CHILDREN AGED 0-14 YEARS LIVING IN POVERTY	
GENERAL CONSIDERATIONS	
Issues	Perinatal diseases Respiratory diseases Diarrhoeal diseases Physical injuries
Type of indicator	Exposure (distal/driving force) 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. 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). 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

	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. 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. ***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 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). 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

	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: *100* (Cpov / Ctot)* where : *Cpov* is the number of children aged 0-14 years living in households with a sustainable income inadequate to meet their basic needs; *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: *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: ***Average household income per child:*** the mean household income (total or disposable) per child. ***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. ***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). ***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

	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* • **Poverty** UNDP *Human development report* • **Human poverty index for developing countries (HPI-1)** • **Human poverty index for developed countries (HPI-2)** *UN Indicators of sustainable development* • **Head count index of poverty** • **Poverty gap index** • **Squared poverty gap index** • **Gini index of income inequality** UNCHS and World Bank *Housing indicators programme* • **Household income distribution** • **Households below poverty line** • **DAC Indicators of poverty reduction** • **Incidence of extreme poverty** • **Poverty gap ratio** • **Inequality** Many indicators have also been developed at national level, often as a basis for allocating health resources e.g.: • **the Carstairs score** • **the Jarman score** • **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. DAC 1999: http://www.oecd.org/dac/indicators/htm/list.htm 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. Jarman, B. 1983 Identification of underprivileged areas. *British Medical Journal* 286, 1705-1709. Townsend, P., Phillimore, P. and Beattie, A. 1988 *Health and deprivation: inequality and the north.* London: Croom Helm Ltd. UN *1996 Indicators of sustainable development. Framework and methodologies.* New York: United Nations. 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. UNCHS (Habitat) 1997 M*onitoring human settlements with urban indicators*.

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

DRINKING WATER SUPPLIES FAILING NATIONAL MICROBIOLOGICAL WATER QUALITY STANDARDS	
GENERAL CONSIDERATIONS	
Issues	Diarrhoeal diseases
Type of indicator	Exposure (distal/state) Can also be used as a measure of action in relation to policies on safe water supply.
Rationale	Access to safe and secure supplies of drinking water is an essential requirement for health. In many areas, however, contamination of water supplies by human and animal wastes means that the available supplies pose severe risks of diarrhoeal (as well as other waterborne) diseases. This indicator provides a measure of the microbiological quality of the available drinking water.
Issues in indicator design	The main problem in designing this indicator is the choice of parameter(s) to use as a basis for quality assessment. Many different microbiological contaminants may occur in drinking water, and these may vary in importance from one area to another, depending on the type of water source, the supply system, water storage facilities, treatment processes, climate and local systems of land management. For this reason, the indicator proposed here is not defined in terms of a specific set of parameters: instead, these should be identified as appropriate. Major differences in the number and significance of the determinants measured are also allowed for, by restricting the indicator to the three key microbiological parameters considered (locally or nationally) to be important for drinking water quality in terms of human health. Another problem is in defining standards against which to assess water quality. WHO have established guidelines for a wide range of parameters, but the relevance of these can vary substantially from one area to another. For this reason, the indicator proposed here used national standards. Variations of these standards from WHO guidelines need to be noted and recognized. A further problem is the availability of reliable data. In many areas, especially those relying on natural water sources, little or no monitoring may be undertaken. In these situations, this indicator cannot be applied; instead, it may be appropriate to develop a more qualitative indicator based on the type of water source (e.g. untreated surface waters, untreated groundwaters, treated waters). Even where water quality monitoring is undertaken on a regular basis, the range of contaminants measured, the measurement methods, and the sampling frequency and design may all vary considerably. This makes comparison of the indicator between countries, or in some cases even between different water companies, difficult. Information on sampling and measurement methods should always be examined, therefore, when constructing and interpreting the indicator.
SPECIFICATION	
Definition	Percentage (or number) of samples failing national drinking water quality standards for the three key microbiological determinants.

Terms and concepts	***Determinant:*** a parameter that is measured as a basis for assessing water quality. ***Three key determinants:*** the three main microbiological determinants considered to be indicative of risks for diarrhoeal diseases on the basis of local conditions. ***National drinking water quality standard:*** a nationally agreed standard for a specified water quality parameter (determinant). Where possible, these should comply with internationally agreed standards and measurement methods (e.g. as recommended by WHO). ***Sample failure:*** a test analysis of a water sample, at the point of delivery (e.g. well, tap) that fails the national drinking water quality standard.
Data needs	National water quality standards for key microbiological drinking water quality parameters. Numbers of samples tested for each parameter. Number of samples failing national drinking water quality standard by parameter.
Data sources, availability and quality	Data on drinking water quality standards on results of testing regimes can usually be obtained from the organizations responsible for drinking water supply. The quality, completeness and availability of test data may be variable and wherever possible information should also be collected on the protocols used for sampling and analysis.
Level of spatial aggregation	Water supply zone
Averaging period	Annual
Computation	Selection of the three determinants to be used as a basis for the indicator should be made in consultation with relevant health and water experts. The indicator can be computed as the average percentage of samples failing the national water quality standards for the selected parameters as follows: $100 * \Sigma (Sfail / Stot) / Ndet$ where: *Sfail* is the number of samples failing national water quality standards for a specified determinant; *Stot* is the total number of samples analysed for that determinant. *Ndet* is the number of determinants (default = 3)
Units of measurement	Percentage or number
Worked example	Assume that for the three determinants selected, the number of failures (and total number of samples analysed) are as follows: A – 85 failures (from 260 samples); B – 31 failures (from 240 samples); C – 2 failures (from 120 samples). In this case, the value of the indicator is calculated as: 100 * [(85/260) + (31/240) + (2/120)] / 3 = 15.7%
Interpretation	This indicator provides a measure of the general quality of drinking water supplies. As such, an increase in the indicator can be interpreted to imply a worsening of drinking water quality and thus increased risks for children's health; a reduction implies an improvement in water quality and a reduced risk to health. Caution is needed in interpretation, however, because of the inherent uncertainties and inconsistencies that exist in the data, and possible variations or biases in the sampling regime. The range of parameters selected for inclusion in the indicator should, therefore, always examined and reported. Marked differences in sampling intensity should also be noted.

