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Implementation of the Environmental Noise Directive 2002/49/EC in Slovenia seen through an equity lens

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ABSTRACT

Introduction: The Environmental Noise Directive 2002/49/EC (END) was introduced into the European Union with the aim to define a common approach to minimize the harmful health effects due to environmental noise on a prioritized basis. Since 2004, Slovenia has implemented the END primarily with its national Decree on the assessment and management of environmental noise. The aim of this paper is to examine how implementation of the END in Slovenia takes in consideration social inequalities and equity, and to investigate the spatial inequalities in environmental noise exposure in Ljubljana. It also presents some changes that were carried out in the national environmental noise legislation valid until 2004 that gave rise to reactions of the public. **Methods:** We analysed national legislation to determine how equity-relevant issues, such as social inequalities in noise exposure and public participation are embedded. Data on environmental noise exposure and sociodemographic and socioeconomic indicators in Ljubljana were used to investigate whether the spatial inequalities in environmental noise exposure exist in Ljubljana. **Results:** The Slovenian Noise Action Plan adopted in 2022 did not consider social aspects for noise reduction interventions. Public participation was identified as one of the most important issues in an equity impact assessment. **Conclusions:** We argue that the collection of data combining noise exposure with socioeconomic indicators can be useful to the implementation of END for spatial planners. By considering social aspects in such a way, decision-making processes for noise reduction priorities and improvement of environments with an equity lens can support health for all.

Keywords: European Noise Directive, Noise, Legislation, Equity, Social Inequalities

INTRODUCTION

Exposure to environmental noise is known to have long term adverse effects on human health including mental health and cognitive development in children^{1,2,3}. Children's diverse experiences and environmental exposures can put them at risk or, on the other hand, help to protect their health at critical moments of their development. Minimising risk and maximising protective factors should be the aim of diverse policies⁴. Urban planning policies should consider the health implications of decisions in order to improve population health and also health equity⁵. Within the European project Equal-Life we extend the study of environmental impacts on children's mental health and cognitive development to diverse factors from their physical and social environment. Environment here is broadly defined to include the physical, social, economic and cultural dimensions, and perceived quality of place and life is also referred to as exposome⁶. Social aspects include sociodemographic (SD), socioeconomic (SE) and procedural justice aspects.

The European Directive 2002/49/EC (END) related to the assessment and management of environmental noise defines a common approach of Member States intended to avoid, prevent or reduce on a prioritized basis the harmful effects due to exposure to environmental noise. Strategic noise maps should be developed for the major noise sources and areas according to the directive criteria. The information on environmental noise and its effects on health should be made available to the public. Member States should provide Action Plans with measures to reduce noise emitted by the major sources, in particular road and rail vehicles and infrastructure, aircraft, outdoor and industrial equipment and mobile machinery. Every five years Member States have to report the results of strategic noise mapping and Action plans to the Commission that publishes a summary report of data from strategic noise maps and action plans⁷.

The recent Report from the Commission on the Implementation of the END concludes that noise exposure has not changed considerably in 20 years of implementing the END⁸. Despite the fact that the aim of the END is to reduce or prevent the harmful effects of noise on human health in the Member States, it does not include binding environmental values, furthermore the regulations on content and procedures are unclear⁹. Moreover, the END does not oblige Member States to assess socio-spatial inequalities in noise exposure and health, nor does it address them in action plans.

Social inequalities exist as a result of differences in the distribution of both beneficial (e.g. restorative spaces) and adverse (e.g. road traffic noise) environmental exposures and differential vulnerability to the health effects of these exposures. Differences in health status constitute health inequities when they are avoidable, unfair and unjust^{10,11}. An intervention may have an impact on the social inequalities that exist between groups through the creation of new inequalities or the exacerbation of existing ones, so-called intervention-generated inequalities^{12,13}. Therefore, it is important to identify and understand social inequalities by applying an equity lens so that inequalities can be prevented or reduced. Here, we use the wording equity lens to refer to analysing the different elements and steps in the policy and/or intervention with regards to equity-relevant aspects such as social inequalities and participation in the policy process. This requires analysing the policy process at different steps in the intervention process, such as in the planning, implementation and evaluation stages.

