interpretation* | Where reliable data exist, this indicator can be interpreted as a measure of the ease of access to specialist maternal and perinatal health care services. An increase in the indicator represents an improvement in accessibility; a fall in the indicator implies a reduction in accessibility. These changes can, of course, occur for different reasons: because of changes in the extent and availability of the services, or because of changes in population numbers and distribution. Care is also needed in interpreting the indicator because the existence of services within the specified travel time does not necessarily mean that it is accessible. For many people, access may be limited by their own circumstances (e.g. family commitments, working hours, physical state or resources), or by the operating practices of the health care centre (e.g. capacity, charges, selection procedures).<br>Uncertainties may also be expected in the indicator, due to data limitations and the need to estimate travel times. |
| *Variations and alternatives* | The main variations that may be required in this indicator are in the way in which access is defined and calculated. The specification of 1 hour as the threshold for travel time is, for example, arbitrary; other thresholds may be more appropriate in some cases. Where travel times cannot easily be calculated, it may also be more practicable to base the indicator on a distance measure (e.g. percentage of women of childbearing age living within 30 km of specialist maternal and perinatal health care facilities). Another alternative is to base the indicator on the average distance to the nearest maternal and perinatal health care facility. Both these alternatives can readily be estimated using GIS techniques. A simpler alternative is the average population-weighted density of the available services (i.e. number of people per facility); this, however, takes no direct account of proximity and is not sensitive to clustering of the services in certain (e.g. more affluent) areas. |
| *Examples* | WHO *Indicators to monitor maternal health goals*<br>• **Percentage of population within 1 hour travel time to health centre offering essential obstetric care facilities**<br>• **Proportion of women tended at least once during pregnancy by trained health personnel** |

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| | World Bank *HNP indicators on socio-economic inequalities*<br>• **Basic antenatal care rate – to a medically trained person**<br>• **Basic antenatal care rate – to a doctor**<br>• **Basic antenatal care rate – to a trained midwife**<br>• **Extended antenatal care rate – two or more visits**<br>• **Attended delivery rate - by a medically trained person**<br>• **Attended delivery rate – by a doctor**<br>• **Attended delivery rate – by a nurse/nurse-midwife** |
| *Useful references* | WHO 1993 *Coverage of maternity care. A tabulation of available information.* Geneva: World Health Organization. |

# ATTRIBUTABLE CHANGE IN NUMBER OF HOUSEHOLDS LACKING BASIC SERVICES

| GENERAL CONSIDERATIONS | |
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| *Issues* | Perinatal diseases<br><br>Diarrhoeal diseases |
| *Type of indicator* | Health outcome |
| *Rationale* | To a large extent children are most at risk in their own home. This is not only because they spend much of their time there, but also because it is there that they are often in most intimate contact with risk factors. This is especially true in the case of diarrhoeal diseases, for it is at home – or in the immediate vicinity of home – that they are most likely to be exposed to contaminated water or food, or to human and animal wastes. The availability and quality of facilities for drinking water, food storage and handling, personal hygiene and waste removal thus have an important influence on risks of diarrhoeal disease.<br><br>Many different types of action may be taken to improve this situation and reduce the risks to children's health. Ultimately the most important, however, is to provide the basic amenities needed to provide adequate water supply, sanitation and hygiene. This indicator is designed to measure and monitor the degree of success of such interventions. |
| *Issues in indicator design* | As with other measures of action, this indicator should ideally be focused on monitoring the degree of success of the actions, rather than simply the action itself. For this reason, the preferred indicator is not one that reports on the existence or extent of policies to improve access to basic amenities, but instead measures changes attributable to such policies.<br><br>One difficulty in this respect is to devise a consistent definition of basic services. Perceived basic needs tend to vary from one country to another, depending on local conditions, experience and expectations. It is also not enough simply to have basic facilities connected to, or provided in the home: these facilities also have to operate reliably. Water supplies, for example, need to be sufficient to meet family needs; waste collection must be regular and must dispose of the waste safely; excreta disposal facilities must operate correctly, and must not cause contamination elsewhere. Defining services in these terms is often difficult. Another difficulty in many cases is lack of reliable data due either to inadequate data collection, or to deliberate misreporting.<br><br>Where suitable data can be obtained (often through household surveys or special monitoring campaigns), the indicator can be designed to measure changes in the number or percentage of children with access to basic services. In principle, the indicator may be developed either to monitor changes in the extent of these services over time, as a result of the introduction of the policies, or to compare areas in which action has been taken with those in which it has not. In both these cases, however, interpretation can be difficult, because changes may be confounded by other events or other differences between the study areas. Ideally, therefore, the indicator should be measured by comparing rates of change in an 'intervention area' (before and after the intervention) with those in a matched 'control area' (a similar areas in which the intervention has not been carried out). |