Variations and alternatives	Many variations on this indicator are possible – for example, by adjusting the number and range of determinants measured, or the computational procedure. One alternative would be to frame the indicator in terms of a single, predefined parameter, such as BOD or total coliforms. The disadvantage of this is that it is likely to limit the relevance of the indicator, and bias it towards specific types of risk. Another alternative would be to adjust it to reflect the number of children served by water of different quality – e.g. by weighting the indicator by the population of children aged 0-5 years in each area. This would have the advantage of making it a more explicit measure of exposure, but difficulties often arise in computing the numbers of children using different sources. Where quantitative measurements are not available, a more qualitative measure can be used, for example by assessing the number of people with access to safe water supplies. This requires the ability to identify 'access' to water, as well as the quality (and continuity) of the supply. A distance of 1000 metres is proposed by the WHO/UNICEF Global water supply and sanitation assessment 2000. However, shorter distances may be more appropriate in many cases.
Examples	UN *Indicators of sustainable development* • **Access to safe drinking water** UNCHS (Habitat) *Urban indicators programme* • **Household connection levels** • **Access to potable water** WHO *Environmental health indicators: framework and methodologies* • **Access to safe and reliable supplies of drinking water** WHO *Catalogue of health indicators* • **Access to safe drinking water** • **WHO Environmental health indicators for the European region** • **Access to drinking water complying with WHO guidelines** • **Access to safe drinking water**
Useful references	UN 1996 *Indicators of sustainable development. Framework and methodologies*. New York: United Nations. UNCHS(Habitat) 1997 M*onitoring human settlements with urban indicators*. Nairobi: United Nations Centre for Human Settlements. WHO 1982 National and global monitoring of water supply and sanitation. CWS series of Cooperative Action for the decade, No.2. WHO 1996 *Catalogue of health indicators: a selection of health indicators recommended by WHO programmes*. Geneva: World Health Organization (under revision). WHO 1997 *Guidelines for drinking water quality. Vols 1-3.* Geneva: World Health Organization. (Available at http://www.who.int/water_sanitation_health/dwq/en/) WHO 1999 *Environmental health indicators: framework and methodologies.* Geneva: World Health Organization. (Available at http://www.who.int/docstore/peh/archives/EHIndicators.pdf)

	WHO 2002 Water quality - guidelines, standards and health: assessment of risk and risk management for water-related infectious disease. Geneva: World Health Organization. (Available at: http://www.who.int/water_sanitation_health/Documents/IWA/iwabooktoc.htm) WHO 2002 *Environmental health indicators: development of a methodology for the WHO European region.* Bonn: World Health Organization. WHO/UNICEF 2000 Water supply and sanitation sector monitoring report 2000. World Health Organization/UNICEF Joint Monitoring Programme.

PEOPLE LIVING IN INFORMAL SETTLEMENTS	
GENERAL CONSIDERATIONS	
Issues	Perinatal diseases Diarrhoeal diseases Physical injuries
Type of indicator	Exposure (distal/state) 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. 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). 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. 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. Similar difficulties occur in obtaining data on the numbers of people who live within these settlements. They are often not covered by formal censuses,

	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). ***Unauthorized housing:*** excludes units where land titles, leases or occupancy permits have been granted (UN 1996). It should be noted that informal settlements do NOT cover the ***homeless***.
Data needs	Number of people living in informal settlements. 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. 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: *100 * Pinf / Ptot)* 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: 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. 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

	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. This indicator can also be defined on the basis of different classifications of informal settlements (or other, similar concepts). 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* • **Population in informal settlements** UN *Indicators of sustainable development* • **Area and population of urban formal and informal settlements**
Useful references	UN 1996 *Indicators of sustainable development. Framework and methodologies*. New York: United Nations. 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. UNCHS (Habitat) 1995 *Monitoring the shelter sector. Housing Indicators review*. Nairobi: United Nations Centre for Human Settlements. UNCHS (Habitat) 1995 *Monitoring human settlements, abridged survey*. Indicators Programme. Nairobi: United Nations Centre for Human Settlements. UNCHS Urban Indicators Programme website: http://www.urbanobservatory.org/indicators/database/ WHO 1999 *Environmental health indicators: framework and methodologies*. Geneva: WHO. (Available at http://www.who.int/docstore/peh/archives/EHIndicators.pdf)

CHILDREN AGED 0-14 YEARS LIVING IN DISASTER-AFFECTED AREAS	
GENERAL CONSIDERATIONS	
Issues	Diarrhoeal diseases Physical injuries
Type of indicator	Exposure (distal/state)
Rationale	Natural disasters, such as floods, drought, earthquakes or landslides are a major cause of disease and death for children, not only directly – as a result of physical injury – but also because of their longer-term legacy. Indeed, diarrhoeal diseases, as a result of contamination of water supplies, breakdown of sanitation facilities and the need to scavenge for food, often take a larger toll of life than the original disaster. Nor are disasters restricted to natural events: war and social conflict can be equally devastating and prove even more intractable to resolve. The number of children living in disaster-affected areas is, therefore, an important indicator of risks to health and the need for international action.
Issues in indicator design	The main problem in designing this indicator is the definition of disaster-affected areas and their associated populations. Not all disasters are sudden and acute events; most are chronic or endemic processes, that wax and wane according to the state of politics, climatic cycles or the level of international aid, but which persist in the background for years or decades. Disaster-affected areas thus have no clear boundaries in either time or space. Because one of the only available responses for those affected is to flee the area in search of safety, sustenance or help, the affected population is also fluid – and not confined to the immediate vicinity of the disaster. In defining this indicator, account thus needs to be taken of the displaced populations, as well as those who remain. A related difficulty is the availability of reliable data. Many of the most disaster-prone areas are also those in which basic statistical systems, such as population counts, are poorly developed; during prolonged periods of strife or natural emergencies they are likely to deteriorate further. Data are therefore scarce, and the data that do exist often of poor quality. An age range of 0-14 years is used for this indicator because risks remain more-or-less uniform (i.e. are not age-dependent) throughout the child's life.
SPECIFICATION	
Definition	Numbers of children aged 0-14 years living in, or refugees from, areas affected by natural or human-made disasters
Terms and concepts	***Disaster:*** a non-routine event or process of either natural or human origin that causes severe social disruption and physical harm to a large number of people.
Data needs	Extent of disaster-affected area Numbers of resident children, aged 0-14 years (including refugees)
Data sources, availability and quality	Data on the extent of disaster-affected areas are likely to come in most cases from the emergency and humanitarian aid agencies, especially international organizations. These may also be able to provide estimates of the numbers affected, either within the area or as refugees. In both cases, data are liable to be uncertain, due to problems of definition and the inevitable difficulties of acquiring reliable information in severely disrupted (and often remote) societies. Estimates thus provide only a general indication of the numbers of