The aim of this paper is to present the process of implementation of the END in Slovenia considering social inequalities and other equity-relevant aspects in the form of a case study. Combined exposure to road traffic noise and kindergarten subsidies for low-income families will be presented as an example of exposome approach in urban planning and also as supportive information for a more targeted prioritisation of the planned measures. The paper also presents some changes that were carried out in the national environmental noise

legislation valid until 2004 that caused reactions of the public complaining about the lack of opportunities for participation in the policy-making process (i.e. procedural justice).

MATERIALS AND METHODS

Review of relevant policy/legal documents

We performed a review of relevant policy/legal documents important for spatial planning and consideration of environmental noise as a physical factor that can affect public health including mental health, well-being and cognitive development of children and youth. We selected relevant noise legislation, environment and spatial planning acts important for an equity impact assessment. All documents were reviewed for the content that would show consideration of public participation, sociodemographic and socioeconomic aspects in policies and plans or interventions in spatial planning at national, regional and/or local level.

Equity impact assessment

We evaluated the level of equity consideration in the case of END implementation, including the preparation of strategic noise maps and action plans. Three phases were put under the equity lens i.e., planning, implementation and evaluation. In each phase we checked the involvement of stakeholders and in particular the engagement of public. We investigated whether all binding legislation and guidelines or other documents were considered in the process. An important point was also the extent to which SD/SE and procedural justice aspects were considered, especially in the preparation of the Noise Action Plan.

Investigating combined exposure: road traffic noise and socioeconomic deprivation in Ljubljana

To illustrate the idea of exposome approach an example of combined exposure to road traffic noise and kindergarten subsidies for low-income families with small children was developed for the situation in the Municipality of Ljubljana (MOL). Our aim was to pinpoint the areas in the MOL that would need priority consideration for noise protection measures due to high exposure to noise in areas where more vulnerable populations reside. In our case, we consider families that get highest subsidies for the kindergarten fee to be more vulnerable.

Several other sociodemographic and socioeconomic indicators (income, education, employment etc.) were obtained from the Statistical Office of the Republic of Slovenia (SURSTAT) and presented at the level of Ljubljana's city districts in Geographic Information System (GIS). These can serve as an example of possible indicators that can be used to investigate the issue of spatial inequalities in an equity impact assessment of specific interventions but were not taken into consideration in the present study.

Data on road traffic noise from strategic noise map were obtained from the MOL for Lden (day-evening-night noise indicator) in the year 2017. Financial support or subsidies that families get from the state for the payment of kindergarten fees can be used as an indicator of the socioeconomic status of families with small children. For that reason, data on families with young children who receive a government-supported subsidy of at least 90% of kindergarten fees (i.e. where the family's own payment therefore does not exceed 10% of the total fees due) was provided from Social Protection Institute of the Republic of Slovenia (IRSSV) for 2020. As we do not expect considerable changes in the strategic noise maps from 2017 and 2020, we assumed the comparison to be still valid. The selection of these indicators was based also on data availability with precision at the building/home address level only for these two

indicators. Both, data for exposure to noise above 65 dBA and data on kindergarten expenses were the only data available at the level of house address. The data were presented as aggregated results at the level of 200x200m for the purpose of personal data protection.

Linear regression was performed for noise exposure indicator Lden and low private payment of kindergarten (i.e. more heavily subsidised) at the 200x200m grid level for the MOL.

RESULTS

Review of relevant policy/legal documents

The legislation acts reviewed in our study are listed in Table 1. Four acts are dedicated to environmental noise: one at the European level, two at a national level, and one at a regional level. Three acts are dedicated to spatial planning at a national level. The Environmental Protection Act is the main national law on the protection of environment and is therefore important for implementation of Environmental Noise Directive in Slovenia.

Table 1: Legislation acts reviewed in this case study for consideration of SD/SE and procedural justice aspects, in spatial planning and environmental health impact assessment with emphasis on noise exposure.

Document	Level	Content
Directive 2002/49/EC - Environmental Noise Directive (END)	EU	Environmental noise
Environmental Protection Act	National	Environment protection
Decree on limit values for environmental noise indicators	National	Environmental noise
Decree on the assessment and management of environmental noise	National	Environmental noise
Decree laying down the content of environmental report and on detailed procedure for the assessment of the effects on certain plans and programs on the environment	National	Spatial planning
Decree on criteria for determining the likely significance of environmental effects of certain plans, programs or other acts and its modifications in the environmental assessment procedure	National	Spatial planning
Decree on activities affecting the environment that require an environmental impact assessment	National	Spatial planning
Action plan / Operational environmental protection program (operational program)	Regional	Environmental noise
Decree on the Municipal Spatial Plan of the City of Ljubljana	Local	Municipality spatial plan

It was established that SD/SE and procedural justice aspects are not considered in the reviewed documents.

