ATTRIBUTABLE CHANGE IN INCIDENCE OF PHYSICAL INJURIES TO CHILDREN AGED 0-14 YEARS REQUIRING TREATMENT

GENERAL CONSIDERATIONS	
Issues	Physical injuries
Type of indicator	Action
Rationale	Children are amongst the most vulnerable groups to injury, both in the home and on the street for a range of reasons: because of the tendency for the world around them to be designed and structured with little regard for children's safety; because of the limited development of their own risk perceptions and behaviours; and because of their inherent physical vulnerability. Successful intervention to reduce risks of injuries to children should be reflected in the injury rate. This can already be seen in some countries, where injury rates from some causes (e.g. road traffic, occupational injuries) have fallen as a result of improved technologies, policies and awareness raising. The annual rate of change in the injury rate thus provides a useful indicator of the direction and trajectory of policy impacts.
Issues in indicator design	Injuries take many different forms, and occur in many different ways. Non-fatal injuries may also be treated by, and reported to, many different authorities – and many may not be reported at all. One of the major difficulties in developing this indicator is thus to ensure consistency in the definitions and the reliability of the data used. Injury rates also vary substantially between different age ranges and by gender (boys tend to be more injury prone than girls). Careful definition of the subpopulation range is therefore essential if the risks to children's health are to be represented effectively. The indicator should also usefully be stratified by gender. More substantially, the problem with this as with any measure of the effectiveness of actions is to specify the changes that can, in truth, be seen as consequences of intervention. This is often difficult because of the confounding effect of long-term trends, and of other, often random and short-term events, that may affect accident rates. One way of minimizing these problems is to standardize the indicator by comparing injury rates after intervention in the area of interest with the projected rates over the same period, derived by extrapolating the rates from beforehand. An age range of 0-14 years is used for this indicator, since risks from physical injuries (albeit often from different causes) extend throughout the child's life.
SPECIFICATION	
Definition	Attributable change in the incidence of physical injury to children aged 0-14 years by gender due to policy intervention
Terms and concepts	***Physical injury***: unintentional injury of sufficient severity to require medical attention. ***Total number of children aged 0-14 years****:* total resident population of children aged 0-14 years, at the time of survey. ***Attributable change:*** the percentage (or number) of fewer or additional accidents to children as a direct or indirect consequence of the intervention.
Data needs	Incidence of unintentional physical injuries to children aged 0-14 years, by gender and external cause Total number of children aged 0-14 years, by gender
Data sources, availability and	Data on the number of childhood injuries should usually be available from routine medical statistics (e.g. hospital admissions/discharges). Data on

quality	external causes of injury are fundamental to prevention policy and planning, and essential for this indicator, but are likely to be weak and unreliable because of differences in referral rates, diagnosis and reporting methods. Where these data are not available, special surveys may be needed. Data on the total number of children aged 0-14 years should be available from national censuses and should be broadly reliable.
Level of spatial aggregation	Health district
Averaging period	Annual
Computation	The indicator can be computed as the percentage change in the incidence of physical injuries 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 injuries after intervention and the projected rates based on a 'no-intervention' scenario. Three steps are involved in the process of indicator development. First the trend in annual injury 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 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 trendline. 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 injuries 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 injuries post-intervention are compared with the projected number and the differences calculated. The indicator is expressed as the percentage difference, compared with the projected number of injuries, as follows: $100 * [\Sigma(Cinj_{rpost} - Cinj_{proj}) / \Sigma (Cinj_{proj})] / Years$ where: $Cinj_{proj}$ is the projected number of injuries during the post-intervention period; $Cinj_{post}$ is the reported number of injuries during the post-intervention period.
Units of measurement	Attributable percentage change
Worked example	A worked example is presented in the Table below. In this case, policy intervention aimed at reducing injury rates was introduced in 1999, and the effectiveness of the policy is determined over the following five years.

Year	1994	1995	1996	1997	1998

1996	5280	109	48.44		
1997	5116	111	46.09		
1998	5107	113	45.19		
2000	4900	115	42.61	42.20	4853.00
2001	4620	117	39.49	40.92	4787.6
2002	4174	119	35.08	39.64	4717.1
2003	4540	121	37.52	38.36	4641.6
2004	4228	123	34.37	37.08	4560.8
Total (post)	**22462**				**23560.3**

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

*Injury rate = 2602.3 – 1.28*Year*

In the fifth column of the table, this rate has been applied to predict the injury rate without intervention, and this is then converted, in the sixth column, to the expected number of injuries, taking account of the population of children aged 0-14 years.

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

100 *(22462 – 23560.3) / 23560.3 = -4.7% - i.e. a reduction of 4.7% in the expected injury rate.

Interpretation	This indicator provides a general measure of changes in accident and injury rates to children as a result of policy intervention. A positive value indicates that the injury rate has increased; a negative value indicates a reduction in the injury rate. 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. Care is, however, needed in making interpretations because of likely inadequacies in the available data and the range of other factors which may affect injury rates. Significant differences in reported rates may occur either geographically or over time, for example, because of differences in reporting methods and referral rates - e.g. due to differences in accessibility of the health care services. Rates of injury are also affected by often subtle variations in cultural, lifestyle and behavioural factors (e.g. in play behaviour of children, in the design and layout of homes and play areas, in parental attitudes to supervision). Where possible, the indicator should therefore be interpreted in the context of other cultural information.
Variations and alternatives	Where policies to prevent injuries 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). More specific versions of this indicator should be used where possible (classified by ICD code), relating to specific causes of injury (e.g. from falls, traffic accidents, physical assault, burns and scalds).
Examples	WHO *Environmental health indicators: framework and methodologies* • Injuries to children
Useful references	Manciaux, M. and Romer, C.J. 1991 *Accidents in childhood and adolescence*. The role of research. Geneva: WHO.