	children at risk. Routine procedures need to be established to acquire, process and validate these data in order to support this indicator. Use of satellite data can also be helpful in attempting to define more accurately disaster-affected areas, especially in relation to disasters that leave a clear signal on the landscape (e.g. due to vegetation deterioration or collapse of buildings).
Level of spatial aggregation	Region
Averaging period	Annual (or shorter term in the case of acute events)
Computation	The indicator can be computed by summing the numbers of children aged 0-14 years both within, and displaced from, the disaster-affected areas. Often this can be done only approximately (e.g. based on assessments by workers in the field). In some cases, however, more reliable estimates can be made by intersecting maps of the extent of the disaster-affected area with data on population distribution (e.g. using GIS techniques).
Units of measurement	Number
Worked example	Assume that the disaster is affecting three areas as follows. In A (which has a population of 320 000 children aged 0-14 years) it covers the whole area; in B (472 000 children), it covers 60% of the area; in C (198 000 children), it covers 85% of the area. The total number of children affected is thus: (1.0 * 320 000) + (0.6 * 472 000) + (0.85 * 198 000) = 771 500
Interpretation	This indicator provides a broad approximation of the numbers of children at risk from natural or human-made disasters. An increase in the indicator thus represents an increased risk, a decrease represents a reduced risk. Because of the inherently approximate nature of the data used to construct the indicator, only broad patterns and trends can be regarded as significant, and care is needed especially in the early stages of any disaster because of the potential for major errors in assessment.
Variations and alternatives	Various alternatives are possible for this indicator. It could, for example, be expressed in terms of the area affected rather than the numbers of children. Alternatively, separate estimates could be made for children still living in the disaster-affected area, and those displaced: this would enable different aspects of the disaster, and different needs for action, to be better specified. Separate indicators could also be developed, if appropriate, for different types of disaster (e.g. floods, drought, seismic events, war). A further alternative – as a measure of effect – is to define the indicator in terms of the numbers of deaths or injuries.
Examples	None known
Useful references	PAHO 2000 *Natural disasters. Protecting the public's health.* Washington: Pan American Health Organization. ReliefWeb: (http://www.reliefweb.int/) WHO 1990 *Emergency preparedness and response: introduction to rapid health assessment.* Geneva: World Health Organization. WHO-Afro 2000 *Environmental health hazard mapping for Africa.* Harare: World Health Organization Regional Office for Africa.

CHILDREN AGED 0-14 YEARS LIVING IN HOUSEHOLDS WITHOUT BASIC SERVICES FOR WATER SUPPLY, SANITATION AND HYGIENE

GENERAL CONSIDERATIONS	
Issues	Diarrhoeal diseases
Type of indicator	Exposure (proximal)
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. This indicator is designed to assess risks of diarrhoeal diseases based on an assessment of these essential services.
Issues in indicator design	The major difficulty in developing this indicator 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. An age range of 0-14 years is used for this indicator because the various risks from lack of access to these facilities tend to persist throughout the child's life.
SPECIFICATION	
Definition	Percentage of children aged 0-14 years living in households lacking basic sanitation, water supply and waste disposal services in the home
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. ***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. ***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. 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.
Data needs	Number of households with basic sanitation, water supply and waste disposal services 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. 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 a simple percentage: *100 * [(Ctot – Cserv) / Ctot]* where: *Ctot* is the total number of children *Cserv* is the number of children in households with basic services
Units of measurement	Percentage or percentage change per year
Worked example	As a static measure of exposure: assume that an area contains 3640 children aged 0-5 years, of whom 2010 live in households with basic services, as defined above. In this case, the value of the indicator is calculated as: 100 * (3640 – 2010) / 3640= 44.8%
Interpretation	This indicator provides a measure of the number of children living in households without basic services. As a measure of exposure, therefore, it can be interpreted as an indicator of the number of children at risk from diarrhoeal diseases due to inadequate sanitation and other facilities in the home. An increase in the indicator implies an increased risk; a reduction in the indicator can be interpreted as a decreased risk. Care is needed in interpretation because of possible uncertainties in the available data. Comparisons between different areas should also be undertaken with caution because of differences in the definition of basic services and in reporting methods.
Variations and alternatives	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), it may be more useful to define separate indicators for different amenities. In this context, four established and useful indicators are: • **access to safe (or improved) water sources** • **access to adequate (or improved) sanitation facilities** • **sound hygiene practices**

	• **access to solid waste facilities** For some applications, it may also be more appropriate to report the indicator in the inverse way – i.e. as the percentage of children that have access to these services. In addition, the indicator may justifiably be restricted to a narrower age range (e.g. 0-4 years), in order to focus on risks to pre-school children, who spend more of their time at home.
Examples	UN *Indicators of sustainable develop*ment • **Basic sanitation: percentage of population with adequate excreta disposal facilities** • **Waste water treatment coverage** WHO *Catalogue of health indicators* • **Access to sanitary means of excreta disposal** • **Access to safe drinking water** WHO *Environmental health indicators: framework and methodologies* • **Proportion of the population with access to adequate excreta disposal facilities** • **Percentage of households receiving piped water to the home** • **Percentage of the population with access to an adequate amount of safe drinking water in the dwelling or within a convenient distance from the dwelling** • **Percentage of population served by regular waste collection services** WHO *Environmental health indicators for the European Region* • **Percentage of the population with access to adequate excreta disposal** • **Percentage of the population supplied from a public water supply** • **Percentage of the population with access to safe drinking water** • **Percentage of the population with access to adequate excreta disposal**
Useful references	UN 1996 *Indicators of sustainable development. Framework and methodologies*. New York: UN. WHO 1996 *Catalogue of health indicators: a selection of health indicators recommended by WHO programmes*. Geneva: WHO (under revision). WHO 1999 *Environmental health indicators: framework and methodologies.* Geneva: WHO. (Available at http://www.who.int/docstore/peh/archives/EHIndicators.pdf) WHO 2002 *Environmental health indicators: development of a methodology for the WHO European region.* Bonn: WHO. WHO and UNICEF 2000 *Global water supply and sanitation assessment. 2000 report.* Geneva: WHO/UNICEF.