| **SPECIFICATION** | |
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| *Definition* | Attributable change in the percentage (or number) of children aged 0-14 years living in households without access to basic services for water supply, sanitation and hygiene. |
| *Terms and concepts* | ***Adequate sanitation services***: facilities that provide for the controlled disposal of human excreta in ways which avoid direct human exposure to faeces, or contamination of food and local water supplies by raw faeces. Suitable facilities might range from simple but effective pit latrines, to flush toilets with sewerage. All facilities, to be effective, must be correctly constructed and properly maintained and available within the home or within 50 metres of the home. Shared or public toilets are normally not considered to be adequate.<br><br>***Adequate water supply services:*** facilities that provide a safe and reliable supply of water, of potable quality, within the home. To be regarded as safe, water must be free from harmful or distasteful contaminants, either naturally or as a result of treatment. Supplies must also be continuous (i.e. running for 24 hours per day) and sufficient to meet the needs of the user for drinking and hygiene. The minimum volume required may be defined as 20 litres per person per day.<br><br>***Adequate solid waste disposal facilities:*** regular and reliable services that provide for the collection (where appropriate) and safe disposal, of domestic solid wastes. Services might comprise: domestic solid waste treatment facilities (e.g. composting plants); domestic bin- or bag-collection systems; contained, community solid waste collection points (e.g. closed waste skips); or controlled solid waste disposal sites (e.g. contained community landfills or incinerators). Facilities should be available within a short walking distance (10 minutes) of the home.<br><br>Note that households should have all three sets of services to be considered adequately provided. Thus households lacking any one of these facilities is considered inadequately served.<br><br>***Attributable change:*** the percentage (or number) of fewer or additional children living in households lacking basic services as a direct or indirect consequence of the intervention. |
| *Data needs* | Number of households with basic sanitation, water supply and waste disposal services<br>Total number of children aged 0-14 years by household |
| *Data sources, availability and quality* | Data on service provision are usually available from the relevant service providers or their regulatory authorities (e.g. local authorities, environmental ministries). Where these data are lacking, special surveys may be necessary to estimate the extent of service provision for a sample of households.<br>Data on the total number of children and number of households are usually available in aggregate form from national censuses, and should be broadly reliable. Alternatively, estimates can be made through sample household surveys. |
| *Level of spatial aggregation* | Local authority district |
| *Averaging period* | Annual |
| *Computation* | The indicator can be computed as the percentage difference in the rates of change between the intervention and control areas, as follows:<br><br>$100 * \{[(Clack/Ctot)_t - (Clack/Ctot)b]_i / n_i\} - \{[(Clack/Ctot)_t - (Clack/Ctot)b)_c\} / n_c$<br><br>where: *Clack* is the number of children living in households lacking one or |

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| | more of the basic services;<br>*Ctot* is the total number of children aged 0-4 years<br>*t* = current year and *b* = baseline (pre-intervention) year<br>*i* = intervention area; c = control area<br>*n* = number of years between current and baseline surveys |
| *Units of measurement* | Percentage or percentage change per year |
| *Worked example* | Assume that, for the intervention area, the baseline (pre-intervention) survey shows that 550 children from a sample of 1200 live in homes lacking one or more of the basic services, whilst the current (post-intervention) survey, four years later shows that 600 from a sample of 1880 children now live in homes relying on coal, wood or dung as the main fuel source for cooking and heating. Assume, also, that for the matched control area, the pre-intervention survey showed that 490 children from a sample of 1170 lived in homes without adequate basic services, while the post-intervention survey, also four years later, showed that 460 from a sample of 1190 children live in homes relying on coal, wood or dung as the main fuel source for cooking and heating. The value of the indicator is thus:<br>100 *{[(600/1880) – (550/1200)/ 5] - [(460/1190) – (490/1170)/4]<br>= 100* [(0.319-0.458)/4] – [(0.386 - 0.418)/4]<br>= 100 * (-0.035 – -0.008) = - 2.7 (i.e. a 2.7% per year reduction in the number of children lacking basic amenities) |
| *Interpretation* | This indicator provides a general measure of changes in potential exposures as a result of inadequate water supply, poor sanitation and poor hygiene in the home. A positive value indicates that the proportion of children potentially exposed has increased; a negative value indicates a reduction in potential exposure (and thus a reduced risk of illness).<br>The extent to which these changes can be truly attributable to the intervention does, of course, need to be interpreted with caution. Many other events may contribute to the measured change, and if these are acting differentially between the intervention and control area they can seriously bias the indicator. Careful selection of the control area is essential to minimize this risk. |
| *Variations and alternatives* | As described above, this indicator requires before and after surveys in both the intervention area and a matched control area. For various reasons this may not be possible: because of cost, because the intervention is taking place everywhere (thereby leaving no suitable control areas), or because suitable baseline surveys were not undertaken before the intervention started. In these cases, a weaker version of the indicator can sometimes be computed, for example simply by comparing the proportions of children living in homes lacking basic amenities before and after intervention in the one area; or by comparing these proportions between intervention and control areas only at one moment in time, after intervention. Inevitably, however, the indicator is more difficult to interpret in these situations, because it becomes impossible to adjust for confounding by other factors, and thus to assess the amount of change actually attributable to the intervention.<br>This indicator may be designed in different ways to reflect local circumstances and data availability. The range of basic services included, for example, and the level of service specified as a threshold, can both be varied according to need. In some cases (e.g. where the availability of the various services differs greatly or where policies are targeted at specific services), it may be more useful to define separate indicators for different amenities. |
| *Examples* | None known, although many indicators of the current state of services and |

