Uptake and impact of the WHO Environmental noise guidelines for the European Region

Experiences from Member States
Abstract

This policy brief examines the uptake and impact of the WHO environmental noise guidelines for the European Region, drawing on the experiences of Member States. The guidelines have played a role in shaping policy at various levels by providing evidence-informed recommendations. They have been well accepted by policymakers, promoting a unified approach to estimate the health effects and disease burden associated with environmental noise. The brief acknowledges the positive reception of the guidelines’ transparent methodology and evidence quality, driving demand for high-quality research. It also recognizes the challenges in implementing noise limits aligned with the guidelines and suggests the provision of best-practice examples, an impact assessment tool, and a long-term roadmap to support implementation. Further research is also needed to address emerging health effects and knowledge gaps, including on susceptible and vulnerable groups. In conclusion, the guidelines have had an impact on policy-making in Europe, promoting public health. The brief highlights the strengths of the guidelines and identifies several challenges to implementation and possible solutions. By working towards recommended exposure levels, policymakers can effectively mitigate the adverse effects of environmental noise and protect communities.

Keywords

NOISE - ADVERSE EFFECTS, PREVENTION AND CONTROL, SURVEYS AND QUESTIONNAIRES, GUIDELINE ADHERENCE, EUROPE

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Key messages

- The WHO Environmental noise guidelines for the European Region (the Guidelines) have had a direct impact on policy-making at the local, regional, national and supranational levels in several Member States and in the European Union (EU).

- Use of a transparent, evidence-informed approach to developing recommendations has resulted in wide acceptance of the Guidelines by policy-makers.

- The provision of interim targets and tools to support quantification of the health impacts of environmental noise could facilitate uptake of the Guidelines by policy-makers at different levels.

- The evidence underpinning the Guidelines on the health effects of noise exposure supports estimation of the disease burden attributable to environmental noise.

- Further research on environmental noise and health will help to close current gaps on emerging adverse health effects.
Uptake and impact of the WHO Environmental noise guidelines for the European Region
Experiences from Member States
Introduction

The WHO Environmental noise guidelines for the European Region (hereafter, the Guidelines) are the third WHO guidelines on the topic of environmental noise to be published since 1999 (WHO Regional Office for Europe, 2018). They provide evidence-informed recommendations for Member States of the WHO European Region on minimizing adverse health effects resulting from the noise pollution of transportation (road traffic, railways and aircraft), wind turbines and leisure activities such as the use of audio devices, clubbing or spectating at sporting events. Compared with previous WHO guidelines on environmental noise, the most significant developments are source-specific recommendations based on evidence-informed guideline exposure levels for different critical health outcomes (cardiovascular diseases, noise annoyance, cognitive impairment, sleep disturbance, hearing loss and tinnitus). The guideline exposure levels are adapted to the most relevant noise indicators used in the WHO European Region for average day-evening-night and night-time noise exposures ($L_{den}$ and $L_{night}$, respectively).

The Guidelines were among the first WHO guidelines in the environment and health domain to use an adapted Grading of Recommendations, Assessment, Development and Evaluations (GRADE) framework to assess evidence and develop recommendations. These recommendations are underpinned by systematic reviews of evidence on various health outcomes, as well as by evidence on interventions to reduce environmental noise exposure and/or adverse health outcomes (Fig. 1).

Fig. 1. Main features of the Guidelines

1. Definition of the relevant risk increase for each critical health outcome
2. Quantification of exposure values for each critical health outcome
3. Comparison of exposure levels for each critical health outcome

- Analyse
- Define
- Identify

- High quality
- Moderate quality
- Low quality
- Very low quality

- 8 systematic reviews
- 5 critical outcomes
- 3 important outcomes
- Guideline exposure level
- Strength of recommendation
- Strong/conditional

**Quality of evidence**
- Benefits and harms
- Values & preferences
- Resource implications
- 4 more factors

**Exposure-response functions**
**Health outcomes**
Following publication of these Guidelines, the WHO European Centre for Environment and Health (WHO ECEH) initiated several activities to promote and evaluate their implementation in WHO European Region Member States.