DIARRHOEA MORTALITY RATE IN CHILDREN AGED 0-4 YEARS	
GENERAL CONSIDERATIONS	
Issues	Diarrhoeal diseases
Type of indicator	Health outcome
Rationale	Diarrhoea and related gastrointestinal illnesses continue to be one of the most important causes of illness and death worldwide, especially amongst young children. Much of this illness is due to exposures to contaminated water or food, as a result, for example, of poor water quality, limited access to water, poor food hygiene and safety, or poor sanitation in the home. Major pathogens include Salmonella, Shigella, *Campylobacter*, *E. coli* and rotavirus. Mortality rates have declined in many countries in recent years, partly as a result of environmental improvements (e.g. in access to effective sanitation and safe drinking water) and advances in health care and treatment (e.g. oral rehydration therapy). This indicator provides a measure of mortality of young children due to diarrhoeal diseases.
Issues in indicator design	Data on mortality rates for diarrhoeal diseases are widely collected and reported. Diarrhoeal diseases, however, take many different forms and can occur in association with a wide array of other illnesses, so differences in diagnosis can occur, affecting the reported mortality rates. For these reasons, also, design of the indicator (e.g. which ICD codes are included) should take account of the context and purpose of application, as well as the completeness and reliability of the available data. An age range of 0-4 years is used for this indicator, since mortality from diarrhoeal diseases tends to be strongly age-related, and at its highest in the very young.
SPECIFICATION	
Definition	Diarrhoea mortality rate in children aged 0-4 years
Terms and concepts	***Death due to diarrhoea in children aged 0-4 years***: death in which diarrhoea is defined as a primary cause of a child of less than five years of age at the time of death. ***Total population of children aged 0-4 years***: number of live children less than five years of age at the midpoint of the survey year (or other survey period).
Data needs	Total number of deaths due to diarrhoea in children aged 0-4 years. Total population of children aged 0-4 years.
Data sources, availability and quality	Data on death due to diarrhoea in children aged 0-4 years should be available through national or regional/local death statistics. Differences in both diagnosis and reporting practice may be significant in these data, especially where diarrhoea is part of a complex of symptoms (e.g. associated with malnutrition). Where statistical data are not available from routine sources, special surveys will be necessary. Data on the total population of children aged 0-4 years should usually be available via national censuses. Inter-census estimates can be made using vital registration data, or demographic models. Care is needed in applying a consistent and appropriate census date, especially where marked seasonal patterns in birth may occur.
Level of spatial	Community, health district

aggregation	
Averaging period	Annual (or shorter term for major outbreaks)
Computation	The indicator can be computed as a simple mortality rate: *1000 * (Ddiar / Ctot)* where: *Ddiar* is the total number of deaths amongst children aged 0-4 years due to diarrhoeal diseases; *Ctot* is the total population of children aged 0-4 years.
Units of measurement	Number per thousand children aged 0-4 years.
Worked example	Assume that 568 reported deaths of children due to diarrhoeal disease occur in an area in one year, amongst a population of 11 400 children. In this case the value of the indicator is: 1 000 * (568 / 11 400) = 49.8 deaths per 1 000 children
Interpretation	This indicator is a powerful measure of health status of children, especially under conditions of inadequate water or food hygiene and basic sanitation. Action to improve these conditions can generally help to reduce mortality rates. Like other infectious diseases, however, marked short-term variations in mortality may occur, making identification of long-term trends difficult. Death of young children due to diarrhoea may also be a result of several different, and often inter-related, exposures: attributing changes in mortality to any one of these without consideration of the others might be misleading. Rates of mortality are also fundamentally affected by the effectiveness of, and access to, the health service and levels of awareness amongst parents.
Variations and alternatives	Variations to this indicator are possible, for example by basing it on a different age range (e.g. 0-1 years of age), or to a more specific set of diseases (e.g. cholera or typhoid). Alternatively, it could be defined using a broader category of illnesses (e.g. diseases of the digestive system - ICD codes 520-579). While this would broaden the potential range of exposures of relevance, it would tend to reduce inconsistencies due to diagnosis. Stratification by gender may be useful in some cases.
Examples	WHO *Catalogue of health indicators* • **Deaths due to diarrhoea among infants and children under 5 years of age** WHO *Environmental health indicators: framework and methodologies* • **Diarrhoea mortality on children** WHO *Environmental health indicators for the European region* • **Diarrhoea mortality rate in children aged 0-4 years**
Useful references	WHO 1987 Diarrhoeal diseases morbidity, mortality and treatment surveys. *Control of Diarrhoeal Diseases Update* 1, 1-13. WHO 1992 *Readings on diarrhoea: student manual*. Division for the Control of Diarrhoea and Acute Respiratory Disease, Geneva: World Health Organization. WHO 1994 *Household survey manual: diarrhoea and acute respiratory infections*. WHO/CDR/94.8. Geneva: World Health Organization. WHO 1996 *Catalogue of health indicators: a selection of health indicators recommended by WHO programmes*. Geneva: World Health Organization

	(under revision). WHO 1999 *Environmental health indicators: framework and methodologies.* Geneva: WHO. (Available at http://www.who.int/docstore/peh/archives/EHIndicators.pdf) WHO 2002 *Environmental health indicators: development of a methodology for the WHO European region.* Bonn: World Health Organization.

