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# Occupational noise

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**Assessing the burden of disease from work-related hearing  
impairment at national and local levels**

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## **Preface**

Policy-makers increasingly rely on measurements of the disease burden of risk factors, and how the burden is distributed by socioeconomic status, to develop rational policies and effective interventions. Despite the growing importance of objective measurements, the health effects of many occupational risk factors have not been quantified. In addition, many workplace risk factors contribute only to disability and not to mortality, and are therefore poorly described by estimates of the number of deaths. Both of these issues have contributed to an underestimation of the effects of occupational risks on the overall health of communities. One of the clearest examples of a risk that has been underestimated is occupational noise that leads to hearing impairment.

The World Health Organization (WHO) carried out an assessment of the global disease burden from occupational noise, as part of a larger initiative to assess the impact of 25 risk factors in a standardized manner (WHO, 2002). This guide builds on the global assessment, by providing a tool for occupational health professionals to carry out more-detailed estimates of the disease burden associated with hearing loss from occupational noise at both national or subnational levels. It is complemented by an introductory volume on methods for assessing the environmental burden of disease (Prüss-Üstün et al., 2003).

The present guide describes how to quantify the burden of disease associated with hearing impairment from occupational noise. The following topics are described:

- noise characteristics and their relevance to workers' health;
- criteria for selecting health outcomes for the burden of disease assessment;
- methods of assessing exposure to workplace noise, for all segments of a population;
- relative risk data for the main health outcome of occupational noise;
- procedures for generating a summary measure of the burden of disease from occupational noise;
- sources of uncertainty in disease burden estimates;
- policy implications.

## Affiliations and acknowledgements

This document was prepared by Marisol Concha-Barrientos, Diarmid Campbell-Lendrum and Kyle Steenland. The Environmental Burden of Disease series is edited by Annette Prüss-Üstün, Diarmid Campbell-Lendrum, Alistair Woodward and Carlos Corvalán. Marisol Concha-Barrientos is at the Asociacion Chilena de Seguridad. Diarmid Campbell-Lendrum, Carlos Corvalán and Annette Prüss-Üstün are at the World Health Organization. Kyle Steenland is at the Rollins School of Public Health, Emory University, and Alistair Woodward is at the School of Population Health, University of Auckland.

In preparing this document, we drew on methods developed for estimating the global burden of disease caused by occupational noise. We therefore thank the additional co-authors of the global analysis, Deboral Imel Nelson and Marilyn Fingerhut, as well as all the reviewers of that report.

We also thank the US Environmental Protection Agency for supporting the development of the Environmental Burden of Disease approaches. Finally, we are grateful to Kevin Farrell for editorial comments, and to Eileen Brown for putting this document into its final format.

## Glossary of terms and list of abbreviations

AF	Attributable fraction (also referred to as the impact fraction). The proportion of the disease burden in a population that can be attributed to a specific risk factor.
DALY	Disability-adjusted life year.
dB	Decibel – units used to measure sound pressure levels on a logarithmic scale.
dB(A)	A-weighted decibel – a measure of sound levels as experienced by humans, calculated using a spectral sensitivity factor (A-filter) that weights sound pressure levels by frequency to correspond to the sensitivity of the human ear.
DBHL	Decibel hearing loss – units used to measure the degree of hearing loss at a specified frequency, relative to a standard of normal hearing.
ILO	International Labour Organization.
$L_{Aeq, 8h}$	Equivalent sound levels, measured over an exposure period of 8 h.
NIHL	Noise-induced hearing loss.
USA	United States of America.
WHO	World Health Organization.

## **Summary**

This guide outlines a method for estimating the disease burden of hearing loss caused by high levels of noise in the workplace, at national, city or local levels. The method assesses exposure at two noise levels (85–90 and >90 dB(A)), and by occupational category and economic subsector. These measurements are combined with the proportions of the working population in different occupations and subsectors, and with the proportion of the working-age population that is employed, by gender. All of the data can be obtained either from national statistics, the International Labour Organization (ILO), WHO, or by extrapolating from existing studies.

The information on exposure is then combined with estimates of the relative risks of developing noise-induced hearing loss (NIHL), derived from literature reviews. This gives the attributable fraction (i.e. the proportion of the total burden of NIHL in the study population that is caused by occupational noise). To give the total disease burden caused by occupational NIHL, the attributable fraction is multiplied by the total disease burden for NIHL. Total disease burden statistics can be obtained either from national statistics, national burden of disease studies, or from WHO. Depending on the aim of the assessment, the attributable burden can be expressed in terms of the incidence of NIHL, or as disability-adjusted life years (DALYs).

In addition to providing aggregate estimates, the method in the guide can be used to highlight the health impacts on population subgroups at particular risk, such as occupational subgroups or women, provided that exposure in these subgroups is assessed separately. The quantification of the health impacts also provides an opportunity to highlight the disease burden that could be avoided by interventions to reduce occupational noise exposures. This can motivate policy action to reduce exposure to this risk factor and thus reduce the disease burden of the population.

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