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## **Burden of disease attributable to selected environmental factors and injuries among Europe's children and adolescents**

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## Preface

The disease burden of a population, and how that burden is distributed across different subpopulations (e.g. infants, women), are important pieces of information for defining strategies to improve population health. For policy-makers, disease burden estimates provide an indication of the health gains that could be achieved by targeted action against specific risk factors. The measures also allow policy-makers to prioritize actions and direct them to the population groups at highest risk. To help provide a reliable source of information for policy-makers, WHO recently analysed 26 risk factors worldwide, including some environmental risk factors, in the World Health Report (WHO, 2002). The Environmental Burden of Disease (EBD) series of guides continues this effort to generate reliable information, and most of the guides provide step-by-step practical assistance on how to assess the environmental burden of disease at national and local levels.

In this guide, we use the Global Burden of Disease methodology (WHO, 2001) to estimate the burden of childhood disease and injury attributable to selected environmental risks in the WHO European Region. The study was carried out by the WHO Regional Office for Europe, European Centre for Environment and Health, Rome Office, through the Institute of Hygiene and Epidemiology, University of Udine and the Institute of Child Health “Burlo Garofolo” in Trieste, Italy, to serve as the basis for the Children’s Environment and Health Action Plan for Europe (CEHAPE), which is to be adopted at the Fourth Ministerial Conference on Environment and Health, Budapest, Hungary, 23–25 June 2004.

Environmental exposures are known to be important contributors to the global burden of disease among children and adolescents, but there are still gaps in our knowledge about the magnitude and regional distribution of the environmental burden among the young. This investigation is the first attempt to assess the overall impact of the environment on child health in the European Region, and to highlight the number of lives (and disabilities) that could be saved by reducing the exposure of children to these hazards. The results indicate that indoor and outdoor air pollution, unsafe water conditions, lead exposure and injuries account for about one third of the total burden of disease in 0–19 year old children, and that substantial public-health gains could result from action aimed at reducing the exposure of children to these environmental risk factors and at preventing injuries.

Based on the results of this study, four Regional priority goals have been proposed for CEHAPE. They are to confront the health burden arising from: 1) lack of adequate water and sanitation; 2) mobility-related and transportation-related injuries, as well as unintentional injuries; 3) indoor and outdoor air pollution; and 4) hazardous chemicals and occupational hazards. In many cases, effective actions for addressing these risk factors exist. Multisectoral approaches, including engineering, educational and law enforcement interventions, have been shown to reduce the incidence of injury and the severity of the consequences. Phasing out lead from gasoline also has proved to be effective at reducing mild mental retardation, cognitive disorders and behavioural problems associated with elevated blood lead levels. And improvement of water quality has a dramatic effect on the health and survival of young children. The four

CEHAPE priorities are to be adopted at the Fourth Ministerial Conference on Environment and Health, in Budapest, Hungary 23–25 June 2004.

The ministerial conference is one in a series that started in Frankfurt in 1989, with the aim of promoting a European-wide political and public-health process on environmental health. Recognizing that environmental health risks cannot be addressed without involving different sectors, these conferences facilitate dialogue and joint action among different stakeholders, and put health firmly on the agenda of environment, transportation and research authorities at different levels of decision-making in Europe. The ministerial conferences in the series have addressed different issues: principles and strategies (in Frankfurt, 1989); situation assessment in national plans (in Helsinki, 1994); action in partnership (in London, 1999); and vulnerable groups (in Budapest, 2004).

We hope the results of this study will serve as a foundation for further EBD studies, and encourage countries to initiate their own. The results would allow preventive actions to be better targeted, and could be used to assess progress in public health. A summary of this report has also been published in: Valent F, Little D, Bertollini R, Nemer LE, Barbone F, Tamburlini G. Burden of disease attributable to selected environmental factors and injury among children and adolescents in Europe. *Lancet* 2004; 363:2032-39.