DIARRHOEA MORBIDITY RATE IN CHILDREN AGED 0-4 YEARS

GENERAL CONSIDERATIONS	
Issues	Diarrhoeal diseases
Type of indicator	Health outcome
Rationale	Diarrhoea and related gastrointestinal illnesses continue to be one of the most important causes of illness and death worldwide, especially amongst young children. Much of this illness is due to exposures to contaminated water or food, as a result, for example, of poor water quality, limited access to water, poor food hygiene and safety, or poor sanitation in the home. Major pathogens include Salmonella, Shigella, *Campylobacter*, *E. coli* and rotavirus. Although mortality rates have declined in many countries in recent years, largely as a result of environmental improvements (e.g. in access to effective sanitation and safe drinking water) and advances in health care and treatment (e.g. oral rehydration therapy), outbreaks of diarrhoeal diseases continue to affect many millions of children. This indicator provides a measure of the incidence of diarrhoeal diseases in young children.
Issues in indicator design	As with almost all measures of morbidity, a major problem with this indicator is data availability and quality. Routine reporting of diarrhoeal diseases tends to be patchy, largely because many cases may not be referred to hospital but may be treated either in the home or by primary health services. Diarrhoeal diseases also take many different forms and can occur in association with a wide array of other illnesses, so differences in diagnosis can occur, affecting the reported disease rates. For these reasons, also, design of the indicator (e.g. which ICD codes are included) should take account of the context and purpose of application, as well as the completeness and reliability of the available data. An age range of 0-4 years is used for this indicator, since younger children tend to be most at risk.
SPECIFICATION	
Definition	Incidence of diarrhoea morbidity in children aged 0-4 years.
Terms and concepts	***Diarrhoea***: three or more watery stools in a 24-hour period, a loose stool being one that would take the shape of the container (WHO 1996), or local definition of diarrhoea. ***Episode of diarrhoea*****:** An episode of diarrhoea begins with a 24-hour period with three or more loose or watery stools. An episode of diarrhoea is considered to have ended after 48 hours without three or more loose watery stools within a 24-hour period. ***Incidence of diarrhoea morbidity*****:** total number of episodes of diarrhoea during a 1-year period amongst the children surveyed. ***Total population of children aged 0-4 years*****:** number of children less than five years of age in the survey, at the time of survey.
Data needs	Number of episodes of diarrhoea among children aged 0-4 years. Total number of children aged 0-4 years.

Data sources, availability and quality	Morbidity data for diarrhoea disease does not tend to be collected on a routine basis, and usually depends on special surveys. Methods for data collection by surveys are recommended by the WHO Division for the Control of Diarrhoea and Acute Respiratory Disease (CDD/ARI) household survey manual (see *Useful references*). The CDD/ARI Household Survey is designed to collect qualitative as well as quantitative information on diarrhoea episodes occurring in the past two weeks. The manual includes instructions on how to convert the results to an annual incidence taking into account seasonal variations.
Level of spatial aggregation	Community, health district
Averaging period	Annual (or shorter term for major outbreaks)
Computation	The indicator can be computed as a simple incidence rate: *Mdiar / Ctot* Where: *Mdiar* is the incidence of diarrhoea in children aged 0-4 years in the survey; *Ctot* the total number of children aged 0-4 years in the survey.
Units of measurement	Number of cases per child per year.
Worked example	Assume that 1 280 cases of diarrhoeal disease are reported within an area in one year, amongst a total of 17 900 children. In this case, the value of the indicator is calculated as 1 280/17 900 = 0.07 cases per child per year.
Interpretation	This indicator is a useful measure of health status of children, especially under conditions of inadequate water or food hygiene and basic sanitation. Action to improve these conditions can generally help to reduce morbidity rates. Like other infectious diseases, however, marked short-term variations in morbidity may occur, making identification of long-term trends difficult, especially on the basis of short-term or irregular surveys. Data on the incidence of diarrhoea are also subject to large margins of error due to inconsistencies in reporting and in definitions, and problems of ensuring adequate sampling in surveys.
Variations and alternatives	Variations on this indicator are possible, for example by focusing on different age groups, or by defining the indicator in terms of specific types of diarrhoeal disease (e.g. cholera or typhoid fever) or in terms of a broader classification (e.g. diseases of the digestive system - ICD codes 520-579). Stratification by gender may also be useful in some cases.
Examples	WHO *Catalogue of health indicators* • **Annual incidence of diarrhoea in children under 5 years of age** WHO *Environmental health indicators: framework and methodologies* • **Diarrhoea morbidity in children** WHO *Environmental health indicators for the European region* • **Diarrhoea mortality rate in children aged 0-4 years**

Useful references	WHO 1987 Diarrhoeal diseases morbidity, mortality and treatment surveys. *Control of Diarrhoeal Diseases Update* 1, 1-13. WHO 1992 *Readings on diarrhoea: student manual*. Division for the Control of Diarrhoea and Acute Respiratory Disease, Geneva: World Health Organization. WHO 1994 *Household survey manual: diarrhoea and acute respiratory infections*. WHO/CDR/94.8. Geneva: World Health Organization. WHO 1996 *Catalogue of health indicators: a selection of health indicators recommended by WHO programmes*. Geneva: World Health Organization (under revision). WHO 1999 *Environmental health indicators: framework and methodologies.* Geneva: World Health Organization. (Available at http://www.who.int/docstore/peh/archives/EHIndicators.pdf) WHO 2002 *Environmental health indicators: development of a methodology for the WHO European region.* Bonn: World Health Organization.

RECURRENCE RATE OF OUTBREAKS OF DIARRHOEAL DISEASE AMONGST CHILDREN AGED 0-4 YEARS

GENERAL CONSIDERATIONS	
Issues	Diarrhoeal diseases
Type of indicator	Health outcome Can also be used as a measure of action in relation to policies and interventions targeted at controlling or responding to disease outbreaks.
Rationale	Diarrhoeal diseases such as cholera often occur as sudden outbreaks, affecting large numbers of people in a short time. These outbreaks not only place great stresses on the health care system, but also demonstrate longer-term, institutional and infrastructural weaknesses – for example in the quality of water supply systems, in food safety and hygiene, or in sanitation facilities. This indicator thus uses the frequency of such outbreaks to provide a measure of risks to children of infection.
Issues in indicator design	As with other measures of morbidity, a major problem with this indicator is data availability and quality. Routine reporting of outbreaks of diarrhoeal diseases tends to be patchy, largely because many cases may not be referred to hospital but may be treated either in the home or by primary health services. Diarrhoeal diseases also take many different forms and can occur in association with a wide array of other illnesses, so differences in diagnosis can occur, affecting the reported disease rates. For these reasons, also, design of the indicator (e.g. which ICD codes are included) should take account of the context and purpose of application, as well as the completeness and reliability of the available data. In measuring the number of outbreaks, a further problem is how best to quantify outbreaks – for example, by the number of separate outbreaks or the numbers of children affected. The latter might be expected to give a more complete measure of the scale of the risk, but may be subject to larger errors due to under-reporting of cases. It also has less relevance in terms of action, since intervention is usually aimed not at treating individual cases, but at preventing or controlling outbreaks at source.
SPECIFICATION	
Definition	Recurrence rate of outbreaks of diarrhoeal diseases amongst children aged 0-4 years.
Terms and concepts	***Diarrhoea***: three or more watery stools in a 24-hour period, a loose stool being one that would take the shape of the container (WHO 1996), or local definition of diarrhoea. ***Episode of diarrhoea*****:** An episode of diarrhoea begins with a 24-hour period with three or more loose or watery stools. An episode of diarrhoea is considered to have ended after 48 hours without three or more loose watery stools within a 24-hour period. ***Outbreak:*** an occurrence of two or more linked cases of the same illness, or an increase in the number of observed cases over the expected number. ***Recurrence rate:*** average frequency of outbreaks of diarrhoeal diseases, per thousand children aged 0-4 years