- In December 2019 a workshop was organized for experts from several Member States to discuss the opportunities, benefits, challenges and barriers to using the Guidelines.

- In 2022 in collaboration with the European Environment Agency (EEA), a survey was conducted on implementation of the Guidelines in local, regional and national policy, targeting all Member States of the WHO European Region (including all EEA member countries).

- In 2023 in follow-up, several respondents were asked to provide additional information.

Box 1 gives more information on methodology of the survey. The most relevant findings of the survey activities are summarized in the following sections.

**Box 1. Methodology of this assessment**

The current assessment of the implementation and impact of the Guidelines in the WHO European Region comprised three main steps.

The first step was a workshop with representatives of several Member States of the WHO European Region, held in 2019 in Bonn, Germany, which allowed a qualitative evaluation of their needs.

The second step was a survey in 2022 on the implementation status of the Guidelines in Member States organized by the ECEH in collaboration with the EEA. This was conducted through an online questionnaire distributed via WHO Environment and Health focal points and communication channels relevant to the environmental noise community. Respondents were asked to indicate the degree of impact of the Guidelines; the most helpful aspects and potential barriers to implementation of the Guidelines; the need for additional information products; and details of the quantification of health impacts in their country. The survey enabled differentiation between local, regional and national respondents. In total, 41 respondents from the 27 Member States of the Region completed the survey.

As a third step, in early 2023 the ECEH asked several survey respondents for more detailed information on the context of interventions or implementation measures in individual Member States of the Region to gain additional insight into the implementation of the Guidelines.
The Guidelines have already influenced policy

The Guidelines have had a direct and immediate impact on several domains of policy-making in Member States of the WHO European Region: they have helped local, regional, national and supranational policymakers to take a harmonized approach when estimating the health effects and disease burden from environmental noise. Box 2 provides more information on the impact of the Guidelines on Directive 2002/49/EC of the European Parliament and of the Council of 25 June 2002 relating to the assessment and management of environmental noise, the European Noise Directive (END) (European Commission, 2002).

The Guidelines have also stimulated the initiation of processes to adapt existing laws and regulations. In four countries so far, this has included the adoption of a new or additional noise source in a law or regulation (e.g. wind turbine noise). Moreover, the approach used in the Guidelines to derive guideline exposure levels is used as a reference to develop noise limits in several Member States.

Lastly, the Guidelines have prompted the adaptation of local and national strategic noise maps and new noise action plans aimed at mitigating environmental noise. This has included the delivery of strategic noise maps below the values defined by the END, the incorporation of noise level targets into local and national noise action plans that aim below those outlined in the END, and the introduction of Annex III of the END, which stipulates the use of exposure–response relationships from the Guidelines to evaluate the health benefits of the END’s noise action plans.
Evidence quality is a key strength of the Guidelines

End users greatly appreciated the use of transparent methodology and an evidence-informed process to develop the Guidelines. In the survey, respondents considered the quality of evidence obtained from applying the adapted GRADE framework as one of the most useful aspects of the Guidelines, along with the source-specific relative risks for all critical health outcomes, as derived from the exposure–response functions. They noted that the Guidelines mark a step change in how to synthesize an evidence base on environmental noise and health (i.e. through systematic reviews) and assess the resulting evidence. This innovative approach has increased the demand for high-quality research in the area.

The source-specific guideline exposure levels for transportation noise enable different policy targets to be formulated for each environmental noise source. They also account for the variability in initiation of the relevant risk increase among environmental noise sources, which is strongly associated with differences in their acoustic characteristics.

The aspects of the Guidelines most relevant to its impacts are the synthesis of the latest scientific evidence, documented assessment of the evidence quality and stepwise process to derive guideline exposure levels.