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In preparing this document the authors drew on methods from the Environmental Burden of Disease developed by the WHO Protection of the Human Environment department, and would therefore like to thank them for their review of this analysis. We would also like to thank J.A. Vincenten and M. Sector, European from the Child Safety Alliance (ECOSA), for reviewing the injury section, as well as Philip Landrigan in the Department of Community and Preventive Medicine, Mount Sinai School of Medicine, for his review.

## **List of abbreviations**

AB	Attributable burden
ALRI	Acute lower respiratory infections
AF	Attributable fraction
ARI	Acute respiratory infections
BLL	Blood lead level
CI	Confidence interval
DALY	Disability-adjusted life year
EBD	Environmental burden of disease
EU	European Union
ICD	International classification of diseases
IQ	Intelligence quotient
MMR	Mild mental retardation
NIS	Newly independent states
PM	Particulate matter
SFU	Solid fuel use
YLD	Years lived with disability
YLL	Years of life lost due to premature mortality
WHO	World Health Organization

## Summary

Although exposures to environmental risks contribute significantly to the burden of disease among children and adolescents (Smith, Corvalan & Kjellstrom, 1999; WHO, 2002), there are still gaps in our knowledge about the magnitude and regional distribution of the environmental burden of disease (EBD) among the young. For the WHO European Region in particular, there are no estimates. This study aims to estimate the burden of childhood disease and injury attributable to environmental risks in the WHO European Region, as well as the health gains that could be achieved by reducing the exposure of the child population to these risks.

We analysed five environmental risks factors:

- outdoor air pollution
- indoor air pollution
- water, sanitation, and hygiene
- lead
- injury.

The burden of disease was measured in terms of the disability-adjusted life year (DALY), a summary measure that accounts for the impact both of “premature” death (i.e. the years of life lost due to premature death, or YLL), and of health problems among those who are alive (i.e. the number of years lived with a disability, or YLD). For the purpose of this study, we also considered the environment in a broad sense, and included both the physical and socioeconomic settings. For this reason, we present the burden of all injuries, not just those directly attributable to the physical environment, such as occupational or domestic hazards. The methods used to estimate the burden of child disease attributable to each risk factor are described separately for each risk factor, and are consistent with those developed by WHO for the Global Burden of Disease (GBD) study (WHO, 2000a). Since patterns of morbidity and mortality vary across the European Region, and environmental factors are likely to be at least partly responsible for such differences, the analyses were performed separately for each of the three WHO European subregions, EUR A, EUR B, and EUR C (see Annex 1 for a list of the Member States in each subregion and for a description of the inclusion criteria). This follows the classification used by WHO (WHO-CHOICE, 2003).

The year 2001 was chosen as the reference year because it ensured a good balance between availability of data and timeliness. Age groups included in the analyses were 0–4, 5–14 and 15–19 years. The age group 15–19 years was used so as to include the entire adolescent population and ensure comparability with other studies. Due to the limited availability of complete data on exposures and health effects in all age groups, estimates of the disease burden attributable to certain risk factors did not include the complete child age range (0–19 years) and should therefore be considered conservative.

The burden of disease attributable to the five environmental risks accounted for one third of the total disease burden for children 0–19 years of age in the EUR Region. Among children 0–4 years of age, the five risks contributed to 21.9–26.5% of all deaths and to 19.8% of all DALYs. Among those 5–14 years old, the risks contributed to 42.1% of all deaths and to 30.8% of all DALYs. Among those 15–19 years old, the risks were responsible for 59.9% of all deaths and for 27.1% of all DALYs. Children living in EUR B and EUR C suffered the most from exposures to the environmental risk factors. Injuries were the leading cause of deaths and DALYs in all age groups in EUR A and among children and adolescents 5–14 years old and 15–19 years old in EUR B and EUR C.

Given the scarcity of published and available literature from certain countries, results of this study may be skewed towards those with available data. More uniform and widespread collection of environmental exposure data, as well as regional standardization and routine collection of morbidity and mortality statistics, are needed to improved burden of disease estimates.