Our main observations are:

- There are no requirements for data on SD/SE indicators to be incorporated in environmental impact assessment procedure. There is only a general recommendation that the spatial plans should provide equal access to all citizens and that overall

- prosperity should be considered.
- There is no specific chapter in the environmental impact assessment legislation dedicated to request for consideration of socioeconomic issues.
- One of the most important issues that may affect citizens due to their SD/SE status is the possibility of their participation in planning, discussing and implementation of new legislation and/or spatial plans and programs. The END is not implemented in terms of public participation as suggested in its text, but is implemented as already stated in the national Environmental Protection Act. Citizens can voice their comments only at the very last stage of the document/plan preparation, namely, during the period of public presentation or later by sending written comments to the Ministry. This, the citizens have no opportunity to further discuss their comments if not adopted by the competent authority.
- Dissemination of information to the public should also consider more vulnerable populations by using several options for information distribution (e.g. addressing certain organisations, sending letters to home address) when it is important to reach a large number of citizens.

We identified certain sources of inequalities that are not explicitly related to socioeconomic indicators but caused complaints from the citizens.

- There are two residential noise protection zones in the *Decree on limit values for environmental noise indicators* meaning that not all citizens are protected from road traffic noise to the same level.
- Another potential source of inequality are the criteria of the END for preparation of strategic noise maps and action plans. An important issue in Slovenia is that due to those criteria the definition of road traffic noise source was changed excluding all roads with less than 1,000,000 vehicles per year. Hence, some citizens are not entitled to complain about the road traffic noise although it has been proven that a smaller number of vehicles may still have significant (negative) effects on well-being and health of the population.
- Important to mention is also the fact that Action plan from the END was implemented as Operational program which is defined in *Environmental Protection Act*. The ensuing effect is that the provisions of the document do not correspond to the requirements of Action plan and are not precise in interventions required to reduce the number of citizens exposed to excess noise. The Operational program targets only the areas that are exposed to noise levels above the national limit value of 65 dBA and does not follow the recommendation of END to consider areas exposed to noise levels above 55 dBA. The Environmental noise guidelines for the European Region of the World Health Organisation³ are also not applied in this process.

Equity impact assessment

The planning phase of END adoption in the Slovenian legal order was performed within the Ministry of Environment and Spatial Planning. The existing environmental and noise legislation was examined and reflected upon in order to explore the options how to implement the END. No guideline documents were identified to facilitate the planning process. Contrary to Health in All Policies approach, already in the planning phase a lack of involvement of other ministries was observed and there were only few experts available for consultation^{5,12,13}. The draft version of the Decree on assessment of noise implementing the END in Slovenia was a subject of public consultation only later in the implementation phase.

In the implementation phase, public participation is considered but the latter is important in all phases of the document development. Limited participation of public is the result of the Environmental Protection Act that requires the collection of public commentaries only in the

phase of draft plans and programs. The public does not have an opportunity for in-depth debate on specific issues that affect their living environment. This is true for all documents that are reviewed in the present case study, where the public is not given enough opportunity and time to thoroughly discuss the documents i.e. implementation of the END, preparation of strategic noise maps and preparation of Action plan / Operational environmental noise protection program. Publication of the document on the internet does not reach all citizens and therefore they cannot participate. When the information reaches the targeted population, not all citizens feel competent to take part in the discussion. Documents to be revised and discussed are usually long and written in professional jargon that some people may not fully understand.

The evaluation phase includes assessment by the European Commission of the implemented legislation and on preparation of strategic noise maps and Action plans (in case of Slovenia this is an Operational program). The most important finding of applying the equity lens in this phase is that sociodemographic and socioeconomic aspects are not considered in the Operational program when setting priorities for measures to protect citizens from noise. This is not required in the END and is not mentioned in the Operational program. As regards the involvement of citizens, the situation is the same as in implementation phase. Citizens have not enough time for consultations from the very first step of development of the Operational program. Vulnerable population, for example children, are not adequately taken into consideration. Environment of kindergartens, schools and playgrounds are not considered to be protected from noise in compliance with World Health Organisation guidelines and END recommendations so that the noise would not exceed 55 dBA in such areas.