Data needs	Number of outbreaks of diarrhoeal disease affecting children aged 0-4 years. Total number of children aged 0-4 years.
Data sources, availability and quality	Information on the number of outbreaks of diarrhoeal diseases can be derived from a variety of sources, including routine passive case reporting by health care workers, community-based surveillance programmes, special surveys and analysis of hospital admission or GP statistics and records. All of these are likely to lead to significant under-estimation of the number of outbreaks, due to incomplete referral and reporting. The age range of people affected may also not always be reported, making specific estimation of this indicator difficult. Serious inconsistencies in the estimates also occur between different areas or reporting periods because of variations in referral rates, in diagnosis and in reporting methods and accuracy. Data on the total number of children aged 0-4 years can usually be obtained from national censuses and should be reliable.
Level of spatial aggregation	Community, health district
Averaging period	Annual or shorter-term (e.g. monthly)
Computation	The indicator can be computed as a simple incidence rate: *1000 * Odiar / Ctot* where: *Odiar* is the incidence of outbreaks of diarrhoea in children aged 0-4 years; *Ctot* the total number of children aged 0-4 years in the survey.
Units of measurement	Number per 1000 children
Worked example	Assume that 12 outbreaks of diarrhoeal disease occur in one year in a city containing 47 000 children aged 0-4 years. In this case the value of the indicator is calculated as: 1 000 * (12 / 47 000) = 0.26 outbreaks per 1 000 children
Interpretation	At a simple level, this indicator can be interpreted to show patterns or trends in the incidence of outbreaks of diarrhoeal diseases in young children. An increase in the indicator suggests a rise in the incidence of outbreaks; a reduction implies a decrease in the outbreak incidence. Considerable care is needed in interpretation, however, because of the inherent inconsistencies and inaccuracies in the available data. Major, largely random fluctuations in the number of outbreaks may also occur from year to year, making identification of trends difficult without a relatively long run of data. Information relating to the incidence of outbreaks should also not be used to infer the absolute numbers of cases, since outbreaks may vary greatly in terms of the numbers of people affected.

Variations and alternatives	The most obvious alternative to this indicator is to compute the number of children affected in outbreaks of diarrhoeal diseases, or the total morbidity. This provides a better measure of the total disease burden, but may fail to show clearly the sporadic and possibly localized nature of the events. Another alternative is to focus the indicator on specific types of diarrhoeal disease, such as cholera. A commonly used – but less specific alternative – is the frequency of outbreaks of water-borne diseases.
Examples	WHO *Environmental health indicators: framework and methodologies* • **Outbreaks of water-borne diseases** WHO *Environmental health indicators for the European region* • **Outbreaks of water-borne diseases**
Useful references	WHO 1982 *National and global monitoring of water supply and sanitation*. CWS series of Cooperative Action for the decade, No.2. WHO 1999 *Environmental health indicators: framework and methodologies.* Geneva: World Health Organization. (Available at http://www.who.int/docstore/peh/archives/EHIndicators.pdf) WHO 2002 *Environmental health indicators: development of a methodology for the WHO European region.* Bonn: World Health Organization. WHO/UNICEF 2001 *Water supply and sanitation sector monitoring report*, *2001*. World Health Organization /UNICEF Joint Monitoring Programme.

ATTRIBUTABLE CHANGE IN NUMBER OF HOUSEHOLDS LACKING BASIC SERVICES

GENERAL CONSIDERATIONS	
Issues	Perinatal diseases 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. 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. 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. 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	
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. ***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. ***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. 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. ***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 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. 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: $100 * \{[(Clack/Ctot)_t - (Clack/Ctot)b]_i / n_i\} - \{[(Clack/Ctot)_t - (Clack/Ctot)b)_c\} / n_c$ where: *Clack* is the number of children living in households lacking one or

	more of the basic services; *Ctot* is the total number of children aged 0-4 years *t* = current year and *b* = baseline (pre-intervention) year *i* = intervention area; c = control area *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: 100 *{[(600/1880) – (550/1200)/ 5] - [(460/1190) – (490/1170)/4] = 100* [(0.319-0.458)/4] – [(0.386 - 0.418)/4] = 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). 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. 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

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

ATTRIBUTABLE CHANGE IN NUMBER OF FOOD OUTLETS FAILING FOOD HYGIENE STANDARDS	
GENERAL CONSIDERATIONS	
Issues	Diarrhoeal diseases
Type of indicator	Action
Rationale	Poor food hygiene is a major source of diarrhoeal diseases in children. Problems may occur throughout the food chain, from primary food production, through processing, manufacturing and sale, to storage, preparation and use in the home. A major source of infection – and one of the main points for control – however, are food retail outlets. Problems in this sector often occur because of inadequate or prolonged storage of food, unhygienic preparation and handling and poor packaging. Because individual retailers may serve a large number of people, problems can quickly cause major outbreaks of food-borne illness. By the same token, monitoring and inspection of these outlets, and legislation to improve their practices, can be an important way of reducing risks. This indicator uses information on the changes in the percentage of outlets failing national (or local) food hygiene standards attributable to these interventions.
Issues in indicator design	Construction of this indicator relies upon the existence of clearly defined and recognized food hygiene standards, and a monitoring regime that tests food hygiene in retail outlets. Where either of these is absent, this indicator may not be appropriate. Even where standards and monitoring do exist, problems may be encountered in compiling this indicator because of uncertainties or inconsistencies in the available data. In particular, a large and well-structured monitoring regime is essential if the full range of different food outlets is to be properly inspected and representative information provided. Methods of monitoring and assessment may also vary greatly: for example, between essentially qualitative inspections of premises to quantitative testing of food samples for biological contamination. Comparisons between different countries may thus be difficult. Finally, there is the issue of how to assess the attributable effect of the policy. This can be difficult against a background of other changes, including changes in market conditions, eating habits and food technology. Not all the changes that occur can necessarily be attributed to intervention; in some cases, intervention may be having a bigger effect than immediately apparent, because – without it – the percentage of outlets failing the food standards would have increased. To assess the attributable effects, the indicator should ideally be computed by comparing inspection failures after intervention with the expected numbers of failures, extrapolated from data before the intervention occurred.
SPECIFICATION	
Definition	Attributable change in the percentage of retail food outlets failing national (or local) food hygiene standards.
Terms and concepts	***Retail food outlet:*** a commercial food retailer; includes food shops, supermarkets, street traders, restaurants and take-aways, selling either fresh or processed produce. ***Food hygiene standards:*** legally defined hygiene standards or norms for food retailing. These typically cover the quality and appropriateness of the premises (e.g. storage and handling facilities, availability of washing areas,