Box 2 provides a snapshot of the impact of the Guidelines at EU level.

Box 2. Impact of the Guidelines at EU level

In the EU, the health effects of environmental noise are addressed by the END (Directive 2002/49/EC), which requires Member States to assess noise exposure and produce noise action plans. In addition, national noise limits may be incorporated into national legislation (European Commission, 2002). In 2020 the END was updated to include common calculation methods for noise levels and their effects on health based on the Guidelines and particularly the formulae presented therein, to assess health impacts. As part of the update, Member States recognized that the Guidelines provide “high quality and statistically significant information that could be used” (European Commission, 2020). They concluded that "consequently, the dose–effect relations introduced in Annex III to Directive 2002/49/EC should be based on these guidelines". As outlined in Annex III, the European Commission assessed the situation in the EU and in March 2023 presented an updated picture to the European Council and the European Parliament (European Commission, 2023). The Commission report highlights that the number of people affected by noise levels above the more stringent WHO recommendations in 2017 was 120 million for road traffic noise, 20 million for railway traffic noise and 62 million for aircraft noise. The Commission introduced a 30% reduction target in the 2021 Action Plan towards zero pollution (European Commission, 2021) and provided a set of measures for tackling noise pollution. Calculations for the “Zero pollution” monitoring and outlook report (European Commission, 2022) were also assessed against WHO recommendations. As illustrated, the Guidelines underpin recent EU policy.
Need for interim targets to support implementation of the Guidelines

The 2019 workshop and survey also identified the main challenges and barriers to the implementation of national noise limits aligned with the Guidelines. The main barrier was that the recommended noise levels were regarded to be unattainably low and, therefore, not feasible. Moreover, many respondents pointed out that the gap between current national noise limits and the Guidelines’ recommended guideline exposure levels is too wide and that interim targets are needed (Peeters and Nusselder, 2019). However, the Guidelines do not provide interim targets.

According to end users of the Guidelines, the economic costs of implementing noise limits aligned with the guideline exposure levels are too great, and would have implications for other public sectors (e.g. the transport or building sector).
Need for improvement in assessing the health effects of environmental noise

Quantification of the harmful effects of environmental noise is challenging because a wide range of acoustic parameters must be considered to generate a comprehensive picture. The Guidelines focus on the most common average noise indicators for average day-evening-night and night-time noise used in the WHO European Region ($L_{den}$ and $L_{night}$) to ensure that their guidance is applicable across Member States. Survey respondents also considered that additional acoustic parameters that account for variability in environmental noise sources would be useful, including intermittency measures and impulse or single event indicators.

Similarly, environmental noise does not affect all population groups equally: susceptible groups such as children need special protection. Future guidelines should, therefore, aim to define the most relevant susceptible and vulnerable groups, and recommend exposure levels that adequately protect their health.

The current source-specific approach acknowledges the diverse harmful effects of individual environmental noise sources; however, a significant proportion of urban populations across Europe are exposed to multiple noise sources at the same time. Therefore, recommendations on overall noise exposure level would be of great value to end users. Another important goal is to develop guidelines that integrate the adverse effects of multiple environmental pollutants that are harmful to human health, such as noise, air and light pollution.

Lastly, the spatial distributions of exposure to environmental noise and its health impacts are not identical; therefore, analysing the beneficial health effects of quiet areas and identifying measures to preserve and protect them are vital to develop more specific recommendations in the future.
Importance of quantifying the health impact of environmental noise

Quantifying the health impact of environmental noise is important in policy because it supports informed decision-making. Annex III of the END, which includes exposure–response functions, is the most useful resource for quantifying the health impact of environmental noise. For a health impact assessment, practitioners can utilize the attributable number of cases or diagnoses for different health outcomes, including cardiovascular diseases and noise annoyance as a metric to quantify the health impact of environmental noise. This information can be provided to both policy-makers at different levels and to the public. Overall, a quarter of respondents to the survey reported using the health impact assessment to assess the health impact of policy measures or projects in order to reduce environmental noise.