Combined exposure: road traffic noise and socioeconomic deprivation in Ljubljana

Preliminary results of linear regression for Lden and payment for kindergarten at the level of Municipality of Ljubljana showed no association. The β coefficient was close to zero. This was not a big surprise as socioeconomic situations are quite equally distributed in Ljubljana when considering the districts.

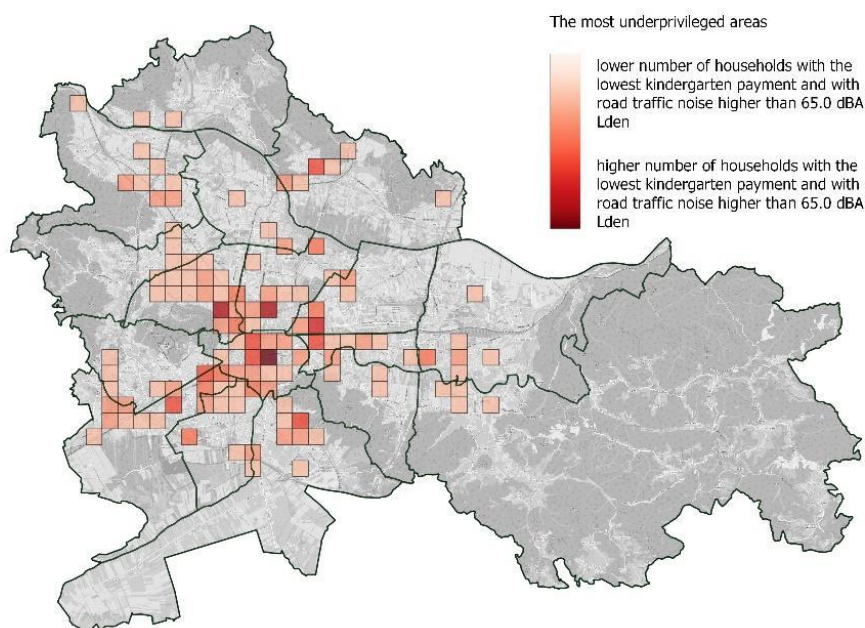


Figure 1: The 200x200 m squares represent areas where data for road traffic noise above 65 dBA and lowest kindergarten payment are combined.

To consider the situation at a more detailed geographic level and in order not to disclose personal-level data, we combined information on environmental noise and cases of families receiving higher kindergarten subsidies due to lower income at 200x200m grid, as shown in the Figure 1. The darkest colour presents the area where more families that pay a lower share of kindergarten fees live and are also exposed to the road traffic noise above the official limits (> 65 dBA).

The above illustration is one example of how socioeconomic indicators may be included in an equity impact assessment to protect more vulnerable populations and thus potentially reduce social inequalities. In the present Operational program, the interventions for noise mitigations are focused on ring road and not on areas that we identified as important when considering also social aspects.

DISCUSSION

We performed an assessment of the process of implementation of END in Slovenia with particular attention to equity-relevant aspects, such as consideration of SD/SE aspects and participation of the public. According to the freedom given to Member States in this implementation process, we observed that in Slovenia certain solutions in implementation process and the content itself do not comply with the high standards set in END. Among the problems identified is the fact that the Action plan was implemented as an Operational program which is less binding to the provisions of END. Furthermore, the END article on public participation was also not implemented accordingly. From an equity-perspective, this has important implications on satisfactory public participation in the policy-making process. This resulted in very limited engagement of citizens and also in increasing dissatisfaction due to the lack of opportunities to discuss the important issues i.e. the measures in Operational program or changes of definitions in relevant legislation.

The results of the present study therefore yield to a conclusion that the environmental noise pollution in Slovenia is unlikely to be reduced soon. Consideration of an equity perspective in the implementation of the END in Slovenia is lacking. The Report from the Commission on the Implementation of the END states that the situation of environmental noise exposure has not changed considerably in the last 20 years in spite of the END⁸. Furthermore, the Zero Pollution Outlook Report has recently estimated that the goal of 30% reduction in number of people chronically disturbed by road transport noise will probably not be achieved; a more realistic prediction is a decline by 19% by 2030. Additional measures need to be taken at national, regional and local level together with reinforced EU action across relevant sectors to achieve any significant further reduction in noise pollution¹⁴. This is particularly true in the case of addressing social inequalities in environmental noise exposure, as the aforementioned Commission report also points out the fact that pollution is not distributed equally across the EU. Vulnerable population, including children, are more sensitive to pollution exposure and those in lower socioeconomic groups tend to be exposed to higher levels of pollution. It is disappointing that the Report from the Commission⁸ does not mention the SD/SE aspects of health impacts in relation to noise exposure. In Slovenia, we observe that consideration of SD/SE aspects as underlying social determinants of health is also not considered. We believe that the suggestions as how to incorporate multiple aspects of environmental health equity into action plans presented by Riedel and colleagues are a good direction for improvements⁹.