	evidence of animal or insect pests) and/or the microbiological safety of the food (e.g. by laboratory testing). Testing regimes may vary both in their frequency and the range of premises and food-stuffs covered. ***Failure of food hygiene standards:*** a reported event (a single occasion at a single retail outlet) of a failure to meet the specified food hygiene standards. Repeat events (i.e. a further failure at a subsequent inspection for the same reason) should usually be counted as a separate event.
Data needs	National (or local) food hygiene standards. Number of retail food outlets inspected. Number of outlets failing on each inspection.
Data sources, availability and quality	Data on food hygiene standards are usually available from the relevant ministries or inspection authorities, at national or local level (in many countries, local authorities are responsible for food hygiene monitoring). Data on the results of inspections are also often available directly from the inspection agencies. Where an established or adequate monitoring and inspection system does not exist, special surveys may be necessary to sample major types of outlet. These need to be carefully designed to ensure proper representation of different types of outlet; as far as possible, sampling should be proportional to the contribution of each type of outlet to total food purchases.
Level of spatial aggregation	Local authority area
Averaging period	Annual
Computation	The indicator can be computed as the percentage change in the proportion of food outlets failing food hygiene standards before and after intervention, over and above any change that would have occurred without intervention. This is done by finding the difference between the rates of inspection failure after intervention and the projected failure rates based on a 'no-intervention' scenario. Three steps are involved in the process of indicator development. First the trend in annual failure rates should be computed for the pre-intervention period. This is best done using regression analysis methods (as available in most statistical packages and spreadsheets such as Excel). This provides a formula that can be used to predict failure rates in the post-intervention period. If no trend is observable (i.e. if the association with time is statistically not significant at the 95% level), then the arithmetic average from the pre-intervention period should be used. Alternatively, it may be possible to derive a trend 'by eye' by graphing the data as a scattergram and interpolating a trend line. Whichever method is used, attention should be paid to the nature of the relationship; in the event of a strongly non-linear trend, for example, an appropriate curvilinear trendline should be fitted, either by transforming the data or by using polynomial curve-fitting functions. Using the fitted trend, the number of failures for the period after policy intervention should then be calculated, by projection of the trendline. Values for each year since intervention should be computed. Finally, the reported number of failures post-intervention are compared with the projected number and the differences calculated. The indicator is expressed as the percentage difference, compared with the projected failures, as follows: $100 * [\Sigma(Ffail_{rpost} - Ffail_{proj}) / \Sigma (Ffail_{proj})]$ where: $Ffail_{proj}$ is the projected number of inspections failed by all food outlets inspected during the post-intervention period; $Ffail_{post}$ is the reported number of inspections failed during the post-

<table>
<tr><td></td><td>intervention period.</td></tr>
<tr><td>Units of measurement</td><td>Percentage change</td></tr>
<tr><td>Worked example</td><td>A worked example is shown in the table below:
<table>
<tr><th rowspan="2">Year</th><th colspan="3">Reported</th><th>Projected</th><th></th></tr>
<tr><th>Total surveyed</th><th>Failures</th><th>Failure rate</th><th>Failure rate</th><th>Failures</th></tr>
<tr><td>1994</td><td>740</td><td>66</td><td>0.089</td><td></td><td></td></tr>
<tr><td>1995</td><td>728</td><td>76</td><td>0.104</td><td></td><td></td></tr>
<tr><td>1996</td><td>760</td><td>73</td><td>0.096</td><td></td><td></td></tr>
<tr><td>1997</td><td>690</td><td>78</td><td>0.113</td><td></td><td></td></tr>
<tr><td>1998</td><td>805</td><td>88</td><td>0.109</td><td></td><td></td></tr>
<tr><td>1999</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2000</td><td>810</td><td>82</td><td>0.101</td><td>0.140</td><td>113.4</td></tr>
<tr><td>2001</td><td>900</td><td>77</td><td>0.086</td><td>0.145</td><td>130.4</td></tr>
<tr><td>2002</td><td>850</td><td>66</td><td>0.078</td><td>0.15</td><td>127.3</td></tr>
<tr><td>2003</td><td>940</td><td>72</td><td>0.077</td><td>0.155</td><td>145.4</td></tr>
<tr><td>2004</td><td>914</td><td>60</td><td>0.066</td><td>0.160</td><td>145.9</td></tr>
<tr><td>Total (post)</td><td>4414</td><td>357</td><td></td><td></td><td>662.4</td></tr>
</table>
In this example, a policy intervention was introduced in 1999, and the indicator is computed for the following five years.

In this case, analysis of the failure rates for the pre-intervention years (1994-1998) gives a small, positive trend, with the formula:

Failure rate = -9.66 + 0.0048*Year

In the fifth column of the table, this rate has been applied to predict the failure rate without intervention, and this is then converted, in the sixth column, to the expected number of failures, taking account of the number of inspections made.