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| | amenities are available (see related Exposure indicator). |
| *Useful references* | UN 1996 *Indicators of sustainable development. Framework and methodologies*. New York: UN.<br><br>WHO 1996 *Catalogue of health indicators: a selection of health indicators recommended by WHO programmes*. Geneva: WHO (under revision).<br><br>WHO 1999 *Environmental health indicators: framework and methodologies.* Geneva: WHO. (Available at http://www.who.int/docstore/peh/archives/EHIndicators.pdf )<br><br>WHO 2002 *Environmental health indicators: development of a methodology for the WHO European region.* Bonn: WHO.<br><br>WHO and UNICEF 2000 *Global water supply and sanitation assessment. 2000 report.* Geneva: WHO/UNICEF. |

| PREVALENCE OF STUNTING IN CHILDREN AGED 0-4 YEARS | |
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| **GENERAL CONSIDERATIONS** | |
| *Issues* | Perinatal diseases |
| *Type of indicator* | Action |
| *Rationale* | Long-term action to reduce the prevalence of low birthweight requires attention to the factors that lead to intrauterine growth retardation (e.g. maternal undernutrition, infection during gestation, maternal smoking). Because low birthweight has long-lasting impacts upon children's (and adults') health, however, action is also needed to redress the effects of children who are born underweight. These might include targeted assistance in terms of nutritional support and education, as well as monitoring of those who are most at risk.<br><br>One measure of the success of these *post hoc* interventions is the prevalence of stunting later in life. Stunting is defined as having a height (or length)-for-age more than two standard deviations below the median of the NCHS/WHO growth reference (WHO, 1995). It is calculated, therefore, by taking body measurements of height or length. Other data needed are age and gender. These data are relatively simple to collect, and measurements are non-invasive and at low cost. |
| *Issues in indicator design* | Stunting is a well-established child health indicator for chronic malnutrition related to environmental and socio-economic circumstances (WHO, 1995; WHO, 1996). Stunting prevalence data on national levels are readily available and are being continuously collected in a standardized way by WHO. This systematic standardization allows the derivation of trends (ACC/SCN 2000, de Onis, 2000) and regional cross-country comparisons of malnutrition levels (WHO1997). The WHO definition, cut-off and reference population used to calculate the indicator has been widely accepted since the 1980s. Special software programmes for calculation of individual z-scores and population prevalence are available free of charge by WHO and CDC (i.e. ANTHRO and EpiInfo).<br><br>Height-for-age represents the linear growth achieved at the age of measurement, taken in the standing position. Length refers to measurement in recumbent position, and is recommended for children below 2 years of age.<br><br>An age range of 0-4 years is used for the indicator because action needs to be taken early in life to reduce long-term adverse effects. |
| **SPECIFICATION** | |
| *Definition* | Percentage (or number) of children aged 0-4 years who are stunted, by gender. |
| *Terms and concepts* | ***Stunting:*** having a height (or length)-for-age more than 2 SD below the median of the NCHS/WHO international reference. |
| *Data needs* | Number of children aged 0-4 years who are stunted.<br>Total number of children aged 0-4 years. |
| *Data sources, availability and quality* | Data on height (or length)-for age are available from many nutritional and other household surveys. Following standardization and quality checking, many of these data are incorporated in the WHO Global Database on Child Growth and Malnutrition. This database is accessible on-line, free of charge (http://www.who.int/nutgrowthdb/ ) and is updated on a continual basis.<br><br>Internationally, there are also several other survey programmes that provide anthropometric data, including the Demographic and Health Surveys funded by USAID, the PAPCHILD surveys funded by the Pan-Arab League and UNFPA, and the LSMS and SDA surveys in sub-Saharan Africa, funded by |