The results of the present study indicate that the citizens in Slovenia were not informed and involved in the implementation of END to the degree this directive requests. Furthermore, the Action plan is not prepared according to the END standards and therefore the ultimate goal of END to reduce the number of citizens living in the environment where noise levels exceed 55

dBA Lden, is difficult to achieve. In case of prioritising specific interventions, the SD/SE and procedural justice aspect should be considered to avoid the generation or exacerbation of social inequalities. With the example of combining data on noise exposure and subsidies for kindergartens, the illustration of priorities changes, pointing to areas where solving the noise problem would also help address social inequalities at least to some extent. Further discussions among Member States are therefore necessary at EU level for improvements to achieve better results in the protection of citizens from noise and also to reduce social inequalities.

CONCLUSION

Considerable freedom was given to Member States in the implementation of the END, and regrettably there has been little progress in the reduction of proportion of citizens exposed to noise as observed by European Commission. For these reasons, we would strongly suggest that the European Environmental Noise Directive should be more binding at the national level. The reduction of noise pollution in the environment should follow more thoroughly the WHO recommendations to protect children's mental health and cognitive development. Further research is needed to investigate how the implementation of the END across Europe can play a role in the prevention of intervention-generated inequalities relating to environmental noise interventions. Consideration of SD/SE and procedural justice aspects would facilitate the decision for targeted measures and improve the quality of life of more vulnerable populations in the meantime, reducing health disparities.

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Appendix 1

Relevant policy/legal documents

Uredba o hrupu v naravnem in življenjskem okolju [Decree on noise in the natural and living environment] Uradni list Republike Slovenije, št. 45/95, 66/96, 59/02 – ZJZ, 41/04 – ZVO-1 in 105/05. Available at <http://www.pisrs.si/Pis.web/pregledPredpisa?id=URED326>

Zakon o varstvu okolja (ZVO-2) [Environmental Protection Act]. Uradni list Republike Slovenije, št. 44/22. Available at <http://www.pisrs.si/Pis.web/pregledPredpisa?id=ZAKO8286>

Uredba o mejnih vrednostih kazalcev hrupa v okolju [Decree on limit values for environmental noise indicators]. Uradni list Republike Slovenije, št. 43/18, 59/19 in 44/22. Available at <http://www.pisrs.si/Pis.web/pregledPredpisa?id=URED7531>

Uredba o ocenjevanju in urejanju hrupa v okolju [Decree on assessment and management of noise in the environment]. Uradni list Republike Slovenije, št. 121/04, 59/19, 44/22 – ZVO-2 in 53/22. Available at <http://www.pisrs.si/Pis.web/pregledPredpisa?id=URED2682>

Uredba o okoljskem poročilu in podrobnejšem postopku celovite presoje vplivov izvedbe planov na okolje [Decree laying down the content of environmental report and on detailed procedure for the assessment of the effects on certain plans and programs on the environment]. Uradni list Republike Slovenije, št. 73/05 in 44/22 – ZVO-2. Available at <http://www.pisrs.si/Pis.web/pregledPredpisa?id=NAVO607>

Uredba o merilih za ocenjevanje verjetnosti pomembnejših vplivov izvedbe plana, programa, načrta ali drugega splošnega akta in njegovih sprememb na okolje v postopku celovite presoje vplivov na okolje [Decree on criteria for determining the likely significance of environmental effects of certain plans, programs or other acts and its modifications in the environmental assessment procedure]. Uradni list Republike Slovenije, št. 9/09 in 44/22 – ZVO-2. Available at <http://pisrs.si/Pis.web/pregledPredpisa?id=URED5016>

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Mestna Občina Ljubljana (MOL). Odlok o občinskem prostorskem načrtu Mestne občine Ljubljana – izvedbeni del [Decree on Municipal Spatial plan of the City of Ljubljana – implementation part]. Ljubljana, MOL, 2010. Available at <https://www.ljubljana.si/assets/OPN-MOL/2010-78-4264-NPB21.pdf>