The difference between the projected and reported totals of failures for the intervention period is then calculated and expressed as a percentage of the projected total:

100 *(357 – 662.4) / 662.4 = 46.1% - i.e. a reduction of 46.1% in the expected failure rate.</td></tr>
<tr><td>Interpretation</td><td>In so far as reliable data are available, this indicator provides a measure of the extent to which action to reduce risks to children from poor food standards in retail outlets is being successful. A negative value for the indicator implies that proportionally fewer premises are failing standards, and thus suggests that action is helping to reduce health risks. A positive value of the indicator implies that food hygiene conditions are getting worse, and thus that policies to reduce health risks are inadequate.
For various reasons, the indicator needs to be interpreted with caution. Major problems clearly arise because of possible inadequacies in the inspection and testing regime, or the quality of the data that this produces. In many cases, inspection may fail to cover informal food outlets, such as street traders (often those who pose the greatest risks). Differences in standards and monitoring regimes between different countries may also make comparisons difficult. Changes in the number of food outlets, and the</td></tr>
</table>

	selection of outlets for inspection, may also cause biases in the indicator. In addition, it needs to be recognized that the retail outlets may not be the true source of the problem (contamination may occur further up the supply chain), and equally poor hygiene after purchase (e.g. storage or preparation in the home) may be a major risk for children.
Variations and alternatives	Where food hygiene policies are introduced in only part of the area of interest, this indicator can be improved, by comparing trends before and after intervention in the intervention area (i.e. where the policy has been applied) with trends before and after intervention in a matched control area (one with similar pollution characteristics but in which the policy has not been applied). The indicator can also be specified in various other – for example, by targeting it at other points in the food chain, or at specific types of food or supplier. Where appropriate, separate assessments might be made for inspections of retail premises and for food testing. In some cases, it may also be appropriate to devise an indicator that measures the scope of the inspection and testing regime (e.g. on the basis of the rigour of the national standards, the scope of premises and foodstuffs tested, and the number of tests made).
Examples	UN *Indicators of sustainable development* • **Proportion of potentially hazardous chemicals monitored in food** WHO *Environmental health indicators: framework and methodologies* • **Monitoring of chemical hazards in food**
Useful references	UN 1996 *Indicators of sustainable development. Framework and methodologies*. New York: United Nations. WHO 1999 *Environmental health indicators: framework and methodologies.* Geneva: World Health Organization. (Available at http://www.who.int/docstore/peh/archives/EHIndicators.pdf)

CHILDREN AGED 0-4 YEARS ABLE TO OBTAIN REHYDRATION THERAPY WITHIN 24 HOURS OF NEED	
GENERAL CONSIDERATIONS	
Issues	Diarrhoeal diseases
Type of indicator	Action
Rationale	Rapid rehydration treatment has been proved to be one of the most effective strategies for combating the problems of cholera. Though it cannot be seen as a substitute for policies that remove the primary risk factors (such as poor sanitation, inadequate water supplies or inefficient waste management), therefore, it undoubtedly needs to be part of the policy response to risks from diarrhoeal diseases, especially in cholera-prone areas. This indicator is designed to assess the degree of coverage provided by rehydration therapies.
Issues in indicator design	Success of rapid rehydration therapies depends on the ability to gain assistance from a trained health worker quickly in the event of need. This depends first and foremost on the availability of trained professionals (though it also depends, of course, on the mother's ability to recognize the symptoms that demonstrate that need). Information on the distribution of trained health care workers is likely to be widely available. How accessible these are, however, is often more difficult to assess; it depends on the transport facilities, as well as on cultural factors (e.g. the mother's freedom to travel when required). It may also depend on the operating practices (e.g. opening hours) at the relevant health centres. The time window available within which to seek assistance is also likely to vary, and will depend on how adept the mother is at detecting early warning signs. All these factors mean that it is difficult to design a robust and reliable indicator of the coverage of rapid rehydration facilities. The indicator developed here, however, provides a simple approximation, by estimating the percentage of children within a day's travel time of the available trained professionals. An age range of 0-4 years is used, because younger children tend to be more at risk.
SPECIFICATION	
Definition	Percentage of children aged 0-4 years able to obtain emergency rehydration therapy within 24 hours of need.
Terms and concepts	***Emergency rehydration therapy:*** emergency treatment to combat dehydration caused by acute diarrhoea. ***Access to assistance within 24 hours of need:*** the ability to travel to, or receive a visit from, a trained health worker within 24 hours of need.
Data needs	Location of health workers trained in rapid rehydration therapies. Place of residence of mothers. Transport routes and facilities.
Data sources, availability and quality	Data on the distribution and location of trained health care professionals, able to give rapid rehydration therapy, may be available from the relevant health services (though data may often be incomplete). Where suitable data are not available, they can be collected by a questionnaire survey of local health care centres and hospitals. Data on the distribution of children aged 0-4 years should usually be available from national censuses and can then be considered relatively reliable. Where census tracts are small, these may be sufficient to estimate the numbers of children 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). Data on transport facilities (e.g. road-lines) may be available in a digital or 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. 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	Community, administrative district, health district
Averaging period	Annual or longer term
Computation	The indicator can be computed as a simple percentage, as follows: *100 * Cnear / Ctot* where: *Cnear* is the number of children aged 0-4 years living within 24 hour's travel of a trained health care worker able to deliver rapid rehydration therapy; *Ctot* is the total number of children aged 0-4 years.
Units of measurement	Percentage
Worked example	Assume that, within an area containing 19 400 children aged 0-4 years, 17 550 live within 24 hour's travel of a trained health care worker able to deliver rapid rehydration therapy. In this case, the value of the indicator is calculated as: 100 * 17 550 / 19 400 = 90.5%
Interpretation	Where reliable data exist, this indicator can be interpreted as a measure of the ease of access to trained health care workers able to deliver rapid rehydration therapy. 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 they are accessible, or that mothers know about them or are able to recognize symptoms requiring attention when they occur. Major 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 24 hours 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 child-bearing age living within 50 km of trained health care worker able to deliver rapid rehydration therapy). A simpler alternative is to assess the average population-weighted density of the available services (i.e. number of people per trained health care worker); 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 *Catalogue of health indicators*

	• **Mother's knowledge of home therapy for diarrhoea** World Bank *HNP Indicators on Socio-Economic Inequalities* • **Oral rehydration treatment rate for diarrhoea** • **Medical treatment rate for diarrhoea** • **Percentage seen in a public facility**
Useful references	Ali, M., Atkinson, D. and Underwood, P. 2000 Determinants of use rates of oral rehydration therapy for management of childhood diarrhoea in rural Bangladesh. *Journal of Health, Population and Nutrition* 18, 103-8. WHO 1996 Catalogue of health indicators: a selection of health indicators recommended by WHO programmes. Geneva: World Health Organization (under revision). World Health Organization. Diarrhoeal diseases: http://www.who.int/aboutwho/en/preventing/diarrhoeal.htm