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| | the World Bank. |
| *Level of spatial aggregation* | Local to national |
| *Averaging period* | Instantaneous (i.e. at time of survey) – ideally ca. every 5 years |
| *Computation* | The indicator can be calculated as a simple percentage, as follows:<br>*100 * (Cstunt / Ctot)*<br>where: *Cstunt* is the number of children aged 0-4 years who are stunted (i.e. more than two SD below the reference height-for-age or length-for-age reference);<br>*Ctot* is the total number of children aged 0-4 years surveyed. |
| *Units of measurement* | Percentage or number |
| *Worked example* | Assume that, from a survey of 5 500 children aged 0-4 years, 690 are defined as stunted. In this case, the value of the indicator is calculated as 100 * (690 /5 500) = 12.5% |
| Interpretation | In general terms, this indicator provides a measure of the success, or otherwise, of actions taken to combat problems of undernutrition and impaired physical development of children. Since low birthweight is one of the major precursors for impaired development, it thereby indicates the extent to which the adverse effects of intrauterine growth retardation have been assuaged.<br>Interpretation nevertheless needs to be conducted with care. Problems in the reliability of data may exist, especially where surveys are small. Reduced growth is also, of course, not only a result of problems prior to, or immediately after, birth; it can also reflect problems of undernutrition, infection or other illnesses throughout the early years of life. In other words it is a consequence of a range of factors closely linked to the overall standard of living, the conditions of the environment and whether a population can meet its basic needs, such as access to food, housing and health care. Using stunting later in life (i.e. to age 4) as an indication of action also assumes that underweight children are surviving. Where rates of perinatal and infant mortality are high, this may not be the case. Ideally, therefore, the indicator needs to be applied and interpreted alongside other measures. |
| *Variations and alternatives* | Variations are possible in the way in which stunting is defined. Instead of using the -2 SD, for example, it may be based on –3 SD. Disaggregated prevalence data by level of severity are available on the web site of the WHO Global Database.<br>Where data on height or length by age are not available, useful proxies are underweight prevalence (measured in terms of weight-for-age) and wasting prevalence (measured in terms of weight for height). |

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| *Examples* | WHO *Catalogue of health indicators*<br>• **Stunting prevalence**<br>• **Underweight prevalence**<br>• **Wasting prevalence** |
| *Useful references* | ACC/SCN 2000 *The fourth report on the world nutrition situation: nutrition throughout the life cycle*. Geneva: Administrative Committee on Coordination, Subcommittee on Nutrition.<br><br>Blanc, A.K. and Wardlaw, T. 2002 Survey data on low birthweight: an evaluation of recent international estimates and estimation procedures. *Annual Meeting of the Population Association of America, Atlanta, May 9-11, 2002*.<br><br>de Onis, M., Frongillo, E.A. Jr. and Blössner, M. 2000 Is malnutrition declining? An analysis of changes in levels of child malnutrition since 1980. *Bulletin of the World Health Organization* 78, 1222-33.<br><br>Mosley, W.H. and Gray, R. 1993 Childhood precursors of adult mortality in developing countries: implications for health programs. In: Gribble, J. and Preston, S.H. *The Epidemiological Transition: Policy and Planning Implications for developing countries.* Washington: National Academy Press, Pp. 69-100.<br><br>UNICEF 2000 *The state of the world's children, 2000.* (available at: http://www.unicef.org/sowc00/)UNICEF, Progress since the World Summit for Children: A statistical review. New York: United Nations Children's Fund, 2001.<br><br>UNICEF website: http://www.childinfo.org/eddb/lbw/index.htm<br><br>USAID *MEASURE DHS+ Demographic and health surveys.* (available at http://www.measuredhs.com/).<br><br>WHO 1996 *Catalogue of Health Indicators: a selection of important health indicators recommended by WHO Programmes.* WHO/HST/SCI/96.8. Geneva: World Health Organization.<br><br>WHO 1995 *Expert Committee Report: Physical status: the use and interpretation of anthropometry. Technical Report Series 854.* Geneva: World Health Organization.<br><br>WHO 1997 *The WHO Global Database on Child Growth and Malnutrition*. WHO/NUT/97.4. Geneva: World Health Organization. (Available at http://www.who.int/nutgrowthdb/ )<br><br>Williams, R.L., Creasy, R.K., Cunningham, G.C., Hawes, W.E., Norris, F.D. and Tashiro, M. 1982 Fetal growth and perinatal viability in California. *Obstetrics and Gynecology* 59, 624-32.<br><br>World Bank *Living standards measurement survey* website*:* http://www.worldbank.org/lsms/tlook |