Box 3 gives an overview of the magnitude of the problem of environmental noise in Europe.

Environment noise is a prominent issue across all EU countries, and road traffic noise is the biggest culprit. Based on data collected under the END, the EEA estimates that more than 20% of the total EU population live in areas where road noise levels are considered harmful to health (Table 1).

<table>
<thead>
<tr>
<th>Noise level</th>
<th>Road</th>
<th>Railway</th>
<th>Aircraft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total (n)</td>
<td>Population (%)</td>
<td>Total (n)</td>
<td>Population (%)</td>
</tr>
<tr>
<td>$L_{den} \geq 55$ dB</td>
<td>95 100 000</td>
<td>21</td>
<td>19 000 000</td>
</tr>
<tr>
<td>$L_{night} \geq 50$ dB</td>
<td>66 000 000</td>
<td>15</td>
<td>15 500 000</td>
</tr>
</tbody>
</table>

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In many cities across the EU, over 50% of the population is exposed to road noise levels of above 55 dB $L_{den}$, which is above WHO recommendations (EEA, 2021). Railway and aircraft noise affects a lower proportion of the population, but both are significant sources of local noise pollution.

Based on the exposure–response functions outlined in the Guidelines and data collected under the END, the EEA also estimated the number of people with specific health outcomes (Fig. 2).
Fig. 2. Key impacts of exposure to unhealthy noise levels in the EU, 2017

These figures are still likely to be underestimates, because negative health effects start to occur below the obligatory reporting noise thresholds specified in the END (i.e. 55 dB $L_{den}$ and 50 dB $L_{night}$). WHO recommends reducing noise levels to below these thresholds, particularly at night. In addition, information provided by EU Member States under the END does not cover all urban areas, roads, railways and airports, so actual health impacts are likely to be higher.
Further tools to improve implementation of the Guidelines

In order to better understand the needs of users of the Guidelines, the ECEH discussed a range of information products and tools at the 2019 workshop. Users suggested the following tools and products to facilitate implementation of the Guidelines:

- best-practice examples of noise mitigation measures;
- an easy-to-use tool for local authorities to calculate the health impact of local environmental noise exposure; and
- a long-term roadmap to lower environmental noise and/or to establish environmental noise limits close to recommended guideline levels that consider other factors, such as economic costs and benefits.
Implications

Guidance is needed on implementing the WHO recommendations on noise exposure levels. Information products and tools are required to support the implementation of more ambitious environmental noise limits to protect population health. This will involve creating roadmaps to implement noise limits close to WHO guideline exposure levels, as well as best-practice examples of noise mitigation measures and a new tool to enable local authorities to calculate the harmful effects of environmental noise.

The Guidelines' source-specific recommendations, based on the exposure–response functions of multiple health outcomes, provide robust, evidence-informed public health advice intended to drive policy action to protect communities from the adverse effects of environmental noise. However, evidence concerning environmental noise and health continues to grow, and emerging adverse health effects, including anxiety disorders, dementia, depression and various forms of cancer will require greater consideration in the future. Similarly, further research is needed to map the variability of environmental noise using more versatile metrics and to account for susceptible and vulnerable groups.
Future needs – in a nutshell

**Increase the evidence base.** Further research on environmental noise and health will close the current gaps on emerging adverse health effects.

**Improve methods to quantify health impacts.** The disease burden from environmental noise is likely to be underestimated and future assessments will benefit from methodological developments.

**Improve tools for impact assessment.** Making easy-to-use, widely accessible tools will support local and regional authorities to quantify the health impacts of environmental noise.

**Strive for continuous improvement.** Establishing national roadmaps to reach guideline exposure levels with the help of interim targets that comprehensively consider costs and benefits would facilitate implementation of the guidelines.
References


The WHO Regional Office for Europe
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